

SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI



THREE YEAR UNDERGRADUATE PROGRAMME

B.Sc. ZOOLOGY (NEP)

LEVEL – 5.5 (SEMESTER V & VI)

FACULTY: SCIENCE AND TECHNOLOGY

(Courses effective from Academic Year 2026-27)

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THREE YEAR UNDERGRADUATE PROGRAMME
B.Sc. ZOOLOGY under FACULTY: SCIENCE AND TECHNOLOGY
Board of Studies in Zoology (Including Apiculture)

Dhote Dr. Jayashree Dipak (Chairman) Shri Shivaji Science College Amravati.	Gadhikar Dr. Yashashri A. G.V.I.S.H. Amravati
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Sant Gadge Baba Amravati University, Amravati
Structure of 3 / 4 Year under Graduate Degree Program in Zoology Discipline
In the faculty of Science & Technology (Science Group) applicable to
Non-autonomous affiliated colleges.

Credit Distribution over Six Verticals for Zoology Discipline.

Vertical	Vertical Type	Semester								Total Credits	Grand Total
		I	II		III	IV	V	VI			
	(i) Three-year UG Degree Programme (Level 4.5.to 5.5)										
a	Major - Zoology (DSC) 60-64 (Minimum 50% of Total Credits)	2+2 (4)	2+2 (4)	Major Mandatory	4+2 (6)	6+2 (8)	6+2 (8)	6+2 (8)	26+12 (38)	48	
				IKS (Subject Specific)	2	0	0	0	2		
				Elective	0	0	2+2 (4)	2+2 (4)	4+4 (8)		
b	Minor - Zoology (from same faculty of DSC) 18-20	2+2 (4)	2+2 (4)	Minor	2+2 (4)	2+2 (4)	2+2 (4)	2+2 (4)	12+12 (24)	24	
c	Generic/ Open Elective Courses (OE) (faculty wise Basket Other than faculty of Major/Minor Subject) 10-12	4	4		2	2	0	0	12	12	
d	(i)Vocational Skill Courses (VSEC) corresponding to Major - Zoology (Skill based/ Advance Practicals wherever applicable) 8-10	0	2		2	2	2	2	10	16	
	(ii) Skill Enhancement Courses SEC (Basket of skill courses approved by the University) 6	2	2		0	0	2	0	6		
e	(i)Ability Enhancement Courses (AEC)- Focus: Linguistic & Communication Skills (Eng.+ Modern Indian Language) 8	2	2		2	2	0	0	8	14	
	(ii)Indian Knowledge System (IKS)2 (Generic)	2	0		0	0	0	0	2		
	(iii)Value Education Courses (VEC) Understanding India, EVS, Digital & Technological Solution. 4	2	2		0	0	0	0	4		
f	(i) Internships/ Apprenticeship corresponding to Major - Zoology OJT	0	0		0	0	0	4	4	18	
	(ii)Field Projects/Community Engagement & Service(CEP) corresponding to Major -Zoology 4-6	0	0		2	2	2	0	6		
	(iii) Co-curricular courses (CC) (health & wellness, yoga education, sports, fitness, cultural activities, NSS/NCC & Fine/ Applied/ Visual/ Performing Arts 8	2	2		2	2	0	0	8		
Total Credits		22	22		22	22	22	22	132	132	
(ii) Four-year UG Degree programme (Level 6.0) A. Honors Degree in Major or Minor											
Vertical Type		Semester VII				Semester VIII					
Major (Offered at Three yearUG Programme)	Mandatory	12-14 (2*4+2*2 or 3*4+2)				12-14 (2*4+2*2 or 3*4+2)				28	
	Elective	4				4				8	
Research Methodology (RM)		4				0				4	
On the Job Training (OJT)		0				4				4	
Total		22				22				44	
Cumulative		(132+44) 176									
(ii) Four-year UG Degree Programme (Level 6.0) B. Honors with Research Degree in Major or Minor											
Vertical Type		Semester VII				Semester VIII					
Major (Offered at Three yearUG Programme)	Mandatory	8-10 (2*4+2 or 2*4)				8-10 (2*4+2 or 2*4)				20	
	Elective	4				4				8	
Research Methodology (RM)		4				0				4	
Research Project (RP)		4				8				12	
Total		22				22				44	
Cumulative		(132+44) 176									

Note:

- a. The strength of the batch of the Practical for UG Classes shall be 16 with an addition of 10% with the permission of Hon'ble Vice Chancellor. However, for Music Discipline the batch size shall be of 7 students. The number of the students required to constitute a batch or calculate the workload shall be in accordance with the relevant Government Resolution in force at the time, applicable to specific time, region, course type, mode of instruction, and other pertinent factors.
- b. 1 Credit shall mean 1 Hour Teaching per Week per Semester (Total 15 Hrs/ Semester), the duration of 1 Teaching Period will be 60 Minutes. For Practical 1 Credit shall mean 2 Hour Teaching per Week per Semester (Total 30 Hrs/ Semester).
- c. For Examination and Evaluation of Theory Courses, 40 % Marks shall be assigned to Internal Examination and 60% Marks shall be assigned to end-semester external university examination.
- d. Co-curricular Courses: Health and wellness, Yoga Education, Sports and Fitness, Cultural Activities, NSS/NCC, Fine/Applied/Visual/Performing Arts During Semester I, II, III, IV, V and VI. These courses may be taught by Physical Education Director or may be assigned to Language Teacher by the Principal of HEI based on the expertise of the concerned.
- e. Value Education Courses to be selected from the Basket of Courses provided by the University. These courses may be assigned to the Language Teacher by the Principal of HEI based on the expertise of the concerned.
- f. Generic / Open Elective Courses (GE/OE): Courses to be selected from the Basket of Courses provided by the University
- g. Abbreviations: Department Specific Core: DSC, Department Specific Elective: DSE, FSC: Faculty Specific Core, FSE: Faculty Specific Elective, Indian Knowledge System: IKS, Inter Faculty Specific Core: IFSC, Inter Faculty Specific Elective: IFSE, Theory : Th, Practical/Practicum: Pr, Environment Studies: ES, Pre-requisite Course mandatory if applicable: Prq, Laboratory: Lab (Practical), Generic/ Open Electives: OE; Vocational Skill and Skill Enhancement Courses: VSEC; Vocational Skill Courses: VSC; Skill Enhancement Courses: SEC; Ability Enhancement Courses: AEC; Value Education Courses: VEC; OJT: On Job Training; Internship/ Apprenticeship; Field projects: FP; Community Engagement and Service: CES; Co-curricular Courses: CC; RM: Research Methodology; Research Project: RP; MIL: Modern Indian Language

Examination and Assessment Process:

- i. The basic principle of the Credit framework is that Credits are a function of the successful completion of a program of study/ vocational education/ training and assessment. No Credit can be earned by the student unless the student is assessed for the achievement of the desired competencies and outcome of a program.
- ii. Exit options are provided with Certificate, Diploma and Basic Bachelor's degrees to the students at the end of the second, fourth and sixth semesters of a Four Years Multidisciplinary Degree Programme. Students will receive a Bachelor's degree with Honors/ Research on successfully completing of all eight semesters of the UG Program either at a stretch or with opted exits and re-entries.
- iii. For the smooth success of four-year degree programme with multiple entry and exit systems, the examination mode should be based on the combination of innovative trends in formative (informal and formal tests administered during the learning process) and summative (evaluation of students learning at the end of an instructional unit) examination modes in line with the UGC Report on 'Evaluation Reforms in Higher Educational Institutions (2019).

Examination, Evaluation and Assessment Scheme

The total marks for each Course shall be based on Continuous Assessment and Semester End Examination.

Each theory course of Major, Minor, GE/OE, AEC, IKS, VEC as mentioned in Teaching Learning Scheme prepared by the Board of Studies shall be evaluated as per the scheme as mentioned in the following table –

Vertical No.	The Vertical	Mode of Examination, Evaluation & Assessment	Theory				Theory (Total)		Practical				Practical (Total)	
			External		Internal				External		Internal			
			Max. Marks	Min. Marks	Max. Marks	Min. Marks	Max. Marks	Min. Marks	Max. Marks	Min. Marks	Max. Marks	Min. Marks	Max. Marks	Min. Marks
a	Major	External & Internal	30	9	20	6	50	20	25	10	25	10	50	20
	Elective (Major)		30	9	20	6	50	20	25	10	25	10	50	20
b	Minor		30	9	20	6	50	20	25	10	25	10	50	20
d	VSC/VSE (Major)	Internal	--	--	50	20	-	-	--	--	50	20	50	20
f	Internship/ Apprenticeship /OJT	Internal	Assessment of these verticals shall be based on various activities/practices. It shall be evaluated by giving maximum marks of 50 per 2 Credit Course with separate activity weightages/levels. A detailed SOP for this assessment process shall be prescribed separately.											
	FP/CEP													

Continuous Assessment Tests (CAT)

For internal assessment, the Continuous Assessment Tests (CAT) shall be conducted as under-

- Three CAT each of 8 / 10 Marks (Theory) as applicable and 10 Marks (Practical).
 - First on completion of 25% Syllabus of the course or on completion of 25 teaching days,
 - Second on completion of 50% Syllabus of the course or on completion of 50 teaching days,
 - Third on completion of 75% Syllabus of the course or on completion of 75 teaching days.
- Each concurrent assessment (CAT-I, II & III) will be mapped to relevant Course Learning Outcome.
- Total Performance in CAT (i.e. 40 %) shall be based on the best two out of three in CAT examinations
- Internal assessment shall be carried out by the respective course teacher by choosing variety of assessment tools/methods such as class test, record book, seminar, case study, field work, mini project work, quiz or any innovative method, which may be deemed to be appropriate for assessing the relevant course outcome.

Conduction of the Examination:

As per the scheme of teaching, learning, examination and evaluation, theory/practical examinations of Semester-I, II, III, IV, V, VI, VII and VIII shall be conducted by the University (except for Internal Examinations as applicable) at the end of each semester.

The theory/practical examinations of all the Semesters shall be held as per the following Schedule –

Sr. No.	Name of the Examination	End Sem Examination	Supplementary Examination*
1	Semester-I, III, V and VII	Winter	Summer
2	Semester-II, IV, VI and VIII	Summer	Winter

- * The University may evolve mechanism for conducting repeat end semester examination. Such repeat examinations shall have to be conducted within one month of the regular even semester examination and on demand examination.
- The practical examination of all semesters shall be conducted by the University at the end of each semester. The HEI shall conduct the Practical examination of odd semesters as per the schedule announced by the University. However, the appointment of the External and Internal Examiners shall be done by the Head or Principal of respective HEI to conduct external examination of the odd semester and the same should be communicated to the University before commencement of the practical examination. The University shall conduct the external practical examination of all even semester by appointing external and internal examiners.
 - The examinations specified above shall be held twice in a year at such places and on such dates as may be prescribed by the University.
 - An applicant to an examination specified above, shall pursue a regular course of study in courses prescribed for the examination concerned for not less than one semester in a particular semester in a College/Institute/University department.
 - Provided that the student shall be eligible to appear for examination if -
 - He/she complies with the provisions of the Ordinance pertaining to the Examination in general from time to time.
 - He/she has prosecuted a regular course of study in a university department/college affiliated to the University.
 - He/she has in the opinion of the Principal shown satisfactory progress in his/her studies.
 - The provisions of Ordinance No. 6 and Ordinance No. 9 shall be mutatis-mutandis applicable to every collegiate/non-collegiate student.
 - The fees for each theory examination and practical examination conducted by the university shall be as prescribed by the University, from time to time.

Additional Instructions to the Paper Setters BSc Zoology as per Scheme under NEP 2020

1. The duration of University theory examination shall be of Two hours or appropriate hours as prescribed in the syllabus/curriculum of the pertinent course
2. The Maximum Marks for the Question Paper shall be 30
3. The Question Paper shall consist of Short Answer type (60%) and Long Answer type (40%) questions.
4. Examiner shall set Long answer type Questions and Short Answer type Questions as specified in the following Table or as applicable as per the curriculum.
5. There shall be internal choice for Short-Answer type Question and Long Answer type Question for every Unit.
6. The Question paper should be set based on the Course Outcomes (COs) defined in the curriculum and setter shall ensure that all the outcomes are addressed through appropriate questions. Read and study the Course Outcomes of a paper/subject/course very carefully.
7. The Questions should help to measure attainment of their corresponding Course Outcomes as prescribed in the syllabus/curriculum. All questions must be mapped to their related Course Outcomes.
8. Questions paper should try to address the different levels of learning (Bloom's Taxonomy)
i.e. Knowledge/Remembering, Understanding, Applying, Analysing, Evaluating and Creating
9. All Units mentioned in the course should be covered with equal weightage. The question paper shall be set so as to cover the entire syllabus of the respective course (paper).
10. The degree of difficulty of the question paper should be such that a student, who has engaged himself in the continuous learning process should be able to clear with ease. However, for scoring further his all-round knowledge and skills should be tested.
11. Model Solutions/answers to the short answer type questions and long answer type questions and scheme of marking for all question shall be submitted along with the question paper in a separate envelope.
12. Please ensure that the total marks for a course/subject/paper amounts to the prescribed total as notified in the scheme/curriculum. The total number of marks available for each question and each part of a question should be shown in the mark scheme and must tally with the marks shown on the question paper.
13. Avoid Questions like "Write short notes on ..."
14. The question paper should be precise and should be designed such that the questions:
 - a) are unambiguous
 - b) are asked for appropriate marks
 - c) The questions should be serially numbered as 01, 02, 03, 04, 05, 06 etc.
 - d) Sub-questions, if any, shall be numbered as A,B,C,D,... continuously for all Units
 - e) It must be ensured that all questions are from within the prescribed syllabus
 - f) The paper setters should specify whether any Charts, Graphs, Tables, Codes, Books etc. are to be provided to the students. The use of which shall be permitted during the actual conduct of the examination.
15. For Short-Answer type Questions, ensure that:
 - The item calls for a single, brief answer
 - The item has been written as a direct question

- The desired response is related to the main point of the item
- Clues to the answer have been avoided (e.g. “a” or “an”, length of the blank)
- The units and degree of precision is indicated for numerical answers.

16. For Long Answer type questions, make sure that:

- Questions starting questions with “who”, “what”, “when”, “where”, “name”, “list” are avoided as these terms limit the response.
- Questions must follow Bloom’s taxonomy with inclusion of following levels:

Distribution of Marks amongst Question paper

Total marks of Theory Paper	Marks for Long + Short Answer	Distribution of Unit wise Long/Short Answer type Questions
30	12 + 18	1. Compulsory Question: Two One Sentence Questions Based on All Four Units, Total Eight Questions carrying 01 Mark Each out of with Compulsory 6 Questions to solve. 2. Questions with Internal Choice of All Four Units: a. Long Answer: on any Two Units Long Questions of Maximum Marks 6 with internal Choice on any Two Units as per the choice of Paper setter. b. Short Answer: on any Two Units Short Questions of Maximum 3 Marks with Internal Choice on any Two Units as per the choice of Paper setter.
		Q1: 6 Marks Based on All Units (Two Questions on Each Unit) Q2: 6 Marks Unit I Q3: 6 Marks Unit II Q4: 6 Marks Unit III Q5: 6 Marks Unit IV

Note: For a unit, an identical pattern of long and short answer shall be adhered for internal choice, that is ‘either-or’ questions shall be in same pattern.

