

Sardar Patel University, Mandi (H.P.)-175001

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Department of Zoology



Scheme & Syllabus of Bachelor of Science(Honourswith Research) in Zoology/Life Sciences [Four Years Multidisciplinary Programme] Based on NEP 2020

Effective from 2026-27 onwards

Table of Contents

S. No.	Contents	Page No.
1	Program Educational Objectives	3
2	Program Specific Outcomes	3
3	Program Outcomes	3-4
4	Breakdown of Credits Semester Wise	5
5	Important Notes	6
6	Semester Wise Scheme	7-9
7	Syllabus	10-28

Programme: B.Sc. in Zoology/ Life Sciences

[PEOs, PSOs and POs]

Program Educational Objectives (PEOs)

The PEOs will enable students to

PEO-1: Develop a strong foundation in Life Sciences through the integrated study of Zoology, Botany, and Chemistry, enabling a comprehensive understanding of biological systems.

PEO-2: Equip students with analytical, practical, and research skills to investigate scientific problems and undertake independent research in specialized areas of Zoology/ Life Sciences.

PEO-3: Foster critical thinking, leadership, communication, teamwork, and ethical values for effective participation in multidisciplinary academic and professional environments.

PEO-4: Prepare graduates for higher education, research, entrepreneurship, and diverse career opportunities in academia, industry, healthcare, biotechnology, environmental management, and government sectors.

PEO-5: Promote lifelong learning, innovation, and social responsibility to contribute meaningfully towards sustainable development and the advancement of science and society.

Program Specific Outcomes (PSOs)

The B.Sc. (Hons. with Research) in Zoology/ Life Sciences programme is designed to

PSO-1: Apply fundamental concepts of Chemistry, Botany, and Zoology to understand the structure, function, diversity, and interactions of living systems.

PSO-2: Demonstrate proficiency in laboratory, field, and analytical techniques for investigating biological and chemical phenomena.

PSO-3: Analyze scientific data, employ appropriate computational and statistical tools, and solve problems using evidence-based approaches.

PSO-4: Evaluate issues related to biodiversity, environmental sustainability, health, and natural resource management through multidisciplinary perspectives.

PSO-5: Conduct independent research in a chosen specialization area, communicate scientific findings effectively, and uphold ethical and professional standards.

Program Outcomes (POs)

After successfully completing B.Sc. (Hons. with Research) in Zoology/ Life Sciences programme the students will be able to

PO1: Disciplinary Knowledge

Demonstrate comprehensive knowledge of fundamental concepts, principles, and applications of Life Sciences, including Botany, Zoology, Chemistry, and allied biological sciences.

PO2: Critical Thinking and Problem Solving

Apply scientific reasoning, analytical thinking, and quantitative approaches to identify, formulate, and solve biological problems.

PO3: Research Competency

Design and conduct experiments, collect and analyze data, interpret results, and communicate scientific findings using appropriate research methodologies.

PO4: Practical and Technical Skills

Demonstrate proficiency in laboratory techniques, field studies, instrumentation, specimen handling, and biological data analysis.

PO5: Environmental and Sustainability Awareness

Evaluate environmental challenges, biodiversity conservation issues, and sustainable utilization of biological resources for societal well-being.

PO6: Digital and Technological Competence

Utilize bioinformatics tools, information and communication technologies, statistical software, and digital resources in scientific investigations.

PO7: Communication Skills

Communicate scientific information effectively through oral presentations, technical reports, scientific writing, and collaborative discussions.

PO8: Ethics and Professional Responsibility

Apply ethical principles, biosafety regulations, and professional standards in scientific research and practice.

PO9: Leadership and Teamwork

Work effectively as an individual and as a member or leader of multidisciplinary teams in academic, research, and professional settings.

PO10: Lifelong Learning

Engage in self-directed learning and adapt to emerging developments in biological sciences, research, innovation, and entrepreneurship.

PO11: Multidisciplinary Integration

Integrate knowledge from biological, chemical, environmental, and technological sciences to address complex real-world problems.

PO12: Employability and Entrepreneurship

Develop competencies required for higher education, research careers, public services, biotechnology industries, environmental agencies, healthcare sectors, and entrepreneurial ventures.

Break-Down of Credits-Semester Wise

Course Type/ Semester	DSC	DSE	MDC	SEC	AEC	VAC	INP/APT/PRT/COM or Vocation Course	DIS	Total
I	12	-	3	3	2	-	-	-	20
II	12	-	3	3	-	2	4	-	24
Exit option with UG Certificate after securing 44 credits along with entry option to second year or third semester									
III	8 (MJ)+4 (MN)	-	3	3	2	2	-	-	22
IV	8 (MJ)+4 (MN)	4	-	-	2	2	-	-	20
Exit option with UG Diploma after securing 86credits along with entry option to third year or fifth semester									
V	8 (MJ)+4 (MN)	8	-	-	2	-	-	-	22
VI	8 (MJ)+4 (MN)	8	-	-	-	-	-	-	20
Award of 3Year Bachelor's Degree after completion of 128 credits									
VII	12(MJ)	4	-	-	-	-	-	4	20
VIII	8(MJ)	4	-	-	-	-	-	8	20
Bachelor's Degree(Honours with Research)after completion of 168 credits									
Total Credits	92 (76MJ+16MN)	28	9	9	8	6	4	12	168

