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| B.sc.,  Wild Life Biology |
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| |  | | --- | | **SYLLABUS** | | **from the academic year**  **2023-2024** | |
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| **TAMILNADU STATE COUNCIL FOR HIGHER EDUCATION, CHENNAI – 600 005**  **Contents**   1. PO and PSO Description 2. UG – Template 3. Methods of Evaluation & Methods of Assessment 4. Semester Index. 5. Subjects – Core, Elective, Nonmajor, Skill Enhanced, Ability Enhanced, Extension Activity, Environment, Professional Competency 6. Course Lesson Box 7. Course Objectives 8. Units 9. Learning Outcome 10. Reference and Text Books 11. Web Sources 12. PO & PSO Mapping tables |
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| **LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK GUIDELINES BASED REGULATIONS FOR UNDER GRADUATE PROGRAMME** | |
| **Programme:** | **B.Sc. WILDLIFE BIOLOGY** |
| **Programme Code:** |  |
| **Duration:** | **3 Years (UG)** |
| **Programme Outcomes:** | **PO1: Disciplinary knowledge:** Capable of demonstrating comprehensive knowledge and understanding of one or more disciplines that form a part of an undergraduate Programme of study  **PO2: Communication Skills:** Ability to express thoughts and ideas effectively in writing and orally; Communicate with others using appropriate media; confidently share one’s views and express herself/himself; demonstrate the ability to listen carefully, read and write analytically, and present complex information in a clear and concise manner to different groups.  **PO3: Critical thinking:** Capability to apply analytic thought to a body of knowledge; analyse and evaluate evidence, arguments, claims, beliefs on the basis of empirical evidence; identify relevant assumptions or implications; formulate coherent arguments; critically evaluate practices, policies and theories by following scientific approach to knowledge development.  **PO4: Problem solving: Capacity** to extrapolate from what one has learned and apply their competencies to solve different kinds of non-familiar problems, rather than replicate curriculum content knowledge; and apply one’s learning to real life situations.  **PO5: Analytical reasoning**: Ability to evaluate the reliability and relevance of evidence; identify logical flaws and holes in the arguments of others; analyze and synthesize data from a variety of sources; draw valid conclusions and support them with evidence and examples, and addressing opposing viewpoints.  **PO6: Research-related skills**: A sense of inquiry and capability for asking relevant/appropriate questions, problem arising, synthesising and articulating; Ability to recognise cause-and-effect relationships, define problems, formulate hypotheses, test hypotheses, analyse, interpret and draw conclusions from data, establish hypotheses, predict cause-and-effect relationships; ability to plan, execute and report the results of an experiment or investigation  **PO7: Cooperation/Team work:** Ability to work effectively and respectfully with diverse teams; facilitate cooperative or coordinated effort on the part of a group, and act together as a group or a team in the interests of a common cause and work efficiently as a member of a team  **PO8: Scientific reasoning**: Ability to analyse, interpret and draw conclusions from quantitative/qualitative data; and critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective.  **PO9: Reflective thinking**: Critical sensibility to lived experiences, with self awareness and reflexivity of both self and society.  **PO10 Information/digital literacy:** Capability to use ICT in a variety of learning situations, demonstrate ability to access, evaluate, and use a variety of relevant information sources; and use appropriate software for analysis of data.  **PO 11 Self-directed learning**: Ability to work independently, identify appropriate resources required for a project, and manage a project through to completion.  **PO 12 Multicultural competence:** Possess knowledge of the values and beliefs of multiple cultures and a global perspective; and capability to effectively engage in a multicultural society and interact respectfully with diverse groups.  **PO 13: Moral and ethical awareness/reasoning**: Ability toembrace moral/ethical values in conducting one’s life, formulate a position/argument about an ethical issue from multiple perspectives, and use ethical practices in all work. Capable of demonstratingthe ability to identify ethical issues related to one‟s work, avoid unethical behaviour such as fabrication, falsification or misrepresentation of data or committing plagiarism, not adhering to intellectual property rights; appreciating environmental and sustainability issues; and adopting objective, unbiased and truthful actions in all aspects of work.  **PO 14: Leadership readiness/qualities:** Capability for mapping out the tasks of a team or an organization, and setting direction, formulating an inspiring vision, building a team who can help achieve the vision, motivating and inspiring team members to engage with that vision, and using management skills to guide people to the right destination, in a smooth and efficient way.  **PO 15: Lifelong learning:** Ability to acquire knowledge and skills, including „learning how to learn‟, that are necessary for participating in learning activities throughout life, through self-paced and self-directed learning aimed at personal development, meeting economic, social and cultural objectives, and adapting to changing trades and demands of work place through knowledge/skill development/reskilling. |
| **Programme Specific Outcomes:** | On successful completion of Bachelor of Physics with Computer Applications programme, the student should be able to:  **PSO1: Disciplinary Knowledge:** Understand the fundamental principles, concepts, and theories related to physics and computer science. Also, exhibit proficiency in performing experiments in the laboratory.  **PSO2: Critical Thinking:** Analyse complex problems, evaluate information, synthesize information, apply theoretical concepts to practical situations, identify assumptions and biases, make informed decisions and communicate effectively  **PSO3: Problem Solving:** Employ theoretical concepts and critical reasoning ability with physical, mathematical and technical skills to solve problems, acquire data, analyze their physical significance and explore new design possibilities.  **PSO4: Analytical & Scientific Reasoning:** Apply scientific methods, collect and analyse data, test hypotheses, evaluate evidence, apply statistical techniques and use computational models.  **PSO5: Research related skills:** Formulate research questions, conduct literature reviews, design and execute research studies, communicate research findings and collaborate in research projects.  **PSO6: Self-directed & Lifelong Learning:** Set learning goals, manage their own learning, reflect on their learning, adapt to new contexts, seek out new knowledge, collaborate with others and to continuously improve their skills and knowledge, through ongoing learning and professional development, and contribute to the growth and development of their field. |

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| **PO/PSO** | **PSO1** | **PSO2** | **PSO3** | **PSO4** | **PSO5** | **PSO6** |
| **PO1** |  |  |  |  |  |  |
| **PO2** |  |  |  |  |  |  |
| **PO3** |  |  |  |  |  |  |
| **PO4** |  |  |  |  |  |  |
| **PO5** |  |  |  |  |  |  |
| **PO6** |  |  |  |  |  |  |

**2. Highlights of the Revamped Curriculum**:

* Student-centric, meeting the demands of industry & society, incorporating industrial components, hands-on training, skill enhancement modules, industrial project, project with viva-voce, exposure to entrepreneurial skills, training for competitive examinations, sustaining the quality of the core components and incorporating application oriented content wherever required.
* The Core subjects include latest developments in the education and scientific front, advanced programming packages allied with the discipline topics, practical training, devising statistical models and algorithms for providing solutions to industry / real life situations. The curriculum also facilitates peer learning with advanced statistical topics in the final semester, catering to the needs of stakeholders with research aptitude.
* The General Studies and Statistics based problem solving skills are included as mandatory components in the ‘Training for Competitive Examinations’ course at the final semester, a first of its kind.
* The curriculum is designed so as to strengthen the Industry-Academia interface and provide more job opportunities for the students.
* The Statistical Quality Control course is included to expose the students to real life problems and train the students on designing a mathematical model to provide solutions to the industrial problems.
* The Internship during the second year vacation will help the students gain valuable work experience, that connects classroom knowledge to real world experience and to narrow down and focus on the career path.
* Project with viva-voce component in the fifth semester enables the student, application of conceptual knowledge to practical situations. The state of art technologies in conducting a Explain in a scientific and systematic way and arriving at a precise solution is ensured. Such innovative provisions of the industrial training, project and internships will give students an edge over the counterparts in the job market.
* State-of Art techniques from the streams of multi-disciplinary, cross disciplinary and inter disciplinary nature are incorporated as Elective courses, covering conventional topics to the latest DBMS and Computer software for Analytics.

**Value additions in the Revamped Curriculum:**

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| --- | --- | --- |
| Semester | Newly introduced Components | Outcome / Benefits |
| I | **Foundation Course**  To ease the transition of learning from higher secondary to higher education, providing an overview of the pedagogy of learning abstract Statistics and simulating mathematical concepts to real world. | * Instil confidence among students * Create interest for the subject |
| I, II, III, IV | **Skill Enhancement papers** (Discipline centric / Generic / Entrepreneurial) | * Industry ready graduates * Skilled human resource * Students are equipped with essential skills to make them employable |
| * Training on Computing / Computational skills enable the students gain knowledge and exposure on latest computational aspects |
| * Data analytical skills will enable students gain internships, apprenticeships, field work involving data collection, compilation, analysis etc. |
| * Entrepreneurial skill training will provide an opportunity for independent livelihood * Generates self – employment * Create small scale entrepreneurs * Training to girls leads to women empowerment |
| * Discipline centric skill will improve the Technical knowhow of solving real life problems using ICT tools |
| III, IV, V & VI | Elective papers-  An open choice of topics categorized under Generic and Discipline Centric | * Strengthening the domain knowledge * Introducing the stakeholders to the State-of Art techniques from the streams of multi-disciplinary, cross disciplinary and inter disciplinary nature * Students are exposed to Latest topics on Computer Science / IT, that require strong statistical background * Emerging topics in higher education / industry / communication network / health sector etc. are introduced with hands-on-training, facilitates designing of statistical models in the respective sectors |
| IV | DBMS and Programming skill, Biostatistics, Statistical Quality Control, Official Statistics, Operations Research | * Exposure to industry moulds students into solution providers * Generates Industry ready graduates * Employment opportunities enhanced |
| II year Vacation activity | Internship / Industrial Training | * Practical training at the Industry/ Banking Sector / Private/ Public sector organizations / Educational institutions, enable the students gain professional experience and also become responsible citizens. |
| V Semester | Project with Viva – voce | * Self-learning is enhanced * Application of the concept to real situation is conceived resulting in tangible outcome |
| VI Semester | Introduction of  Professional Competency component | * Curriculum design accommodates all category of learners; ‘Statistics for Advanced Explain’ component will comprise of advanced topics in Statistics and allied fields, for those in the peer group / aspiring researchers; * ‘Training for Competitive Examinations’ –caters to the needs of the aspirants towards most sought - after services of the nation viz, UPSC, ISS, CDS, NDA, Banking Services, CAT, TNPSC group services, etc. |
| Extra Credits:  For Advanced Learners / Honors degree | | * To cater to the needs of peer learners / research aspirants |

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| **Skills acquired from the Courses** | Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill |

**Credit Distribution for UG Programmes**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Sem I** | **Credit** | **H** | **Sem II** | **Credit** | **H** | **Sem III** | **Credit** | **H** | **Sem IV** | **Credit** | **H** | **Sem V** | **Credit** | **H** | **Sem VI** | **Credit** | **H** |
| Part 1. Language – Tamil | 3 | 6 | Part..1. Language – Tamil | 3 | 6 | Part..1. Language – Tamil | 3 | 6 | Part..1. Language – Tamil | 3 | 6 | 5.1 Core Course –\CC IX | 4 | 5 | 6.1 Core Course –  CC XIII | 4 | 6 |
| Part.2 English | 3 | 6 | Part..2 English | 3 | 6 | Part..2 English | 3 | 6 | Part..2 English | 3 | 6 | 5.2 Core Course – CC X | 4 | 5 | 6.2 Core Course –  CC XIV | 4 | 6 |
| 1.3 Core Course – CC I | 5 | 5 | 2..3 Core Course – CC III | 5 | 5 | 3.3 Core Course – CC V | 5 | 5 | 4.3 Core Course – CC VII  Core Industry Module | 5 | 5 | 5. 3.Core Course CC -XI | 4 | 5 | 6.3 Core Course –  CC XV | 4 | 6 |
| 1.4 Core Course – CC II | 5 | 5 | 2.4 Core Course – CC IV | 5 | 5 | 3.4 Core Course – CC VI | 5 | 5 | 4.4 Core Course –  CC VIII | 5 | 5 | 5. 4.Core Course –/ Project with viva- voce  CC -XII | 4 | 5 | 6.4 Elective -VII Generic/ Discipline Specific | 3 | 5 |
| 1.5 Elective I Generic/ Discipline Specific | 3 | 4 | 2.5 Elective II Generic/ Discipline Specific | 3 | 4 | 3.5 Elective III Generic/ Discipline Specific | 3 | 4 | 4.5 Elective IV Generic/ Discipline Specific | 3 | 3 | 5.5 Elective V Generic/ Discipline Specific | 3 | 4 | 6.5 Elective VIII  Generic/ Discipline Specific | 3 | 5 |
| 1.6 Skill Enhancement Course SEC-1 | 2 | 2 | 2.6 Skill Enhancement Course SEC-2 | 2 | 2 | 3.6 Skill Enhancement Course SEC-4,  (Entrepreneurial Skill) | 1 | 1 | 4.6 Skill Enhancement Course SEC-6 | 2 | 2 | 5.6 Elective VI Generic/ Discipline Specific | 3 | 4 | 6.6 Extension Activity | 1 | - |
| 1.7 Skill Enhancement -(Foundation Course) | 2 | 2 | 2.7 Skill Enhancement Course –SEC-3 | 2 | 2 | 3.7 Skill Enhancement Course SEC-5 | 2 | 2 | 4.7 Skill Enhancement Course SEC-7 | 2 | 2 | 5.7 Value Education | 2 | 2 | 6.7 Professional Competency Skill | 2 | 2 |
|  |  |  |  |  |  | 3.8 E.V.S. | - | 1 | 4.8 E.V.S | 2 | 1 | 5.8 Summer Internship /Industrial Training | 2 |  |  |  |  |
|  | **23** | **30** |  | **23** | **30** |  | **22** | **30** |  | **25** | **30** |  | **26** | **30** |  | **21** | **30** |
| **Total – 140 Credits** | | | | | | | | | | | | | | | | | |

**Choice Based Credit System (CBCS), Learning Outcomes Based Curriculum Framework (LOCF) Guideline Based Credit and Hours Distribution System**

**for all UG courses including Lab Hours**

**First Year – Semester-I**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **List of Courses** | **Credit** | **No. of Hours** |
| Part-1 | Language – Tamil | 3 | 6 |
| Part-2 | English | 3 | 6 |
| Part-3 | Core Courses & Elective Courses [in Total] | 13 | 14 |
| Part-4 | Skill Enhancement Course SEC-1 | 2 | 2 |
| Foundation Course | 2 | 2 |
|  |  | **23** | **30** |

**Semester-II**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **List of Courses** | **Credit** | **No. of Hours** |
| Part-1 | Language – Tamil | 3 | 6 |
| Part-2 | English | 3 | 6 |
| Part-3 | Core Courses & Elective Courses including laboratory [in Total] | 13 | 14 |
| Part-4 | Skill Enhancement Course -SEC-2 | 2 | 2 |
| Skill Enhancement Course -SEC-3 (Discipline / Subject Specific) | 2 | 2 |
|  |  | **23** | **30** |

**Second Year – Semester-III**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **List of Courses** | **Credit** | **No. of Hours** |
| Part-1 | Language - Tamil | 3 | 6 |
| Part-2 | English | 3 | 6 |
| Part-3 | Core Courses & Elective Courses including laboratory [in Total] | 13 | 14 |
| Part-4 | Skill Enhancement Course -SEC-4 (Entrepreneurial Based) | 1 | 1 |
| Skill Enhancement Course -SEC-5 (Discipline / Subject Specific) | 2 | 2 |
| E.V.S | - | 1 |
|  |  | **22** | **30** |

**Semester-IV**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **List of Courses** | **Credit** | **No. of Hours** |
| Part-1 | Language - Tamil | 3 | 6 |
| Part-2 | English | 3 | 6 |
| Part-3 | Core Courses & Elective Courses including laboratory [in Total] | 13 | 13 |
| Part-4 | Skill Enhancement Course -SEC-6 (Discipline / Subject Specific) | 2 | 2 |
| Skill Enhancement Course -SEC-7 (Discipline / Subject Specific) | 2 | 2 |
| E.V.S | 2 | 1 |
|  |  | **25** | **30** |

**Third Year**

**Semester-V**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **List of Courses** | **Credit** | **No. of Hours** |
| **Part-3** | Core Courses including Project / Elective Based | 22 | 26 |
| **Part-4** | Value Education | 2 | 2 |
| Internship / Industrial Visit / Field Visit | 2 | 2 |
|  |  | **26** | **30** |

**Semester-VI**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **List of Courses** | **Credit** | **No. of Hours** |
| **Part-3** | Core Courses including Project / Elective Based & LAB | 18 | 28 |
| **Part-4** | Extension Activity | 1 | - |
| Professional Competency Skill | 2 | 2 |
|  |  | **21** | **30** |