Table 3: Model Question Paper Pattern

Sr. No of Questions	Questions	Marks allotted to each Question
B.Sc. (Zoology) Semester Examination NEP -2020 Paper Title As per Curriculum Time: Two Hours Total marks: 30 N.B.: 1. Question No 1 is compulsory 2. Draw well labelled diagrams whenever necessary. 3. Students may use various colors to signify answers.		
Q1:	Write answer in One Sentence: (Solve any Six) [Set two questions on each unit (out of total Four units). Students should solve any six questions out of eight and each question carry one mark] i. ----- ii. ----- iii. ----- iv. ----- v. ----- vi. ----- vii. ----- viii. -----	Max. Marks (1x6) = 06
Q 2:	Answer in short (Any Two of the Following) [Paper Setter shall set Four Questions on Unit decided for Short Type Questions carrying 3 Marks Each. Students should solve any Two Questions out of Four] a) ----- b) ----- c) ----- d) -----	06 Marks (3x2)= 06
Q 3:	Explain in detail (Any One of the following) [Paper Setter shall set Two Questions on Unit decided for Long Type Questions carrying 6 Marks Each. Students should solve any One Questions out of Two] e) ----- f) -----	6 Marks (6x1) = 06
Q 4:	Answer in short (Any Two of the Following) [Paper Setter shall set Four Questions on Unit decided for Short Type Questions carrying 3 Marks Each. Students should solve any Two Questions out of Four] g) ----- h) ----- i) ----- j) -----	06 Marks (3x2)= 06
Q 5:	Explain in detail (Any One of the following) [Paper Setter shall set Two Questions on Unit decided for Long Type Questions carrying 6 Marks Each. Students should solve any One Questions out of Two] k) ----- l) -----	6 Marks (6x1) = 06

Faculty: Science & Technology (Science Group)
(Teaching and Learning Scheme: B.Sc. - Zoology with Minor -----)
(Three Years- Six Semesters Bachelors Degree Programme)
THIRD YEAR: SEMESTER – V

Mode of Teaching	Vertical Number	The Vertical	Type of Course	Course Code	Course Name	Credits	Workload (Hrs/Week)	Vertical Workload (Hrs/Week)
Classroom Teaching / Lab Work (Practical)/ Outdoor / Field	a.	Major (Zoology)	Theory 8	133231	Human Physiology	2	2	16
			Theory 9	133232	Evolution and Animal Adaptations	2	2	
			Theory 10	133233	Applied Animal Biotechnology	2	2	
			Lab/Practical 15	133234	Practical based on Theory 8 to 10	2	4	
		Major (Zoology) Elective (Select any one)	Elective Theory 1	133235	Basics of Entomology	2	2	
			Elective Lab/Practical 16	133236	Practical based on Elective Theory Basics of Entomology	2	4	
			Elective Theory 1	133237	Fisheries & Aquatic Resource Management	2	2	
			Elective Lab/Practical 16	133238	Practical based on Elective Theory Fisheries & Aquatic Resource Management	2	4	
	b.	Minor (Other subject in combination with Zoology)	Theory 5	133239	Forest Ecology & Wildlife Management	2	2	6
			Lab/Practical 17	133240	Practical based on Theory 5	2	4	
	d.	VSC (Related to Major)	Lab/Practical 18	133241	Practical based On Medical laboratory Techniques	2	4	4
		SEC (Skilled Base Related to Major)	Lab/Practical 19	133242	Practical based on Sericulture	2	4	4
	f.	FP/CES	Project	133243	Field Project Phase III	2	4	4
		AI	Theory	-	Foundation of Artificial Intelligence	Grading	2	2
		TOTAL				22	36	36

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Marks
5.5	V	133231	Human Physiology	2	30	2 Hrs	30
Course Objectives:		After this course, students will be able to - To impart knowledge of structure and functions of human physiological systems. - To understand the physiology of blood and circulatory system in maintaining homeostasis. - To explain mechanisms of respiration, digestion, excretion, and neural coordination. - To study muscle physiology and sensory mechanisms in humans. - To develop conceptual understanding of integration of organ systems.					
Course Outcome:		After successful completion of this course, the students will be able to. - Describe composition, functions of blood, haemoglobin, blood groups, and coagulation process. - Explain structure and functioning of heart along with cardiac cycle, blood pressure, pulse, and ECG. - Illustrate physiological processes of respiration, gas transport, digestion, and absorption. - Explain structure and functions of kidney, neuron, brain, and mechanisms of urine formation and nerve impulse transmission. - Describe muscle contraction mechanism and physiology of eye and ear. - Apply physiological concepts to understand maintenance of human homeostasis and body coordination.					
Unit		Contents				Workload Allotted	Weightage of Marks Allotted
Unit I		Blood and Circulatory System 1.1 Composition, properties and functions of blood 1.2 Haemoglobin, anemia, blood groups and blood coagulation 1.3 Structure and working mechanism of human heart 1.4 Cardiac cycle, pulse, blood pressure and electrocardiogram (ECG)				8 Hrs	8 Marks
Unit II		Respiratory and Digestive Physiology 2.1 Structure of respiratory organs and mechanism of respiration 2.2 Transport of O ₂ and CO ₂ 2.3 Structure of digestive system and digestive glands 2.4 Physiology of digestion and absorption				7 Hrs	7 Marks
Unit III		Excretory and Nervous System 3.1 Structure of kidney and nephron 3.2 Physiology of urine formation and osmoregulation 3.3 Structure of neuron and nerve impulse transmission 3.4 Autonomic Nervous System and Neurotransmitters				8 Hrs	8 Marks
Unit IV		Muscle Physiology and Sense Organs 4.1 Types of muscles and structure of skeletal muscle 4.2 Mechanism of muscle contraction (Sliding filament theory) 4.3 Structure and physiology of human eye 4.4 Structure and physiology of human ear				7 Hrs	7 Marks
References:		1. Guyton, A.C. & Hall, J.E. (2021). <i>Textbook of Medical Physiology</i> . Elsevier. 2. Tortora, G.J. & Derrickson, B. (2017). <i>Principles of Anatomy and Physiology</i> . Wiley. 3. Ganong, W.F. (2019). <i>Review of Medical Physiology</i> . McGraw-Hill. 4. Sherman, S.I. (2018). <i>Human Physiology</i> . Pearson.					

5. Vander, A.J., Sherman, J.H. & Luciano, D.S. (2016). *Vander's Human Physiology*. McGraw-Hill.
6. Guyton, A.C. (Latest edition). *Medical Physiology*. Elsevier.
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9. Widmaier, E.P., Raff, H. & Strang, K.T. (2019). *Vander's Human Physiology*. McGraw-Hill.
10. Berne, R.M. & Levy, M.N. (2018). *Physiology*. Elsevier.
11. Ross & Wilson (2014). *Anatomy and Physiology in Health and Illness*. Elsevier.
12. Singh, H. (2015). *Textbook of Human Physiology*. S. Chand Publishing.

Examination, Evaluation and Assessment Scheme

1. External Theory -- 30 Marks
2. Internal- 20 Marks

Distribution of Internal Marks

- | | | |
|---|-------|----------|
| 1. Continuous Assessment Test (Best 2 out of 3 tests) | ----- | 10 Marks |
| 2. Report of Seminar / Field visit/ Case study/ Any innovative method | ----- | 10 Marks |

Total -----	20 Marks
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Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Marks
5.5	V	133232	Evolution and Animal Adaptations	2	30	2 Hrs	30
Course Objectives:		After this course, students will be able to - To introduce students to the fundamental concepts of organic evolution and its historical development. - To understand major theories of evolution including Lamarckism, Darwinism, and Neo-Darwinism. - To develop knowledge of population genetics and Hardy–Weinberg equilibrium. - To explain evidences supporting evolution from fossils, anatomy, embryology, and molecular biology. - To study structural, physiological, and behavioral adaptations of animals in different environments. - To understand evolutionary strategies such as adaptive radiation, mimicry, and camouflage.					
Course Outcome:		After successful completion of this course, the students will be able to. - Explain the origin of life and basic concepts of molecular evolution. - Compare and evaluate different theories of evolution. - Apply principles of population genetics in evolutionary studies. - Interpret fossil records and other evidences of evolution. - Identify and explain adaptations of animals to aquatic, aerial, desert, and arboreal habitats. - Analyze evolutionary strategies such as mimicry, camouflage, and behavioral adaptations.					
Unit		Contents				Workload Allotted	Weightage of Marks Allotted
Unit I		Evolutionary Principles 1.1 Origin of life and molecular evolution 1.2 Lamarckism, Darwinism and Neo-Darwinism (Modern Synthesis) 1.3 Population genetics: gene pool and evolutionary forces 1.4 Speciation and isolating mechanisms				8 Hrs	8 Marks
Unit II		Evidences of Organic Evolution 2.1 Fossil records and geological time scale 2.2 Comparative anatomy and evolutionary relationships 2.3 Connecting links and vestigial structures 2.4 Embryological and molecular evidences				7 Hrs	7 Marks
Unit III		Environmental Adaptations in Animals 3.1 Structural and physiological adaptations 3.2 Adaptations to extreme environments (cold, heat, altitude) 3.3 Adaptations to desert and arboreal habitats 3.4 Eco physiological adaptations (osmoregulation and thermoregulation)				8 Hrs	8 Marks
Unit IV		Evolutionary Adaptation Strategies 4.1 Adaptive radiation and convergent evolution 4.2 Cryptic adaptations (camouflage and concealment mechanisms) 4.3 Protective and warning coloration 4.4 Behavioural adaptations (migration, dormancy, social behaviour)				7 Hrs	7 Marks

References:

1. Dobzhansky, T. (1970). *Genetics of the Evolutionary Process*. Columbia University Press.
2. Futuyma, D.J. (2013). *Evolution*. Sinauer Associates.
3. Freeman, S. & Herron, J.C. (2014). *Evolutionary Analysis*. Pearson.
4. Ridley, M. (2004). *Evolution*. Blackwell Publishing.
5. Barton, N.H., Briggs, D.E.G., Eisen, J.A., Goldstein, D.B. & Patel, N.H. (2007). *Evolution*. Cold Spring Harbor Laboratory Press.
6. Strickberger, M.W. (2000). *Evolution*. Jones & Bartlett.
7. Mayr, E. (2001). *What Evolution Is*. Basic Books.
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9. Colbert, E.H. & Morales, M. (1991). *Evolution of the Vertebrates*. Wiley-Liss.
10. Kardong, K.V. (2018). *Vertebrates: Comparative Anatomy, Function, Evolution*. McGraw-Hill.
11. Hall, B.K. & Hallgrímsson, B. (2008). *Strickberger's Evolution*. Jones & Bartlett.
12. Futuyma, D.J. & Kirkpatrick, M. (Latest ed.). *Evolution*. Sinauer/Oxford.

Examination, Evaluation and Assessment Scheme

1. External Theory -- 30 Marks
2. Internal- 20 Marks

Distribution of Internal Marks

1. Continuous Assessment Test (Best 2 out of 3 tests)	-----	10 Marks
2. Report of Seminar / Field visit/ Case study/ Any innovative method	-----	10 Marks
Total -----		20 Marks

NEP2020: Scheme of Implementation for Three year Degree of Bachelor of Science in Zoology Discipline

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Marks
5.5	V	133233	Applied Animal Biotechnology	2	30	2 Hrs	30
Course Objectives:		After this course, students will be able to - To introduce the fundamental concepts of animal cell and tissue culture and their applications in biotechnology. - To understand principles of sterile techniques, culture media preparation, and contamination control. - To provide knowledge of molecular tools such as PCR, DNA sequencing, and immunotechnological methods. - To familiarize students with transgenic animals, cloning, and assisted reproductive technologies. - To develop understanding of biotechnological applications in animal health, production, and conservation. - To create awareness about biosafety, bioethics, and regulatory frameworks in animal biotechnology.					
Course Outcome:		After successful completion of this course, the students will be able to. - Explain principles and applications of animal cell and tissue culture techniques. - Demonstrate knowledge of sterile techniques, culture media, and cryopreservation methods. - Understand molecular techniques such as PCR, gene transfer, and DNA sequencing. - Describe immunotechnological tools and their applications in diagnostics. - Analyze applications of biotechnology in livestock improvement, cloning, and vaccine development. - Evaluate ethical, biosafety, and conservation aspects of animal biotechnology.					
Unit		Contents				Workload Allotted	Weightage of Marks Allotted
Unit I		Animal Cell Culture and Techniques 1.1 Animal cell and tissue culture – principles and applications 1.2 Culture media, sterilization and contamination control 1.3 Primary cell culture and cell lines 1.4 Cryopreservation and bio banking of animal germplasm				8 Hrs	8 Marks
Unit II		Molecular Tools in Animal Biotechnology 2.1 DNA isolation and blotting techniques (Southern, Northern) 2.2 Gene cloning vectors and transfer methods in animals (electroporation, microinjection, biolistic method) 2.3 PCR-based amplification and diagnostic applications 2.4 Antibody-based techniques (ELISA, hybridoma technology)				7 Hrs	7 Marks
Unit III		Biotechnology in Animal Health and Production 3.1 Transgenic and genetically modified animals 3.2 Animal cloning and assisted reproductive technologies (IVF, AI) 3.3 Vaccine development and disease diagnostics 3.4 Genetic improvement of livestock				8 Hrs	8 Marks
Unit IV		Applied Zoological Biotechnology 4.1 Biotechnology applications in fisheries and aquaculture 4.2 Wildlife conservation and genetic resource management 4.3 Molecular tools in zoological studies (DNA fingerprinting and forensic applications) 4.4 Safety regulations and ethical issues in animal biotechnology				7 Hrs	7 Marks

References:

1. Freshney, R.I. (2016). *Culture of Animal Cells: A Manual of Basic Technique and Specialized Applications*. Wiley-Blackwell.
2. Glick, B.R., Pasternak, J.J. & Patten, C.L. (2010). *Molecular Biotechnology: Principles and Applications of Recombinant DNA*. ASM Press.
3. Brown, T.A. (2016). *Gene Cloning and DNA Analysis: An Introduction*. Wiley.
4. Alberts, B. et al. (2014). *Molecular Biology of the Cell*. Garland Science.
5. Lodish, H. et al. (2016). *Molecular Cell Biology*. W.H. Freeman.
6. Primrose, S.B. & Twyman, R.M. (2006). *Principles of Gene Manipulation and Genomics*. Blackwell.
7. Old, R.W. & Primrose, S.B. (2014). *Principles of Gene Manipulation*. Wiley.
8. Gupta, P.K. (2014). *Biotechnology and Genomics*. Rastogi Publications.
9. Watson, J.D. et al. (2013). *Recombinant DNA: Genes and Genomes*. Cold Spring Harbor.
10. Singh, B.D. (2018). *Biotechnology: Expanding Horizons*. Kalyani Publishers.
11. Verma, A.S. & Singh, A. (2014). *Animal Biotechnology*. Academic Press.
12. Hughes, D.B. (2005). *Animal Biotechnology*. Wiley-Blackwell.