Abbreviations:DSC-Discipline Specific Core, DSE- Discipline Specific Elective, MDC-Multidisciplinary Course, SEC-Skill Enhancement Course, AEC-Ability Enhancement Course, VAC-Value Added Course, MJ-Major, MN-Minor, INP/APT/PRT/COM-Internship / Apprenticeship/ Project/ Community Outreach, DIS-Dissertation

Important Notes

- In the first semester, students will be offered three different subjects within the same stream: A, B, and C.
- The student will be required to give his/her Major and Minor at the end of the second semester. Such choices, including DSCs made at the end of the second semester, shall remain in effect until the VI semester.
- The DSCs of another discipline for the first two semesters of students who opt for Major programmes will be treated as Minors.
- MDCs must be selected from a broad discipline/pool of MDCs other than Major and Minor disciplines/subjects.
- AEC/VAC/SEC-3 should be chosen from a pool of courses. Every discipline shall provide these courses, some of which will be offered discipline-specific, while the rest can be open to students of all other disciplines. However, the two SECs (SEC-1 & SEC-2) must be chosen from the discipline-specific (Core and Minor).
- Internship / Apprenticeship/ Project/ Community Outreach will be determined at the end of the first semester to enable students to carry out some INP/APT/PRT/COMactivities during winter vacation.
- To pursue an Honours & Honours with research in the 4th year, students will have to successfully complete 3-year UG Degree and choose only one discipline in both semesters, in which s/he have studied 6 DSCs and 5 DSEs in the first three years.
- A student who secures 75% or more marks in aggregate till semester 6 (up to a 3-year degree) shall be eligible for a 4-year degree Honours with Research, provided SPU has approved the college to offer it.
- The Dissertation and Project will start in the VII semester. However, the evaluation and assessment will be conducted in both the VII and VIII semesters.
- As permitted under the UGC Guidelines for Multiple Entry and Exit in Academic Programmes offered in Higher Education Institutions, students will be allowed to enter/re-enter in the odd semesters and after even semesters, provided they fulfill the minimum requirements for entry and exit.
- A student shall be eligible to appear in the end-semester examination only if he/she has a minimum of 75% attendance. The terms and rules governing condoning can be found in the Examination Section of the Ordinance.

Semester Wise Scheme

Course & Academic Level	Semester	Discipline Specific Courses Core (DSC) Credits -4	Discipline Specific Electives (DSE) Credits-4	Minor Courses Credits-4	Multidisciplinary Courses (MDC) Credits -3	Skill Enhancement Courses (SEC) Credits -3	Ability Enhancement Courses (AEC) Credits-2	Internship/Apprenticeship/Community Outreach (I/A/P/C) Credits-4	Value Addition Courses (VAC) Credits-2	Total Credits
100-109 Introductory Foundational Level Courses	I	(DSC 1A) Fundamentals of Invertebrate BZOOL-DSC-101 (DSC 1B) Choose from Botany/Chemistry and Geology		(MC-1) DSC1C Choose from Botany/Chemistry / Geology	MDC1 Economic Zoology BZOOL-MDC-101	SEC1 Apiculture BZOOL-SEC-101	AEC 1	-		20
	II	(DSC2A) Biology of Vertebrates BZOOL-DSC-201 (DSC 2B) Choose from Botany/Chemistry /Geology		(MC-2) Choose from Botany/Chemistry / Geology	MDC2 Wildlife of Himachal Pradesh BZOOL-MDC-102	SEC2 Sericulture BZOOL-SEC-102		I/A/P/C-1	VAC1 Environmental Education	24
Level 4.5	Exit I	Student on exit will be awarded an undergraduate certificate (in the field of study)after securing 44 credits in the semester I&II								44

Semester-I

S. No.	Course Code	Course Title	Category	L	T	P	C	CH	Theory Assessment		Practical Assessment		Total
									IA	ESE	IA	ESE	
1	BZOO- DSC-101 T	Fundamentals of Invertebrate	DSC	3	0	0	3	3	25	50	-	-	75
2	BZOO- DSC-101 P	Fundamentals of Invertebrate	DSC	0	0	1	1	2	-	-	5	20	25
3	BBOTA- DSC-101T	Phycology and Mycology	DSC	3	0	0	3	3	25	50	-	-	75
4	BBOTA- DSC-101P	Phycology and Mycology	DSC	0	0	1	1	2	-	-	5	20	25
5	BCHEM- DSC-101T	Inorganic Chemistry-I	DSC	3	0	0	3	3	25	50	-	-	75
6	BCHEM- DSC-101P	Inorganic Chemistry-I	DSC	0	0	1	1	2	-	-	-	-	25
7	BXXXX*- MDC-101*	-----	MDC	3	0	0	3	3	25	50	-	-	75
8	BZOO- SEC-101	Apiculture	SEC	3	0	0	3	3	25	50	-	-	75
9	BXXX- AEC-101	-----	AEC	2	0	0	2	2	15	35	-	-	50
Total							20	23					
Cumulative Credits							20						

Abbreviations: L-Lecture, T-Tutorial, P-Practical, C-Credits, CH-Contact Hours, IA-Internal Assessment, ESE- End Semester Examination

Note:

- XXXX*- Short form of the department whose MDC is offered in the curriculum

Semester-II

S. No.	Course Code	Course Title	Category	L	T	P	C	CH	Theory Assessment		Practical Assessment		Total
									IA	ESE	IA	ESE	
1	BZOOOL-DSC-201 T	Biology of Vertebrates	DSC	3	0	0	3	3	25	50	-	-	75
2	BZOOOL-DSC-201 P	Biology of Vertebrates	DSC	0	0	1	1	2	-	-	5	20	25
3	BBOTA-DSC-201T	Pteridophyta and Gymnosperms	DSC	3	0	0	3	3	25	50	-	-	75
4	BBOTA-DSC-201P	Pteridophyta and Gymnosperms	DSC	0	0	1	1	2	-	-	5	20	25
5	BCHEM-DSC-201T	Organic Chemistry-I	DSC	3	0	0	3	3	25	50	-	-	75
6	BCHEM-DSC-201P	Organic Chemistry-I	DSC	0	0	1	1	2	-	-	-	-	25
7	BXXXX-MDC-201*	-----	MDC	3	-	-	3	3	25	50	-	-	75
8	BZOOOL-SEC-201	Sericulture	SEC	3	-	-	3	3	25	50	-	-	75
9	BXXXX.-VAC-101	Environmental Education	AEC	2	-	-	2	2	15	35	-	-	50
10	BZOOOL-INP-101	-----	INP	0	-	4	4	12	100	-	-	-	100
Total							24	35					
Cumulative Credits							44						

Note:

- Exit option with UG Certificate after securing 44 credits(*with 4 credits of I/A/P/C/ or work-based vocational course offered during winter/summer term), along with entry option to second year or third semester

SEMESTER-I

Syllabus of B.Sc. in Zoology/Life Sciences Programme (DSC)

S. No.	Course Code	Course Title	L	T	P	C	CH	Course Type
1	BZOO- DSC-101 T	Diversity of Invertebrate	3	0	0	3	45	Core
Prerequisite		Students should have a sound understanding of fundamental biological concepts covered up to the +2 level.						

i. Course Objectives:

1. To introduce the general characters and classification of major invertebrate phyla from Protozoa to Echinodermata.
2. To study important biological phenomena such as locomotion, canal system, polymorphism, metamorphosis, torsion, and water vascular system.
3. To understand important biological phenomena and life of different Invertebrates Phyla.

ii. Course Outcomes: On completion of this course, the students are expected to

CO1	Understand the general characters and classification of major invertebrate phyla from Protozoa to Echinodermata.
CO2	Gain basic knowledge of important biological phenomena such as locomotion, canal system, polymorphism, metamorphosis, torsion, and water vascular system.
CO3	Understand the life cycles and pathogenic significance of important parasitic invertebrates.
CO4	Develop an understanding of the diversity, adaptations, and evolutionary significance of invertebrate animals.

iii. Syllabus:

Section	Contents	Contact Hours
1	Protozoa: General characters and classification upto classes, locomotion in Protozoa. Life cycle and pathogenicity of <i>Plasmodium vivax</i> . Porifera: General characters and classification up to classes; Canal System in <i>Sycon</i> . Coelenterata: General characters and classification up to classes; Polymorphism, Corals and Coral Reefs.	13 Hours
2	Platyhelminthes: General characters and classification upto classes; Life history and pathogenicity of <i>Fasciola hepatica</i> and <i>Taenia solium</i> . Aschelminthes: General characters and classification upto classes; Life history and pathogenicity of <i>Ascaris lumbricoides</i>	10 Hours
3	Annelida: General characters and classification up to classes; Type study of	12 Hours

	<i>Pheretima posthuma</i> (Earthworm). Arthropoda: General characters and classification upto orders; Type study: <i>Periplaneta americana</i>, Metamorphosis in Insects.	
4	Mollusca: General characters and classification upto classes; Type study <i>Pila globosa</i>, Torsion and detorsion in Gastropoda. Echinodermata: General characters and classification upto classes; Water-vascular system and instar fish. Larval form of Echinodermata.	10 Hours

iv. Suggested readings:

1. Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W., & Spicer, J.I. (2002). *The Invertebrates: A New Synthesis* (3rd ed.). Blackwell Science.
2. Barrington, E.J.W. (1979). *Invertebrate Structure and Function* (2nd ed.). E.L.B.S. and Nelson.
3. Borradaile, L.A., & Potts, E.A. (1961). *Invertebrates: A Manual for the Use of Students*. Asia Publishing House.
4. Dhami, P.S., & Dhami, J.K. (2014). *Invertebrate Zoology* (5th ed.). R. Chand & Co. ISBN: 81-8045-042-2.
5. Kotpal, R.L. (2019). *Invertebrates* (12th ed.). Rastogi Publications. ISBN: 81-7133-469-5.
6. Ruppert, E.E., & Barnes, R.D. (2006). *Invertebrate Zoology* (8th ed.). Holt Saunders International Edition.

v. Evaluation Pattern:

Components	Internal Assessment	Practical	Semester End Examination
Marks	25	25	50
Total Marks	100		

vi. Components of Internal Evaluation:

S. No.	Type of Assessment	Marks
1	Assignments & Presentations	5 Marks
2	Class Test/House Test	15 Marks
3	Attendance (The marks would be given in the following manner: (75%-79.9%:1Mark;80%-84.9%: 2; 85%-89.9%: 3; 90%-94.9%: 4 and 95%-100%: 5).	5 marks

vii. Instructions for the Paper Setter:

1. Pattern of Class Test/Mid Semester Examination

S. No.	Particulars	Details
1	Maximum Marks	15 Marks
2	Number of Sections	2 (Section A & Section B)
3	Section A and B	Five short-answer questions (1 mark each), all compulsory, and three long-answer questions, of which any two are to be attempted (5 marks each).