**Consolidated Semester wise and Component wise Credit distribution**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Parts** | **Sem I** | **Sem II** | **Sem III** | **Sem IV** | **Sem V** | **Sem VI** | **Total Credits** |
| **Part I** | 3 | 3 | 3 | 3 | - | - | 12 |
| **Part II** | 3 | 3 | 3 | 3 | - | - | 12 |
| **Part III** | 13 | 13 | 13 | 13 | 22 | 18 | 92 |
| **Part IV** | 4 | 4 | 3 | 6 | 4 | 1 | 22 |
| **Part V** | - | - | - | - | - | 2 | 2 |
| **Total** | 23 | 23 | 22 | 25 | 26 | 21 | **140** |

**\*Part I. II, and Part III components will be separately taken into account for CGPA calculation and classification for the under graduate programme and the other components. IV, V have to be completed during the duration of the programme as per the norms, to be eligible for obtaining the UG degree.**

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| **Methods of Evaluation** | | |
| **Internal Evaluation** | Continuous Internal Assessment Test | 25 Marks |
| Assignments |
| Seminars |
| Attendance and Class Participation |
| **External Evaluation** | End Semester Examination | 75 Marks |
|  | Total | 100 Marks |
| **Methods of Assessment** | | |
| **Recall (K1)** | Simple definitions, MCQ, Recall steps, Concept definitions | |
| **Understand/ Comprehend (K2)** | MCQ, True/False, Short essays, Concept explanations, Short summary or  overview | |
| **Application (K3)** | Suggest idea/concept with examples, Suggest formulae, Solve problems,  Observe, Explain | |
| **Analyze (K4)** | Problem-solving questions, Finish a procedure in many steps, Differentiate | |
|  | between various ideas, Map knowledge | |
| **Evaluate (K5)** | Longer essay/ Evaluation essay, Critique or justify with pros and cons | |
| **Create (K6)** | Check knowledge in specific or offbeat situations, Discussion, Debating or  Presentations | |

**B. Sc. Wildlife Biology Curriculum**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Course Code** | **Title of the Course** | **Credits** | **Hours/wk** | | **Maximum Marks** | | |
| **Theory** | **Practical** | **CIA** | **CEE** | **Total** |
| **FIRST SEMESTER** | | | | | | | |
| 11T | Part – I Language Tamil I | 3 | 6 | - | 25 | 75 | 100 |
| 12E | Part II-English | 3 | 6 | - | 25 | 75 | 100 |
| 13A | Core course I: Animal  Diversity – Non Chordata | 5 | 5 |  | 25 | 75 | 100 |
|  | Core Practical I | 5 | 5 | 4 | - |  | - |
| 1AA | Allied A: paper I  Biochemistry | 3 | 4 | - | 30 | 45 | 75 |
|  | Allied Practical | 2 | 2 | 2 | - | - | - |
| 1FA | Environmental Studies | 2 | 2 | - | - | 50 | 50 |
| **Total** | | **23** | **30** |  |  |  | **425** |
| **SECOND SEMESTER** | | | | | | | |
| 21T | Part I- Language Tamil | 3 | 6 | - | 25 | 75 | 100 |
| 22E | Part II-English | 3 | 6 | - | 25 | 75 | 100 |
| 23A | Core course II: Animal  Diversity – Chordata | 5 | 5 |  | 25 | 75 | 100 |
| 23P | Core Practical I | 5 | 5 | 4 | 25 | 75 | 100 |
| 2AA | Allied A: Paper II  Biochemistry | 3 | 4 | - | 30 | 45 | 75 |
| 23Q | Allied A : Practical | 2 | 2 | 2 | 25 | 25 | 50 |
| 2FB | Value Education – Human  Rights | 2 | 2 | - | - | 50 | 50 |
| Total | | **23** | 30 |  |  |  | **575** |

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| --- | --- | --- | --- | --- | --- | --- | --- |
| **THIRD SEMESTER** | | | | | | | |
| 31T | Part I- Language Tamil | 3 | 6 | - | 25 | 75 | 100 |
| 32E | Part II-English | 3 | 6 | - | 25 | 75 | 100 |
| 33A | Core course I:  Sustainable Development and Fundamentals of Natural Resource Management | 5 | 5 |  | 25 | 75 | 100 |
|  | Core Practical II | 5 | 5 | 2 | - |  | - |
| 3AJ | Allied B: Paper I  Botany | 3 | 4 | - | 30 | 45 | 75 |
|  | Allied B Practical | 1 | 1 | 2 | - | - | - |
| 3ZA | Skill Based I: Entomology | 2 | 2 | - | 30 | 45 | 75 |
| 3FC | Non Major Elective I \*  Yoga. | - | 1 | - | - | - | 50 |
| **Total** | | **22** | **30** |  |  |  | **500** |

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| --- | --- | --- | --- | --- | --- | --- | --- |
| **FOURTH SEMESTER** | | | | | | | |
| 41T | Part I- Language Tamil | 3 | 6 | - | 25 | 75 | 100 |
| 42E | Part II-English | 3 | 6 | - | 25 | 75 | 100 |
| 43A | Core course IV:  Ecology, Evolution &  Zoogeography | 5 | 5 |  | 25 | 75 | 100 |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 43P | | Core Practical II | 5 | | 5 | 2 | 25 | 75 | 100 |
| 4AJ | | Allied B: Paper II  Botany | 3 | | 3 | - | 30 | 45 | 75 |
| 4PJ | | Allied B Practical | 2 | | 2 | 2 | 25 | 25 | 50 |
| 4ZB | | Skill Based I: Ornithology | 2 | | 2 | - | 30 | 45 | 75 |
| 4FD | | Non Major Elective II \*  General Awareness. | 2 | | 1 | - | - | - | 50 |
| **Total** | | | **25** | | **30** |  |  |  | **650** |
|  | | | | | | | | | |
| **FIFTH SEMESTER** | | | | | | | | | |
| 53A | | Core Course V: Wildlife Management Techniques | 4 | | 5 | - | 25 | 75 | 100 |
| 53B | | Core Course VI:  Conservation Biology. | 4 | | 5 | - | 25 | 75 | 100 |
| 53C | | Core Course VII:  Biology of Vertebrates | 4 | | 5 | - | 25 | 75 | 100 |
|  | | Core Practical III | 4 | | 5 | 2 | - | - | - |
|  | | Core Practical IV | - | | - | 2 | - | - | - |
| 5EA | | Elective Course I:  Eco –development and Ecotourism | 3 | | 4 |  | 30 | 45 | 75 |
| 5EB | | Elective Course II: Indian  Wildlife laws &Forensics | 3 | | 4 | - | 25 | 25 | 50 |
|  | | Elective Course V: Practical | - | | - | 2 | - | - | - |
| 57A | | Internship/Project work #\*\* | 2 | | - | - | 25 | - | 25 |
| 5ZC | | Skill Based III: Biostatistics  & Computer Applications | 2 | | 2 | - | 30 | 45 | 75 |
| **TOTAL** | | | **26** | | 30 |  |  |  | **525** |
|  | | | | | | | | | |
| **SIXTH SEMESTER** | | | | | | | | | |
| 63A | Core Course VIII:  Forestry & Silviculture | | | 4 | 6 | - | 25 | 75 | 100 |
| 63B | Core Course IX:  Animal Behavior | | | 4 | 6 | - | 25 | 75 | 100 |
| 63C | Core Course X:  Aquatic Biology and wetland Ecosystem | | | 4 | 6 | - | 25 | 75 | 100 |
| 63P | Core Practical III | | |  | - | 2 | 25 | 75 | 100 |
| 63Q | Core Practical IV | | |  | - | 2 | 25 | 75 | 100 |
| 6EA | Elective Course III: Marine National Parks in India | | | 3 | 5 | - | 30 | 45 | 75 |
| 6EB | Elective Course IV: Field Biology, Remote sensing and Geo-informatics | | | 3 | 5 | - | 30 | 45 | 75 |
| 63R | Elective Course V: Practical | | |  | - | 2 | 25 | 25 | 50 |
| 6ZD | Skill Based IV:  Forest Based Industry using Exotic species (Lantana, Lac) | | | 2 | 2 | - | 30 | 45 | 75 |
|  | Extension activities\*\* | | | 1 |  | \* | 50 | - | 50 |
|  | **TOTAL** | | | **21** | 30 |  |  |  | **825** |
|  | **GRAND TOTAL** | | | **140** |  |  |  |  | **3500** |
| **Remarks: English Soft Skill Two Hours Will be handled by English Teachers**  **(4+2 = 6 hours for English).** | | | | | | | | | |
|  | | | | | | | | | |
| **ONLINE COURSES** | | | | | | | | | |
|  | | **1.** | **SWAYAM** | | | | | | |
|  | | **2.** | **MOOC’S** | | | | | | |

**Remarks:** EnglishSoft Skill - **2 hours** will be handled by English Teachers.(4+2=6)

* Non Major Elective I: Basic Tamil I / Advanced Tamil I / Yoga / Women studies and Non major Elective II: Basic Tamil II / Advanced Tamil II / General Awareness.
* It is compulsory that those who opt for any languages other than Tamil, they should choose Basic Tamil (Who don’t studied Tamil) or Advanced Tamil (For those who studied Tamil up to HSC).

\*\* Only internal marks.

#Internship/ Project work has to be completed in summer vacation during the time period decided by the department.

# #VALUE ADDED COURSE (OPTIONAL)

|  |  |  |
| --- | --- | --- |
| **S.No** | **PAPAERS** | **TOTAL**  **MARKS** |
| 1. | Tiger Monitoring. | 100 |
| 2. | Data Mining. | 100 |
| 3. | Economics of Conservation. | 100 |
| 4. | Intellectual Property Rights. | 100 |

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| **Course code** | | 13A | **ANIMAL DIVERSITY – NON CHORDATA** | | **L** | **T** | | **P** | **C** |
| **Core/Elective/ SBS** | | | **Core Course I** | | **4** | **0** | | **0** | **4** |
| **Pre-requisite** | | | Basic knowledge about life forms  **Ve** | |  | |  | | |
| **Course Objectives:** | | | | | | | | | |
| 1. To understand the taxonomy, relationship and evolution of animals. 2. To identify the phyla of invertebrate animals, and recognize their distinguishing features and characters. 3. To appraise the diversity of animals in a phylogenetic context. 4. To understand how different body designs solve biological problems related to physiological and environmental challenges. 5. To develop an appreciation for the role of invertebrates in biological communities, ecological interactions, and conservation. | | | | | | | | | |
| **Expected Course Outcomes:** | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | |
| 1 | The learner will be able to understand the diversity and basic taxonomy of Non chordates. | | | | | | | K2 | |
| 2 | The learner will get an idea of adaptation and importance of non-chordates. | | | | | | | K3 | |
| 3 | The learner will be able to identify the animal at different taxonomic level | | | | | | | K4 | |
| 4 | The paper will give a strong observation skill and prompt him to think about its conservation, its role in biodiversity and its potentials in technological prospects. | | | | | | | K5 | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create | | | | | | | | | |
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| **Unit:1** | | **CLASSIFICATION AND PROTISTA** | | | **17 hours** | | | | |
| Concept of five kingdom classification of life. Introduction to Protista & Animal kingdom – Systems of classification & nomenclature - levels of organization - Types of symmetry. General characters of Protista & Classification with examples.  **Type study:** Paramecium.  **General topics:** Parasitic Protista, Life Cycle of Plasmodium, Locomotion & Nutrition in Protozoa. | | | | | | | | | |
| **Unit:2** | | **PORIFERA AND COELENTERATA** | | | **17 hours** | | | | |
| Characters & classification (up to class) of Porifera & Coelenterata with examples –salient features of –*Ctenophora*.  **Type study:** Leucosolenia, Obelia Colony.  **General topics:** Canal system in sponge, Polymorphism in Coelenterata, Diversity (Types) of corals and structure of coral polyp, Coral reefs. | | | | | | | | | |
| **Unit:3** | | **PLATYHELMINTHES, ASCHELMINTHES AND ANNELIDS** | | **18 hours** | | | | | |
| Characters & classification (up to class) of Platyhelminthes, Aschelminthes & Annelids with examples.  **Type study:** *Taenia, Ascaris, Megascolex*.  **General topics:** Coelom coelomoducts & metamerism, Parasitic adaptations in Helminths and annelids, Filter feeding in Polychaetes. | | | | | | | | | |

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| **Unit:4** | | **ARTHROPODA** | **18 hours** |
| Characters & classification (up to class) of Arthropoda with examples. Brief descriptions of *Limulus* (living fossil), *Sacculina* (Parasitic castration), Copepods, Scorpion, Spider, *Peripatus* (affinities), Millipedes (role in ecosystem) & Centipedes (General Description).  **Type study:** Cockroach & Prawn,  **General topics:** Crustacean larvae, Social Insects | | | |
| **Unit:5** | | **MOLLUSCA AND ECHINODERMATA AND HEMICHORDATA.** | **18 hours** |
| Characters & classification (up to class) of Mollusca and Echinodermata with examples. Characters of Hemichordata. Brief descriptions of Fresh water Mussel, *Chiton, Sepia*, Star fish, Sea Cucumber & *Balanoglossus*  **Type study:** *Pila*, Starfish (External & Water vascular system only).  **General topics:** Larval forms of Mollusca, Torsion & de-torison in Mollusca, Economically important Mollusca, Echinoderm larva, Evolutionary affinities of Hemichordata. | | | |
| **Unit:6** | | **Contemporary Issues** | **2 hours** |
| Expert lectures, online seminars – webinars | | | |
|  | | **Total Lecture hours** | **90 hours** |
| **Text Book(s)** | | | |
| 1 | Nair NC. (2017). *Invertebrata and Chordata,* Saras Publication Nagercoil,Tamilnadu. | | |
| 2 | Nair NC, Leelavathy S, SoundaraPandian N Murugan T and Arumugam N. (2010). *A Text*  *Book of Invertebrates,* Saras Publication Nagercoil, Tamilnadu. | | |
| 3 | Kotpal RL, Agarwal SK and Khetarpal RP. (1990). *Modern Text book of Invertebrates,*  Rastogi Publications, Meerut. | | |
| 4 | Jordan And Verma. (1963). *Invertebrate Zoology,* S. Chand & Co, New Delhi | | |
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| **Reference Books** | | | |
| 3 | Anderson TA. (2001). *Invertebrate Zoology*, Oxford University Press, New Delhi. | | |
| 4 | Barrington EJW*.* (1967). *Invertebrate Structure and Functions*. English Language Book Society. | | |
| 5 | Hyman LH, *The Invertebrates (6 vols).* McGraw-Hill Companies Inc. NY | | |
| 8 | Ebanasar J and Sheeja BD. *Outlines of five kingdoms of life,* Shine and Twinkle Publication, Nagercoil. | | |
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| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | |
| 1 | National Digital Library of India https://ndl.iitkgp.ac.in/ | | |
| 2 | SwayamPrabhahttps:/[/www.swa](http://www.swayamprabha.gov.in/index.php/program/archive/9)y[amprabha.gov.in/index.php/program/archive/9](http://www.swayamprabha.gov.in/index.php/program/archive/9) | | |
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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** | S | S | S | M | M | M | M | M | M | M |
| **CO3** | M | M | M | S | M | M | S | S | M | S |
| **CO3** | M | S | M | M | M | S | M | M | S | M |
| **CO4** | M | M | S | M | M | M | S | M | M | S |