Examination, Evaluation and Assessment Scheme

1. External Theory -- 30 Marks
2. Internal- 20 Marks

Distribution of Internal Marks

1. Continuous Assessment Test (Best 2 out of 3 tests)	-----	10 Marks
2. Report of Seminar / Field visit/ Case study/ Any innovative method	----	10 Marks
Total -----		20 Marks

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Marks
5.5	V	133234	Practical based on Theory 8 to 10 Major	2	60	3 Hrs	50
Course Objectives:		After this course, students will be able to - To develop hands-on skills in fundamental techniques of human physiology and experimental zoology. - To train students in clinical and laboratory measurements such as blood grouping, haemoglobin estimation, blood pressure, and pulse rate. - To provide practical understanding of anatomical, histological, and physiological systems through models, slides, and demonstrations. - To introduce students to basic experimental techniques in genetics, molecular biology, and biotechnology. - To familiarize students with ICT-based tools and modern biotechnological demonstrations such as PCR and ELISA. - To enhance observational, analytical, and laboratory reporting skills in biological sciences.					
Course Outcome:		After successful completion of this course, the students will be able to. - Perform and interpret basic physiological tests such as blood grouping, Hb estimation, and blood pressure measurement. - Demonstrate understanding of human organ systems using models, slides, and ICT tools. - Analyze reflex actions, nerve functions, and muscle physiology through experimental approaches. - Identify anatomical structures and evolutionary evidences such as fossils and adaptive traits. - Demonstrate basic principles of molecular biology and biotechnology techniques like DNA isolation and PCR (theoretical/virtual). - Apply laboratory safety, handling techniques, and scientific reporting in biological experiments.					
Lab/ Practical-15		List of Practicals: - Determination of Blood Groups (ABO & Rh System) - Estimation of Haemoglobin (Hb) Content - To enumerate total count of R.B.C (Erythrocytes). - To enumerate total count of W.B.C (Leucocytes). - Measurement of Blood Pressure and Pulse Rate - Study of Human ECG (Demonstration/Chart-Based) - Study of Respiratory System & Lung Capacity (Spirometry – if available) - Qualitative Tests for Digestive Enzymes - Study of Nephron (Permanent Slides/Models) - Reflex Action Experiment (Reaction Time Test) - Identification of Tissues – Muscle & Nervous Tissue (Histology/slides or model based) - Study of Fossils and Geological Time Scale (ICT/Model based) - Study of Adaptive Features in Animals (Specimen/ICT Based) - Isolation of DNA (Demonstration/Basic Extraction Wet Lab as well as ICT based) - Preparation & Sterilization for animal cell culture (Dummy items/ICT based) - Demonstration based/ interactive ICT tools (if facilities available) - PCR demonstration (video/software-based) - ELISA kit demonstration - Chromatography (amino acids)					

References:

1. Guyton, A.C. & Hall, J.E. (2021). *Textbook of Medical Physiology*. Elsevier.
2. Tortora, G.J. & Derrickson, B. (2017). *Principles of Anatomy and Physiology*. Wiley.
3. Chatterjee, C.C. (2016). *Human Physiology (Vol I & II)*. CBS Publishers.
4. Ghai, C.L. (2018). *A Textbook of Practical Physiology*. Jaypee Brothers.
5. Pal, G.K. & Pal, P. (2019). *Practical Physiology*. Orient Blackswan.
6. Gupta, P.K. (2014). *Biotechnology and Genomics*. Rastogi Publications.
7. Freshney, R.I. (2016). *Culture of Animal Cells*. Wiley-Blackwell.
8. Alberts, B. et al. (2014). *Molecular Biology of the Cell*. Garland Science.
9. Singh, B.D. (2018). *Biotechnology: Expanding Horizons*. Kalyani Publishers.
10. Kardong, K.V. (2018). *Vertebrates: Comparative Anatomy, Function, Evolution*. McGraw-Hill.
11. Rastogi, V.B. (2016). *Modern Practical Zoology*. Medtech.
12. Verma, P.S. & Tyagi, B.S. (2015). *Animal Physiology and Biotechnology Practical Manual*. S. Chand.

- Distribution of Marks:**

Practical External (25 Marks)		Practical Internal (25 Marks)	
Major Experiment	10 Marks	Student performance and Attendance during regular practical	10 Marks
Minor Experiment	05 Marks	Certified Practical Record	05 Marks
Histological Slides / Specimens	05 Marks	Submission of Experimental Survey Report	05 Marks
Viva- voce	05 Marks	Use of ICT	05 Marks
Total	25 Marks	Total	25 Marks

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Marks
5.5	V	133235	Major Elective 1- Basics of Entomology	2	30	2 Hrs	30
Course Objectives:		After this course, students will be able to - To introduce students to the scope, branches, and classification of insects in the animal kingdom. - To understand the morphology, anatomy, and physiological systems of insects. - To study insect growth, metamorphosis, and developmental patterns. - To explore the ecological and economic importance of insects in natural ecosystems. - To familiarize students with beneficial and harmful insects affecting agriculture, health, and livestock. - To understand principles and methods of insect pest management, including Integrated Pest Management (IPM).					
Course Outcome:		After successful completion of this course, the students will be able to. - Explain the classification, diversity, and significance of insects. - Identify major morphological and anatomical features of insects. - Describe insect life cycles, metamorphosis, and developmental biology. - Analyze the role of insects in pollination, biological control, and pest management. - Differentiate between beneficial, harmful, medical, and veterinary insects. - Apply basic principles of Integrated Pest Management for sustainable control of insect pests.					
Unit		Contents				Workload Allotted	Weightage of Marks Allotted
Unit I		Fundamentals of Entomology 1.1 Scope, branches and classification of insects 1.2 Morphology and identification of insects 1.3 Growth, metamorphosis and life cycle 1.4 Importance of insects				8 Hrs	8 Marks
Unit II		Insect Biology 2.1 Anatomy and physiology of insects 2.2 Feeding habits and nutrition 2.3 Nervous system and behaviour 2.4 Reproduction and development				7 Hrs	7 Marks
Unit III		Applied Entomology 3.1 Beneficial insects and their uses 3.2 Pollination and biological control 3.3 Agricultural and household pests 3.4 Medical and veterinary insects				8 Hrs	8 Marks
Unit IV		Insect Ecology and Pest Management 4.1 Insect ecology and adaptations 4.2 Population dynamics of insects 4.3 Integrated Pest Management (IPM) 4.4 Methods of insect pest control				7 Hrs	7 Marks

References:

1. Chapman, R.F. (2013). *The Insects: Structure and Function*. Cambridge University Press.
2. Gullan, P.J. & Cranston, P.S. (2014). *The Insects: An Outline of Entomology*. Wiley-Blackwell.
3. Triplehorn, C.A. & Johnson, N.F. (2005). *Borror and DeLong's Introduction to the Study of Insects*. Thomson Brooks/Cole.
4. Pedigo, L.P. & Rice, M.E. (2014). *Entomology and Pest Management*. Pearson.
5. Chapman, R.F. (1998). *The Insects: Structure and Function*. Cambridge.
6. Richards, O.W. & Davies, R.G. (1977). *Imms' General Textbook of Entomology*. Chapman & Hall.
7. Metcalf, R.L. & Flint, W.P. (1979). *Destructive and Useful Insects*. McGraw-Hill.
8. Pedigo, L.P. (2002). *Entomology and Pest Management*. Prentice Hall.
9. Mathur, R. & Upadhyay, V.B. (2015). *A Textbook of Entomology*. S. Chand.
10. Kapoor, V.C. (2017). *Entomology for Zoologists*. Oxford & IBH.
11. David, B.V. & Ramamurthy, V.V. (2016). *Elements of Economic Entomology*. Namrutha Publications.
12. Atwal, A.S. & Dhaliwal, G.S. (2018). *Agricultural Pests of India*. Kalyani Publishers.

Examination, Evaluation and Assessment Scheme

1. External Theory -- 30 Marks
2. Internal- 20 Marks

Distribution of Internal Marks

1. Continuous Assessment Test (Best 2 out of 3 tests)	-----	10 Marks
2. Report of Seminar / Field visit/ Case study/ Any innovative method	-----	10 Marks
Total -----		20 Marks

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Marks
5.5	V	133236	Practical based on Major Elective 1 - Basics of Entomology	2	60	3 Hrs	50
Course Objectives:		After this course, students will be able to - To introduce students to the diversity, classification, and importance of insects. - To understand insect morphology, anatomy, and physiological systems. - To study insect life cycles, metamorphosis, and developmental biology. - To provide knowledge of beneficial and harmful insects in agriculture and health. - To develop skills in insect identification and preservation techniques. - To understand ecological roles and pest management strategies including IPM.					
Course Outcome:		After successful completion of this course, the students will be able to. - Identify and classify common insects based on morphological characteristics. - Demonstrate knowledge of insect anatomy, mouth parts, and adaptations. - Understand insect life cycles and metamorphosis patterns. - Distinguish between beneficial and harmful insects in agriculture and ecosystems. - Apply basic techniques of insect collection, preservation, and field observation. - Analyze insect pest problems and understand principles of Integrated Pest Management (IPM).					
Lab/ Practical-16		List of Practicals A. MAJOR PRACTICALS (Any 5–6) - Collection, preservation and identification of common insects (order level). - Study of insect morphology using representative specimens (cockroach, grasshopper, honeybee). - Study of mouth parts of insects (biting, chewing, siphoning, piercing-sucking types). - Study of insect metamorphosis (complete and incomplete) using life cycle charts/models. - Study of insect wings and wing venation patterns for identification. - Dissection/diagrammatic study of digestive system of cockroach (demonstration/ICT-based). B. MINOR PRACTICALS (Any 4) - Study of insect antennae types. - Study of insect legs (adaptations). - Study of insect eggs, larvae, pupae (specimens/models). - Identification of common agricultural pests (aphids, bollworm, whitefly). C. SPECIMEN / SLIDE STUDIES - Cockroach (external morphology) - Honeybee (social insect structure) - Mosquito (vector insect) - Butterfly/Moth (Lepidoptera) - Grasshopper (Orthoptera) - Termite (social insect colony structure) D. FIELD VISITS (2–3 Suggested) - Agricultural field visit – observation of crop insect pests and damage symptoms. - Visit to apiculture unit (bee keeping farm) – study of beneficial insects. - Visit to fisheries/agro-horticulture farm or entomology research lab (if available).					

References:

1. Chapman, R.F. (2013). *The Insects: Structure and Function*. Cambridge University Press.
2. Gullan, P.J. & Cranston, P.S. (2014). *The Insects: An Outline of Entomology*. Wiley-Blackwell.
3. Triplehorn, C.A. & Johnson, N.F. (2005). *Borror and DeLong's Introduction to the Study of Insects*. Cengage.
4. Pedigo, L.P. & Rice, M.E. (2014). *Entomology and Pest Management*. Pearson.
5. Richards, O.W. & Davies, R.G. (1977). *Imms' General Textbook of Entomology*. Chapman & Hall.
6. Metcalf, R.L. & Flint, W.P. (1979). *Destructive and Useful Insects*. McGraw-Hill.
7. Atwal, A.S. & Dhaliwal, G.S. (2018). *Agricultural Pests of India*. Kalyani Publishers.
8. Mathur, R. & Upadhyay, V.B. (2015). *Textbook of Entomology*. S. Chand.
9. Kapoor, V.C. (2017). *Entomology for Zoologists*. Oxford & IBH.
10. David, B.V. & Ramamurthy, V.V. (2016). *Elements of Economic Entomology*. Namrutha Publications.
11. Chapman, R.F. (1998). *The Insects: Structure and Function*. Cambridge.
12. Pedigo, L.P. (2002). *Entomology and Pest Management*. Prentice Hall.

- **Distribution of Marks:**

Practical External (25 Marks)		Practical Internal (25 Marks)	
Major Practical (Any 1)	10 Marks	Student performance and Attendance during regular practical	10 Marks
Minor Practical (Any 1)	05 Marks	Certified Practical Record	05 Marks
Slides / Specimen Study	05 Marks	Submission of Report	05 Marks
Viva	05 Marks	Use of ICT	05 Marks
Total	25 Marks	Total	25 Marks

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Marks
5.5	V	133237	Major Elective-1 Fisheries and Aquatic Resource Management	2	30	2 Hrs	30
Course Objectives:		After this course, students will be able to - To introduce students to the scope, importance, and diversity of fisheries resources. - To understand fish biology, life cycle, and aquatic organism diversity. - To develop knowledge of aquaculture practices including pond management and hatchery techniques. - To study aquatic ecosystems, biodiversity, and conservation strategies. - To understand fisheries resource management, economics, and sustainable utilization. - To create awareness about aquatic pollution and environmental challenges.					
Course Outcome:		After successful completion of this course, the students will be able to. - Explain the scope and types of fisheries and their importance in economy and nutrition. - Identify major aquatic organisms and understand fish biology and life cycles. - Apply principles of aquaculture including breeding, nutrition, and pond management. - Analyze aquatic biodiversity and environmental issues affecting aquatic ecosystems. - Evaluate fisheries resource management practices and sustainability concepts. - Understand fisheries economics, marketing, and policy frameworks.					
Unit		Contents				Workload Allotted	Weightage of Marks Allotted
Unit I		Fundamentals of Fisheries 1.1 Scope and importance of fisheries 1.2 Types of fisheries 1.3 Diversity of aquatic organisms 1.4 Fish biology and life cycle				8 Hrs	8 Marks
Unit II		Aquaculture Practices 2.1 Principles of aquaculture 2.2 Pond and water quality management 2.3 Fish breeding and hatchery techniques 2.4 Fish nutrition and health management				7 Hrs	7 Marks
Unit III		Aquatic Biodiversity and Conservation 3.1 Aquatic ecosystems and biodiversity 3.2 Utilization of aquatic resources 3.3 Conservation of aquatic flora and fauna 3.4 Aquatic pollution and environmental issues				8 Hrs	8 Marks
Unit IV		Fisheries Resource Management 4.1 Fisheries resource management 4.2 Sustainable fisheries practices 4.3 Fish harvesting and marketing 4.4 Fisheries economics and policies				7 Hrs	7 Marks

References:

1. Jhingran, V.G. (1991). *Fish and Fisheries of India*. Hindustan Publishing Corporation.
2. Pillay, T.V.R. (1990). *Aquaculture: Principles and Practices*. Blackwell.
3. Bardach, J.E., Ryther, J.H. & McLarney, W.O. (1972). *Aquaculture: The Farming and Husbandry of Freshwater and Marine Organisms*. Wiley.
4. Stickney, R.R. (2000). *Encyclopedia of Aquaculture*. Wiley.
5. Boyd, C.E. (2015). *Water Quality in Ponds for Aquaculture*. Springer.
6. Lakra, W.S. et al. (2010). *Fisheries and Aquaculture in India*. ICAR.
7. Kapoor, B.G. (2004). *Fish Biology*. Science Publishers.
8. Santhanam, R. et al. (2012). *Aquaculture Practices in India*. Oxford & IBH.
9. Lagler, K.F. (1977). *Ichthyology*. Wiley.
10. Bal, D.V. & Rao, K.V. (2014). *Marine Fisheries*. Tata McGraw-Hill.
11. Parker, R. (2002). *Aquaculture Science*. Delmar.