2. Pattern of End Semester Examination

Part	Section/Block	Questions Set	Questions to be Attempted	Marks per Question	Marks to be Attempted
A	Section/Block I	2	Any 1	10	10
B	Section/Block II	2	Any 1	10	10
C	Section/Block III	2	Any 1	10	10
D	Section/Block IV	2	Any1	10	10
E	All Sections/Blocks (I, II, III & IV)	7 Short-Answer Compulsory Questions	Any 5	2	10
Total	—	15 Questions	—	—	50 Marks

viii. Pass marks

S. No.	Requirement	Minimum Percentage
1	Pass in each individual component (CCE*, ESE**)	35%
2	Pass in aggregate of the subject	40%

*Continuous and Comprehensive Evaluation **End Semester Examination

PRACTICAL

S. No.	Course Code	Course Title	L	T	P	C	CH	Course Type
2	BZOO- DSC-101 P	Diversity of Invertebrate- Practical	0	0	0	1	30	Core

i. Course Objectives: To develop practical knowledge of invertebrate diversity through the study of specimens, slides and field work.

ii. Course Outcomes: Students will be able to identify major invertebrates, recognize key morphological features, and develop basic observational and reporting skills.

iii. Syllabus:

1. Study of the following specimens:

Spongilla, Scypha, Euplectella, Hydra, Obelia, Physalia, Aurelia, Metridium, Tubipora, Madrepora, Favia, Gorgonia, Fungia, Fasciola, Taenia, Echinococcus, Schistosoma, Ascaris (Male and Female), Ancylostoma (Male and Female), Enterobius, Trichuris, Trichinella, Nereis, Heteronereis, Aphrodite, Chaetopterus, Pheretima, Hirudinaria, Peripatus, Palaemon, Cancer, Limulus, Scolopendra, Julus, Palamnaeus, Lepisma, Schistocerca, Poecilocus, Gryllus, Mantis, Phyllium, Forficula, Butterfly, Moth, Xenopsylla, Periplaneta, Apis, Chiton, Cypraea, Dentalium, Pila, Aplysia, Unio, Helix, Loligo, Sepia, Octopus, Astraea, Pentaceros, Ophiura, Echinus, Cucumaria and Antedon.

2. Study of the following permanent slides:

Amoeba, Entamoeba, Euglena, Noctiluca, Paramecium, Conjugation in Paramecium, Vorticella, Opalina, Nyctotherus, Balantidium, Sycon (T.S. and L.S.), Spongin fibres, Hydra, Obelia, Ephyra Larva of Aurelia, Miracidium, Cercaria larva of fasciola, Scolex of Taenia solium, Mature and Gravid Proglottids of Taenia solium, Hexacanth larva of Taenia solium, T.S. of Ascaris (Male and Female), Parapodium of Nereis, T.S. of pharynx, gizzard and typhlosolar region of Pheretima, Septal nephridia of Pheretima, Daphnia, Nauplius, Mysis and Zoea larva of crustaceans, Glochidium larva of Unio, Radula of Pila, Bipinnaria larva of Asterias.

3. Staining of any two available materials: *Hydra/ Sertularia/ Obelia/ Gemmules of Spongilla.*

iv. Suggested Readings:

1. Lal, S.S. (2008). *Practical Zoology: Invertebrates* (9th ed.). Rastogi Publications, Meerut. ISBN: 81-7133-875-5.
2. Jordan, E. L. and Verma, P. S. (2019). *Invertebrate Zoology* (15th ed.). S. Chand Publishing, New Delhi.

v. Instructions for End Semester Exam:

S. No.	Type of Assessment	Marks
1	Performance	12 Marks
2	Viva-Voce	4 Marks
3	Practical File/Record	4 Marks
4	Internal Assessment	5 Marks
4	Total	25 Marks

SEMESTER-II

Syllabus of B.Sc. in Zoology/Life Sciences Programme (DSC)

S. No.	Course Code	Course Title	L	T	P	C	CH	Course Type
1	BZOO- DSC-201 T	Biology of Vertebrates	3	0	0	3	45	Core
Prerequisite		Students should have a sound understanding of fundamental biological concepts covered up to the +2 level.						

i. Course Objectives:

1. To understand the diversity and classification of chordates from Hemichordates to Mammals.
2. To study the structure, adaptations, and evolutionary significance of representative vertebrates.

ii. Course Outcomes: On completion of this course, the students are expected to

CO1	Classify major chordate groups based on their distinguishing characteristics.
CO2	Describe the morphology of representative vertebrates.
CO3	Explain important adaptations such as migration and flight Mechanism of Vertebrates.
CO4	Understand the evolutionary trends and diversity of chordates.

iii. Syllabus:

Section	Contents	Contact Hours
1	Brief Introduction to Hemichordates, Chordates, Protochordates and Cyclostomes. General characters and classification of Pisces up to classes. Type study: <i>Scoliodon</i> . Migration in Fishes.	12 Hours
2	General characters and classification of Amphibian up to orders; Type study: <i>Rana tigrina</i> . General characters and classification of reptiles up to orders. Type study: <i>Uromastix</i>	11 Hours
3	General characters and classification of Aves up to orders; Type study: <i>Columba</i> . Flight adaptations and migration in birds.	12 Hours
4	General characters and classification of mammals up to orders. Type study: <i>Oryctolagus</i>	10 Hours

iv. Suggested readings:

1. Dhami, P.S., & Dhami, J.K. (1991). *Chordate Zoology*. S. Chand Publishing, New Delhi. ISBN: 9788180450426.
2. Grewal, B., Chakravarty, R. (2017). *A Naturalist's Guide to the Mammals of India*. Prakash Books India Pvt. Ltd.