\*S-Strong; M-Medium; L-Low

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| **Course code** | | 23A | **ANIMAL DIVERSITY - CHORDATA** | | **L** | **T** | | **P** | **C** |
| **Core/Elective/ SBS** | | | **Core Course II** | | **4** | **0** | | **0** | **4** |
| **Pre-requisite** | | | Basic knowledge on life forms  **Ve** | |  | | **23** | | |
| **Course Objectives:** | | | | | | | | | |
| 1. To understand the taxonomy and relationship and evolution of animals. 2. To identify the class of vertebrate animals, and recognize their vertebrate distinguishing features. 3. To appraise the diversity of animals in a phylogenetic context. 4. To understand how different body designs solve biological problems related to physiological and environmental challenges. 5. To develop an appreciation for the role of vertebrates in biological communities, ecological interactions, and conservation problems. | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | |
| 1 | The learner will be able to understand the diversity and basic taxonomy of  chordates. | | | | | | | K2 | |
| 2 | The learner will get an idea of adaptation and importance of chordates. | | | | | | | K3 | |
| 3 | The learner will be able to identify any vertebrate animal at different taxonomic level. | | | | | | | K4 | |
| 4 | The paper will give a strong observation skill and prompt him to think about its conservation role in biodiversity and its potentials in technological Prospects. | | | | | | | K5 | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create | | | | | | | | | |
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| **Unit:1** | | **FISHES** | | | **17hours** | | | | |
| General characters and classification of Chordata (up to class) with examples. Brief descriptions of  *Amphioxus*, *Ascidia*, Hag fish, Scolidon, Mullet, Anabas, Cat fish, Sea horse.  **General topics:** Affinities of Prochordates, Accessory respiratory organs in teleost, Types of Fins and function Comparison of Teleost and elasmobranches, Evolutionary significance of Dipnoi, Migration of Fishes. | | | | | | | | | |
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| **Unit:2** | | **AMPHIBIA** | | | **17hours** | | | | |
| Classification and characters of Amphibia (up to order with examples). Habitat, classification, examples and brief descriptions of Proteus - Salmander –Newts - Ambystoma - Mud puppy –  Congo eels – Sirens –Toads (Indian, African and South American) – Tree frogs – Rana. | | | | | | | | | |
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| **Unit:3** | | **REPTILIA** | | **18hours** | | | | | |
| Classification and characters of Reptilia (up to order with examples). Habitat, classification, examples and brief descriptions- Varanus – Uromastix – Chameleon – Phrynosoma – Iguano – Heloderma – Typhlops – Him snakes –Uropeltis – Xenopeltis – Boas & Pythons – Vipers –  Cobras – Coral snakes – Rattle snakes –Crocodiles – Alligator –Gharial – Tortoise & Turtles. | | | | | | | | | |
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| **Unit:4** | | **AVES** | | **18hours** | | | | | |
| – Salient features of Aves – classification up to Family. Brief descriptions with examples of  Fowls - Swifts – Humming Birds – Hornbills – Frog mouths – Night jars – Plover – Turns – Gulls – Herons –Strokes – Ibis – Spoon Bills – Doves – Hoopoe – King fisher – Bee eater – | | | | | | | | | |

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| Vultures - Rollers – Cookoos – Coucals – Fowls – Quails – Pelicans – Cormorants – Flamingo – Woodpeckers –Bee eaters – Fly catchers – Bush chat – Fan tails -Wag tails – Parrots &Parakeets  Cockatoos – Owls – Trogons – Tits – Larks – Prinia – Shrike – Drongo – Finches – Swallow – Thrushes – Bulbul – Sun bird – Pitta – Warbler & Barblers. | | | |
| **Unit:5** | | **MAMMALS** | **18hours** |
| Classification and characters of Mammals (up to order with examples). Habitat, classification, examplesand brief descriptions of Echidna- Platypus–Tasmanian wolf–Kangaroo–opossum – Shrew  – Hedgehog – Bats - Rodents – Hare – Aquatic Mammals - Ant eaters – Felids - Canids– Herspestids–Mustellids-Bear-Hyena-Oldworldmonkeys–NewworldMonkeys–Artiodactyla- Elephants – Perissiodactyla. | | | |
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| **Unit:6** | | **CONTEMPORARY ISSUES** | **2 hours** |
| Expert lectures, online seminars – webinars / Field work | | | |
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|  | | **Total Lecture hours** | **90hours** |
| **Text Book(s)** | | | |
| 1 | Arumugam N. *Animal Diversity - Volume - 2 - Chordata*, Saras Publication, Nagercoil, Tamilnadu. | | |
| 2 | Thangamani A, Prasannakumar S, Narayanan LM, Arumugam N. (2014). [*A Text Book*](https://www.saraspublication.com/osc/catalog/text-book-chordates-p-136.html)[*ofChordates*](https://www.saraspublication.com/osc/catalog/text-book-chordates-p-136.html)*,* Saras Publication, Nagercoil, Tamilnadu. | | |
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| **Reference Books** | | | |
| 1 | EkambaranathaAyya and Ananthakrishnan TN. (1995). *Manual of Zoology Vol – II*, S.  Viswanathan Pvt. Ltd. Chennai. | | |
| 2 | KotpalRL. (2019). *Mordern Text Book of Zoology Vertebrates*, 4th edition, Rastogi  Publications, Meerut. | | |
| 3 | Young JZ. (1950). *Life of Vertebrates.* Clarendon Press, Oxford, UK. | | |
| 4 | Pough Harvey F, Christine M .Janis and John B. Heiser. (2002)*. Vertebrate Life*, Pearson  Education Inc. New Delhi. | | |
| 5 | Verma PS.(2013).*Chordate Zoology*, S Chand Publishers, New Delhi. | | |
| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | |
| 1 | National Digital Library of India https://ndl.iitkgp.ac.in/ | | |
| 2 | SwayamPrabhahttps://[www.swayamprabha.gov.in/index.php/program/archive/9](http://www.swayamprabha.gov.in/index.php/program/archive/9) | | |

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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** | S | M | M | M | M | M | M | S | M | M |
| **CO3** | M | S | M | M | M | M | S | S | M | S |
| **CO3** | M | M | M | M | S | M | S | M | S | M |
| **CO4** | M | M | M | M | M | S | S | M | S | S |

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| **Course code** | | 23P | **CHORDATA AND NON-CHORDATA**  **PRACTICAL** | **L** | **T** | | **P** | **C** |
| **Core/Elective/ SBS** | | | Core Practical I |  |  | | 4 | 4 |
| **Pre-requisite** | | | Knowledge on taxonomy of Animals |  | | **23** | | |
| **Course Objectives:** | | | | | | | | |
| The main objectives of this course are to:   1. To develop skill of Taxonomy 2. To improve hands on practice skill 3. To develop field knowledge | | | | | | | | |
| **Expected Course Outcomes:** | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | |
| 1 | The learner will be able to explain taxonomy of animals | | | | | | K3 | |
| 2 | The learner will be Develop concept of ecosystems and interactions | | | | | | K3 | |
| 3 | The learner will be Identify Fishes, Insects & Birds | | | | | | K3 | |
| 4 | Importance of Biodiversity | | | | | | K3 | |
| 5 | Identify Non Chordata and Chordata with its ecological significance | | | | | | K4 | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create | | | | | | | | |
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| **MAJOR PRACTICAL** | | | | | | | | |
| 1. Identification of given Insect order based on the dichotomous key provided. 2. Identification of family of given Fish 3. Based on the sketch of body parts identify family of snake based on the Key provided. 4. Micrometry measurement of given Protozoan /micro arthropod / any sample. 5. Digital Projection of a Forest/ Reef / Benthic / Aquatic ecosystem and identifications vertebrates &invertebrates in the projection. | | | | | | | | |
| **MINOR PRACTICAL** | | | | | | | | |
| 1. Cockroach/Mosquito: Mounting of Appendages & Mouthparts 2. Earth worm: Mounting of body setae 3. Fish: Mounting of Scales 4. Motility of Paramecium – Hanging drop method. | | | | | | | | |
| **VISIT**  Visit to any nearby area of biodiversity significance (Report should be included in record). The trip may be undertaken during holydays or other free hours or anytime without affecting class hours. | | | | | | | | |
| **SUBMISSION OF REPORT**   1. Submission of Field Report on Bird Watching: Report of minimum 5 days bird watching in a locality should be submitted during examination. The trip may be undertaken during holydays or other free hours or anytime without affecting class hours individually. 2. Submission of Photo Album of invertebrates & Vertebrates with identification and classification (Evaluation of report should be based on field effort, diversity of photos, classification and identification. Costly presentation of photos albums should compulsorily be discouraged, as the objective of this is to make students familiar with fauna. The collection may be undertaken during holydays or other free hours or anytime without affecting class hours, individually). | | | | | | | | |

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| **SPOTTERS** | |
| 1. **Classify giving reasons:** *Paramecium,Obelia*,Liverfluke,*Ascaris,Pila*,Starfish,   *Balanoglossus*, Any fish, Tree frog, Snake, King Fisher and Bat.   1. **Draw labeled sketches**: *Amphioxus*, Trochophore, AnyEchinodermlarvae. 2. **Biological significance:** *Paramecium*–Conjugation,MalarialParasite,Gemmules,   *Limulus*, Hippo campus, Nautilus. Axolotl larva,   1. **Relate structure and function:** Spicules of sponges, Scolex of tapeworm,   *Nereis*parapodium, Carapace and plastron of Turtle, Electric organ – *Narcine*.   1. **Descriptive Notes:** *Hydra, Physalia*, Rotifer, Sea cucumber, Chiton, Placoid scales, Chameleon, Quillfeather. | |
| **QUESTION PATTERN: (50 + 50 MARKS)**  **External:** Major: 15, Minor: 10, Record: 5, Spotter: 15 (5 spotters each carry 3 marks), Field report and bird watching: 5 mark. **Internal:** Submission of Album (identification and photo of  minimum 30 species): 5 marks, Field study/tour (minimum 10 hr.): 5 marks, Model practical 30 marks, Record: 5 Marks, Attendance 5 marks. | |
| **TotalPractical Hours 60(Each Semester) x 2 = 120 Hours PerYear** | |
| **Text Book(s)** | |
| 1 | Verma, PS.(2000).*A Manual of Practical Zoology- Chordates*, S Chand Publications, New  Delhi. |
| 2 | Verma, PS.(2010).*A Manual of Practical Zoology-Invertebrares*, S Chand Publications,  New Delhi. |

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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** | M | M | M | S | S | M | S | M | M | S |
| **CO3** | S | M | S | M | M | S | M | M | S | M |
| **CO3** | M | S | M | M | S | S | M | S | M | M |
| **CO4** | M | M | M | M | M | M | S | M | M | M |

\*S-Strong; M-Medium; L-Low

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| **Course code** | | | | 33A | **SUSTAINABLE DEVELOPMENT AND FUNDAMENTALS OF NATURAL RESOURCE MANAGEMENT** | | **L** | | | **T** | | **P** | **C** |
| **Core/Elective/ SBS** | | | | | Core Course  III | | **4** | | | **0** | | **0** | **4** |
| **Pre-requisite** | | | | | Basic knowledge on natural resource  **Ve** | |  | | | | **23** | | |
| **Course Objectives:** | | | | | | | | | | | | | |
| 1. To understand development is concern with developing an economic growth, Environmental Protection, Social Inclusion. 2. To understanding the nature of environmental biology 3. To offer resources for upcoming generation. 4. To improve the quality of living of all organisms and maintain the ecological balance for sustainable development. | | | | | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | | | | | |
| 1 | | Understand the Basic concept of Sustainable Development (SD),the environment, social and economic dimensions. | | | | | | | | | | K2 | |
| 2 | | Students will understand how soil fertility is determined and how plant nutrient deficiencies are identified and means of improving soil fertility and adding nutrient for plant growth. | | | | | | | | | | K3 | |
| 3 | | Apply theoretical frameworks to real world sustainability issues. | | | | | | | | | | K3 | |
| 4 | | Apply skills of inquiry, including college – level research, in the analysis of sustainability issues. | | | | | | | | | | K3 | |
| 5 | | Apply skills of inquiry, including college – level research, in the analysis of sustainability issues. | | | | | | | | | | K5 | |
| 6 | | Students will be able to critically evaluate current events and public information related to natural resources as being scientifically – based or opinion based and contribute to the knowledge base of information. | | | | | | | | | | K5 | |
|  | | Explain and evaluate current challenges to sustainability, including modern world social, environmental and economic structure and crises. | | | | | | | | | | K5 | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create | | | | | | | | | | | | | |
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| **Unit:1** | | | | **INTRODUCTION TO NATURAL RESOURCES** | | | | **14hours** | | | | | |
| Concept of resource, classification of natural resources. Factors influencing resources availability, distribution and uses. Interrelationships among different type of natural resources. Social and economic dimension of resource management. | | | | | | | | | | | | | |
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| **Unit:2** | | | | **FOREST RESOURCES AND LAND RESOURCES** | | | | **14hours** | | | | | |
| Forest vegetation, status and distribution, major forest types and their characteristics. Use and over –exploitation, case studies. Timber extraction, mining, dams and their effect on forest and tribal people, forest management. Land as a resources.dry land, land use classification, land degradation, man induced landslides, soil erosion and desertification. | | | | | | | | | | | | | |
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| **Unit:3** | | | | **FOOD RESOURCES AND APPROACHES IN RESOURCE MANAGEMENT** | | | | | **15hours** | | | | |
| World food problems, changes caused by agriculture and over- grazing, effects of modern agriculture, fertilizer-pesticide problems, water logging. Salinity, case studies. Ecological approach, ethnological approach, implication of the approaches, integrated resources management strategies. | | | | | | | | | | | | | |
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| **Unit:4** | | | | **SUSTAINABLILITY** | | | | | **15hours** | | | | |
| Introduction to sustainability & its factors, requirement for sustainability: food security and agriculture, renewable resources –water and energy, non – renewable resources, factors and trade – offs, sustainability conflicts, a conceptual framework for linking sustainability and sustainable development. Sustainable Forest, Management, Agenda -21 and UNEP programs towards sustainable development | | | | | | | | | | | | | |
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| **Unit:5** | | | **DIMENSION OF SUSTAINABLE DEVELOPMENT** | | | | | | **15hours** | | | | |
| Society , environment ,culture and economy : current challenges – natural, political, socio – economic imbalance; sustainable development initiative and policies of various countries : global, regional , national, local ; needs of present and future generation – political , economic, environmental. | | | | | | | | | | | | | |
| **Unit:6** | | | | **CONTEMPORARY ISSUES** | | **2 hours** | | | | | | | |
| Expert lectures, online seminars – webinars | | | | | | | | | | | | | |
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|  | | | | **Total Lecture hours** | | **75 hours** | | | | | | | |
| **Text Book(s)** | | | | | | | | | | | | | |
| 1 | Franco, I.B. and Tracey, J. (2019), “Community capacity – building for sustainable development: Effectively striving towards achieving local community sustainability targets”, International journal of Sustainability in Higher Education, Vol.20 No.4,pp. 691-725. | | | | | | | | | | | | |
| 2 | Francois Remade 1984.Ecology of Natural Resources. John Wiley &Sons Ltd.  Odum, E.P.1971. Fundamentals of Ecology. W.B.Saunders Co.USA,574p. | | | | | | | | | | | | |
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| **Reference Books** | | | | | | | | | | | | | |
| 1 | Elliott, Jennifer, 2012.An Introduction to Sustainability Development.4th Ed.Routledge, London. | | | | | | | | | | | | |
| 2 | Rogers,peter P., Kazi F .Jalal, and John A.Boyd “ An Introduction to sustainable development”.(2012) | | | | | | | | | | | | |
| 3 | Soubbotina , Tatyana p.2004.Beyond Economic Growth : An Introduction to sustainable Development.WBI learning resources series.Washington DC ;World Bank. | | | | | | | | | | | | |
| 4 | Kerr,Julie,Introduction to energy and climate: Developing a sustainale environment.CRC Press,2017. | | | | | | | | | | | | |
| 5 | Bell, Simon, and Stephen Morse. Sustainability indicators: measuring the immeasurable?.Routledge , 2012. | | | | | | | | | | | | |
| 6 | Sorensen, Bent. Energy, Resources and Welfare: Exploration of Social Frameworks for Sustainable Development. Academic Press, 2016. | | | | | | | | | | | | |
| 7 | Global Change and Natural Resources Management, Vitousek, P.M.1994. Beyond global warming, Ecology and global change, Ecology 75,1861-1876. | | | | | | | | | | | | |
| 8 | Agarwal, K.C., 2001. Envirinmentl Biology, Nidhi Publication Ltd .Bikaner.  Cunningham, W.P.Cooper, T.H.Gorhani,E &Hepworth,M.T.2001,Environmental Encyclpopedia, Jaico Publishing House. | | | | | | | | | | | | |
| 9 | Miller T.G.Jr.Envirinmental science, Wadsworth publishing Co.(TB) | | | | | | | | | | | | |
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| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | | | | | | | | | | |
| 1 | National Digital Library of India https://ndl.iitkgp.ac.in/ | | | | | | | | | | | | |
| 2 | SwayamPrabha<https://www.swayamprabha.gov.in/index.php/program/archive/9> | | | | | | | | | | | | |

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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** | M | M | M | M | M | M | M | M | M | M |
| **CO3** | M | M | M | S | M | M | M | M | S | M |
| **CO3** | M | M | M | M | S | M | S | M | S | M |
| **CO4** | S | M | M | M | M | M | M | S | M | M |