Examination, Evaluation and Assessment Scheme

1. External Theory -- 30 Marks
2. Internal- 20 Marks

Distribution of Internal Marks

1. Continuous Assessment Test (Best 2 out of 3 tests)	-----	10 Marks
2. Report of Seminar / Field visit/ Case study/ Any innovative method	-----	10 Marks
Total -----		20 Marks

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Marks
5.5	V	133238	Practical based on Major Elective 1- Fisheries and Aquatic Resource Management	2	60	3 Hrs	50
Course Objectives:		After this course, students will be able to - To develop practical skills in identification of fishes and aquatic organisms. - To understand fish anatomy and physiological systems through models and specimens. - To train students in water quality analysis and aquaculture practices. - To provide field-based exposure to fisheries systems and aquatic biodiversity. - To develop skills in observation, data recording, and scientific reporting. - To introduce basic techniques of fisheries resource assessment and management.					
Course Outcome:		After successful completion of this course, the students will be able to. - Identify common fish species and aquatic organisms. - Demonstrate understanding of fish anatomy and functional systems. - Analyze basic water quality parameters relevant to aquaculture. - Recognize fish diseases and aquaculture practices. - Apply field-based learning in fisheries and aquatic ecosystem studies. - Prepare scientific reports based on field visits and laboratory observations.					
Lab/ Practical-16		List of Practicals A) MAJOR PRACTICALS - Identification of common freshwater and marine fishes (morphological study). - Study of external anatomy of fish (fins, scales, body regions). - Estimation of water quality parameters (pH, temperature, dissolved oxygen demonstration/field). - Study of fish breeding techniques (induced breeding – chart/ICT based). - Study of fish digestive and respiratory system (diagram/specimen-based). - Preparation of fish feed and understanding nutritional requirements (demonstration). B) MINOR PRACTICALS - Study of fish scales (cycloid, ctenoid, ganoid). - Identification of aquatic weeds and plankton (basic level). - Study of fish diseases (white spot, fin rot – charts/images). - Identification of fishing gears and nets. C) SPECIMEN / SLIDE STUDY - Rohu (Labeo rohita) - Catla (Catla catla) - Catfish (Heteropneustes fossilis) - Tilapia - Fish scales slides - Fish gill structure (model/slides) - Plankton samples (phyto & zooplankton) D) FIELD VISITS (2–3) - Fish farm / Aquaculture pond visit – observation of culture practices. - Local fish market visit – study of fish varieties and marketing system. - River/lake ecosystem visit – biodiversity and water quality observation.					

References:

1. Jhingran, V.G. (1991). *Fish and Fisheries of India*. Hindustan Publishing Corporation.
2. Lagler, K.F. (1977). *Ichthyology*. Wiley.
3. Kapoor, B.G. (2004). *Fish Biology*. Science Publishers.
4. Santhanam, R., Ramanathan, N. & Jegadeesan, G. (2012). *Aquaculture Practices in India*. Oxford & IBH.
5. Boyd, C.E. (2015). *Water Quality in Ponds for Aquaculture*. Springer.
6. Pillay, T.V.R. (1990). *Aquaculture: Principles and Practices*. Blackwell.
7. Bardach, J.E., Ryther, J.H. & McLarney, W.O. (1972). *Aquaculture: The Farming and Husbandry of Freshwater and Marine Organisms*. Wiley.
8. Stickney, R.R. (2000). *Encyclopedia of Aquaculture*. Wiley.
9. ICAR (Latest Edition). *Handbook of Fisheries and Aquaculture*. Indian Council of Agricultural Research.
10. FAO (Latest Reports). *Fisheries and Aquaculture Technical Papers*. Food and Agriculture Organization.
11. Bal, D.V. & Rao, K.V. (2014). *Marine Fisheries of India*. Tata McGraw-Hill.
12. Parker, R. (2002). *Aquaculture Science*. Delmar Publishers.

- **Distribution of Marks:**

Practical External (25 Marks)		Practical Internal (25 Marks)	
Major Practical	10 Marks	Student performance and Attendance during regular practical	10 Marks
Minor Practical	05 Marks	Certified Practical Record	05 Marks
Slides / Specimen Study	05 Marks	Submission of Report	05 Marks
Viva	05 Marks	Use of ICT	05 Marks
Total	25 Marks	Total	25 Marks

NEP2020: Scheme of Implementation for Three year Degree of Bachelor of Science in Zoology Discipline

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Marks
5.5	V	133239	Minor- 5. Forest Ecology and Wildlife Management	2	30	2 Hrs	30
Course Objectives:		After this course, students will be able to - To introduce students to the fundamentals of forest ecology and ecosystem functioning. - To understand forest types, vegetation patterns, and ecological factors affecting forests. - To study forest biodiversity, conservation strategies, and natural resource management. - To develop knowledge of wildlife diversity, habitat ecology, and behavioural adaptations. - To understand human–wildlife interactions and conflict management strategies. - To familiarize students with wildlife laws, protected areas, and conservation policies.					
Course Outcome:		After successful completion of this course, the students will be able to. - Explain basic principles of forest ecology and ecosystem structure. - Identify major forest types and understand vegetation patterns. - Analyze biodiversity conservation and forest resource management practices. - Describe wildlife diversity, habitat requirements, and adaptations. - Evaluate human–wildlife conflicts and mitigation strategies. - Understand conservation laws, protected areas, and sustainable management practices.					
Unit	Contents					Workload Allotted	Weightage of Marks Allotted
Unit I	Fundamentals of Forest Ecology 1.1 Scope and importance of forest ecology 1.2 Forest types and vegetation patterns 1.3 Forest ecosystem structure and functions 1.4 Ecological factors affecting forests					8 Hrs	8 Marks
Unit II	Forest Biodiversity and Conservation 2.1 Forest biodiversity and natural resources 2.2 Conservation of forest flora and fauna 2.3 Forest degradation and deforestation 2.4 Afforestation and social forestry					7 Hrs	7 Marks
Unit III	Wildlife Biology and Habitat Management 3.1 Diversity and distribution of wildlife 3.2 Wildlife habitat and ecological adaptations 3.3 Wildlife behaviour and population dynamics 3.4 Human–wildlife interactions and conflicts					8 Hrs	8 Marks
Unit IV	Wildlife Conservation and Management 4.1 Principles of wildlife management 4.2 Protected areas and wildlife conservation strategies 4.3 Wildlife laws and conservation policies 4.4 Sustainable management of forest and wildlife resources					7 Hrs	7 Marks

References:

1. Odum, E.P. (2005). *Fundamentals of Ecology*. Cengage Learning.
2. Krebs, C.J. (2009). *Ecology: The Experimental Analysis of Distribution and Abundance*. Pearson.
3. Smith, T.M. & Smith, R.L. (2015). *Elements of Ecology*. Pearson.
4. Hunter, M.L. (1996). *Fundamentals of Conservation Biology*. Blackwell.
5. Primack, R.B. (2014). *Essentials of Conservation Biology*. Sinauer Associates.
6. Giles, R.H. (1984). *Wildlife Management*. W.H. Freeman.
7. Dasmann, R.F. (1981). *Wildlife Biology*. Wiley.
8. Bookhout, T.A. (1996). *Research and Management Techniques for Wildlife and Habitats*. The Wildlife Society.
9. Negi, S.S. (2010). *Handbook of National Parks, Wildlife Sanctuaries and Biosphere Reserves in India*. Indus Publishing.
10. Singh, S.K. (2017). *Forest Ecology and Environment*. S. Chand.
11. Champion, H.G. & Seth, S.K. (1968). *A Revised Survey of Forest Types of India*. Government of India Publication.

Examination, Evaluation and Assessment Scheme

1. External Theory -- 30 Marks
2. Internal - 20 Marks

Distribution of Internal Marks

- | | | |
|---|-------|----------|
| 1. Continuous Assessment Test (Best 2 out of 3 tests) | ----- | 10 Marks |
| 2. Report of Seminar / Field visit/ Case study/ Any innovative method | ----- | 10 Marks |

Total -----	20 Marks
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Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Marks
5.5	V	133240	Practical based on Theory Minor-Forest Ecology and Wildlife Management	2	60	3 Hrs	50
Course Objectives:		After this course, students will be able to - To develop practical understanding of forest ecosystems and biodiversity. - To identify wildlife species, tracks, and ecological adaptations. - To understand forest vegetation patterns through specimens and fieldwork. - To gain field exposure to protected areas and conservation practices. - To develop skills in ecological observation and scientific documentation. - To understand human impact on forests and wildlife conservation methods.					
Course Outcome:		After successful completion of this course, the students will be able to. - Identify forest types and ecosystem components using practical tools. - Recognize wildlife species through specimens, tracks, and signs. - Analyse ecological relationships in forest ecosystems. - Demonstrate understanding of biodiversity and conservation methods. - Apply field observation techniques in forest and wildlife studies. - Prepare scientific reports based on field visits and ecological observation					
Lab/ Practical - 17		List of Practical's A) MAJOR PRACTICALS - Study of forest ecosystem structure using models/diagrams. - Identification of forest types and vegetation patterns (herbarium/chart-based). - Study of wildlife diversity using skulls, feathers, and tracks (specimen-based). - Analysis of food chain and food web in forest ecosystem. - Study of ecological adaptations in forest-dwelling animals. - Mapping of protected areas and wildlife sanctuaries in India. B) MINOR PRACTICALS - Study of animal footprints and pug marks. - Identification of medicinal forest plants. - Study of nesting habits of birds (charts/ICT). - Identification of endangered and endemic species. C) SPECIMEN / SLIDE STUDY - Deer skull / horn structure - Tiger/Leopard footprint models - Bird feathers (owl, peacock) - Herbivore and carnivore teeth models - Wood samples (forest types) - Nesting materials of birds - Plant leaves of forest species D) FIELD VISITS - Visit to wildlife sanctuary/national park (e.g., Tadoba, Pench, Melghat). - Visit to forest nursery or afforestation site. - Visit to zoological park or biodiversity park.					
References		- Odum, E.P. (2005). <i>Fundamentals of Ecology</i>. Cengage Learning. - Krebs, C.J. (2009). <i>Ecology: The Experimental Analysis of Distribution and Abundance</i>. Pearson. - Smith, T.M. & Smith, R.L. (2015). <i>Elements of Ecology</i>. Pearson. - Hunter, M.L. (1996). <i>Fundamentals of Conservation Biology</i>. Blackwell Science. - Primack, R.B. (2014). <i>Essentials of Conservation Biology</i>. Sinauer Associates.					

6. Bookhout, T.A. (1996). *Research and Management Techniques for Wildlife and Habitats*. The Wildlife Society.
7. Giles, R.H. (1984). *Wildlife Management*. W.H. Freeman.
8. Dasmann, R.F. (1981). *Wildlife Biology*. Wiley.
9. Champion, H.G. & Seth, S.K. (1968). *A Revised Survey of Forest Types of India*. Government of India.
10. Negi, S.S. (2010). *Handbook of National Parks, Wildlife Sanctuaries and Biosphere Reserves in India*. Indus Publishing.
11. Singh, S.K. (2017). *Forest Ecology and Environment*. S. Chand.
12. Wani, S.A. & Khan, M.A. (2018). *Wildlife and Forest Management Practical Manual*. Discovery Publishing.

• **Distribution of Marks:**

Practical External (25 Marks)		Practical Internal (25 Marks)	
Major Practical (Any 1)	10 Marks	Student performance and Attendance during regular practical	10 Marks
Minor Practical (Any 1)	05 Marks	Certified Practical Record	05 Marks
Slides / Specimen Study	05 Marks	Submission of Report	05 Marks
Viva-voce	05 Marks	Use of ICT	05 Marks
Total	25 Marks	Total	25 Marks

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Marks
5.5	V	133241	VSC Advance Applications (Career oriented) / Practical based on Major- Medical Laboratory Techniques	2	30	2 Hrs	50
Course Objectives:		After this course, students will be able to - To develop core competencies in clinical and diagnostic laboratory sciences - To familiarize students with laboratory workflows, quality control, and safety standards - Handle various instruments used in pathology laboratory - Preparations of different stains and smears used in medical field for diagnosis. - Understand and perform basic cytology and haematology procedures					
Course Outcomes:		After successful completion of the course, the students will be able to: - Understand the basics of reagent preparation, instrument handling and can perform common analytical techniques in Clinical Biochemistry. - To perform the various type of tests involved in hematology, biochemistry and can handle automated instruments. - To learn various staining techniques and understand principle and application of various techniques.					
Lab/ Practical-18		Laboratory Practical's: A. Study of Instruments : - Preparation of normal and molar solutions. (0.1 N NaOH, 1N HCl, 0.1 M H₂SO₄ etc.) - Study of sterilization Instruments and their use : Autoclave , Laminar Airflow , Hot air Oven - Study of compound Microscope and its use. B. Hematological Procedures : - To study Morphology of RBC, WBC and Composition of Blood. - To study composition of Urine and parameters for Urine Analysis (Color ,pH ,Turbidity ,Glucose ,Protein) - Normal values in Hematology (CBC Counts) - Stains used in Hematology - Differential count of Leucocytes. - Erythrocyte Sedimentation Rate by suitable method - Westergren or Wintrobe method. - Estimation of haemoglobin by Sahli's acid haematin method. - Preparation of blood film and study of haemin crystals in blood. - Detection of blood group. - Determination of bleeding and clotting time.					
Reference		- Clinical Pathology and Hematology; Maheshwari, Nanda; Jaypee. - Essential Haematology; Victor Hoffbrand, Paul Moss, John Pettit. - Essentials in Hematology and Clinical Pathology; Nayak, Ramadas. - Essentials of Haematology; Second Edition; Kawthalkar Shirish M.; Jaypee; 2013. - Essentials of Haematology; Shirish M. Kawthalkar; Jaypee Brothers. - Harrison's Hematology and Oncology; 3rd Edition (Harrison's Specialty); Dan Longo; McGraw-Hill. - Medical Biochemistry by C. Jaypee; 2012. - Practical Hematology; Dacie J V; Churchill Livingstone; 2006. - Precise Haematology; Usha Rusia, Meera Sikka, Renu Saxena; Wiley India. - Principles of Anatomy & Physiology; Thirteenth Edition; - Gerard J. Tortora & Bryan Derrickson; Biological Science Textbooks, Inc.; 2012.					