3. Grewal, B., Sen, S., Singh, S., Devasar, N., & Bhatia, G. (2016). *Birds of India: A Pictorial Field Guide*. Om Books International.
4. Kotpal, R.L. (2011). *Modern Textbook of Zoology: Vertebrates*. Rastogi Publications. ISBN: 81-7133-891-7.
5. Lal, S.S. (2016). *Practical Zoology: Vertebrates* (11th ed.). Rastogi Publications, Meerut. ISBN: 9789350780169.
6. Menon, V. (2014). *Indian Mammals*. Hachette India.
7. Pough, F.H., Janis, C.M., & Heiser, J.B. (2005). *Vertebrate Life* (8th ed.). Pearson International.
8. Young, J.Z. (2004). *The Life of Vertebrates* (3rd ed.). Oxford University Press.

v. Evaluation Pattern:

Components	Internal Assessment	Practical	Semester End Examination
Marks	25	25	50
Total Marks	100		

vi. Components of Internal Evaluation:

S. No.	Type of Assessment	Marks
1	Assignments & Presentations	5 marks
2	Class Test/House Test	15 Marks
3	Attendance (The marks would be given in the following manner: (75%-79.9%:1 Mark; 80%-84.9%: 2; 85%-89.9%: 3; 90%-94.9%: 4 and 95%-100%: 5).	5 marks

vii. Instructions for the Paper Setter:

1. Pattern of Class Test/Mid Semester Examination

S. No.	Particulars	Details
1	Maximum Marks	15 Marks
2	Number of Sections	2 (Section A & Section B)
3	Section A and B	Five short-answer questions (1 mark each), all compulsory, and three long-answer questions, of which any two are to be attempted (5 marks each).

2. Pattern of End Semester Examination

Part	Section/Block	Questions Set	Questions to be Attempted	Marks per Question	Marks to be Attempted
A	Section/Block I	2	Any 1	10	10

B	Section/Block II	2	Any 1	10	10
C	Section/Block III	2	Any 1	10	10
D	Section/Block IV	2	Any1	10	10
E	All Sections/Blocks (I, II, III & IV)	7 Short-Answer Compulsory Questions	Any 5	2	10
Total	—	15 Questions	—	—	50 Marks

viii. Pass marks

S. No.	Requirement	Minimum Percentage
1	Pass in each individual component (CCE, ESE)	35%
2	Pass in aggregate of the subject	40%

PRACTICAL

S. No.	Course Code	Course Title	L	T	P	C	CH	Course Type
2	BZOO- DSC-201 P	Biology of Vertebrates- Practical	0	0	0	1	30	Core

- i. **Course Objectives:** To develop practical skills in the identification and study of diverse chordate groups and their distinguishing characteristics.
- ii. **Course Outcomes:** Students will be able to identify and classify chordate specimens, interpret morphological features, and apply field-based observational skills in vertebrate zoology.

iii. Syllabus:

1. Study of the following specimens:

Balanoglossus, Herdmania, Amphioxus, Petromyzon, Myxine, Scoliodon, Sphyrna, Myliobatis, Trygon, Pristis, Torpedo, Lepisosteus, Onchorynchus, Anguilla, Ophiocephalus, Syngnathus, Labeo, Catla, clarius, Acipenser, Tetradon, Exocoetus, Schizothorax, Eche-neis, Hippocampus, Ichthyophis, Uraeotyphlus, Salamandra, Bufo, Hyla, Rhacophorus, Varanus, Chelone, Hemidactylus, Chamaeleon, Draco, Uromastix, Crotalus, Python, Vipera, Naja, Krait, Hydrophis, Crocodylus, Gavialis, Photographic presentations of 6 different orders of Aves and 6 different orders of Mammals.

2. Study of permanent slides:

Placoid scales in *Scoliodon*, Cycloid scales in *Labeo*, Tadpole larva of *Rana*, VS skin Frog, TS stomach Frog, TS testis frog, TS ovary Frog, VS Eye Pigeon, down feathers in Pigeon, TS gizzard Pigeon, VS skin Rabbit, TS kidney Rabbit, TS testis Rabbit, TS ovary Rabbit, TS bone Rabbit.

3. Skeleton of *Rana*, *Varanus* and *Oryctolagus*.
4. Staining of Placoid, Ctenoid and Cycloid scales of fishes.
5. Study of key for identification of poisonous and non-poisonous snakes.
6. Educational /study tour and submission of report.

iv. Suggested Readings:

1. Lal, S.S.(2016). *Practical Zoology Vertebrate*, XI Edition. Rastogi Publication, Meerut, ISBN 9789350780169.
2. Kotpal R.L.(2011). *Modern Text Book of Zoology. Vertebrates*. Rastogi publication, ISBN No 81-7133-891-7.

v. Instructions for End Semester Exam:

S. No.	Type of Assessment	Marks
1	Performance	12 Marks
2	Viva-Voce	4 Marks
3	Practical File/Record	4 Marks
4	Internal Assessment	5 Marks
5	Total	25 Marks

SEMESTER-I

Syllabus of B.Sc.in Zoology/Life Sciences Programme (SEC-1)