\*S-Strong; M-Medium; L-Low

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| **Course code** | | | 3ZA | **ENTOMOLOGY** | | | **L** | | **T** | | **P** | **C** |
| **Core/Elective/ SBS** | | | | **Skill Based Course I** | | | **3** | | **0** | | **0** | **3** |
| **Pre-requisite** | | | | Knowledge on Arthropods  **Ve** | | |  | | | **23** | | |
| **Course Objectives:** | | | | | | | | | | | | |
| 1. To give an introduction to diversity of world Insects. 2. To make aware of the various protocols in entomology. 3. To prompt the students to undertake entomology as profession or passion. | | | | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | | | | |
| 1 | | Understand the basic concepts in entomology | | | | | | | | | K1 | |
| 2 | | Identify various insects and butterflies | | | | | | | | | K2 | |
| 3 | | Identify insect damages | | | | | | | | | K2 | |
| 4 | | Understand Apiculture and Sericulture as social relevance | | | | | | | | | K3 | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create | | | | | | | | | | | | |
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| **Unit:1** | | | **MORPHOLOGY** | | | | | **8hours** | | | | |
| General Body plan – Structure of head, wings thorax, abdomen, appendages and genetalia.  Types of mouth parts. Classification & habits of insects up to orders with examples. | | | | | | | | | | | | |
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| **Unit:2** | | | **BUTTERFLIES AND MOTHS** | | | | | **9 hours** | | | | |
| Butterflies & Moths – Body parts of Butterfly - Identification of types of Swallowtails: Club tails – Roses - Bird wings – Mime –Mormon – Raven - Helen - peacock – Jay – Blue bottles – Sword tails – Zebra. Whites, sulfurs and orange-tips. | | | | | | | | | | | | |
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| **Unit:3** | | | **BEHAVIORAL ENTOMOLOGY** | | | **9 hours** | | | | | | |
| Reproductive behavior in insects (mate finding, courtship, territoriality, parental care, parental investment and sexual selection) - Role of different signals in host searching (plant and insects)  and host acceptance, ovipositional behaviour, pollination behaviour, coevolution of plants and insect pollinators | | | | | | | | | | | | |
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| **Unit:4** | | | **DAMAGE AND CONTROL** | | | **8 hours** | | | | | | |
| Insect Damage and Sign Categories - Bark beetles and wood borers - Gall makers & defoliating insects - Fluid-feeding insects - Terminal and root insects - Seed and cone pests  Insect sampling in a forest ecosystem - Forecasting and assessing risk of insect outbreaks Insects and silviculture – Insect Control methods (Synthetic & Biological – Brief outline). | | | | | | | | | | | | |
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| **Unit:5** | | | **COMMERCIAL ENTOMOLOGY** | | | **9 hours** | | | | | | |
| Principles and practice of Apiculture & Sericulture. Applications of entomology in Wildlife  Forensics. | | | | | | | | | | | | |
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| **Unit:6** | | | **CONTEMPORARY ISSUES** | | **2 hours** | | | | | | | |
| Expert lectures, online seminars – webinars | | | | | | | | | | | | |
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|  | | | **Total Lecture hours** | | **45hours** | | | | | | | |
| **Text Book(s)** | | | | | | | | | | | | |
| 1 | Imms AD.(1972). *Text book of Entomology Vol. I & II.* Ed. By Richard and Owen. ELBS | | | | | | | | | | | |
| 2 | Nair K.K.Anandhakrishnan TN & David BV. *General and applied Entomology.* Tata  Mc.Graw Hill Publ. Delhi. | | | | | | | | | | | |
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| **Reference Books** | | | | | | | | | | | | |
| 1 | Kehimkar ID. (2008).*Book of Indian butterflies.* Oxford University Press. | | | | | | | | | | | |
| 2 | Metcalf RL, Luckmann WH, editors. (1994). *Introduction to insect pest management.* John  Wiley & Sons. | | | | | | | | | | | |
| 3 | Jayashree KV, Tharadevi CS &Arumugam N.(2014). *Apiculture,* SarasPublication  Nagercoil,Tamilnadu. | | | | | | | | | | | |
| 4 | Pedigo LP.(1989). *Entomology and pest management.* Macmillan Publishing Company. | | | | | | | | | | | |
| 5 | Eikichi Hiratsuka. (2000). *Silkworm breeding,* Oxford and IBH publications, New Delhi | | | | | | | | | | | |
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| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | | | | | | | | | |
| 1 | Applied Entomology <https://swayam.gov.in/nd2_cec20_bt02/preview> | | | | | | | | | | | |
| 2 | SwayamPrabhahttps:/[/www.swa](http://www.swayamprabha.gov.in/index.php/program/archive/9)y[amprabha.gov.in/index.php/program/archive/9](http://www.swayamprabha.gov.in/index.php/program/archive/9) | | | | | | | | | | | |

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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** | S | M | M | M | S | M | M | M | S | S |
| **CO2** | M | S | M | M | S | M | S | S | M | M |
| **CO3** | S | M | M | M | M | S | S | M | M | S |
| **CO4** | S | M | M | M | M | S | S | M | M | S |

\*S-Strong; M-Medium; L-Low

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| **Course code** | | | 43A | **ECOLOGY, EVOLUTION AND ZOOGEOGRAPHY** | | | **L** | **T** | | **P** | **C** | |
| **Core/Elective/ SBS** | | | | Core Course IV | | | **4** | **0** | | **0** | **4** | |
| **Pre-requisite** | | | | Knowledge on Animal diversity & Taxonomy | | |  | | **23** | | | |
| **Course Objectives:** | | | | | | | | | | | | |
| 1. To develop awareness about the environment and the interaction of various components.  2. To develop an idea of the adaptations and its significance in relation to evolution.  3. To make the students aware of how organic evolution occurred and how the various life forms come into existence.  4. To make the students aware of the historical periods during the evolution of earth and status of fauna during the particular age.  5. To understand the distribution of the various faunal components. | | | | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | | | | |
| 1 | | The students will be able to present an overview of diversity of life forms in an ecosystem, will be able to differ between Qualitative & Quantitative study. | | | | | | | | K2 | | |
| 2 | | The learner can correlate choice of habitat for organisms to abiotic factors, aspect  of energy transfer and will be able to explain the necessity for and adaptations, providing examples. | | | | | | | | K3 | | |
| 3 | | Students will be able to describe the history and development of evolutionary | | | | | | | | K4 | | |
| 4 | | Students will be able to describe the history of life on earth. | | | | | | | | K5 | | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create | | | | | | | | | | | | |
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| **Unit:1** | | | **ECOLOGICAL CONCEPTS** | | | | **15 hours** | | | | | |
| Ecosystem structure & function. Limiting factors. Biogeochemical cycles: Carbon, Nitrogen, water and Phosphorous. Concept of Species, Population dynamics and Growth curves. Food web Pyramids & Trophic levels. Animal relationships: - Mutualism, commensalism, parasitism, Competition, Predation, Prey and Predator relationship. | | | | | | | | | | | | |
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| **Unit:2** | | | **ECOSYSTEMS** | | | | **15 hours** | | | | | |
| Habitat ecology: Freshwater, Estuarine and Terrestrial ecosystems (Detailed study). Eco tone & Edge effect. Air, Water, Noise & Thermal Pollution. E-Waste – definition and management. Fundamentals of Machine Learning. | | | | | | | | | | | | |
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| **Unit:3** | | | **THEORIES OF EVOLUTION** | | | **14 hours** | | | | | | |
| Theories of Organic evolution. Fossils – types and formation. Evidences of evolution Convergent & Divergent evolution. Natural selection – Isolation & Speciation. | | | | | | | | | | | | |
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| **Unit:4** | | | **GEOLOGICAL TIME SCALE** | | | **14 hours** | | | | | | |
| Hardy Weinberg Equilibrium & Genetic drift. Colouration - Mimicry types &Significance. Geological time scale (Pre-cambrian Eon; Up to periods for Paleozoic & Mesozoic era; up to epoch for Cenozoicera | | | | | | | | | | | | |
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| **Unit:5** | | | **ZOO GEOGRAPHY** | | | **15 hours** | | | | | | |
| Zoogeographical regions – Palaearctic, Nearctic, Neotropical, Oriental, Australian and Ethiopian regions - their Climatic and faunal peculiarities. Wallace line, Discontinuous distribution - Continental Drift. Brief outlines of Human evolution. | | | | | | | | | | | | |
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| **Unit:6** | | | **CONTEMPORARY ISSUES** | | **2 hours** | | | | | | |
| Expert lectures, Online Seminars – Webinars/Field Study | | | | | | | | | | | |
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|  | | | **Total Lecture hours** | | **75hours** | | | | | | |
| **Text Book(s)** | | | | | | | | | | | |
| 1 | Arumugam N. (2014). *Concepts of Ecology*, Saras Publication, Nagercoil, Tamilnadu. | | | | | | | | | | |
| 2 | [Verma](https://www.google.co.in/search?tbo=p&tbm=bks&q=inauthor%3A%22P.%2BS.%2BVerma%22) PS and VK.(2004). *Cell Biology, Genetics, Evolution and Ecology*, S Chand Publishers, New Delhi. | | | | | | | | | | |
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| **Reference Books** | | | | | | | | | | | |
| 1 | Gupta PK. *Cytology, Genetics and Evolution*, Rastogi Publications, Meerut. | | | | | | | | | | |
| 2 | [Verma](https://www.google.co.in/search?tbo=p&tbm=bks&q=inauthor%3A%22P.%2BS.%2BVerma%22)PS and [Agarwal](https://www.google.co.in/search?tbo=p&tbm=bks&q=inauthor%3A%22V.%2BK.%2BAgarwal%22) VK. (2001). [*Environmental Biology: Principles of Ecology*,](https://books.google.co.in/books?id=EmNUcSaL2SIC&dq=ecology%2Bbooks%2Bs%2Bchand&hl=en&sa=X&ved=0ahUKEwjXv77n7q7bAhUISI8KHVawDMoQ6AEIKDAA) S Chand Publishers, New Delhi | | | | | | | | | | |
| 3 | Sharma PD. (2018-19). *Elements of Ecology*, Rastogi Publications, Meerut. | | | | | | | | | | |
| 4 | Odum EP.(1971). *Fundamentals of Ecology*, W.B Saunders College Publishing, Philadelphia. | | | | | | | | | | |
| 5 | Benton AH and Werner WE*.* (1976).*Field Biology and Ecology*, Tata McGraw Hill, New Delhi. | | | | | | | | | | |
| 6 | Ridley M. (2003). *Evolution*, Blackwell Publishing. | | | | | | | | | | |
| 7 | Barton NH, Briggs DEG, Eisen JA, Goldstein DB and Patel NH. (2007). *Evolution*. Cold Spring, Harbour Laboratory Pres. US. | | | | | | | | | | |
| 8 | Hall BK and Hallgrimsson B. (2008). *Evolution*, Jones and Bartlett Publishers. | | | | | | | | | | |
| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | | | | | | | | |
| 1 | National Digital Library of India https://ndl.iitkgp.ac.in/ | | | | | | | | | | |
| 2 | Wildlife Ecology <https://swayam.gov.in/nd1_noc20_bt38/preview> | | | | | | | | | | |
| 4 | Evolutionary Biology <https://swayam.gov.in/nd2_cec20_bt06/preview> | | | | | | | | | | |

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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** | M | M | M | S | M | S | M | S | M | S |
| **CO2** | M | S | M | S | M | S | M | M | S | M |
| **CO3** | M | M | S | M | S | S | M | M | M | S |
| **CO4** | S | S | S | S | S | M | S | S | S | M |

\*S-Strong; M-Medium; L-Low

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| **Course code** | | 4ZB | **ORNITHOLOGY** | | **L** | | **T** | | **P** | **C** |
| **Core/Elective/ SBS** | | | **Skill Based Course II** | | **3** | | **0** | | **0** | **3** |
| **Pre-requisite** | | | Knowledge on Birds diversity  **Ve** | |  | | | **23** | | |
| **Course Objectives:** | | | | | | | | | | |
| 1. To give an introduction to bird science. 2. To make aware of the various protocols in ornithology. 3. To prompt the students to undertake ornithology as profession or passion. | | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | | |
| 1 | Appreciate the diversity of birds of the world and understand how birds are  Classified. | | | | | | | | K2 | |
| 2 | Learn how birds evolved and are still evolving. | | | | | | | | K3 | |
| 3 | Recognize some of the ways that birds are communicate, find food, and attract  Mates | | | | | | | | K4 | |
| 4 | Understand the role of birds in the world and how they interact with ecosystem. | | | | | | | | K3 | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create | | | | | | | | | | |
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| **Unit:1** | | **BIRD DESCRIPTION** | | | | **8hours** | | | | |
| Classification of birds upto order level.Terms used in description of Birds Plumage & parts – Types of Bills – Types of feet – Identification of birds in the field based on tail, bill, crest, leg & colour. | | | | | | | | | | |
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| **Unit:2** | | **BIRD WATCHING AND MIGRATION** | | | | **8hours** | | | | |
| Keys for bird identification - Bird watching equipment – Field guides – Photography – identification of calls – Feet and beak modification in Birds, Bird migration - Methods to study migration - Common migrants of south India. | | | | | | | | | | |
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| **Unit:3** | | **FORAGING, MATING AND SONG** | | **9hours** | | | | | | |
| Diversity of foods and foraging behaviors - Social foraging - mating preferences - Pair- bonds, courtship, and divorce - Production and control of song - Song variation in space and time - Functions of bird song. | | | | | | | | | | |
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| **Unit:4** | | **BREEDING** | | **9hours** | | | | | | |
| Timing of breeding - Breeding territories - Nests and nest building - Eggs & Clutch size - Clutch and egg replacement - Incubation & Hatching - Altricial and precocial young - Parent/offspring recognition - Parental care in birds. | | | | | | | | | | |

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| **Unit:5** | **DEMOGRAPHY** | **-9hours** |
| Avian populations change – over time and space –Methods of estimation - Classifying bird species assemblages-Recent avian extinctions- Causes of avian population decline-Major threats to bird Populations - Conservation solutions - Value of wild birds- evBird data access. Influences of climatic changes in avian communities. | | |

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| **Unit:6** | | | **CONTEMPORARY ISSUES** | **2 hours** | |
| Expert lectures, online seminars – webinars/ Field observations | | | | | |
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|  | | | **Total Lecture hours** | **45hours** | |
| **Text Book(s)** | | | | | |
| 1 | Salim Ali and S. Dillon Ripley. (1973). *Handbook of the Birds of India and Pakistan,* Volume  9. Oxford University Press. | | | | |
| 2 | Podulka S, Rohrbaugh RW and Bonney R. (2004). *Handbook of bird biology.* Cornell Lab of  Ornithology. | | | | |
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| **Reference Books** | | | | | |
| 1 | Ali S and Ripley SD. (1983). *Handbook of the birds of India and Pakistan.* Compact edition.  Oxford University Press and BNHS, Mumbai. | | | | |
| 2 | Caughley G, Sinclair AR. *Wildlife ecology and management.* Blackwell Science. | | | | |
| 3 |  | | | | |
| Chi | nnaSathan and Bal Pandey*, The Nesting behaviour of Indian Birds,* Sugeeth Pub | | | lications. |
|  | | | | | |
| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | | |
| 1 | National Digital Library of India https://ndl.iitkgp.ac.in/ | | | | |
| 2 | Cornell Lab All about Birds https:/[/www.allaboutbirds.org/guide/](http://www.allaboutbirds.org/guide/) | | | | |

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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **Cos** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** | S | M | M | M | M | M | M | M | M | M |
| **CO2** | M | M | M | M | M | M | M | M | M | M |
| **CO3** | M | S | S | M | S | S | S | S | M | M |
| **CO4** | M | M | M | M | S | M | M | M | S | M |

\*S-Strong; M-Medium; L-Low

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| **Course code** | | 43P | **ECOLOGY AND EVOLUTION** | **L** | **T** | | **P** | **C** |
| **Core/Elective/ SBS** | | | **Core Practical II** | **0** | **0** | | **2** | **2** |
| **Pre-requisite** | | | Knowledge of animal anatomy, ecology and  Evolution |  | | **23** | | |
| **Course Objectives:** | | | | | | | | |
| 1. To develop hands on skill in doing ecological experiments 2. To understand adaptations and evolutionary mechanism | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | |
| 1 | Able to analyze various ecological parameters | | | | | | K3 | |
| 2 | Able to identify the animals based on call sounds | | | | | | K3 | |
| 3 | Able to evolutionary principles in her or his own research | | | | | | K3 | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create | | | | | | | | |
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| **MAJOR PRACTICAL** | | | | | | | | |
| 1. Water quality analyzes – calcium and magnesium 2. Prepare a square (1m2) quadrate and construct a rectangular (0.5m2) and circular (1m radius) quadrate inside the square quadrate estimate the density and project it for 1square km and compare the results. 3. Estimate the Net primary productivity of water sample (Assuming the experiment taking place at an aquatic ecosystem) using dark and light bottle experiment. 4. Estimate the pH, Carbonate & Bicarbonates in given water samples and state the relationship. 5. Estimate the salinity at three different temperature and Plot the temperature salinity graph. | | | | | | | | |
| **MINOR PRACTICAL** | | | | | | | | |
| 1. Identification of call of at least five birds from the given 20 call sounds. (For examination the call sound can be projected using audio devise). 2. Identification of call of at least five birds from the given 20 call sounds. (For examination the call sound can be projected using audio devise). 3. Estimation of Temperature of Given Water Samples 4. Identification of Zoogeographical realms from the world Map & Describe the specific fauna 5. Demonstration of usage of M-Stripes app and Distance software in wildlife census. | | | | | | | | |
| **VISIT AND SUBMISSION**  **Report of Visit** to Zoological park (minimum two days or two zoos) and report should be submitted with description of scientific name and habitat of animal displayed should be submitted on the practical exam. | | | | | | | | |
| **Report of** participation in a wildlife census or 5 day participation in a nature camp or 5 day internship in a sanctuary/ reserve / in an institute or research lab (internal of external) of wildlife  Significance with description of daily activities, procedures followed and observations should be submitted individually. | | | | | | | | |