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| | 12. Biochemistry; Fourth Edition; U. Satyanarayana & U. Chakrapani; Elsevier; 2013.
13. Rapid Review of Hematology; Ramadas Nayak; Jaypee Brothers.
14. Short Textbook of Haematology; Shah B.S.; C.B.S. Publisher and Distributor.
15. Williams Hematology; Kenneth Kaushansky, Marshall A. Lichtman, E. Beutler, Thomas J. Kipps, Josef Prchal, Uri Seligsohn. |
|--|---|

Note: Mode of Examination: Internal (There is no External Examination)

Evaluation of Practical Marks	Marks
Hands on experiment	20
Attendance	10
Visit to Pathology lab and submission of report	10
Record Submission	10
Total Marks-	50

NEP2020: Scheme of Implementation for Three year Degree of Bachelor of Science in Zoology Discipline

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Marks
5.5	V	133242	SEC (Skill oriented) / Practical based on Major- Sericulture	2	30	2 Hrs	50
Course Objectives:		After this course, students will be able to - To introduce students to the practical aspects of sericulture and silk production. - To develop skills in mulberry cultivation, silkworm rearing, and cocoon management. - To familiarize students with life cycle and biology of silkworm (<i>Bombyx mori</i>). - To train students in disease identification and management in silkworms. - To create awareness about sericulture as a sustainable rural livelihood industry.					
Course Outcomes:		After successful completion of the course, the students will be able to: - Demonstrate practical knowledge of sericulture techniques and mulberry cultivation. - Identify different stages of silkworm development and cocoon types. - Perform basic silkworm rearing and maintenance procedures. - Detect common diseases and pests affecting silkworms. - Understand the economic importance of silk production and its applications.					
Lab/ Practical-19		Laboratory Practicals: - Study of life cycle of <i>Bombyx mori</i> with specimens/diagrams. - Identification of mulberry plant varieties used in sericulture. - Preparation and maintenance of silkworm rearing house (rearing techniques). - Study of silkworm egg incubation and hatching conditions. - Feeding techniques and care during larval stages of silkworm. - Study of different instars of silkworm larvae. - Identification and study of silk glands (diagram/model/slide). - Study of cocoon types and harvesting techniques. - Identification of common silkworm diseases (grasserie, flacherie, pebrine). - Post-cocoon technology: silk extraction and reeling process (demonstration/video-based).					
Reference		- Jhingran, V.G. – <i>Sericulture in India</i> - Ganga, G. & Sulochana Chetty – <i>An Introduction to Sericulture</i> - Krishnaswami, S. – <i>Improved Method of Sericulture</i> - FAO – <i>Sericulture Training Manual</i> - Singh, B.K. – <i>Textbook of Applied Entomology</i> - Central Silk Board Publications – Government of India					

Note: Mode of Examination: Internal (There is no External Examination)

Evaluation of Practical Marks	Marks
Practical Record / Journal Work	15
Practical Performance	10
Project / Assignment Work	10
Attendance & Discipline	05
Viva-Voce (Oral Examination)	05
Total Marks-	50

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Marks
5.5	V	133243	FP/ CEP in Zoology - III	2	60	NA	50
Course Objectives:		After this course, students will be able to - To develop an appreciation of rural culture, lifestyle and wisdom amongst students. - To learn about the status of various development programmes. - To understand the causes of distress and poverty faced by vulnerable households and explore solutions for the same. - To apply classroom knowledge of courses to field realities and thereby improve the quality of learning.					
Course Outcomes:		After successful completion of the course, the students will be able to: - Gain an understanding of rural life, Indian culture and ethos and social realities - Develop a sense of empathy and bonds of mutuality with the local community - Appreciate significant contributions of local communities to Indian society and Economy - Learn to value the local knowledge and wisdom of the community - Identify opportunities for contributing to community's socio-economic improvements					
Guidelines/ SoP for FP/CEP		For understanding key principles of CE, forms of CE, operational guidelines and implementation strategy please refer https://www.ugc.gov.in/pdfnews/4187860_Revised-Final-Guidelines.pdf As per NEP 2020, students of B Sc. III of Semester V and VI need to perform a Field Project (FP) for TWO (2) credits i.e. 50 Marks. The guidelines regarding the field project are as follows: - The total time allocation for the student to carry out field project is 60 hours. - Students should participate in field-based projects under the supervision of faculty. - Assignment of project topics to individual students or groups of students (max 4 students in one group) and one faculty member from the department will act as Guide for the student or group of students. - For a SURVEY based project related questionnaire (15 or more questions) should be prepared. - The departmental coordinator/guide should check the questions and finalize the questionnaire. The question that may create unnecessary complications should be avoided. The questions should be qualitative as well as quantitative. - If the project is related to work that does not involve survey work, then the questionnaire part can be replaced accordingly (e.g. Sample collection/Data collection/ Experimental base etc). - The student should compile all the relevant data and carry out its analysis. - A project report should be written individually in the standard format (2 Copies): Index, Introduction, Materials, Methods, Result, Conclusion/output, References (Numeric citation type) etc. - The project report should be of minimum 6 pages (excluding Title page, Certificate, Index, Acknowledgement etc.). Submit the project report with the Guide's signature to the department. - The oral /poster presentation for all the projects should be arranged in the department. To evaluate the project, examiner should be appointed by HoD. - The total project work including preparation of questionnaire to presentation should be evaluated for 2 credits (50 Marks).					

Some suggested forms of FP/ CEP are

1. Study of BMI and lifestyle patterns among college students
2. Analysis of dietary habits and their effect on health status of students
3. Assessment of sleep patterns and stress levels in youth population
4. Study of adaptive features of urban wildlife species in changing environment
5. Comparative study of animal adaptations in polluted and non-polluted areas
6. Observation of seasonal behavioral adaptations in local fauna
7. Awareness of biotechnology applications in animal health and agriculture
8. Public perception of genetically modified organisms (GMOs) in food safety
9. Awareness and utilization of veterinary biotechnology services in rural areas
10. Diversity and abundance of insect pests in agricultural crops
11. Study of pollinator insect diversity in garden and crop ecosystems
12. Household insect pests and their control practices in local area
13. Water quality analysis and its effect on aquatic biodiversity in local water bodies
14. Study of fish consumption patterns and nutritional awareness in population
15. Assessment of freshwater biodiversity in pond/lake ecosystem
16. Biodiversity assessment of vertebrate and invertebrate fauna in local forest/green area
17. Impact of human activities on forest ecosystem and wildlife diversity
18. Study of food chain and ecological interactions in forest ecosystem
19. Awareness of diagnostic laboratory tests and their importance in disease detection
20. Accessibility and utilization of pathology and diagnostic laboratory services in community
21. Awareness and practices of sericulture among farmers and rural population
22. Mulberry cultivation and its economic importance in rural livelihood

Distribution of Marks and the scheme of FP/CEP Examination is as follows:

- | | |
|--|----------|
| • Students' performance | 20 Marks |
| • Submission of duly certified FP/CEP report | 20 Marks |
| • Presentation (PPT or Poster) | 10 Marks |

Total**50 Marks**

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Marks
5.5	V		Foundation of Artificial Intelligence (AI)	Grading	30	2 Hrs	30
Course Objectives:		After studying this course, students will be able to To introduce AI concepts in a simple, real-life way with focus on understanding applications, ethics, and future opportunities.					
Course Outcome:		After completion of the course, the students will be able to: - Explain the basic concepts, history, and types of AI with real-life examples. - Describe AI structures and architectures using simple real-world analogies. - Identify and analyse applications of AI in the area of arts, commerce, humanities, and daily life. - Evaluate ethical, social issues and predict future opportunities of AI in their own fields.					
Unit		Contents				Workload Allotted	Weightage of Marks Allotted
Unit I		Introduction to Artificial Intelligence 1.1 Definition of AI: What is Intelligence? Natural vs. Artificial, Simple definition of AI; 1.2 History & Evolution of AI: From early computers to modern AI; 1.3 Types of AI: Narrow AI vs. General AI vs. Super AI; 1.4 AI in Everyday Life: Google Maps, E-commerce suggestions, Chatbots, Social Media feeds; 1.5 Key Components: Data, Algorithms, Computing Power				8 Hrs	8 Marks
Unit II		AI Structures, Architectures & Techniques 2.1 Basic Structure of an AI System; AI Architectures (Simplified): Rule Based System, Machine Learning, Neural Networks; 2.2 Key Concepts: Knowledge Representation (using symbols, facts), Search & Problem Solving (maze example, finding shortest route), 2.3 Natural Language Understanding (Google Translate, chatbots)				7 Hrs	7 Marks
Unit III		Applications of AI in Society 3.1 AI in Different Fields: Education (Personalized learning apps, plagiarism checkers), Healthcare (Disease prediction, medical chatbots), Commerce (Fraud detection in banking, stock market predictions, customer support), 3.2 Daily Life (Smart home devices, language translation, travel assistants); 3.3 AI & Decision Making: Hiring, Loan Approval, Court Decisions; 3.4 Advantages of AI, Limitations of AI				8 Hrs	8 Marks
Unit IV		Ethical, Social & Future Aspects of AI 4.1 Ethical Concerns in AI: Privacy issues (CCTV, online data), Bias & Fairness (AI preferring certain groups), Job Displacement (automation replacing humans); 4.2 Responsible AI: Transparency, Accountability, Human oversight; 4.3 Future Trends in AI: Self-driving cars, AI in governance, creative industries; 4.4 AI and You (Career Perspective): Opportunities in Digital Marketing, Content Creation, Business Analytics, HR Tech, Creative Industries (non-programming roles)				7 Hrs	7 Marks

References:

1. Melanie Mitchell – Artificial Intelligence: A Guide for Thinking Humans
2. Boden, Margaret A., Artificial Intelligence: A Very Short Introduction
3. Elaine Rich – Artificial Intelligence (3rd Edition)
4. Godbole, Achyut, Artificial Intelligence (आर्टिफिशियल इंटेलिजेंस), Bookganga Publication.
5. Kulkarni, Dr Anand, आर्टिफिशियल इंटेलिजेंस या वाटेवर, Sakal Media Pvt. Ltd.
6. Stuart Russell – Human Compatible (2019)
7. Thorpe, Josh, AI for Students: Creative Hacks for Academic Success, Promptly Books

Examination, Evaluation and Assessment Scheme

1. External Theory -- 30 Marks
2. Internal - 20 Marks

Distribution of Internal Marks

1. Continuous Assessment Test (Best 2 out of 3 tests)	-----	15 Marks
2. Attendance	-----	05 Marks
Total -----		20 Marks

Faculty: Science & Technology (Science Group)
(Teaching and Learning Scheme: B.Sc. - Zoology with Minor -----)
(Three Years- Six Semesters Bachelors Degree Programme)
THIRD YEAR: SEMESTER – VI

Mode of Teaching	Vertical Number	The Vertical	Type of Course	Course Code	Course Name	Credits	Workload (Hrs/Week)	Vertical Workload (Hrs/Week)
Classroom Teaching / Lab Work (Practical)/ Outdoor / Field	a.	Major (Zoology)	Theory 10	133244	Endocrine & Reproductive Biology	2	2	16
			Theory 11	133245	Basic Immunology	2	2	
			Theory 12	133246	Biophysical Techniques and Biostatistics	2	2	
			Lab/Practical 20	133247	Practical based on Theory 10 to 12	2	4	
		Major (Zoology) Elective (Select any one)	Elective Theory 2	133248	Applied Zoology & Entrepreneurships in life sciences	2	2	
			Elective Lab/Practical 21	133249	Practical based on Elective Theory 2	2	4	
			Elective Theory 2	133250	Zookeeping & Ecotourism	2	2	
			Elective Lab/Practical 21	133251	Practical based on Elective Theory 2	2	4	
	b.	Minor (Other subject in combination with Zoology)	Theory 6	133252	Vector Biology & Disease Control	2	2	6
			Lab/Practical 22	133253	Practical based on Theory 6	2	4	
	d.	VSE Related to Major Elective (Select any one)	Lab/Practical 23	133254	Practical based on Elective Theory 2	2	4	4
			Lab/Practical 23	133255	Practical based on Elective Theory 2			
	f.	Internship / Apprenticeship	OJT	133256	Corresponding to Major: On Job Training	4	8	8
TOTAL						22	34	34

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Marks
5.5	VI	133244	Major- Endocrine & Reproductive Biology	2	30	2 Hrs	30
Course Objectives:		After this course, students will be able to - To introduce students to the structure, functions, and regulation of the endocrine system and hormonal coordination in animals and humans. - To develop understanding of endocrine glands, hormone action, feedback mechanisms, and endocrine disorders associated with major glands. - To provide comprehensive knowledge of male and female reproductive systems, gametogenesis, reproductive hormones, and reproductive physiology. - To explain the biological processes of fertilization, embryonic development, pregnancy, and reproductive health management. - To create awareness about contraception, infertility, assisted reproductive technologies, and the significance of reproductive health in society.					
Course Outcome:		After successful completion of this course, the students will be able to - Understand the organization of endocrine glands, types of hormones and their role in maintaining physiological balance in animals and humans. - Explain the mechanism of hormone action, hormonal feedback regulation and common endocrine disorders associated with major endocrine glands. - Describe the structure and functions of male and female reproductive systems along with the process of gamete formation and reproductive hormonal regulation. - Interpret the biological events of fertilization, embryonic development, pregnancy and reproductive health management including modern reproductive technologies.					
Unit		Contents				Workload Allotted	Weightage of Marks Allotted
Unit I		Basics of Endocrinology and Hormonal Regulation 1.1 Introduction to Endocrine System and Types of Hormones 1.2 Mechanism of Hormone Action and Feedback Control 1.3 Hypothalamus and Pituitary Gland 1.4 Disorders related to Pituitary and Growth Hormones				8 Hrs	8 Marks
Unit II		Major Endocrine Glands and Functions 2.1 Thyroid and Parathyroid Glands 2.2 Adrenal Gland and Stress Hormones 2.3 Endocrine Pancreas and Regulation of Blood Glucose 2.4 Pineal Gland and Hormonal Disorders				7 Hrs	7 Marks
Unit III		Human Reproductive System and Gamete Formation 3.1 Male Reproductive System and Functions 3.2 Female Reproductive System and Functions 3.3 Spermatogenesis and Oogenesis 3.4 Reproductive Hormones and Menstrual Cycle				8 Hrs	8 Marks
Unit IV		Fertilization, Development and Reproductive Health 4.1 Fertilization and Early Embryonic Development 4.2 Pregnancy, Placenta and Parturition 4.3 Contraceptive Methods and Family Welfare Programmes 4.4 Infertility and Assisted Reproductive Technologies (ART)				7 Hrs	7 Marks

References:

1. Hadley, M. E. & Levine, J. E. (2007). *Endocrinology*. Pearson Education, New Delhi.
2. Turner, C. D. & Bagnara, J. T. (2011). *General Endocrinology*. Saunders College Publishing.
3. Guyton, A. C. & Hall, J. E. (2021). *Textbook of Medical Physiology*. Elsevier.
4. Williams, R. H. (2016). *Williams Textbook of Endocrinology*. Elsevier Publications.
5. Verma, P. S., Tyagi, B. S. & Agarwal, V. K. (2014). *Animal Physiology*. S. Chand & Company Ltd., New Delhi.
6. Rastogi, S. C. (2019). *Essentials of Animal Physiology*. New Age International Publishers.
7. Gilbert, S. F. (2017). *Developmental Biology*. Sinauer Associates Inc.
8. Carlson, B. M. (2014). *Human Embryology and Developmental Biology*. Elsevier.
9. Vander, A., Sherman, J. & Luciano, D. (2018). *Human Physiology: The Mechanisms of Body Function*. McGraw Hill Education.
10. Tortora, G. J. & Derrickson, B. (2019). *Principles of Anatomy and Physiology*. Wiley Publications.
11. NCERT Biology (Class XII) – Human Reproduction and Reproductive Health Chapters.
12. Government of India – National Family Welfare Programme and Reproductive Health Guidelines.