S. No.	Course Code	Course Title	L	T	P	C	CH	Course Type
1	BZOO-SEC-101 T	Apiculture	3	0	0	3	45	Core

i. Course Objectives:

1. To provide knowledge of honey bee biology, beekeeping practices, hive management, and the economic importance of apiculture and its products.

ii. Course Outcomes: On completion of this course, the students are expected to

CO1	Explain the biology, classification, and social organization of honey bees.
CO2	Demonstrate knowledge of apiary management, beehives, and honey extraction techniques.
CO3	Identify common bee diseases, enemies, and their control measures.
CO4	Evaluate the importance, products, challenges, and future prospects of the beekeeping industry.

iii. Syllabus:

Section	Contents	Contact Hours
1	History, Classification and Biology of Honey Bees. Social Organization of Bee Colony. Artificial bee rearing (apiary), beehives – Newton and Langstroth Bee pasturage Selection of bee species for apiculture	17 Hours
2	Bee keeping equipment Methods of extraction of honey (indigenous and modern). Bee diseases and enemies, Control and preventive measures.	10 Hours
3	Products of apiculture industry and its uses (honey, bees wax, propolis), pollen etc. Bee Keeping Industry–recent efforts, modern methods in employing artificial Beehives for cross pollination in horticultural gardens. Bee keeping industry: challenges & perspectives.	18 Hours

iv. Suggested readings:

1. Bisht, D.S. *Apiculture*. ICAR Publication.
2. Kumar, R., Hajam, Y.A., & Agrawal, O.P. *Honey: A Miraculous Product of Nature*. CRC Press.
3. Mishra, R.C. *Perspectives in Indian Apiculture*. Agro-Bios Publications.
4. Prost, P.J. (1962). *Apiculture*. Oxford and IBH Publishing Co., New Delhi.
5. Singh, S. (1982). *Beekeeping in India*. Indian Council of Agricultural Research (ICAR), New Delhi.

v. Evaluation Pattern:

Components	Internal Assessment	Semester End Examination
Marks	25	50
Total Marks	75	

vi. Components of Internal Evaluation:

S. No.	Type of Assessment	Marks
1	Assignments & Presentations	5 marks
2	Class Test/House Test	15 Marks
3	Attendance (The marks would be given in the following manner: (75%-79.9%: 1Mark; 80%-84.9%: 2; 85%-89.9%: 3; 90%-94.9%: 4 and 95%-100%: 5).	5 marks

vii. Instructions for the Paper Setter:**1. Pattern of ClassTest/ Mid Semester Examination**

S. No.	Particulars	Details
1	Maximum Marks	15 Marks
2	Number of Sections	2 (Section A & Section B)
3	Section A and B	Five short-answer questions (1 mark each), all compulsory, and three long-answer questions, of which any two are to be attempted (5 marks each).

2. Pattern of End Semester Examination

Part	Section/Block	Questions Set	Questions to be Attempted	Marks per Question	Marks to be Attempted
A	Section/Block I	2	Any 1	12	12
B	Section/Block II	2	Any 1	12	12
C	Section/Block III	2	Any 1	12	12
D	All Sections/Blocks (I, II & III)	10 Short-Answer Questions	Any 7	2	14
Total	—	16 Questions	—	—	50 Marks

viii. Pass marks

S. No.	Requirement	Minimum Percentage
1	Pass in each individual component (CCE, ESE)	35%
2	Pass in aggregate of the subject	40%

SEMESTER-II

Syllabus of B.Sc. in Zoology/Life Sciences Programme (SEC-2)

S. No.	Course Code	Course Title	L	T	P	C	CH	Course Type
1	BZOO-SEC-201 T	Sericulture	3	0	0	3	45	Core

i. Course Objectives:

1. To provide fundamental knowledge of silkworm biology, mulberry cultivation, silkworm rearing, and the economic importance of sericulture.

ii. Course Outcomes: On completion of this course, the students are expected to

CO1	Explain the biology, classification, and life cycle of silkworms and the process of silk production.
CO2	Demonstrate knowledge of mulberry cultivation, silkworm rearing, cocoon harvesting, and processing techniques.
CO3	Identify major pests and diseases of silkworms and describe their management strategies.
CO4	Evaluate the scope, employment opportunities, and socio-economic significance of sericulture in India.

iii. Syllabus:

Section	Contents	Contact Hours
1	Introduction to Sericulture: Origin, history and economic importance of sericulture; The Silk Road; Classification and distribution of silkworms; Food plants of silkworms; Indigenous and exotic races; Mulberry and non-mulberry sericulture; Life cycle of <i>Bombyx mori</i> ; Silk gland structure and silk production.	15 Hours
2	Mulberry Cultivation and Silkworm Rearing: Selection of suitable mulberry varieties and establishment of mulberry plantations; Rearing house design and essential rearing appliances; Disinfection methods and commonly used disinfectants (Formalin, Bleaching Powder, and RKO); Silkworm rearing techniques for early-age and late-age larvae; Types of mountages and cocoon spinning; Harvesting, processing, and storage of cocoons.	17 Hours
3	Pests, Diseases and Scope of Sericulture: Major pests of silkworms (Uzi fly, dermestid beetles, and vertebrate pests); Silkworm diseases of protozoan, viral, fungal, and bacterial origin; Pest and disease management strategies; Sericulture in India—status, distribution, employment opportunities, and prospects of mulberry and non-mulberry sericulture; Role of women in the sericulture sector.	18 Hours

iv. Suggested readings:

1. Fuzi Publishing Co. Ltd. (1972). *Handbook of Silkworm Rearing: Agriculture and Technical Manual-1*. Tokyo, Japan.

2. Jolly, M.S. (Ed.). *Appropriate Sericultural Techniques*. Central Sericultural Research and Training Institute (CSR&TI), Mysore.
3. Narasimhanna, M.N. (1988). *Manual of Silkworm Egg Production*. Central Silk Board (CSB), Bangalore.
4. Sengupta, K. (1989). *A Guide for Bivoltine Sericulture*. Central Sericultural Research and Training Institute (CSR&TI), Mysore.
5. Ullal, S.R. and Narasimhanna, M.N. *Handbook of Practical Sericulture*. Central Silk Board (CSB), Bangalore.
6. Wupang-Chun and Chen Da-Chung (1988). *Silkworm Rearing*. Food and Agriculture Organization (FAO), Rome.

v. Evaluation Pattern:

Components	Internal Assessment	Semester End Examination
Marks	25	50
Total Marks	75	

vi. Components of Internal Evaluation:

S. No.	Type of Assessment	Marks
1	Assignments & Presentations	5 marks
2	Class Test/House Test	15 Marks
3	Attendance (The marks would be given in the following manner: (75%-79.9%: 1 Mark; 80%-84.9%: 2; 85%-89.9%: 3; 90%-94.9%: 4 and 95%-100%: 5).	5 marks

vii. Instructions for the Paper Setter:

1. Pattern of Class Test/Mid Semester Examination

S. No.	Particulars	Details
1	Maximum Marks	15 Marks
2	Number of Sections	2 (Section A & Section B)
3	Section A and B	Five short-answer questions (1 mark each), all compulsory, and three long-answer questions, of which any two are to be attempted (5 marks each).

2. Pattern of End Semester Examination

Part	Section/Block	Questions Set	Questions to be Attempted	Marks per Question	Marks to be Attempted
A	Section/Block I	2	Any 1	12	12
B	Section/Block II	2	Any 1	12	12
C	Section/Block	2	Any 1	12	12

	III				
D	All Sections/Blocks (I, II & III)	10 Short- Answer Questions	Any 7	2	14
Total	—	16 Questions	—	—	50 Marks

viii. Pass marks

S. No.	Requirement	Minimum Percentage
1	Pass in each individual component (CCE, ESE)	35%
2	Pass in aggregate of the subject	40%

SEMESTER-I

Syllabus of B.Sc.in Zoology/Life Sciences Programme (MDC-1)

S. No.	Course Code	Course Title	L	T	P	C	CH	Course Type
1	BZOOI-MDC-101 T	Fundamentals of Economic Zoology	3	0	0	3	45	Core

i. Course Objectives:

1. To provide fundamental knowledge of integrated pest management and sustainable pest control strategies.
2. To develop an understanding of apiculture, sericulture, animal husbandry, and poultry farming as important components of agricultural and rural development.

ii. Course Outcomes: On completion of this course, the students are expected to

CO1	Explain the principles and methods of integrated pest management, including the role of biological agents.
CO2	Describe the biology, management, products, and economic importance of apiculture and sericulture.
CO3	Demonstrate knowledge of livestock breeding, artificial insemination, and scientific animal husbandry practices.
CO4	Understand the principles of poultry breeding, broiler management, and egg production, processing, and marketing.

iii. Syllabus:

Section	Contents	Contact Hours
1	Integrated Pest Management: Concept and principles of Integrated Pest Management (IPM); Pest control methods—cultural, physical, mechanical, chemical, biological, botanical (herbal), and legal approaches; Role of pheromones and other semiochemicals in pest monitoring and management.	15 Hours
2	Apiculture: Diversity of honeybee species in India; Life cycle and social organization of honeybees; Bee products and their economic importance; Major bee pests, predators, and diseases. Sericulture: Introduction and scope of sericulture; Types of silk and economically important silkworms; Silkworm species and their host plants; Basic practices in silk production.	15 Hours
3	Animal Husbandry: Principles of cattle breeding; Preservation and storage of semen; Artificial insemination and its significance in livestock improvement. Poultry Farming: Principles of poultry breeding and selection; Management of breeding stock and broilers; Egg production, processing, preservation, and marketing.	15 Hours

iv. Suggested readings:

- Atwal, A.S. *Agricultural Pests of India and South-East Asia*. Kalyani Publishers.
- Denis, H. *Agricultural Entomology*. Timber Press.
- Hafez, E.S.E. *Reproduction in Farm Animals*. Lea &Febiger Publishers.
- Mishra, R.C. *Perspectives in Indian Apiculture*. Agro-Bios Publications.
- Ullal, S.R. and Narasimhanna, M.N. *Handbook of Practical Sericulture*. Central Silk Board (CSB), Bangalore.

v. Evaluation Pattern:

Components	Internal Assessment	Semester End Examination
Marks	25	50
Total Marks	75	

vi. Components of Internal Evaluation:

S. No.	Type of Assessment	Marks
1	Assignments & Presentations	5 Marks
2	Class Test/House Test	15 Marks
3	Attendance (The marks would be given in the following manner: (75%-79.9%:1 Mark; 80%-84.9%: 2; 85%-89.9%: 3; 90%-94.9%: 4 and 95%-100%: 5).	5 marks

vii. Instructions for the Paper Setter:**1. Pattern of Mid Semester Examination**

S. No.	Particulars	Details
1	Maximum Marks	15 Marks
2	Number of Sections	2 (Section A & Section B)
3	Section A and B	Five short-answer questions (1 mark each), all compulsory, and three long-answer questions, of which any two are to be attempted (5 marks each).