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| **SPOTTERS** | | | |
| 1. Identification : Freshwater and marine planktons 2. Biological significance : Rocky, Sandy and Muddy shore fauna 3. Comment of Animal Relation Ship: *Sacculina*on Crab /Hermit Crab & Sea Anemone. 4. Ecological Adaptation: *Chameleon, Balanus, Chaetopterus, Anabas* 5. Comment on the Evolutionary Significance; Fossil, Limulus, Analogousorgans, Homologousorgans. | | | |
| **QUESTION PATTERN: (50 +50 MARKS)**  **External:** Major: 15, Minor: 10, Record: 5, Spotter: 15 (5 spotters each carry 3 marks), Zoo visit Report: 5 marks. **Internal:** Census or equal training: 5 marks, Field study (minimum 20 hr.): 5 marks, Model Practical: 30 Marks, Record 5 marks, Attendance:5 marks. | | | |
|  | | **Total Practical hours** | **60 hours** |
| **Text Book(s)** | | | |
| 1 | Slingsby, D and Cook C. *Practical Ecology,* Palgrave Macmillan publications | | |
| 2 | Practical Zoology Volume 1,2,3, Saras Publications, Nagercovil | | |

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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** | S | S | S | M | S | S | M | S | M | S |
| **CO2** | M | M | M | S | M | S | S | M | S | M |
| **CO3** | S | S | M | M | S | M | M | S | M | S |

\*S-Strong; M-Medium; L-Low

Fifth Semester

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| **Course code** | | 53A | **WILDLIFE MANAGEMENT TECHNIQUES** | | **L** | **T** | | **P** | **C** |
| **Core/Elective/ SBS** | | | Core Course V | | **4** | **0** | | **0** | **4** |
| **Pre-requisite** | | | Knowledge on Basic concepts of Wildlife  **Ve** | |  | | **23** | | |
| **Course Objectives:** | | | | | | | | | |
| The main objectives of this course are to:   1. To train the students in the usage of various techniques used in wildlife sciences. 2. To train the students to develop skill in using various instruments.   3. To train the students reading the population estimation techniques. | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | |
| 1 | Trained to assess various population estimation techniques. | | | | | | | K3 | |
| 2 | The students will be trained in the usage of various wildlife instruments. | | | | | | | K3 | |
| 3 | Able to identify all the indirect signs related to wild animals. | | | | | | | K5 | |
| 4 | In total the student will develop skill in wildlife management techniques | | | | | | | K6 | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create | | | | | | | | | |
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| **UNIT 1** | | **WILDLIFE MANAGEMENT** | | | **14 hours** | | | | |
| Wildlife Management: Basic concepts and principles - Wildlife management before and after implementation of Wild Life (Protection) Act, 1972 – IUCN – CITES – NBA – IBA – Project Tiger – Project Elephant – Project Crocodile. Captive breeding & Reintroduction of wild animals. | | | | | | | | | |
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| **UNIT II** | | **SIGN SURVEY AND OCCUPANCY** | | | **14 hours** | | | | |
| Identification of Pug marks & hoof marks of various animals. Identification of scats, dung, pellet based on structure. Other indirect signs of animal presence. Herbivore sign survey and estimation of density – Occupancy analysis based on indirect sign survey. | | | | | | | | | |
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| **UNIT III** | | **POPULATION ESTIMATION** | | **15 hours** | | | | | |
| Quadrate sampling – different types and estimation of density & abundance. Transect lines and sampling- estimation of abundance. Planning of ideal census methods – sample counts – Block counts – Roadside counts – Dung count – Pugmark & waterhole counts (Calculation for population number estimation in these methods), Drones – monitoring terrain & wildlife. | | | | | | | | | |
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| **UNIT IV** | | **CHEMICAL RESTRAINTS** | | **15 hours** | | | | | |
| Chemical restraints: Advantage & Disadvantage – Syringes & darts –planning operation. Wildlife health monitoring – Body condition evaluation – Monitoring infection -Infectious diseases. Postmortem – External examination – internal examination – examination of abnormalities – Preservation & diagnosis of specimen. | | | | | | | | | |
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| **UNIT V** | | **ZOOS,SANCTUARIES AND NATIONAL PARKS** | | **15 hours** | | | | | |
| **Zoos, Zoological Parks, Wildlife Sanctuaries, National Parks & Tiger Reserves**: Definition – in-situ and ex-situ conservation, formation, management and administration. Case studies (VOC park zoo, Arignar Anna Zoological Park, Srivilliputtur Wildlife Sanctuary, Vedanthangal bird sanctuary, Mukkuruthi and Guindy National Parks, Mudumalai and Periyar Tiger Reserves - Nilgiri Biosphere Reserve. | | | | | | | | | |



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| **Unit:6** | | **CONTEMPORARY ISSUES** | **2 hours** |
| Expert lectures, online seminars – webinars | | | |
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|  | | **Total Lecture hours** | **75hours** |
| **Text Book(s)** | | | |
| 1 | Dasmann RF. *Wildlife Biology,* John Wiley & Sons, New York. | | |
| 2 | Gilas RH Jr.(ed.), *Wildlife Management Techniques, 3rd ed. The Wildlife Society,*Washington  D.C., Nataraj Publishers, Dehra Dun. | | |
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| **Reference Books** | | | |
| 1 | Robinson W L and Eric G Bolen. (2002). *Wildlife Ecology and Management,* Maxmillan  Publishing Company, New York. | | |
| 2 | Rodgers WA. (1991). *Techniques for Wildlife Census in India - A Field Manual:* 5. Technical Manual - T M - 2. WII. | | |
| 3 | Saharia VB. (1982). *Wildlife of India,* Natraj Publishers, Dehra Dun. | | |
| 4 | Teague RD (ed.),(1987).*A Manual of Wildlife Conservation* (The Wildlife Society, 8. Wsashington D.C.). Nataraj Publishers, Dehra Dun. | | |
| 5 | WII. A Guide to Chemical Restraint of Animals. | | |
| 6 | Saharia, V.B. 1982 Wildlife in India, Nataraj Publishers, Dehra Dun | | |
| 7 | Seshadri, B.1986 India’s Wildlife reserves , Sterling Pub’rs Pvt. Ltd., New Delhi | | |
| 8 | Giles, R.H. Jr. (Ed) 1984. Wildlife Management Techniques 3rd edition. The wildlife Society, Washington. D.C. Nataraj Publishers,Dehradun. India | | |
| 9 | Dasmann, Rf. 1964, Wildlife Biology. John and Wiley and sons Newyork. Pp231. | | |
| 10 | Rodgers, W.A 1991. Techniques for Wildlife census in India – A Field manual technical Manual – Wildlife Institute of India, Dehra Dun | | |
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| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | |
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| 1 | Ecology &Wildlife MOOChtt[ps://www.mooc](http://www.mooc-list.com/course/ecology-and-wildlife-)-[list.com/course/ecology-and-wildlife-](http://www.mooc-list.com/course/ecology-and-wildlife-)  conservation-futurelearn | | |
| 2 | SwayamPrabha<https://swayamprabha.gov.in/index.php/program/current/9/272109> | | |

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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** | S | S | M | S | M | S | S | M | S | M |
| **CO2** | M | M | M | M | M | M | M | S | M | S |
| **CO3** | M | M | S | M | S | S | M | M | M | S |
| **CO4** | S | M | S | M | S | M | S | M | M | S |

\*S-Strong; M-Medium; L-Low

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| **Course code** | | 53B | **CONSERVATION BIOLOGY** | | **L** | **T** | | **P** | **C** |
| **Core/Elective/ SBS** | | | Core Course VI | | **4** | **0** | | **0** | **4** |
| **Pre-requisite** | | | Knowledge of Animal diversity & Ecology  **Ve** | |  | | **23** | | |
| **Course Objectives:** | | | | | | | | | |
| 1. To give the student a state-of-the-art insight of scientific developments in Conservation Biology. 2. To learn to use this information in an integrative way. 3. To study the various conservation measures adopted in India. | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | |
| 1 | Analyse and interpret the problems in conservation Biology. | | | | | | | K5 | |
| 2 | The learner will be able to understand the distribution and diversity of fauna. | | | | | | | K2 | |
| 3 | Explain the various strategies adopted in conservation of various species. | | | | | | | K6 | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create | | | | | | | | | |
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| **Unit:1** | | **BIODIVERSITY AND CONSERVATION** | | | **14hours** | | | | |
| Biodiversity – Classification with examples – *in situ* & *ex situ* conservation methods – Sanctuary  – National Parks – Tiger reserves (examples) – Zoo’s – botanical gardens – germ plasm conservation – DNA libraries – Tissue culture & cloning. Conservation reserves – Sacred Grooves - People participation in Conservation. | | | | | | | | | |
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| **Unit:2** | | **WETLAND ECOSYSTEM** | | | **14hours** | | | | |
| Distribution of Teleosts, Anura & Squamata in India. Conservation of wetlands **-** Estuarine habitats in India – Backwaters – Mangroves & significance – impacts of dams. Detailed study of Pitchavaram Mangroves, Kuttanad Ecosystem, Sundarbans.- Migration of Fishes, Hill stream  adaptations in fishes. | | | | | | | | | |
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| **Unit:3** | | **AMPHIBIANS AND REPTILES** | | **15hours** | | | | | |
| Parental care in amphibians, Origin of Amphibians - Aquatic amphibians and reptiles in India, Conservation & threats to tortoise & turtles - Evolution & Adaptive radiation of Reptiles, Dinosaurs the extinct reptiles, Identification of Poisonous and non-poisonous snakes, Poison apparatus and types of  poison. | | | | | | | | | |
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| **Unit:4** | | **DIVERSITY OF MAMMALS** | | **15hours** | | | | | |
| Diversity of Marsupials – Aquatic mammals and adaptation - Adaptive radiation in Mammals,  Endemic & endangered mammals of south India - Dentition in mammals **-** Diversity of Small cats in India, Diversity of Civets & Mongoose in India-NTCA and Tiger monitoring. | | | | | | | | | |

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| **Unit:5** | **CONSERVATION OF MAMMALS** | **15hours** |
| Distribution and conservation of Old World Monkeys, Distribution and conservation of Indian ungulates, Corridors - Securing Conservation of Indian Rhino - Breeding biology & feeding ecology of Elephants – Human Corridors (case studies) in India and abroad. conflicts & Mitigation in Indian landscape – Understanding National Biodiversity portal. | | |
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| **Unit:6** | | **Contemporary Issues** | **2 hours** |
| Expert lectures, online seminars – webinars / Field studies | | | |
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|  | | **Total Lecture hours** | **75hours** |
| **Text Book(s)** | | | |
| 1 | Arumugam N. (2014). [*Animal Diversity - Volume - 2 - Chordata*,](https://www.saraspublication.com/osc/catalog/animal-diversity-volume-chordata-p-172.html) Saras Publication, Nagercoil,Tamilnadu. | | |
| 2 | EkambaranathaAyyar and Ananthakrishnan TN.(1993).*Manual of Zoology Vol – II*, S. Viswanathan Pvt. Ltd. Chennai. | | |
| 3 | Menon V,S.K Tiwari,K.Ramkuar,Sunil Kyarong ,U Ganguly ,R.Sukumar.(2017). Right Of Passage: Elephant Corridors of India | | |
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| **Reference Books** | | | |
| 1 | Indraneil Das. (2008).*Snakes and other reptiles of India* NatrajPublicationS, Delhi. | | |
| 2 | Kartikshanker and Choudhury BC.(2007). *Marine turtles of the Indian subcontinent*, Natraj  Publications, Delhi. | | |
| 3 | Kotpal RL.(2015). *Mordern Text Book of Zoology Vertebrates*, Rastogi Publications, Meerut. | | |
| 4 | Prater SH. (1971). *The book of Indian animals* Natraj Publications, Delhi. | | |
| 5 | Romulus Whitaker and Ashok captain. (2004).*Snakes of India: the field guide,* Natraj  Publications, Delhi. | | |
| 6 | Thangamani A, Prasannakumar S, Narayanan LM, Arumugam N. (2018). [*A Text Book*](https://www.saraspublication.com/osc/catalog/text-book-chordates-p-136.html)[*ofChordates*](https://www.saraspublication.com/osc/catalog/text-book-chordates-p-136.html)*,* Saras Publication, Nagercoil, Tamilnadu. | | |
| 7 | Verma PS. (2010).*Chordate Zoology*, S Chand Publishers, New Delhi. | | |
| 8 | Anderson J andSlater DL. (1981).*Catalogue of Mammals, Vols. I and II,* Cosmo Publications, NewDelhi. | | |
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| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | |
| 1 | Wildlife Conservation <https://swayam.gov.in/nd1_noc20_bt39/preview> | | |
| 2 | National Digital Library of India https://ndl.iitkgp.ac.in/ | | |

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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** | S | M | M | S | M | S | S | S | M | M |
| **CO2** | M | S | S | S | M | S | M | M | S | M |
| **CO3** | M | S | M | S | S | M | S | S | M | S |

\*S-Strong; M-Medium; L-Low

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| **Course code** | | 53C | **BIOLOGY OF VERTEBRATE** | | **L** | **T** | | **P** | **C** |
| **Core/Elective/ SBS** | | | Core Course VII | | **4** | **0** | | **0** | **4** |
| **Pre-requisite** | | | Knowledge in animal diversity, vertebrate  **Ve** | |  | |  | | |
| **Course Objectives:** | | | | | | | | | |
| 1. To enable the students understand the basic principles, classification, diversity and adaptations of vertebrates. 2. To understand what the vertebrates are. 3. To understand different categories of vertebrates. 4. To understand the general characters of each class of vertebrates. 5. To understands the level of organization in vertebrate classes. 6. To understand the origin and evolutionary relationship in different classes of vertebrates | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | |
| 1 | Student should be able to describe unique characters of amphibians, reptiles, aves and mammals. | | | | | | | K1 | |
| 2 | Student should be able to recognize life functions of amphibians, reptiles, aves and mammals. | | | | | | | K2 | |
| 3 | To understand the ecological role of different classes of vertebrates. | | | | | | | K2 | |
| 4 | To understand the diversity of vertebrates | | | | | | | K2 | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create | | | | | | | | | |
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| **Unit:1** | | **ICHTHYOLOGY** | | | **14hours** | | | | |
| Ichthyology: Diversity of fishes, Characteristics of Fishes with suitable examples, Food and feeding habits – breeding habits of fresh water fishes – Detailed study on golden mahaseer fish | | | | | | | | | |
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| **Unit:2** | | **HERPETOLOGY** | | | **14hours** | | | | |
| Herpetology: AMPHIBIA: Diversity, Characteristics of amphibia with suitable examples. Distribution and salient features of South Indian amphibians. Food and feeding habits – breeding habits – detailed study on Rhacophorus malabaricus | | | | | | | | | |
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| **Unit:3** | | **REPTILIA** | | **15hours** | | | | | |
| Unit III: REPTILIA: Diversity, Characteristics of Reptilia with suitable examples. Distribution and salient features of South Indian reptiles. Food and feeding habits – breeding habits of Indian Lizards, snakes, turtles, tortoises and crocodiles. Key characters of venomous and non-venomous Snakes | | | | | | | | | |

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| **Unit:4** | **ORNITHOLOGY** | **15hours** |
| Ornithology: Classification of Birds up to orders with suitable examples. Food and feeding habits – breeding habits and Adaptation of Indian birds: Coastal birds – Inland water birds – Birds of terrestrial, high altitudes and deserts. Biology of Bird migration. | | |