Examination, Evaluation and Assessment Scheme

1. External Theory -- 30 Marks
2. Internal- 20 Marks

Distribution of Internal Marks

1. Continuous Assessment Test (Best 2 out of 3 tests)	-----	10 Marks
2. Report of Seminar / Field visit/ Case study/ Any innovative method	-----	10 Marks
Total -----		20 Marks

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Marks
5.5	VI	133245	Major- Basic Immunology	2	30	2 Hrs	30
Course Objectives:		After this course, students will be able to - Define immune system - List different cells of the immune system and their functions in body - Compare Innate and adaptive immune responses - Explain key lymphoid organs and their role in immune system. - Describe Antibodies , Antigens , Cytokines and complements and their role in immune system					
Course Outcome:		After successful completion of this course, the students will be able to - Understand the basics of immune system and how it protects against diseases. - Compare and contrast humoral versus cell-mediated immune responses - Distinguish various cell types involved in immune responses, role of Antigen and Antibody in immune responses - Understand the role of Compliments and cytokines in immunity and immune cell activation					
Unit		Contents				Workload Allotted	Weightage of Marks Allotted
Unit I		Immune System and Immunity 1.1 Hematopoiesis and differentiation of immune cells 1.2 Cells of the immune system: Granulocytes and Agranulocytes 1.3 Innate immunity and its components 1.4 Acquired immunity and relationship between innate and adaptive immunity				8 Hrs	8 Marks
Unit II		Lymphoid Organs and Antigens 2.1 Primary and secondary lymphoid organs 2.2 Antigenicity and immunogenicity 2.3 Factors affecting immunogenicity 2.4 Epitopes, haptens, adjuvants and Superantigens				7 Hrs	7 Marks
Unit III		Antibodies and Antigen-Antibody Reactions 3.1 Structure of immunoglobulins (IgG as a model) 3.2 Classes of immunoglobulins (IgG, IgA, IgM, IgD and IgE) 3.3 Antigen-antibody interactions and effector functions 3.4 Monoclonal antibodies: Hybridoma technology and applications				8 Hrs	8 Marks
Unit IV		Complement System and Cytokines 4.1 Introduction and functions of complement system 4.2 Classical, alternative and lectin pathways 4.3 Cytokines: types and general properties 4.4 Cytokine receptors and role of cytokines in immune responses				7 Hrs	7 Marks

NEP2020: Scheme of Implementation for Three year Degree of Bachelor of Science in Zoology Discipline

References:

1. Basic Immunology: Abul K. Abbas, Andrew H. Lichtman. Latest edition, Publisher: Elsevier Health Sciences.
2. Immunology. David A. Goldsby, Janis Kuby, Thomas J. Kindt, Barbara A. Osborne Latest edition, Publisher: W. H. Freeman Company.
3. Immunology. Ivan Roitt, Jonathan Brostoff, David Male, David K. Male (Editor). Latest edition , Publisher: Elsevier Health Sciences.
4. Cellular Interactions and Immunobiology (Biotol S.) Latest edition. Publisher: ButterworthHeinemann.
5. Defence Mechanisms, Biotol Series, Butterworth/Heinemann, Oxford, UK.
6. HighYield Immunology. Arthur G. Johnson . Latest edition / Pub. Publisher: Lippincott Williams & Wilkins.
7. B Alberts et al, Essential Cell Biology: An Introduction to the Molecular Biology of the Cell. 2/e, 2003. ISBN 0-8153-3480-X (with CD-ROM). A short version of the Alberts book listed above

Examination, Evaluation and Assessment Scheme

1. External Theory -- 30 Marks

2. Internal- 20 Marks

Distribution of Internal Marks

1. Continuous Assessment Test (Best 2 out of 3 tests) ----- 10 Marks

2. Report of Seminar / Field visit/ Case study/ Any innovative method ----- 10 Marks

Total ----- 20 Marks

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Marks
5.5	VI	133246	Major- Biophysical Techniques and Biostatistics	2	30	2 Hrs	30
Course Objectives:		After this course, students will be able to - Understand techniques and mechanism of biophysics. - Understand Scope and application of statistics in Zoology and Allied sciences					
Course Outcome:		After successful completion of this course, the students will be able to - Understand the principles and applications of major biophysical techniques used in biological research. - Demonstrate knowledge of instrumentation and working mechanisms of techniques such as spectroscopy, chromatography, electrophoresis and centrifugation. - Use statistical graphical methods for scientific data interpretation. - Understand basic statistical concepts including measures of central tendency.					
Unit	Contents					Workload Allotted	Weightage of Marks Allotted
Unit I	Techniques in Biophysics: - Principle, Working and applications 1.1 Basic phenomenon in Biophysics (Surface tension, Light, adsorption, colloids and Viscosity) 1.2 Centrifugation: Principles of sedimentation, relative centrifugal Field (RCF), and types of rotors 1.3 Ultracentrifugation: Differential and density gradient centrifugation. 1.4 Beer-Lambert Law, Colorimeter and Spectrophotometer. 1.5 Fluorescence Spectroscopy: Intrinsic and extrinsic fluorescence.					8 Hrs	8 Marks
Unit II	Separation Techniques:- Principle, Working and applications 2.1 Cellulose acetate paper chromatography, Ion-exchange Chromatography. 2.2 Affinity chromatography, High-Performance Liquid Chromatography (HPLC). 2.3 Nucleic Acid Electrophoresis: Agarose gel electrophoresis 2.4 Protein Electrophoresis: SDS-PAGE.					7 Hrs	7 Marks
Unit III	Presentation of Data 3.1 Tabular Representation of Data. Graphic Representation of Data. 3.2 Line Diagram – Histogram – Frequency Polygon – Frequency Curve – Cumulative Frequency Curve. 3.3 Types of Bar Diagram. 3.4 Pictogram, Cartogram.					8 Hrs	8 Marks
Unit IV	Measures of Central Tendency 4.1 Types of Averages - Mean, Median, Mode. 4.2 Standard Deviation 4.3 Standard Error 4.4 Coefficient of Variation.					7 Hrs	7 Marks

References:

1. Biophysics by W Hoope Edtr., Springer – Verlag New York
2. Molecular Biophysics by R B Setlaw & EC Pollard Addison Wesley Reading MA.
3. Biophysics by Volkensyteinl M V.
4. Molecular Biology of the cell by Watson et al.
5. Biophysics by C Sybesma.
6. Biophysical Chemistry Vol. 1,2 & 3 by C R Cantor & P R Sachimmel.
7. Physical Chemistry of Nucleic Acid by V A Bloomfield.
8. Physical Biochemistry by K E Van Holde.
9. Biological Spectroscopy by J Campbell.
10. Intermediate Physics for Medicine and Biology by R K Hobbble.
11. Biophysics by Roy
12. Rohtagi V.K. and. Saleh A. K. M. E (2015): An Introduction to Probability Theory and Mathematical Statistics, 3rd Edition, Wiley.
13. Miller I. and Miller M. (1999): Mathematical Statistics, 6th Edition, Oxford & IBH Pub.
14. Ross S. M. (2014): Introduction to Probability Models, 11th Edition, Academic Press.
15. Dudewicz E. J. and S. N. Mishra S. N. (1988): Modern Mathematical Statistics, Wiley International Student Edition.

Examination, Evaluation and Assessment Scheme

1. External Theory -- 30 Marks
2. Internal- 20 Marks

Distribution of Internal Marks

1. Continuous Assessment Test (Best 2 out of 3 tests)	-----	10 Marks
2. Report of Seminar / Field visit/ Case study/ Any innovative method	-----	10 Marks
Total -----		20 Marks

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Marks
5.5	VI	133247	Practical's based on Major Theory 11 to 13	2	60	3 Hrs	50
Course Objectives:		After this course, students will be able to - Understand the principles and applications of major biophysical techniques. - Perform separation of biomolecules using chromatography and electrophoresis. - Present scientific data using appropriate tabular and graphical methods. - Calculate and interpret basic statistical parameters.					
Course Outcome:		After successful completion of this course, the students will be able to - Understand the Histology of Endocrine Glands - Understand Semen analysis - Understand Identification of blood groups - Understand classification and construction of statistical tools.					
Lab/ Practical-20		List of Practicals: A) Practicals on Endocrine and Reproductive Biology Demonstration/Experiment/Using ICT Tools and Charts 1. Histology of Endocrine Glands : Pituitary, Thyroid , Adrenal, Pancreas 2. Study of abnormal sperm count. 3. Semen analysis 4. Study of different types of cells present in bone marrow 5. Examination and submission of slide testis, ovary, epididymis, prostate B) Practicals on Basic Immunology Demonstration/Experiment/Using ICT Tools and Charts 1. Identification of blood groups - A, B, AB, O and Rh 2. Screening of antigen and antibody (screening test in antibody production (Ouchterlony Double Diffusion). 3. Estimation of antigen and antibody content in the samples by Radial Immunodiffusion. 4. Counter - current immune electrophoresis. 5. Dot ELISA. C) Practicals on Biophysical Techniques and Biostatistics 1. Demonstration of separation of suspended particles using centrifugation. 2. Measurement of absorbance using Colorimeter/Spectrophotometer. 3. Separation of biomolecules by Cellulose Acetate Paper Chromatography and determination of R _f values. 4. Preparation of Agarose gel and separation of nucleic acids by Agarose gel electrophoresis. 5. Analysis of nucleic acid separation by Agarose gel electrophoresis. 6. Classification and tabular presentation of data. 7. Construction of Bar, Line and Pie Diagrams from given data. 8. Calculations of Mean, Median, Mode, Standard Deviation and Standard Error from given data.					
References:		1. Biophysical chemistry- Principles and technique: Upadhyay, Nath 2. Statistical techniques in Bioassay Z.Govindarajulu (2000): Pub. S.Kargar 3. Statistical method in Bioassay Pub D.J.Finney (1971):. Griffin 4. Laboratory manual for Biochemistry and Molecular biology, Shivnery Publishers R.N. Vankhede & S. N. Niwane 5. Basic Immunology: Abul K. Abbas, Andrew H. Lichtman. Latest edition, Publisher: Elsevier Health Sciences. 6. Immunology. David A. Goldsby, Janis Kuby, Thomas J. Kindt, Barbara A. Osborne Latest edition, Publisher: W. H. Freeman Company.					

7. Immunology. Ivan Roitt, Jonathan Brostoff, David Male, David K. Male (Editor). Latest edition , Publisher: Elsevier Health Sciences.
8. Cellular Interactions and Immunobiology (Biotol S.) Latest edition. Publisher: ButterworthHeinemann.
9. Defence Mechanisms, Biotol Series, Butterworth/Heinemann, Oxford, UK.
10. HighYield Immunology. Arthur G. Johnson . Latest edition / Pub. Publisher: Lippincott Williams & Wilkins.
11. B Alberts et al, Essential Cell Biology: An Introduction to the Molecular Biology of the Cell. 2/e, 2003. ISBN 0-8153-3480-X (with CD-ROM). A short version of the Alberts book listed above.

• **Distribution of Marks:**

Practical External (25 Marks)		Practical Internal (25 Marks)	
Major Experiment	10 Marks	Student performance and Attendance during regular practical	10 Marks
Minor Experiment	05 Marks	Certified Practical Record	05 Marks
Problem on Biostatistics	05 Marks	Submission of computerized problems solved by students	05 Marks
Viva - voce	05 Marks	Use of ICT	05 Marks
Total	25 Marks	Total	25 Marks

NEP2020: Scheme of Implementation for Three year Degree of Bachelor of Science in Zoology Discipline

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Marks
5.5	VI	133248	Major Elective -2. Applied Zoology & Entrepreneurships in life sciences	2	30	2 Hrs	30
Course Objectives:		After this course, students will be able to - To introduce students to the applied aspects of Zoology and their relevance in agriculture, fisheries, health, and environmental sustainability. - To develop understanding of entrepreneurship concepts, innovation, and start-up opportunities in life sciences and bio-based industries. - To provide knowledge about animal resource utilization, biotechnology, and commercial biological enterprises for sustainable development. - To enhance professional, managerial, leadership, and communication skills required for entrepreneurship and self-employment in life sciences. - To create awareness about research, bioethics, intellectual property rights, and career opportunities in applied zoology and biological industries.					
Course Outcome:		After successful completion of this course, the students will be able to - Understand the scope and applications of Applied Zoology in various life science sectors. - Explain entrepreneurial concepts, business planning and start-up opportunities in biological sciences. - Identify industrial and commercial applications related to animal-based and bio-resource enterprises. - Develop awareness about career opportunities, bioethics and intellectual property rights in life sciences. - Acquire basic professional and managerial skills necessary for entrepreneurship and sustainable development.					
Unit		Contents				Workload Allotted	Weightage of Marks Allotted
Unit I		1.1 Scope and Significance of Applied Zoology 1.2 Animal Resource Utilization and Sustainable Practices 1.3 Wildlife Conservation, Biodiversity and Ecotourism 1.4 Modern Applications of Zoology in Agriculture, Fisheries and Health				8 Hrs	8 Marks
Unit II		2.1 Fundamentals of Entrepreneurship in Biological Sciences 2.2 Innovation, Start-ups and Bio-based Enterprises 2.3 Leadership, Communication and Entrepreneurial Skills 2.4 Business Planning, Funding Agencies and Government Support Schemes				7 Hrs	7 Marks
Unit III		3.1 Sericulture, Apiculture and Lac Culture Industries 3.2 Vermiculture, Organic Farming and Waste Management 3.3 Aquaculture, Poultry and Dairy-based Enterprises 3.4 Animal Biotechnology and Commercial Biological Products				8 Hrs	8 Marks
Unit IV		4.1 Career Avenues in Applied Zoology and Life Sciences 4.2 Research, Intellectual Property Rights and Bioethics 4.3 Entrepreneurship Development through Skill-based Training 4.4 Marketing, Branding and Management of Life Science Enterprises				7 Hrs	7 Marks

References:

1. Shukla, G. S. & Upadhyay, V. B. (2018). *Economic Zoology*. Rastogi Publications, Meerut.
2. Nagabhushanam, R. & Smita Oswal. (2015). *Applied Zoology*. Oxford & IBH Publishing Co., New Delhi.
3. Khanna, S. S. & Yadav, P. R. (2016). *An Introduction to Entrepreneurship*. Sultan Chand & Sons, New Delhi.
4. Hisrich, R. D., Peters, M. P. & Shepherd, D. A. (2017). *Entrepreneurship*. McGraw Hill Education.
5. Kumar, H. D. (2000). *Modern Concepts of Ecology*. Vikas Publishing House, New Delhi.
6. Rathore, N. S. & Choudhary, G. N. (2010). *Entrepreneurship in Small Scale Industries*. Himalaya Publishing House.
7. Srivastava, C. B. L. (2013). *Applied and Economic Zoology*. Narendra Publishing House.
8. Tripathi, G. (2011). *A Textbook of Environmental Studies and Biodiversity Conservation*. Pointer Publishers, Jaipur.
9. Dubey, R. C. (2014). *A Textbook of Biotechnology*. S. Chand & Company Ltd., New Delhi.
10. Vasantharaj David, B. (2008). *Elements of Economic Entomology*. Popular Book Depot, Chennai.
11. ICAR Manuals on Apiculture, Sericulture, Fisheries and Dairy Enterprises.
12. Government of India – Start-up India, MSME, and Biotechnology Industry Research Assistance Council (BIRAC) Guidelines and Reports.