2. Pattern of End Semester Examination

Part	Section/Block	Questions Set	Questions to be Attempted	Marks per Question	Marks to be Attempted
A	Section/Block I	2	Any 1	12	12
B	Section/Block II	2	Any 1	12	12
C	Section/Block III	2	Any 1	12	12
D	All Sections/Blocks (I, II & III)	10 Short-Answer Questions	Any 7	2	14
Total	—	16 Questions	—	—	50 Marks

viii. Pass marks

S. No.	Requirement	Minimum Percentage
1	Pass in each individual component (CCE, ESE)	35%
2	Pass in aggregate of the subject	40%

SEMESTER-II

Syllabus of B.Sc. in Zoology/ Life Sciences Programme (MDC-2)

S. No.	Course Code	Course Title	L	T	P	C	CH	Course Type
1	BZOOI-MDC-201 T	Wildlife of Himachal Pradesh	3	0	0	3	45	Core

i. Course Objectives:

1. To provide knowledge of the wildlife diversity, ecological significance, and faunal wealth of Himachal Pradesh.
2. To develop an understanding of wildlife conservation, protected area management, and sustainable approaches to human–wildlife coexistence.

ii. Course Outcomes: On completion of this course, the students are expected to

CO1	Describe the biodiversity, wildlife distribution, and flagship fauna of Himachal Pradesh.
CO2	Explain the role of protected areas and Ramsar sites in wildlife conservation.
CO3	Analyze major threats to wildlife and evaluate strategies for biodiversity conservation.
CO4	Assess human–wildlife interactions and the importance of ecotourism in sustainable development and conservation.

iii. Syllabus:

Section	Contents	Contact Hours
1	Wildlife Diversity of Himachal Pradesh: Geographical features, climate, and biodiversity of Himachal Pradesh; Diversity and distribution of wildlife; Species accounts of flagship fauna with special reference to the Snow Leopard, Himalayan Monal, and Western Tragopan	15 Hours
2	Protected Areas and Wildlife Conservation: Protected area network of Himachal Pradesh—National Parks, Wildlife Sanctuaries, and Conservation Reserves; Major threats to wildlife including habitat loss, pollution, poaching, and other anthropogenic pressures; Ramsar Sites of Himachal Pradesh—concept, location, ecological importance, and conservation significance.	15 Hours
3	Human–Wildlife Interactions and Sustainable Development: Human–wildlife conflict: causes, consequences, and mitigation measures; Ecotourism and wildlife conservation—concept, economic importance, challenges, and sustainable practices for responsible wildlife tourism and biodiversity conservation.	15 Hours

iv. Suggested readings:

- Ali, S. and Ripley, S.D. (1983). *A Pictorial Guide to the Birds of the Indian Subcontinent*. Bombay Natural History Society and Oxford University Press, New Delhi.
- Besten, J.W. (2004). *Birds of Kangra*. Moon Peak Publishers, Dharamshala and Mosaic Books, New Delhi.

- Daniel, J.C. (2002). *The Book of Indian Reptiles*. Bombay Natural History Society, Mumbai.
- Fauna of Himachal Pradesh (2021). *State Fauna Series, Volume 26 (Parts I & II)*. Zoological Survey of India, Kolkata.
- Julka, J.M., Paliwal, R. and Mehta, H.S. (1999). *Mammals of Himachal Pradesh*. Zoological Survey of India, Solan.
- Negi, S.S. (1992). *Himalayan Wildlife: Habitat and Conservation*. Indus Publishing Company, New Delhi.
- Prater, S.H. (1980). *The Book of Indian Animals* (3rd ed.). Bombay Natural History Society and Oxford University Press, Mumbai.)

v. Evaluation Pattern:

Components	Internal Assessment	Semester End Examination
Marks	25	50
Total Marks	75	

vi. Components of Internal Evaluation:

S. No.	Type of Assessment	Marks
1	Assignments & Presentations	5Marks
2	Class Test/House Test	15 Marks
3	Attendance (The marks would be given in the following manner: (75%-79.9%:1 Mark; 80%-84.9%: 2; 85%-89.9%: 3; 90%-94.9%: 4 and 95%-100%: 5).	5 marks

vii. Instructions for the Paper Setter:

1. Pattern of Class Test/Mid Semester Examination

S. No.	Particulars	Details
1	Maximum Marks	15 Marks
2	Number of Sections	2 (Section A & Section B)
3	Section A and B	Five short-answer questions (1 mark each), all compulsory, and three long-answer questions, of which any two are to be attempted (5 marks each).

2. Pattern of End Semester Examination

Part	Section/Block	Questions Set	Questions to be Attempted	Marks per Question	Marks to be Attempted
A	Section/Block I	2	Any 1	12	12
B	Section/Block II	2	Any 1	12	12
C	Section/Block III	2	Any 1	12	12
D	All Sections/Blocks (I, II & III)	10 Short-Answer Questions	Any 7	2	14
Total	—	16 Questions	—	—	50 Marks

viii. Pass marks

S. No.	Requirement	Minimum Percentage
1	Pass in each individual component (CCE, ESE)	35%
2	Pass in aggregate of the subject	40%