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| **Unit:5** | | **MAMMOLOGY** | **15hours** |
| Unit V: Mammology: Distribution of mammals - marine, aquatic, arboreal, aerial, fossorial and terrestrial. Food and feeding habits – Herbivores, carnivores and omnivores. Breeding biology of scaly ant-eater, whales, elephant and tiger. | | | |
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| **Unit:6** | | **CONTEMPORARY ISSUES** | **2 hours** |
| Expert lectures, online seminars – webinars/visit to institutions. | | | |
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|  | | **Total Lecture hours** | **75hours** |
| **Text Book(s)** | | | |
| 1 | 1. Khanna,S and H.R Singh.2006.A Text book of fish biology and Fisheries | | |
| 2 | 2. Ranjit Daniels.2005.Amphibians of peninsular India. Indian Academy of Sciences, Uni. Press, India. | | |
| 3 | 3. Welty, J. 1982. The Life of Birds. Saunders College Publishing, New York. | | |
| 4 | 4. J.C. Daniel. Amphibians and Reptiles of India | | |
| 5 | 5. Prater, Mammals of India | | |
| 6 | 6. Vivek Menon, 2014. Field guide of Mammals of India | | |
| 7 | 7. Ali, S., and S.D. Ripley. 1969. The Handbook of Birds of India and Pakistan. Oxford University Press – Delhi. | | |
| 8 | 8. Farner D.S. and J.K. King. 1971-75. Avian Biology. 1-5 vols. Academy Press, Delhi. | | |
| 9 | 9. Kannan. P. 2014. Snakes and other reptiles of Nilgiris. HADP | | |
| 10 | 10. Whitaker. R. 2002. Snakes of India. A Field Guide. | | |
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| **Reference Books** | | | |
| 1 | Das. I. 1985. Indian Turtles, A field guide. WWF India. B.Sc. Zoology (Wildlife Biology) 2013-14 onwards Annexure No. 24B Page 3 of 13 SCAA Date: 24.04.2015 | | |
| 2 | Day F. 1958. The Fishes of India Vols. I and II. William Dawson and Sons Ltd., London | | |
| 3 | Deoras, P.J. 1965. Snakes of India. National Book Trust, New Delhi.. | | |
| 4 | Goin. G.J. and O.R. Goin. 1971. Introduction to Herpetology. W.H. Freeman and Company, San Francisco | | |
| 5 | Lagler, K.F. J.F. Rardoh and R.R. Miller. 1962. Ichthyology. The Study of Fishes. John Wiley and Sons, New York. | | |
| 6 | Love, M.S. and G.M. Galliet, 1979. Readings in Ichthyology. Prentice - Hall of India, New Delhi. | | |
| 7 | Murthy, T.S.N. 1987. The snakes of India. International Book Distributors, Dehra Dun | | |
| 8 | Osellariors, Augue A. and J. Attridge. 1975. Reptiles. Hutchinson University Library, London. | | |
| 9 | Robinson, D. 1976. Tortoises, Turtles and Terrapins, John Bartholomew & Sons Ltd., Edinburgh | | |
| 10 | Sedgwick. A. 1962. A student’s Text Book of Zoology Vol. II Vertebrata. Central Book Depot. Allahabad. | | |
| 11 | Young, J.Z. 1950. The life of vertebrates. Clarendon press, Oxford. | | |
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| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | |
| 1 | National Digital Library of India https://ndl.iitkgp.ac.in/ | | |
| 2 | SwayamPrabha<https://www.swayamprabha.gov.in/index.php/program/archive/9> | | |

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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** | S | M | M | M | M | M | M | S | M | S |
| **CO2** | M | S | M | M | M | M | M | M | S | M |
| **CO3** | M | S | M | S | S | M | S | M | M | S |
| **CO4** | S | S | S | S | M | S | M | S | M | M |
| CO5 | M | M | S | M | S | M | M | M | S | M |

\*S-Strong; M-Medium; L-Low

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| **Course code** | | 5EA | **ECO DEVELOPMENT AND ECOTURISM** | | **L** | **T** | | **P** | **C** |
| **Core/Elective/ SBS** | | | **Elective Course I** | | **3** | **0** | | **0** | **3** |
| **Pre-requisite** | | | **Knowledge about the ecology and Ecotourism** | |  | | **23** | | |
| **Course Objectives:** | | | | | | | | | |
| To make the students equipped with principles and applications of Eco-development Programmers | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | |
| 1 | Explain the diverse nature of tourism, including culture and place, global/local perspectives, and experience design and provision. | | | | | | | K2 | |
| 2 | Develop and evaluate eco-tourism policy and planning initiatives. | | | | | | | K2 | |
| 3 | Apply principles of sustainability to the practice of tourism in the local and global context. | | | | | | | K3 | |
| 4 | Evaluate and apply various research methods commonly used in the context of tourism. | | | | | | | K5 | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create | | | | | | | | | |
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| **Unit:1** | | **DEFINITION AND PRINCIPLES** | | | **8hours** | | | | |
| Definition and Principles of eco-development and eco tourism – Description for identification of areas– Criteria for area identification - identification of resource organizations – Baseline survey | | | | | | | | | |
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| **Unit:2** | | **PARTICIPATORY RURAL APPRAISAL (PRA)** | | | **8hours** | | | | |
| Participatory Rural Appraisal (PRA) exercise – History of the area - Collection of socioeconomic details - Preparation of social map- Resource map- problem analysis and prioritization addressing the problems-SWOT analysis | | | | | | | | | |
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| **Unit:3** | | **COMMITTEES** | | **9 Hours** | | | | | |
| Formation of Eco-development Committees - Micro plan preparation and its implementation – Finding funding agencies- Fund utilization – Formation of revolving fund – Community development fund – Welfare fund | | | | | | | | | |
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| **Unit:4** | | **ECO CLUBS** | | **9 Hours** | | | | | |
| Formation of self help groups, Nature clubs and Eco clubs for students, Wildlife protection team – creation of alternative income generation activities – value addition and utilization of NTFP- Involvement in forest protection and gathering intelligence and information – awards and rewards | | | | | | | | | |
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| **Unit:5** | | **ECO DEVELOPMENT AREA** | | **9Hours** | | | | | |
| Study on successful eco development areas – Case studies – Periyar Tiger Reserve and Kalakkad-Mundanturai Tiger Reserves - Monitoring and evaluation of eco-development programmes, data collection, analysis and interpretation, report writing and preparation of ecodeveloment Plan | | | | | | | | | |

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| **Unit:6** | | **CONTEMPORARY ISSUES** | **2 hours** | |
| Expert lectures, online seminars – webinars | | | | |
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|  | | **Total Lecture hours** | **45hours** | |
| **References Book(s)** | | | |
| 1 | Eco Development- Towards a philosophy of environmental Education -Balasubramanian and Arun, Regional Institute of Higher Education, Singapore, 1984 | | |
| 2 | Joint Forest Management- The Haryana Experience- Sarin Madhu, Centre for Environmental Education, Ahmedabad, 1996 | | |
| 3 | Microplanning Manual for Joint Forest Management areas- Bahshih Singh, Varalekshmi, Tata Energy Research Institute, New Delhi, 1998 | | |
| **4** | People and Protected Areas- Towards participatory conservation in India- Ashish Kothari, Neena Singh, Saloni Suri, Sage Publications, New Delhi, 1996 | | |
| 5 | Participatory Rural Appraisal- Methods and Applications in Rural Planning- Amitava Mukherjee, Vikas Publishing House, New Delhi, 1995 | | |
| 6 | Learning to share- Experiences and Reflexions on PRA and community participation- Neela Mukherjee & others, Concept Publishing Company, New Delhi, 1997 | | |
| 7 | Participatory Rural Appraisal- Methodology and Application- Neela Mukherjee, Concept Publishing Company, New Delhi, 1993 | | |
| 8 | Ecotourism- A guide for planners and Managers- Lidberg, Kreg etc, Natraj Publishers, New Delhi, 1999 | | |
| 9 | Tourism and Development in India- Sunitha Chopra, Ashish Publishing House, New Delhi, 1991 | | |
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| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | |
| 1 | Forest Biometry <https://swayam.gov.in/nd1_noc20_bt04/preview> | | |
| 2 | Forests and their Management <https://swayam.gov.in/nd1_noc20_bt01/preview> | | |
| 3 | National Digital Library of India https://ndl.iitkgp.ac.in/ | | |

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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** | S | M | M | S | M | M | M | M | M | M |
| **CO2** | M | S | M | M | M | M | M | M | S | M |
| **CO3** | S | M | M | L | M | L | M | M | L | M |
| **CO4** | M | M | M | M | L | M | M |  | S | S |

\*S-Strong; M-Medium; L-Low

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| **Course code** | | 5EB | **INDIAN WILDLIFE LAWS & FORENSICS.** | | **L** | **T** | | **P** | **C** |
| **Core/Elective/ SBS** | | | **Elective course**  **II** | | **3** | **0** | | **0** | **2** |
| **Pre-requisite** | | | Basic knowledge on wildlife conservation  **Ve** | |  | |  | | |
| **Course Objectives:** | | | | | | | | | |
| 1. To make the student get aware with various legislations related to wildlife and conservation. 2. To make the student get familiar with wild life forensics. | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | |
| 1 | Able to follow and interpret various rules and regulations related to wildlife. | | | | | | | K2 | |
| 2 | Identify various crimes and give necessary information to public regarding the  Wildlife conservation. | | | | | | | K3 | |
| 3 | The learner will be able to identify the necessity of forensics related to wildlife  Crimes. | | | | | | | K3 | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create | | | | | | | | | |
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| **Unit:1** | | **BIODIVERSITY ACT** | | | **8hours** | | | | |
| History of Wildlife laws in India – Highlights of Biological Diversity Act, 2002 & Biological  Diversity Rules, 2004. | | | | | | | | | |
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| **Unit:2** | | **WPA AND CONSERVATION** | | | **9hours** | | | | |
| Introduction to Wildlife Protection Act (over view of Chapters) - Declarations & regulations related to Sanctuaries , National parks & Closed areas – Central Zoo Authority & recognition of  Zoos. | | | | | | | | | |
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| **Unit:3** | | **WPA-TRADE** | | **8hours** | | | | | |
| Prohibition of trade related to wildlife – Prevention & detection of offences. Introduction to  animal involved in Schedule I to V. Plants in Schedule VI. Overview of Amendments. | | | | | | | | | |
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| **Unit:4** | | **WILDLIFE TRADE** | | **9hours** | | | | | |
| Wildlife trade – important species and parts traded - special reference to turtles, reptiles, birds  and mammals. Collection of physical and biological evidences from crime scene. Radio isotopes in forensics | | | | | | | | | |
| **Unit:5** | | **WILDLIFE FORENSICS** | | **9hours** | | | | | |
| Forensic entomology in wildlife crimes - wildlife toxicology - cyber forensics in wildlife -  forensic veterinary pathology - forensic photography - role of diatoms in wildlife forensics – Introduction to molecular forensics – species, sex and geo-referencing samples – FINS. | | | | | | | | | |
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| **Unit:6** | | **CONTEMPORARY ISSUES** | | **2 hours** | | | | | |
| Expert lectures, online seminars – webinars, Field visit | | | | | | | | | |
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|  | | **Total Lecture hours** | | **45hours** | | | | | |

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| **Text Book(s)** | |
| 1 | Lawmann . (2017).*Wildlife Protection Act 1972,* Kamal Publishers, New Delhi. |
| 2 | Majumdar AB (Author), Nandy D, Mukherjee S. (2013). *Environment and Wildlife Laws in*  *India*, LexisNexis Publishers. |

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| **Reference Books** | |
| 1 | Huffman JE and Wallace JR. (2018). *Wildlife Forensics Methods and Applications,* Willey  Blackwell Publishers, UK. |
|  | |
| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | |
| 1 | The Indian Wildlife (Protection) Act 1972 <http://envfor.nic.in/legis/>  **wildlife/wildlife1.html** |
| 2 | [https://Indiacode.nic.in/bitstream/123456789/1726/1/197253.pdf](https://indiacode.nic.in/bitstream/123456789/1726/1/197253.pdf) |

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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** | S | M | S | M | S | S | M | M | S | M |
| **CO2** | M | S | M | S | M | S | M | S | M | S |
| **CO3** | M | S | M | S | M | M | M | M | S | S |

\*S-Strong; M-Medium; L-Low

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| **Course code** | | | 5ZC | **BIOSTATISTICS AND COMPUTER**  **APPLICATIONS** | | **L** | **T** | | **P** | **C** |
| **Core/Elective/ SBS** | | | | **Skill Based Course III** | | **3** | **0** | | **0** | **3** |
| **Pre-requisite** | | | | Aptitude in basic Mathematics & Biology  **Ve** | |  | | **23** | | |
| **Course Objectives:** | | | | | | | | | | |
| 1. To develop awareness about the application of statistics in Wildlife Biology 2. To train how the biological data are processed and interpretations are made. 3. To give an introduction to computer and databases. | | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | | |
| 1 | | The course will give an idea how data should be managed & Processed. | | | | | | | K2 | |
|  | | The course will develop the research aptitude of the students. | | | | | | |  | |
| 2 | | The course will help use of different statistical tools to interpretat the research aptitude of the students. | | | | | | | K2 | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create | | | | | | | | | | |
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| **Unit:1** | | | **SAMPLING AND GRAPH** | | | **8 hours** | | | | |
| Types of Sampling – Concept of Sampling in Biology. Frequency distribution – Individual, discrete & Continuous series. ***Drawing practice***: Histogram, Ogive, Bar, Pie chart. | | | | | | | | | | |
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| **Unit:2** | | | **MEASURES OF CENTRAL TENDENCY** | | | **9hours** | | | | |
| Concept & equations of Mean & deviation (individual, discrete & continuous series)  ***Problem Solving:*** (individual series alone) Mean, median, mode and Standard Deviation. | | | | | | | | | | |
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| **Unit:3** | | | **CORRELATION AND REGRESSION** | | **9hours** | | | | | |
| Concept & types of Co-relation & regression.  ***Problem Solving:*** Co-efficient of Correlation, Regression for X on Y & Y on X. | | | | | | | | | | |
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| **Unit:4** | | | **TEST OF SIGNIFICANCE** | | **8hours** | | | | | |
| Concept of Students “t”, Chi square.  ***Problem Solving:*** “t” test – independent & dependent, Chi square. | | | | | | | | | | |
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| **Unit:5** | | | **COMPUTER- APPLICATION** | | **9hours** | | | | | |
| Central Processing Unit – Output & Input devices – Storage devices – Software & hardware – Basic operation of MS Word, Excel & Power Point – Browsers & Search engines – Introduction to Biological databases – significance of NCBI –Taxonomic browser. | | | | | | | | | | |
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| **Unit:6** | | | **CONTEMPORARY ISSUES** | | **2 hours** | | | | | |
| Expert lectures, online seminars – webinars | | | | | | | | | | |
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|  | | | **Total Lecture hours** | | **45hours** | | | | | |
| **Text Book(s)** | | | | | | | | | | |
| 1 | Ramakrishnan P. (2015). *Biostatistics* ,Saras Publication Nagercoil, Tamilnadu. | | | | | | | | | |
| 2 | Arumugam N. (2015).*Basic Concepts of Biostatistics,* Saras Publication Nagercoil,  Tamilnadu, | | | | | | | | | |

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| **Reference Books** | |
| 1 | Banerjee PK. (2014). *Introduction to Biostatistics*, 5th edition, S. Chand Publication, New  Delhi. |
| 2 | Pandey M. (2015). *Biostatistics Basic and Advanced,* Publishers Viva Books, New Delhi. |
|  | |
| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | |
| 1 | Introduction to Biostatistics <https://swayam.gov.in/nd1_noc19_bt19/preview> |
| 2 | Biostatistics and Design experiments <https://swayam.gov.in/nd1_noc20_bt11/preview> |
| 3 | National Digital Library of India https://ndl.iitkgp.ac.in/ |

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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** | M | M | M | M | M | S | M | S | M | M |
| **CO2** | M | S | M | M | M | M | S | M | S | S |