Examination, Evaluation and Assessment Scheme

1. External Theory -- 30 Marks
2. Internal- 20 Marks

Distribution of Internal Marks

1. Continuous Assessment Test (Best 2 out of 3 tests)	-----	10 Marks
2. Report of Seminar / Field visit/ Case study/ Any innovative method	-----	10 Marks
Total -----		20 Marks

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Marks
5.5	VI	133249	Practical based on Major Elective2 Applied Zoology & Entrepreneurships in life sciences	2	60	3 Hrs	50
Course Objectives:		After this course, students will be able to - To introduce students to the applied aspects of Zoology and their relevance in agriculture, fisheries, health, and environmental sustainability. - To develop understanding of entrepreneurship concepts, innovation, and start-up opportunities in life sciences and bio-based industries. - To provide knowledge about animal resource utilization, biotechnology, and commercial biological enterprises for sustainable development. - To enhance professional, managerial, leadership, and communication skills required for entrepreneurship and self-employment in life sciences. - To create awareness about research, bioethics, intellectual property rights, and career opportunities in applied zoology and biological industries.					
Course Outcome:		After successful completion of this course, the students will be able to - Understand the scope and applications of Applied Zoology in various life science sectors. - Explain entrepreneurial concepts, business planning and start-up opportunities in biological sciences. - Identify industrial and commercial applications related to animal-based and bio-resource enterprises. - Develop awareness about career opportunities, bioethics and intellectual property rights in life sciences. - Acquire basic professional and managerial skills necessary for entrepreneurship and sustainable development.					
Lab/ Practical-22		List of Practicals Major Practicals - Study of instruments used in applied zoology and biotechnology laboratories. - Preparation and maintenance of vermicompost unit. - Study of honey bee colony organization and apiculture practices. - Study of sericulture techniques and life cycle of silkworm. - Preparation of a mini business plan for a life science enterprise. - Field visit to dairy, poultry, fish farm, sericulture/apiculture unit or biotechnology industry and submission of report. Minor Practicals - Study of lac culture and host plants. - Identification of commercial fish species, poultry and dairy breeds. - Demonstration of organic farming and waste management methods. - Study of animal biotechnology products and biofertilizers. Specimen / Slide Study - Identification and economic importance of: honey bee, silkworm, lac insect, earthworm, fish species, poultry breeds, dairy breeds and biofertilizers. - Study of permanent slides/charts of honey bee mouthparts, silkworm stages, earthworm anatomy, fish scales and microorganisms used in biofertilizers. Field Study - Visit to aquaculture unit, vermicompost unit, biodiversity park or biological industry with report submission.					

References

1. Shukla, G. S. & Upadhyay, V. B. (2018). *Economic Zoology*. Rastogi Publications, Meerut.
2. Nagabhushanam, R. & Smita Oswal. (2015). *Applied Zoology*. Oxford & IBH Publishing Co., New Delhi.
3. Khanna, S. S. & Yadav, P. R. (2016). *An Introduction to Entrepreneurship*. Sultan Chand & Sons, New Delhi.
4. Hisrich, R. D., Peters, M. P. & Shepherd, D. A. (2017). *Entrepreneurship*. McGraw Hill Education.
5. Kumar, H. D. (2000). *Modern Concepts of Ecology*. Vikas Publishing House, New Delhi.
6. Rathore, N. S. & Choudhary, G. N. (2010). *Entrepreneurship in Small Scale Industries*. Himalaya Publishing House.
7. Srivastava, C. B. L. (2013). *Applied and Economic Zoology*. Narendra Publishing House.
8. Tripathi, G. (2011). *A Textbook of Environmental Studies and Biodiversity Conservation*. Pointer Publishers, Jaipur.
9. Dubey, R. C. (2014). *A Textbook of Biotechnology*. S. Chand & Company Ltd., New Delhi.
10. Vasantharaj David, B. (2008). *Elements of Economic Entomology*. Popular Book Depot, Chennai.
11. ICAR Manuals on Apiculture, Sericulture, Fisheries and Dairy Enterprises.
12. Government of India – Start-up India, MSME, and Biotechnology Industry Research Assistance Council (BIRAC) Guidelines and Reports.

- **Distribution of Marks:**

Practical External (25 Marks)		Practical Internal (25 Marks)	
Major Practical	10 Marks	Assignment / Seminar	05 Marks
Minor Practical	05 Marks	Class Record & Journal	05 Marks
Specimen / Slide Identification	05 Marks	Field Visit Report	05 Marks
Viva-Voce	05 Marks	Attendance & Practical Performance	10 Marks
Total	25 Marks	Total	25 Marks

NEP2020: Scheme of Implementation for Three year Degree of Bachelor of Science in Zoology Discipline

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Marks
5.5	VI	133250	Major Elective-2. Zookeeping and Ecotourism	2	30	2 Hrs	30
Course Objectives:		After this course, students will be able to - To introduce students to the principles and practices of zookeeping, animal care, and zoo management. - To develop understanding of wildlife conservation, captive breeding, and animal welfare practices in modern zoos. - To familiarize students with the concepts, scope, and significance of ecotourism and sustainable tourism. - To enhance knowledge about biodiversity conservation, protected areas, and community participation in wildlife tourism. - To develop professional, technical, and entrepreneurial skills related to zoo administration, wildlife conservation, and ecotourism industries.					
Course Outcome:		After successful completion of this course, the students will be able to - Students will understand the structure, functions, and management principles of modern zoos. - Students will acquire knowledge about captive animal care, welfare, and conservation practices. - Students will explain concepts of ecotourism, biodiversity conservation, and sustainable tourism. - Students will develop professional and entrepreneurial skills related to wildlife tourism and zoo management. - Students will identify career opportunities in zookeeping, wildlife conservation, and ecotourism sectors.					
Unit		Contents				Workload Allotted	Weightage of Marks Allotted
Unit I		Fundamentals of Zookeeping and Wildlife Conservation 1.1 Introduction to Zoos: History, Types, and Functions 1.2 Principles of Animal Housing and Enclosure Design 1.3 Feeding, Nutrition, and Health Care of Captive Animals 1.4 Role of Zoos in Wildlife Conservation and Education				8 Hrs	8 Marks
Unit II		Zoo Management and Animal Welfare 2.1 Zoo Administration and Record Maintenance 2.2 Animal Behaviour Monitoring and Enrichment Techniques 2.3 Captive Breeding and Conservation Programs 2.4 Zoo Ethics, Animal Welfare Laws, and Safety Measures				7 Hrs	7 Marks
Unit III		Ecotourism and Biodiversity Conservation 3.1 Concept, Scope, and Importance of Ecotourism 3.2 Biodiversity Hotspots and Protected Areas in India 3.3 Sustainable Tourism and Environmental Impact Management 3.4 Community Participation in Wildlife and Nature Tourism				8 Hrs	8 Marks
Unit IV		Wildlife Tourism, Entrepreneurship, and Career Opportunities 4.1 Wildlife Safari Management and Nature Interpretation 4.2 Ecotourism Entrepreneurship and Eco-friendly Business Models 4.3 Role of Technology and Media in Ecotourism Promotion 4.4 Career Opportunities in Zoos, Wildlife Conservation, and Tourism Sector				7 Hrs	7 Marks

References:

1. Kleiman, D. G., Allen, M. E., Thompson, K. V. & Lumpkin, S. (2010). *Wild Mammals in Captivity: Principles and Techniques for Zoo Management*. University of Chicago Press.
2. Hutchins, M., Smith, B. & Allard, R. (2003). *Zoo and Aquarium Animal Management and Conservation*. Smithsonian Institution Press.
3. Singh, S. (2009). *Ecotourism and Sustainable Development*. ABD Publishers, Jaipur.
4. Weaver, D. (2008). *Ecotourism*. John Wiley & Sons, Australia.
5. Negi, S. S. (2003). *Biodiversity and Ecotourism*. International Book Distributors, Dehradun.
6. Dasmann, R. F. (1981). *Wildlife Biology*. John Wiley & Sons.
7. Hosetti, B. B. (2016). *Biodiversity Conservation and Management*. Daya Publishing House, New Delhi.
8. Mukherjee, S. (2018). *Wildlife Tourism and Conservation*. Scientific Publishers, Jodhpur.
9. Government of India. *Wildlife Protection Act, 1972* and latest amendments.
10. Central Zoo Authority (CZA), India – Guidelines and Manuals on Zoo Management and Animal Welfare.

Examination, Evaluation and Assessment Scheme

1. External Theory -- 30 Marks
2. Internal- 20 Marks

Distribution of Internal Marks

1. Continuous Assessment Test (Best 2 out of 3 tests)	-----	10 Marks
2. Report of Seminar / Field visit/ Case study/ Any innovative method	-----	10 Marks
Total -----		20 Marks

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Marks
5.5	VI	133251	Practical based on Major Elective-2 Zookeeping and Ecotourism	2	60	3 Hrs	50
Course Objectives:		After this course, students will be able to - To introduce students to the principles and practices of zookeeping, animal care, and zoo management. - To develop understanding of wildlife conservation, captive breeding, and animal welfare practices in modern zoos. - To familiarize students with the concepts, scope, and significance of ecotourism and sustainable tourism. - To enhance knowledge about biodiversity conservation, protected areas, and community participation in wildlife tourism. - To develop professional, technical, and entrepreneurial skills related to zoo administration, wildlife conservation, and ecotourism industries.					
Course Outcome:		After successful completion of this course, the students will be able to - Students will understand the structure, functions, and management principles of modern zoos. - Students will acquire knowledge about captive animal care, welfare, and conservation practices. - Students will explain concepts of ecotourism, biodiversity conservation, and sustainable tourism. - Students will develop professional and entrepreneurial skills related to wildlife tourism and zoo management. - Students will identify career opportunities in zookeeping, wildlife conservation, and ecotourism sectors.					
Lab/ Practical-22		List of Practicals Major Practicals - Study of zoo layout and functional sections - Study of animal enclosure design and enrichment techniques - Feeding and nutrition management of captive animals - Health care, sanitation, and quarantine practices in zoos - Observation and recording of animal behaviour in captivity - Zoo administration and record maintenance - Captive breeding and conservation programmes - Ecotourism management and nature interpretation techniques Minor Practicals - Preparation of diet chart for captive animals - Study of zoo safety measures and animal welfare practices - Identification of biodiversity hotspots of India - Study of protected areas: National Parks and Sanctuaries - Survey of eco-friendly tourism practices - Study of wildlife tourism promotional tools and media Specimens / Slides Study - Mammalian hair samples - Bird feathers - Horns / antlers (models/photos) - Animal footprints / pugmarks - Animal feed samples - Camera trap photographs - Zoo record sheets - Ecotourism brochures / interpretation materials					

	Field Visits (Any 1–2) • Zoo / Mini Zoo • National Park / Wildlife Sanctuary • Bird Sanctuary / Biodiversity Park • Ecotourism Site / Nature Interpretation Centre
References	1. Kleiman, D. G., Allen, M. E., Thompson, K. V. & Lumpkin, S. (2010). <i>Wild Mammals in Captivity: Principles and Techniques for Zoo Management</i>. University of Chicago Press. 2. Hutchins, M., Smith, B. & Allard, R. (2003). <i>Zoo and Aquarium Animal Management and Conservation</i>. Smithsonian Institution Press. 3. Singh, S. (2009). <i>Ecotourism and Sustainable Development</i>. ABD Publishers, Jaipur. 4. Weaver, D. (2008). <i>Ecotourism</i>. John Wiley & Sons, Australia. 5. Negi, S. S. (2003). <i>Biodiversity and Ecotourism</i>. International Book Distributors, Dehradun. 6. Dasmann, R. F. (1981). <i>Wildlife Biology</i>. John Wiley & Sons. 7. Hosetti, B. B. (2016). <i>Biodiversity Conservation and Management</i>. Daya Publishing House, New Delhi. 8. Mukherjee, S. (2018). <i>Wildlife Tourism and Conservation</i>. Scientific Publishers, Jodhpur. 9. Government of India. <i>Wildlife Protection Act, 1972</i> and latest amendments. 10. Central Zoo Authority (CZA), India – Guidelines and Manuals on Zoo Management and Animal Welfare.

• **Distribution of Marks:**

Practical External (25 Marks)		Practical Internal (25 Marks)	
Major Practical / Specimen	10 Marks	Assignment / Seminar	05 Marks
Minor Practical / Slide	05 Marks	Class Record / Journal	05 Marks
Field Report / Spotting	05 Marks	Field Visit Report	10 Marks
Viva-Voce	05 Marks	Attendance & Participation	05 Marks
Total	25 Marks	Total	25 Marks

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Marks
5.5	VI	133252	Minor- 6. Vector Biology and Disease Control	2	30	2 Hrs	30
Course Objectives:		After this course, students will be able to - To introduce students to the concept, diversity, and biological characteristics of disease vectors. - To develop understanding of vector-borne diseases and their transmission mechanisms. - To familiarize students with the ecology, life cycle, and identification of major insect vectors. - To explain the principles and methods of vector surveillance and control strategies. - To create awareness about public health importance and integrated vector management practices. - To provide basic knowledge of emerging vector-borne diseases and preventive measures.					
Course Outcome:		After successful completion of this course, the students will be able to. - Identify major vectors and describe their morphology, biology, and life cycles. - Explain the transmission and epidemiology of important vector-borne diseases. - Differentiate various biological, chemical, and environmental vector control methods. - Understand vector surveillance techniques and disease prevention strategies. - Apply principles of integrated vector management in public health programs. - Recognize the significance of community participation in vector-borne disease control.					
Unit		Contents				Workload Allotted	Weightage of Marks Allotted
Unit I		Introduction to Vector Biology 1.1 Concept and importance of vectors 1.2 Classification of vectors: Mechanical and Biological vectors 1.3 Morphology and life cycle of mosquitoes, houseflies, and ticks 1.4 Vector adaptation and environmental factors affecting vectors				8 Hrs	8 Marks
Unit II		Major Vector-Borne Diseases 2.1 Malaria and Dengue 2.2 Filariasis and Chikungunya 2.3 Plague, Typhus, and Lyme disease 2.4 Transmission mechanisms and epidemiology of vector-borne diseases				7 Hrs	7 Marks
Unit III		Vector Surveillance and Control 3.1 Vector surveillance and sampling methods 3.2 Physical and environmental control measures 3.3 Chemical control: Insecticides and larvicides 3.4 Biological control and Integrated Vector Management (IVM)				8 Hrs	8 Marks
Unit IV		Public Health and Emerging Vector Issues 4.1 National Vector Borne Disease Control Programme (NVBDCP) 4.2 Community participation and health education 4.3 Emerging and re-emerging vector-borne diseases 4.4 Climate change and its impact on vector distribution				7 Hrs	7 Marks

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References:

1. Pedigo, L.P. & Rice, M.E. *Entomology and Pest Management*. Pearson Education.
2. Service, M. *Medical Entomology for Students*. Cambridge University Press.
3. Eldridge, B.F. & Edman, J.D. *Medical Entomology: A Textbook on Public Health and Veterinary Problems*. Springer.
4. Gullan, P.J. & Cranston, P.S. *The Insects: An Outline of Entomology*. Wiley-Blackwell.
5. Park, K. *Textbook of Preventive and Social Medicine*. Banarsidas Bhanot Publishers.
6. World Health Organization (WHO). *Vector-Borne Diseases and Vector Control Manuals*.
7. Chapman, R.F. *The Insects: Structure and Function*. Cambridge University Press.

Examination, Evaluation and Assessment Scheme

1. External Theory -- 30 Marks
2. Internal - 20 Marks

Distribution of Internal Marks

- | | | |
|---|-------|----------|
| 1. Continuous Assessment Test (Best 2 out of 3 tests) | ----- | 10 Marks |
| 2. Report of Seminar / Field visit/ Case study/ Any innovative method | ----- | 10 Marks |

Total -----	20 Marks
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Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Marks
5.5	VI	133253	Practical based on Theory Minor-Vector Biology and Disease Control	2	60	3 Hrs	50
Course Objectives:		After this course, students will be able to - To introduce students to the concept, diversity, and biological characteristics of disease vectors. - To develop understanding of vector-borne diseases and their transmission mechanisms. - To familiarize students with the ecology, life cycle, and identification of major insect vectors. - To explain the principles and methods of vector surveillance and control strategies. - To create awareness about public health importance and integrated vector management practices. - To provide basic knowledge of emerging vector-borne diseases and preventive measures.					
Course Outcome:		After successful completion of this course, the students will be able to. - Identify major vectors and describe their morphology, biology, and life cycles. - Explain the transmission and epidemiology of important vector-borne diseases. - Differentiate various biological, chemical, and environmental vector control methods. - Understand vector surveillance techniques and disease prevention strategies. - Apply principles of integrated vector management in public health programs. - Recognize the significance of community participation in vector-borne disease control.					
Lab/ Practical - 18		List of Practical's Major Practical's - Study of morphology and identification of mosquito vectors – <i>Anopheles</i>, <i>Culex</i>, and <i>Aedes</i>. - Study of life cycle stages of mosquitoes (egg, larva, pupa, adult). - Collection and identification of houseflies, lice, fleas, and ticks. - Preparation and observation of temporary mounts of mosquito mouthparts and legs. - Survey of mosquito breeding habitats in local areas. - Demonstration of vector surveillance methods: light traps, ovitraps, and larval sampling. - Study of biological control agents used against vectors (<i>Gambusia</i> fish, larvivorous organisms, <i>Bacillus thuringiensis</i>). - Field study and report on vector-borne diseases and preventive measures in nearby communities. Minor Practical's - Identification of mechanical and biological vectors. - Study of symptoms and transmission of malaria, dengue, and filariasis. - Observation of preserved specimens/charts of vector-borne pathogens. - Demonstration of insecticides and larvicides used in vector control. - Study of personal protective measures against vectors (bed nets, repellents, screens). - Preparation of awareness material/posters related to vector-borne diseases. Slides / Specimen Study <i>Anopheles</i> mosquito <i>Aedes</i> mosquito <i>Culex</i> mosquito - Housefly (<i>Musca domestica</i>) - Tick and flea specimens - Mosquito larva and pupa slides					

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	Excursion / Field Visit • Visit to nearby stagnant water bodies for mosquito breeding survey. • Field visit to public health department / malaria control unit. • Observation visits to sanitation and waste disposal sites. • Survey and documentation of vector prevalence in rural or urban habitats. • Preparation and submission of excursion report related to vector biology and disease control.
References	1. Service, M. <i>Medical Entomology for Students</i>. Cambridge University Press. 2. Eldridge, B.F. & Edman, J.D. <i>Medical Entomology: A Textbook on Public Health and Veterinary Problems</i>. Springer. 3. Gullan, P.J. & Cranston, P.S. <i>The Insects: An Outline of Entomology</i>. Wiley-Blackwell. 4. Pedigo, L.P. & Rice, M.E. <i>Entomology and Pest Management</i>. Pearson Education. 5. Chapman, R.F. <i>The Insects: Structure and Function</i>. Cambridge University Press. 6. WHO (World Health Organization). <i>Manual on Practical Entomology in Malaria</i>. WHO Publications. 7. WHO (World Health Organization). <i>Vector Surveillance and Control Manuals</i>. WHO Publications. 8. Park, K. <i>Textbook of Preventive and Social Medicine</i>. Banarsidas Bhanot Publishers. 9. Tyagi, B.K. <i>Vector Biology and Control</i>. Scientific Publishers, India. 10. Directorate of National Vector Borne Disease Control Programme (NVBDCP), Government of India – Training Manuals and Guidelines.

• **Distribution of Marks:**

Practical External (25 Marks)		Practical Internal (25 Marks)	
Major Practical	10 Marks	Assignment	05 Marks
Minor Practical	05 Marks	Project / Field Report	05 Marks
Specimen / Slide Identification	05 Marks	Attendance	05 Marks
Viva-voce	05 Marks	Practical Performance and Participation	10 Marks
Total	25 Marks	Total	25 Marks

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Marks
5.5	VI	133254	VSE Advance Applications (Career oriented) / Practical based on Major Elective – 2. Applied Zoology & Entrepreneurships in life sciences	2	30	2 Hrs	50
Course Objectives:		After this course, students will be able to - To introduce students to the applied aspects of Zoology and their relevance in agriculture, fisheries, health, and environmental sustainability. - To develop understanding of entrepreneurship concepts, innovation, and start-up opportunities in life sciences and bio-based industries. - To provide knowledge about animal resource utilization, biotechnology, and commercial biological enterprises for sustainable development. - To enhance professional, managerial, leadership, and communication skills required for entrepreneurship and self-employment in life sciences. - To create awareness about research, bioethics, intellectual property rights, and career opportunities in applied zoology and biological industries.					
Course Outcomes:		After successful completion of this course, the students will be able to - Understand the scope and applications of Applied Zoology in various life science sectors. - Explain entrepreneurial concepts, business planning and start-up opportunities in biological sciences. - Identify industrial and commercial applications related to animal-based and bio-resource enterprises. - Develop awareness about career opportunities, bioethics and intellectual property rights in life sciences. - Acquire basic professional and managerial skills necessary for entrepreneurship and sustainable development.					
Lab/ Practical-24		Laboratory Practical's: Major Practical's - Study of animal resource utilization and sustainable practices - Demonstration of vermicomposting and organic waste management techniques - Study of biodiversity conservation and ecotourism models - Study of entrepreneurship concepts and start-up models in life sciences - Preparation of a simple business plan for bio-based enterprise - Study of leadership, communication and entrepreneurial skills - Study of marketing, branding and management of biological products - Survey of government schemes and funding agencies for life science enterprises Minor Practical's - Study of sericulture and apiculture industries - Identification of aquaculture, poultry and dairy enterprise models - Demonstration of organic farming methods - Study of animal biotechnology products and commercial applications - Preparation of project report for small-scale life science enterprise - Study of bioethics and intellectual property rights case examples					

	Specimen / Slide Study (Any 7–8) • Honey bee • Silkworm stages • Lac insect • Earthworm • Commercial fish species • Poultry breeds • Dairy breeds • Biofertilizers and related microorganisms Field Visits (Any 1–2) • Aquaculture / Fish Farm • Vermicompost or Organic Farming Unit • Dairy / Poultry / Apiculture Unit • Biotechnology Industry / Biodiversity Park
References	1. Shukla, G. S. & Upadhyay, V. B. (2018). <i>Economic Zoology</i>. Rastogi Publications, Meerut. 2. Nagabhushanam, R. & Smita Oswal. (2015). <i>Applied Zoology</i>. Oxford & IBH Publishing Co., New Delhi. 3. Khanna, S. S. & Yadav, P. R. (2016). <i>An Introduction to Entrepreneurship</i>. Sultan Chand & Sons, New Delhi. 4. Hisrich, R. D., Peters, M. P. & Shepherd, D. A. (2017). <i>Entrepreneurship</i>. McGraw Hill Education. 5. Kumar, H. D. (2000). <i>Modern Concepts of Ecology</i>. Vikas Publishing House, New Delhi. 6. Rathore, N. S. & Choudhary, G. N. (2010). <i>Entrepreneurship in Small Scale Industries</i>. Himalaya Publishing House. 7. Srivastava, C. B. L. (2013). <i>Applied and Economic Zoology</i>. Narendra Publishing House. 8. Tripathi, G. (2011). <i>A Textbook of Environmental Studies and Biodiversity Conservation</i>. Pointer Publishers, Jaipur. 9. Dubey, R. C. (2014). <i>A Textbook of Biotechnology</i>. S. Chand & Company Ltd., New Delhi. 10. Vasantharaj David, B. (2008). <i>Elements of Economic Entomology</i>. Popular Book Depot, Chennai. 11. ICAR Manuals on Apiculture, Sericulture, Fisheries and Dairy Enterprises. 12. Government of India – Start-up India, MSME, and Biotechnology Industry Research Assistance Council (BIRAC) Guidelines and Reports.

Note: Mode of Examination: Internal (There is no External Examination)

Evaluation of Practical Marks	Marks
Practical Record / Journal	10
Field Visit Report (Fish Farm / Organic Farming Unit / Biodiversity Park)	10
Spotting / Identification of animals & materials	10
Viva-Voce (Oral examination)	10
Project / Model / Brochure	10
Total Marks-	50

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Marks
5.5	VI	133255	VSE Advance Applications (Career oriented) / Practical based on Major Elective –2. Zookeeping and Ecotourism	2	30	2 Hrs	50
Course Objectives:		After this course, students will be able to - To introduce students to the principles and practices of modern zoo management and animal care. - To develop skills in handling, feeding, and maintaining captive wild animals ethically and scientifically. - To familiarize students with ecotourism concepts and its role in biodiversity conservation. - To understand habitat design, enrichment techniques, and welfare standards in zoological parks. - To train students in visitor management and interpretation in ecotourism settings. - To develop career-oriented competencies in zookeeping, wildlife tourism, and conservation sectors.					
Course Outcomes:		After successful completion of the course, the students will be able to: - Apply scientific methods for animal care and zoo management practices. - Demonstrate knowledge of enclosure design, feeding schedules, and health monitoring of captive animals. - Identify ecotourism components and evaluate their conservation significance. - Develop basic skills in wildlife interpretation and environmental awareness programs. - Analyze ethical issues in captivity, wildlife tourism, and conservation practices. - Explore career opportunities in zoological parks, sanctuaries, and ecotourism industries.					
Lab/ Practical-24		Laboratory Practicals: - Study of zoo layout, functional zones, and administrative structure - Design of animal enclosures with emphasis on habitat simulation and enrichment techniques - Preparation of species-specific feeding charts and nutritional management of captive animals - Study of health care practices, sanitation measures, and quarantine protocols in zoos - Observation, recording, and analysis of animal behaviour in captivity - Zoo record maintenance including animal inventory, health records, and documentation systems - Study of captive breeding programmes and conservation management strategies - Ecotourism planning and techniques of nature interpretation and visitor education - Study of protected areas (National Parks, Wildlife Sanctuaries, Conservation Reserves) and their management - Survey of biodiversity hotspots and eco-sensitive regions of India - Field visit report and analysis (Zoo / Sanctuary / Ecotourism site) with interpretation of conservation practices					

References	1. Rees, P.A. – <i>An Introduction to Zoo Biology and Management</i> 2. Kleiman, D.G., Thompson, K.V. – <i>Wild Mammals in Captivity</i> 3. Fowler, M.E. – <i>Zoo and Wild Animal Medicine</i> 4. Tribe, A. & Booth, R. – <i>Understanding Animal Welfare</i> 5. Carter, R. & Lowman, G. – <i>Ecotourism: A Sustainable Option</i> 6. Fennell, D.A. – <i>Ecotourism (2nd Edition)</i> 7. Gurung, D.B. & De Coursey, M.A. – <i>Ecotourism and Conservation</i> 8. Singh, S. – <i>Wildlife Tourism and Conservation Biology</i>
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Note: Mode of Examination: Internal (There is no External Examination)

Evaluation of Practical Marks	Marks
Practical Record / Journal	10
Field Visit Report (Zoo / Sanctuary / Ecotourism site)	10
Spotting / Identification of animals & materials	10
Viva-Voce (Oral examination)	10
Project / Model / Brochure (Ecotourism or Enclosure design)	10
Total Marks-	50

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Marks
5.5	VI	133256	Internship / Apprenticeship Corresponding to Major: On Job Training (OJT)	4	120	-	-
Course Objectives:		After this course, students will be able to - Bridge the gap between classroom learning and real-world experience. - It enables students to apply theoretical knowledge in practical settings. - Helping them develop essential skills like problem-solving, communication, and teamwork. - The program also provides an opportunity for career exploration and networking, giving students a head start in the job market.					
Course Outcomes:		After successful completion of the course, the students will be able to: - By completing 120 hours of OJT, students earn 4 academic credits, gaining valuable hands-on experience relevant to their major subjects. - It encourages self-discovery, builds confidence, and prepares students for professional challenges while emphasizing ethical and professional conduct. - Overall, the OJT program is designed to equip students with the skills and experiences needed to succeed in their future careers.					
Guidelines/ SoP for Internship / Apprenticeship Corresponding to Major: On Job Training (OJT)		Guidelines/ SoP for Internship / Apprenticeship Corresponding to Major: On Job Training (OJT) 1. Eligibility and Duration: Students are eligible to start searching and engaging in OJT after Semester IV examinations. The 120 hours of OJT must be completed before the completion/commencement of Semester VI examination. Ensure that all activities of OJT are conducted outside regular lecture and practical hours. Attendance for other courses in semester V and VI should be as per norms and it should not be affected due to OJT activities. 2. Approval Process for Self-Identified OJT: Students opting for self-identified OJT must ensure the role is relevant to their major subjects. Prior approval must be obtained from the assigned mentor/OJT Coordinator by submitting an OJT proposal detailing: Organization details. Job role and description. Relevance to major subjects. The mentor/OJT Coordinator will review and provide written approval. 3. Documentation and Reporting: 1 Weekly Reports: Students must prepare and submit weekly reports as per the college's prescribed format detailing tasks, learnings, and reflections. 2 Final Report: Based on the weekly reports, students are required to compile a Final Report summarizing their OJT experience. The Final Report must follow the prescribed format. Students must deliver a presentation summarizing key aspects of their OJT including learnings and achievements. 4. Roles and Responsibilities: 1 Students: Proactively search for suitable OJT opportunities after Semester IV exams. Ensure relevance to major subjects if opting for self-identified OJT and obtain prior approval. Complete 120 hours of OJT within the stipulated time. Submit Weekly Reports, Final Report, and prepare for the Presentation and Viva. Demonstrate professionalism, punctuality, and ethical behavior during the OJT. 2 Mentors: Guide students in selecting appropriate OJT opportunities. Review and approve self-identified OJT proposals. Provide feedback on Weekly Reports and assist with the Final Report. Support students in preparing for the Presentation and Viva. Evaluate					

5. **OJT Coordinator:** Oversee the implementation and execution of the OJT policy. Coordinate with mentors, students.
6. **Maintain records of students:** OJT progress and assessment outcomes. Ethical Considerations and Integrity: Students must maintain academic integrity by submitting original reports and avoiding plagiarism. Any form of misrepresentation or falsification of data will result in disqualification and disciplinary action.
7. **Amendment of Policy:** In exceptional circumstances the Principal reserves the right to exercise discretion to amend the policy. Any amendments will be communicated to students and faculty through official channels.
8. **Assessment and Credits:** The OJT carries 4 credits, awarded based on the following evaluation criteria: Criteria Completion of Internship of 120 hrs Submission of Weekly Reports Submission of Final Report Presentation Viva, all assigned tasks, reports, and presentations must be completed as per the schedule. Failure to fulfil any requirement will result in the student being marked as failed for the activity.
9. **Backlog Management:**
 - I. Students who are declared failed in the On-the-Job Training (OJT) during their regular attempt shall be provided with an opportunity to clear the backlog by resubmitting the pending components of the OJT, in accordance with guidelines,
 - II. If the pending component involves incomplete mandatory hours of On-the-Job Training and the student wishes to complete: i) the training with the same employer, the student shall be permitted to complete only the remaining hours necessary to fulfil the 120-hour requirement. ii) The training with a different employer, the student shall be required to undergo the full 120 hours of training afresh.
 - III. In cases where the pending component pertains solely to the presentation OR submission of reports (as per the prescribed format) and presentation OR submission of reports (as per the prescribed format), presentation and viva, the OJT of 120 hours already completed by the student may be considered valid for resubmission purposes for additional 3 attempts, excluding the original attempt.