\*S-Strong; M-Medium; L-Low

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| **Course code** | | 63A | **FORESTRY & SILVICULTURE** | | **L** | | **T** | | **P** | **C** |
| **Core/Elective/ SBS** | | | **Core Course VIII** | | **4** | | **0** | | **0** | **4** |
| **Pre-requisite** | | | Basic knowledge about forest management | |  | | | **23** | | |
| **Course Objectives:** | | | | | | | | | | |
| 1. The Forestry course is designed to teach technical knowledge. 2. To develop skills for a learner on forest management. | | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | | |
| 1 | Gain knowledge and develop a good idea about silviculture. | | | | | | | | K2 | |
| 2 | Familiarize and aware with social forestry and agro forestry & its management. | | | | | | | | K2 | |
| 3 | Understand and able to carry out forest survey. | | | | | | | | K3 | |
| 4 | The learner can involve in forest management and preparation inventories. | | | | | | | | K3 | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create | | | | | | | | | | |
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| **Unit:1** | | **SILVICULTURE** | | | | **14hours** | | | | |
| Factors influencing vegetation – Regeneration of forests – Methods of propagation – grafting - Nursery & Planting techniques - Clear felling, Coppice and Con systems – Silviculture management in India. | | | | | | | | | | |
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| **Unit:2** | | **MENSURATION & SURVEY** | | | | **15hours** | | | | |
| Methods of measuring - diameter, girth, height and volume of trees - form-factor - volume estimation of stand - annual increment. Sampling methods and sample plots. Methods of forest survey – map reading. | | | | | | | | | | |
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| **Unit:3** | | **FOREST MANAGEMENT** | | **14 hours** | | | | | | |
| Types of forests in India – identification and dominant flora – Impact of fire on forests – Biotic threats on forest – Proliferation of IAS in forest - Preparation of inventories – Management of forest plantations – commercial forests – forest cover monitoring. | | | | | | | | | | |
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| **Unit:4** | | **SOCIAL FORESTRY & MANAGEMENT** | | **15 hours** | | | | | | |
| Agro forestry – Scope & necessity. Social/Urban Forestry – Joint Forest Management – Tribal participation in forest management. Soil conservation – causes of erosion – role of forests. Watershed management & Environmental function of forests. | | | | | | | | | | |
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| **Unit:5** | | **FOREST RESOURCE UTILIZATION** | **15hours** |
| Harvesting practices – logging and extraction - Non timber forest products – Wood seasoning and preservation – Composite woods - Anatomical structure of wood - defects and abnormalities. Timber identification. | | | |
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| **Unit:6** | | **CONTEMPORARY ISSUES** | **2 hours** |
| Expert lectures, online seminars – webinars | | | |
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|  | | **Total Lecture hours** | **75hours** |
| **Text Book(s)** | | | |
| 1 | Arumugam N and Kumaresan V. (2014). *Environmental Studies,* Saras Publication Nagercoil,  Tamilnadu. | | |
| 2 | Agarwala VP. (1980)*. Forests in India.* Oxford and IBH Publishing Co., New Delhi. | | |
| 3 | K.Manikandan and S.Prabhu .(2015) Indian Forestry : A Break through Approach to Forest service. ,Fourth revised edition, Jain brothers ,New Delhi | | |
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| **Reference Books** | | | |
| 1 | Puri GS, Meher VM, Gupta RK and Puri S.(1981)*. Forest Ecology.* Oxford and IBH  Publishing Co., New York. | | |
| 2 | Stebbin EP. (1977). *A Manual of Elementary Forest Zoology For India*. International Book  Distributors, Dehra Dun. | | |
| 3 | Sukachev V and Dlis N. (1964)*. Fundamentals of Forest Biogeocoenology,* Oliver and Boyd,  Edinburgh. | | |
| 4 | Tiwari KM and Singh RV. (1980)*. Social Forestry Plantations.* Oxford and IBH Publishing Co., New Delhi. | | |
| 5 | Warning RH and Schlesinger WH. (1985). *Forest Ecosystems: Concepts andManagement.*  Academic Press, New York. | | |
|  | | | |
| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | |
| 1 | Forest Biometry <https://swayam.gov.in/nd1_noc20_bt04/preview> | | |
| 2 | Forests and their Management <https://swayam.gov.in/nd1_noc20_bt01/preview> | | |
| 3 | National Digital Library of India https://ndl.iitkgp.ac.in/ | | |

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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** | S | M | M | M | M | M | S | M | M | S |
| **CO2** | M | S | S | S | M | M | M | M | S | M |
| **CO3** | S | M | M | S | S | S | S | S | M | M |
| **CO4** | M | M | S | M | M | S | S | M | M | S |

\*S-Strong; M-Medium; L-Low

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| **Course code** | | 63B | **ANIMAL BEHAVIOUR** | | **L** | **T** | | **P** | **C** |
| **Core/Elective/ SBS** | | | **Core Course**  **IX** | | **4** | **0** | | **0** | **4** |
| **Pre-requisite** | | | Knowledge of Animal ecology and evolution | |  | | **2 3** | | |
| **Course Objectives:** | | | | | | | | | |
| The main objectives of this course are to:   1. The course will give a basic idea of different types of animal behavior and its significance. 2. The course also gives an insight to the students about the reason for various types of behavior. 3. The course also explains how different animals adapt different behavior in order to over different strategies and how it is used in adaptation. | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | |
| 1 | The student will be able to explain the basic concepts of animal behavior. | | | | | | | K2 | |
| 2 | Observe and understand the reasons of various strange behaviour in animals. | | | | | | | K2 | |
| 3 | Analyse the various animal relations in an interdisciplinary approach. | | | | | | | K4 | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create | | | | | | | | | |
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| **Unit:1** | | **INTRODUCTION TO BEHAVIOUR** | | | **15hours** | | | | |
| Historical out lines – patterns, objectives & mechanism of behavior. Reflex action - types -  Reflex arch - complex behaviour. Kinesis: orthokinesis & klinokinesis. Taxis: kinds of taxis -Sun- compass orientation, dorsal- light reaction – Biological rhythms. | | | | | | | | | |
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| **Unit:2** | | **LEARNING AND MOTIVATION** | | | **14hours** | | | | |
| Learning & Instinct: conditioning, habituation, sensitization, reasoning - classical and modern concepts with examples. Motivation – types, models & examples – Motivational conflict – decision making & displacement. Hormones& Pheromones in behavior. | | | | | | | | | |
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| **Unit:3** | | **ALTRUISM AND SEXUAL SELECTION** | |  | | | | | |
| Altruism and evolution-reciprocal altruism - group selection - kin selection - inclusive fitness, cooperation. Parental care & Cost benefit analysis. Courtship - Male rivalry – Female choice –  Infanticide – Mate guarding – Cryptic mate choice -Polygamous sexual conflicts. | | | | | | | | | |
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| **Unit:4** | | **SOCIAL ORGANISATION AND COMMUNICATION** | **15hours** |
| Social Organization in honey bees –foraging – Bee dance. Echolocation in bats – Herd composition in elephants – Migratory path and concept of corridor. Social behavior in Felids –  Predation. Pack formation and splitting in Wild dogs. Social Spacing– Communal defense- Aggression - territory defending. | | | |
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| **Unit:5** | | **COMMUNICATION** | **15hours** |
| Song of Birds & behavior– role in mating – territory defending & others. Vocal communication  in mammals – interspecies and intraspecific significance. Alarm Calls in animals - Signals & cues. Crypsis & Mimicry –– Evolution of sex – Methods to study behavior. | | | |
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| **Unit:6** | | **CONTEMPORARY ISSUES** | **2 hours** |
| Expert lectures, online seminars – webinars | | | |
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|  | | **Total Lecture hours** | **75hours** |
| **Text Book(s)** | | | |
| 1 | Arumugam NA and Natarajan P. *Animal Behaviour – Ethology,* Saras Publication Nagercoil,Tamilnadu. | | |
| 2 | Ridley M. (1986). *Animal Behaviour - A concise Introduction* , Blackwell Scientific  Publications, Oxford. | | |
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| **Reference Books** | | | |
| 1 | Leshner AI, (1978).*An Introduction to Behavioural Endocrinology,* Oxford UniversityPress,  New York. | | |
| 2 | Slater P J B.0(1985). *An Introduction to Ethology,* Cambridge University Press, Cambridge. | | |
| 3 | Wallace R A. (1979). *The Ecology and Evolution of Animal Behaviour,* Goodyear Publishing  Company Inc., Santa Monica, California. | | |
| 4 | Wilson E O. (1978). *Sociobiology*, The Belknap Press, Harvard University Press, Cambridge,  MA. | | |
| 5 | Manning A and Dawkins MS.(2012). *An Introduction to Animal Behaviour*, 6th edition,  Cambridge University Press, UK. | | |
| 6 | Marler P and Hamilton J.(1966). *Mechanism of Animal Behaviour,* John Wiley & Sons, USA. | | |
| 7 | David McFarland. (1985).*Animal Behaviour,* Pitman Publishing Limited, London, UK. | | |
|  | | | |
| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | |
| 1 | National Digital Library of India https://ndl.iitkgp.ac.in/ | | |
| 2 | SwayamPrabha<https://www.swayamprabha.gov.in/index.php/program/archive/9> | | |
| 3 | Animal Behaviour MOOC Course <https://www.mooc-list.com/tags/animal-behaviour> | | |

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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** | S | M | M | S | M | M | S | M | M | M |
| **CO2** | M | M | M | M | M | M | M | M | S | S |
| **CO3** | M | S | M | M | M | M | M | S | S | S |
| **CO4** | S | M | M | S | M | M | S | M | S | S |
| **CO5** | M | M | S | M | M | S | M | M | M | M |

\*S-Strong; M-Medium; L-Low

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| **Course code** | | 63C | **AQUATIC BIOLOGY AND WETLAND ECOSYSTEM** | | **L** | **T** | | **P** | **C** |
| **Core/Elective/ SBS** | | | **Core Course X** | | **4** | **0** | | **0** | **4** |
| **Pre-requisite** | | | Knowledge of Animal ecology and evolution  **Ve** | |  | | **23** | | |
| **Course Objectives:** | | | | | | | | | |
| 1. Objectives: To make the students equipped with principles and applications of Fresh water and Estuarine Ecosystem. | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | |
| 1 | Understand the dynamics of aquatics ecosystems and their potential responses to changes | | | | | | | K2 | |
| 2 | Apply conservation and management principles for conservation and sustainable use of aquatic resources | | | | | | | K3 | |
| 3 | Analyse and critically evaluate ideas, data and information and apply relevant scientific principles to solve problems by, for example, creating hypotheses, testing theories and predictions, designing and conducting experiments and statistically analysing data | | | | | | | K4 | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create | | | | | | | | | |
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| **Unit:1** | | **LIMNOLOGY** | | | **14hours** | | | | |
| Limnology: Introduction, History, Present Status of Limnology. Definition of limnology. Freshwater environments: Extent and distribution of fresh waters. Lotic environments. Freshwater communities. Wetlands. Definition and classification of freshwater wetlands- natural and man-made. | | | | | | | | | |
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| **Unit:2** | | **PONDS** | | | **15hours** | | | | |
| Ponds: Classification of ponds. Physicochemical properties of pond water. Primary production. Swamps and marshes: Types of swamps. Permanent and seasonal swamps. Physicochemical conditions, Nutrient cycling, Biotic components. | | | | | | | | | |
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| **Unit:3** | | **LAKE AND RESERVOIRS** | | **15hours** | | | | | |
| Lakes and reservoirs: Origin. Characteristics. Classification. Eutrophication and pollution of lakes. Ramsar sites in South India. Rivers: Origin and characteristics of river. Functions. Biological productivity. Reservoir, impact of reservoir in wildlife. | | | | | | | | | |
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| **Unit:4** | | **MAJOR THREATS OF FRESH WATER ECOSYSTEM** | | **15hours** | | | | | |
| Major threats to freshwater ecosystems, including pollution and sand mining. Impact of large dams and fragmentation on river ecology and fishery. Association of birds and other wildlife with wetland ecosystems. | | | | | | | | | |

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| **Unit:5** | | **THE ESTUARINE ENVIRONMENT** | | **14hours** |
| The estuarine environment: Dynamics of estuaries. Biodiversity of estuarine systems. Backwaters and estuaries of South India. Mangrove ecosystems: Definition, Origin, Adaptations of mangrove flora and fauna. Major mangrove ecosystems in India | | | | |
|  | | | | |
| **Unit:6** | | **CONTEMPORARY ISSUES** | **2 hours** | |
| Expert lectures, online seminars – webinars | | | | |
|  | | | | |
|  | | **Total Lecture hours** | **75hours** | |
| **Reference Books** | | | | |
| 1 | Wetzel, R.G. 1983. Limnology: Second Edition. Michigan State University. C.B.S | | | |
| 2 | 2. Welch, P.S. 1952. Limnology. 2nd Edition. McGraw Hill Book Co. NY. P536. | | | |
| 3 | 3. Odum. E.P. 1971. Fundamentals of Ecology. Sounders Publ. Philadelphia, p. 574. | | | |
| **4** | 4. Veerbala Rastogi and Jayaraj. 1986. Fundamentals of Ecology. Kedharnath publication | | | |
| 5 | 5. Sheeja and Ebanasar. 2006. Ecosystem dynamics of ponds and rivers in India. Shine and Twinkle pub. | | | |
| 6 | 6. Handbook Of Tropical Estuarine Biology by S.Z, Qasim, 2004 | | | |
|  | | | | |
| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | |
| 1 | National Digital Library of India https://ndl.iitkgp.ac.in/ | | | |
| 2 | SwayamPrabha<https://www.swayamprabha.gov.in/index.php/program/archive/9> | | | |

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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **Cos** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** | S | M | M | S | M | M | S | S | M | M |
| **CO3** | M | S | M | M | S | S | M | S | M | S |
| **CO3** | S | M | M | M | M | M | S | M | S | S |

\*S-Strong; M-Medium; L-Low

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| **Course code** | | | 6EA | **MARINE NATIONAL PARKS IN INDIA** | | **L** | **T** | | **P** | **C** |
| **Core/Elective/Supportive** | | | | **Elective course III** | | **3** | **0** | | **0** | **3** |
| **Pre-requisite** | | | | Basic knowledge in marine animals and national parks  **Ve** | |  | |  | | |
| **Course Objectives:** | | | | | | | | | | |
| To understand the significance of Marine National Parks, its habitats and their functioning.  To understand the threats of marine national parks  To study the Laws of Regulation. | | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | | |
| 1 | | Basic oceanography to understand influence of unique characteristics of marine environments on marine life. | | | | | | | **K2** | |
| 2 | | Mechanistic understand of how process occurring within organisms interact with higher- level organization. | | | | | | | **K2** | |
| 3 | | Integrated approaches to studying population ecology, marine habitats, and ecosystem. In depth for select habitats and ecosystem. | | | | | | | **K4** | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create | | | | | | | | | | |
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| **Unit:1** | | | **INTRODUCTION TO MARINE NATIONAL PARKS** | | | **9hours** | | | | |
| Introduction to Marine National Parks – Characteristics of Marine National Parks - Physical, Chemical and Biological factors; Values and importance of Marine National Parks, their biodiversity wealth. Significance of Marine protected Areas – MPAs Network in India | | | | | | | | | | |
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| **Unit:2** | | | **MARINE MAMMALS** | | | **8hours** | | | | |
| Marine Mammals: Diversity, distribution, distinctive features, adaptations and conservations. Important Marine Wild Animals and their Importance of Marine Mammals: Seals, otters, Walruses, Whales, Dolphins, porpoises and Dugong. Marine Birds, Marine Turtles and Snakes.  Aquatic Mammals and their Morphological adaptations. | | | | | | | | | | |
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| **Unit:3** | | | **THREATS OF MARINE NATIONAL PARKS** | | **8hours** | | | | | |
| State and Central Government initiatives to conserve marine national parks in India. Threats to Marine national parks: Climate change, Invasive alien species, faster economic development. Organizations involved in marine National parks – WII, BNHS, DOD, CMFRI, Threats and conservation of Marine national park: Anthropogenic pressure –Pollution and its effect on marine national parks in India. Remedial measures. | | | | | | | | | | |
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| **Unit:4** | | | **DETAILED STUDY ON MARINE NATIONAL PARKS** | | **9hours** | | | | | |
| Rani Jhansi Marine National Park in Andaman and Nicobar Islands, Gahirmatha Marine Park in Odisha, Gulf of Mannar Marine National Park In Tamil Nadu, Malvan Marine Park in Maharashtra, Mahatma Gandhi Marine National Park In Andaman and Nicobar Islands, Marine National Park In Gujarat. | | | | | | | | | | |
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| **Unit:5** | | | **LAWS AND REGULATIONS** | | **9hours** | | | | | |
| Laws and regulations: Biodiversity Act 2002 –Marine National Park related laws and regulation.  The Indian Fisheries Act -1857- Water prevention and control of pollution Act 1974 , 1976.  Coastal Zone Regulation Act 1991 and its amendments. Exclusive Economic Zone (EEZ). Integrated Coastal Zone Management (ICZM). | | | | | | | | | | |
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| **Unit:6** | | | **CONTEMPORARY ISSUES** | | **2 hours** | | | | | |
| Expert lectures, online seminars – webinars | | | | | | | | | | |
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|  | | | **Total Lecture hours** | | **45hours** | | | | | |
| **Text Book(s)** | | | | | | | | | | |
| 1 | Prater,S.H. 1971. The Book of Indian Animals.Bombay Natural History Society.Oxford University Press, Chennai. | | | | | | | | | |
| 2 | Thangamani *et.al*.2007.A text book of Chordated .Saras Publication,Nagercoil.Kanyakumari. | | | | | | | | | |
| 3 | Marine Parks and Aquaria of the United States: A Reference Guide Hardcover – Import, 1 January 1990 by [Anthony L. Pacheco](https://www.amazon.in/s/ref=dp_byline_sr_book_1?ie=UTF8&field-author=Anthony+L.+Pacheco&search-alias=stripbooks) (Author), [Susan E. Smith](https://www.amazon.in/s/ref=dp_byline_sr_book_2?ie=UTF8&field-author=Susan+E.+Smith&search-alias=stripbooks) (Author) | | | | | | | | | |
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| **Reference Books** | |
| 1 | Invitation to Oceanography by Paul R. Pinet 2013, Jones &Bartlett Learning publication house |
| 2 | An Introduction to the Biology of Marine Life, James Sumich WCB/McGraw Hill 1999 |
| 3 | Bal and Rao. 1989. Marine Biology. |
| 4 | Venkataraman,K.,Sivaperman C., and C.Raghunathan (Editors) 2013.Ecology and Conservation of Tropical Marine Faunal Communities.Springer Heidelberg New York,London. |
|  | |
| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | |
| 1 | National Digital Library of India https://ndl.iitkgp.ac.in/ |
| 2 | SwayamPrabha<https://www.swayamprabha.gov.in/index.php/program/archive/9> |

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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **Cos** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** | S | L | M | M | L | M | S | M | S | M |
| **CO2** | L | M | S | L | M | L | M | S | M | S |

\*S-Strong; M-Medium; L-Low

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| **Course code** | | | 6EB | **FIELD BIOLOGY, GEO-INFORMATICS AND** | | **L** | **T** | | **P** | **C** |
| **Core/Elective/ SBS** | | | | **Elective IV** | | **3** | **0** | | **0** | **3** |
| **Pre-requisite** | | | | Knowledge of ecology and statistics  **Ve** | |  | |  | | |
| **Course Objectives:** | | | | | | | | | | |
| 1. To give an introduction to basic geology. 2. To give idea about the usage of GIS software. 3. To train the students in the creation of maps. | | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | | |
| 1 | | Understand the use of geological principles in wildlife sciences. | | | | | | | K3 | |
| 2 | | Able to geo-reference the data in cartograms. | | | | | | | K3 | |
| 3 | | The students will able overlay layers in maps and generate it. | | | | | | | K3 | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create | | | | | | | | | | |
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| **Unit:1** | | | **INTRODUCTORY GEOLOGY** | | | **10 hours** | | | | |
| Map reading – topo sheets – Google map – satellite imageries – contours, hilly areas, valleys, drainage, reservoirs, buildings, settlements, roads, trek paths, cultivated areas, state boundary, RF boundary. Digital images& pixels – Latitudes & longitudes - Topography maps – Contour lines – Colours & symbols – Scale –types & measuring distance - Mountains & Plateaus in India – Major rivers in India. | | | | | | | | | | |
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| **Unit:2** | | | **GPS** | | | **9hours** | | | | |
| GPS - applications in identifying locations mapping & Navigation. Introduction to GIS maps – Digitization of Maps and Projection. Brief outlines to Arc View – Mapinfo& QGIS. Satellite images and availability. | | | | | | | | | | |
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| **Unit:3** | | | **DATA ANALYSIS** | | **8 hours** | | | | | |
| Data Entry and Preparation, Spatial Data Generation, Concept of Database and Metadata,  Spatial Modelling and Data Visualization. | | | | | | | | | | |
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| **Unit:4** | | | **MANAGING DATA SOURCE** | | **8hours** | | | | | |
| Opening Data –CRS – OTF – XML files – Shape files – Delimited text files / CSV files - creating layers – Exploring data formats and fields. | | | | | | | | | | |
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| **Unit:5** | | | **MAP MAKING** | | **8hours** | | | | | |
| Working with Raster and Vector data in GIS software. Usage of general tools in Q- GIS - transferring of GPS data to GIS and remote sensing in wildlife conservation. Map making. Mountains & Plateaus in India – Major rivers in India. | | | | | | | | | | |
| **Unit:6** | | | **CONTEMPORARY ISSUES** | | **2 hours** | | | | | |
| Expert lectures, online seminars – webinars | | | | | | | | | | |
|  | | | **Total Lecture hours** | | **45hours** | | | | | |
| **Text Book(s)** | | | | | | | | | | |
| 1 | Kang-tsung. (2006).*Chang Introduction to Geographic Information Systems.* Mcgraw Higher  Ed,NY. | | | | | | | | | |
| 2 | Chipman LK. (2015). *Remote Sensing And Image Interpretation.* 7thedition.Willey. | | | | | | | | | |

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| **Reference Books** | |
| 1 | Elangovan K GIS: *Fundamentals, Applications and Implementations*, New India Publishing  Agency |
|  | Giles, R.H. Jr. (Ed) 1984. Wildlife Management Techniques 3rd edition. The wildlife Society, Washington. D.C. Nataraj Publishers, Dehradun. India |
|  | Dasmann, Rf. 1964, Wildlife Biology. John and Wiley and sons Newyork. Pp231. |
|  | Rodgers, W.A 1991. Techniques for Wildlife census in India – A Field manual technical Manual – Wildlife Institute of India, Dehra Dun |
|  | |
| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | |
| 1 | Q GIS User Guide Release 2.8. https://docs.qgis.org/2.8/pdf/en/QGIS-2.8-UserGuide-en.pdf. |
| 2 | Map Info Professional. https://en.wikipedia.org/wiki/MapInfo\_Professional. |
| 3 | ArcGIS https://en.wikipedia.org/wiki/ArcGIS. |

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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** | S | M | M | S | S | M | S | S | S | M |
| **CO2** | M | S | S | M | M | S | M | M | M | S |
| **CO3** | M | S | M | M | M | S | M | M | M | S |

\*S-Strong; M-Medium; L-Low

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| **Course code** | | 6ZB | **FOREST BASED INDUSTRY USING EXOTIC SPECIES (LANTANA,LAC)** | | **L** | **T** | | **P** | **C** |
| **Core/Elective/ SBS** | | | **Skill Based Course IV** | | **2** | **0** | | **0** | **2** |
| **Pre-requisite** | | | Knowledge of exotic species and Lac | |  | | **23** | | |
| **Course Objectives:** | | | | | | | | | |
| 1. To develop entrepreneurship in forest resource based industry. 2. To eradicate exotic species in forest area. 3. To develop sustainable use of exotic species. | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | |
| On the successful completion sof the course, student will be able to: | | | | | | | | | |
| 1 | Make the students to understand the impact of exotic species in forest area. | | | | | | |  | |
| 2 | Apply different strategies to value add on the byproduct of exotic species. | | | | | | |  | |
| 3 | The students will be able to analyze pre and post eradication of exotics in forest area. | | | | | | |  | |
| 4 | To create the students as entrepreneurship for the successful utilization of exotic species as their livelihood income. | | | | | | |  | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create | | | | | | | | | |
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| **Unit:1** | | **LANTANA CAMERA** | | | **5hours** | | | | |
| Lantana camera - Introduction, History, Distribution, Habitat, Morphology, Chemical constituents and ecology. Process making lantana furniture, marketing lantana furniture. | | | | | | | | | |
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| **Unit:2** | | **INDUSTRIAL USES OF LANTANA** | | | **6hours** | | | | |
| Lantana camera: Industrial uses – Paper industry – Rubber industry; Medical uses – Folkloric uses ,other economic uses (Green herbicides, insecticides ,biocides, fungicides.) | | | | | | | | | |
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| **Unit:3** | | **POSITIVE AND NEGATIVE IMPACT OF LANTANA CAMERA** | | **6hours** | | | | | |
| Positive impact of Lantana camera- Herbal Medicine, Industrial Uses of Lantana, Mulching for Soil Fertility. Invasion by L. camara, Lantana and Fire, Allelopathic Effect, Impact on wild animal and Livestock. | | | | | | | | | |
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| **Unit:4** | | **LAC CULTURE** | | **5hours** | | | | | |
| Lac Introduction – Lac insect Taxonomy –Distribution – Life cycle – Host Plants – Strains of Lac insects –Lac cultivation (Local practice, Improved practice, Propagation of lac insect, Innoculation period, harvesting of lac) , composition of Lac | | | | | | | | | |
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| **Unit:5** | | **LAC PROCESSING** | | **6hours** | | | | | |
| Stick lac, seed lac, shellac –Hand made process , Heat process, Solvent process; Lac products and their use – Lac dye ,Lac wax ,Shellac, Bleached shellac, Dew axed bleached shellac , Aleuritic acid (Shellac Aleuritic powder ). | | | | | | | | | |

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| **Unit:6** | | **CONTEMPORARY ISSUES** | **2 hours** |
| Expert lectures, online seminars – webinars | | | |
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|  | | **Total Lecture hours** | **30hours** |
| **Text Book(s)** | | | |
| 1 | Lac-Culture in India by N. Ghorai | | |
| 2 | Text Book Of Applied Zoology, Vermiculture, Apiculture, Sericulture, Lac-Culture, Agricultural Pests And Their Controls Paperback – 1 January 2005 | | |
| 3 | Text Book of Applied Zoology: Vermiculture, Apiculture, Sericulture, Lac Culture, Agricultural Pests and their Controls Hardcover – 1 February 2008 ,by [Pradip Jabde](https://www.amazon.in/s/ref=dp_byline_sr_book_1?ie=UTF8&field-author=Pradip+Jabde&search-alias=stripbooks) (Author) | | |
| 4 | Lac Crop Harvesting and Processing In book: [Industrial Entomology (pp.181-196)](https://www.researchgate.net/publication/321530934_Industrial_Entomology) February 2017 | | |
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| **Reference Books** | | | |
| 1 | Lantana camara Linn. (Verbenaceae) Michael D. Day and Myron P. Zalucki | | |
| 2 | Ecology and Use of Lantana camara in India. The Botanical Review Girish C. S. Negi, Subrat Sharma, Subash C.R. Vishvakarma, Sher S. Samant, Rakesh K. Maikhuri, Ram C. Prasad & Lok M. S. Palni | | |
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| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | |
| 1 | https://swayam.gov.in/nd2\_cec19\_bt05/preview 2 | | |
| 2 | <https://link.springer.com/content/pdf/10.1007/s12229-019-09209-8.pdf> | | |

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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** | M | M | M | M | M | M | M | M | M | M |
| **CO3** | S | M | S | M | M | S | M | M | M | M |
| **CO3** | M | M | M | M | S | M | M | S | M | M |
| **CO4** | M | M | M | M | M | M | M | M | M | S |

\*S-Strong; M-Medium; L-Low

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| **Course code** | | 63P | **FUNDAMENTALS OF WILDLIFE**  **BIOLOGY – PRACTICAL** | **L** | **T** | | **P** | **C** |
| **Core/Elective/ SBS** | | | **Core Practical III** | **0** | **0** | | **2** | **2** |
| **Pre-requisite** | | | Knowledge in basic concepts of wildlife sciences |  | | **23** | | |
| **Course Objectives:** | | | | | | | | |
| 1. Give an insight to basics of life sciences 2. Handling experiments related to life science 3. Gain hands on experience in experimentation | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | |
| 1 | Do basic experiments in life sciences | | | | | | K3 | |
| 2 | Develop analytical skills in experimentation | | | | | | K3 | |
| 3 | Making observations during experimentation | | | | | | K3 | |
| 4 | Interpret the results of experiments | | | | | | K3 | |
| **K1** – Remember; **K2** – Understand; **K3** – Apply; **K4** – Analyze; **K5** – Evaluate; **K6** – Create | | | | | | | | |
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| **MAJOR PRACTICAL** | | | | | | | | |
| **Wildlife Management Techniques**  1. Vegetation analysis –Quadrat method  2. Population estimation of herbivores – Block count method  3. Population estimation of carnivores - Pugmark tracing  4. Camera trapping of tiger  **Biology of vertebrates**  5. Classification and identification of fishes, amphibians, reptiles – any five using photographs  6. Classification and identification of birds and mammals – any five using photograph | | | | | | | | |
| **MINOR PRACTICAL** | | | | | | | | |
| **Conservation Biology**  7. Prepare housing facilities for captive breeding of Lion-tailed macaque and vulture)  8. Mark and locate biodiversity hotspots in India by using the map  9. Mark and locate biosphere reserves of India by using the map | | | | | | | | |
| SPOTTERS | | | | | | | | |
| 1. **Identify the given indirectSign**   Pug mark (male & female), Scratch mark, rake mark of tiger, leopards, bear, wild dog and small cats..   1. **Identify the given Reserve plotted in the Map and comment on itsimportance.** MTR, PTR, PKTR, KMTR, Anamali, Sathyamangalam, Bandipur, Nagarhole, Panna, Manas, Rajaji, Corbet, Sunderbans, Sariska, Pench, Melghat&Kanha. 2. **Identify the WPA Schedule, IUCN Status andcomment.**   Tiger, Wild Dog, Leopard cat, Elephant, Barking Deer, Sambar Deer, Blue Whale, Gangetic Dolphin, Peacock.   1. **Call Identification of common birds – any five birds**   **5 Identification of venomous and non-venomous south Indian snakes (Any five)** | | | | | | | | |

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| **SUBMISSION 1** |
| A Photography training have to be undertaken and the candidate needs to submit a photo album of  wildlife photography of self-experience (Minimum 15 hours need to be spend in field). |

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| **SUBMISSION 2** | |
| The candidate need to submit a report of ecotourism of a locality or a report of candidates involvement in conservation effort or the report of candidates involvement in wildlife awareness programme or the report of a similar programme approved by the department.(Minimum 15 hours  need to be spend in field). | |
| **QUESTION PATTERN: (50+50 MARKS)**  **External:** Major: 20, Minor: 10, Record: 5, Spotter: 15 (5 spotters each carry 3 marks).**Internal:**  Submission 1: 5 marks, submission 2: 5 marks, Model Practical: 30 marks, Record: 5 Marks,  Attendance 5 marks.. | |
| **TotalPractical Hours 30(Each Semester) x 2 = 60 Hours PerYear** | |
| **Text Book(s)** | |
|  | PS Verma and Srivastava PC. (2012).*Advanced Practical Zoology,* S. Chand Publications,  Chennai. |
|  | |
| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | |
|  | <https://www.pdfdrive.com/zoology-books.html> |

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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** | S | S | M | M | M | S | M | M | M | S |
| **CO2** | M | M | S | M | M | M | S | M | S | M |
| **CO3** | M | S | S | S | S | M | S | M | M | M |
| **CO4** | M | M | M | M | M | M | S | M | S | S |

\*S-Strong; M-Medium; L-Low

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| **Course code** | | 63Q | **CONSERVATION BIOLOGY AND FORESTRY – PRACTICAL** | **L** | **T** | | **P** | **C** |
| **Core/Elective/ SBS** | | | **Core Practical IV** | **0** | **0** | | **2** | **2** |
| **Pre-requisite** | | | Knowledge on conservation biology and forestry |  | | **23** | | |
| **Course Objectives:** | | | | | | | | |
| 1. To create basic knowledge on Conservation 2. To create awareness in forestry 3. To develop hands on practice in Conservation, | | | | | | | | |
|  | | | | | | | | |
| **Expected Course Outcomes:** | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | |
| 1 | Understand sampling techniques in wildlife science | | | | | | K4 | |
| 2 | Understand population analysis protocol | | | | | | K4 | |
| 3 | Understand basic methods in forestry. | | | | | | K4 | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create | | | | | | | | |
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| **MAJOR PRACTICAL** | | | | | | | | |
| 1. Determination of optimum size of a quadrat using species area curve (Innovative lab methods can be used for practical examination). 2. Estimate the abundance and density using multiple square quadrates (Innovative lab methods can be used for practical examination). 3. Lay a line transect in two different habitat and compare the diversity and species richness of the two area (Innovative lab methods can be used for practical examination). 4. Estimate the density and deviation of Population using the Belt transect method. 5. Prepare a line transect and estimate the density of given individual herbivores based on the dung sample. (For examination purpose, picture of five repeated survey with five to ten quadrates (10x1m) can be given with presence of dungs and pellets indicated may be given and student should estimate the population density). 6. Estimation of Avian population density using point count method (For examination above given protocol can be followed). | | | | | | | | |
| **MINOR PRACTICAL** | | | | | | | | |
| 1. Measurement of height of given tree by estimating singal pole method 2. Calculate the log volume based on perimeter. 3. Estimate the canopy cover of given tree (both conical and circular). | | | | | | | | |
| SPOTTERS | | | | | | | | |
| 1. **Comment onTaxonomy:**   *Casuarina, Cedrus, Dipterocarpus, Emblica, PinusPterocarpus, Shorea, Salmalia & Terminalis.*   1. **Comment on Silviculture importance:**   *Butea, Cassia, Largerstroemia, Pterocarpus, Albizzia, Anthocephalus*   1. **Comment on Ecological role:**   Bamboo, *Elaeocarpus, Ficus, Rhododentron, Mahonia, Shizigium, Shola grass*   1. **Comment of Commercialuse:**   *Sandalum, Dalbergia, Azadirachta, Tectona, Tamarindus*   1. **Comment onEradication:**   *Parthenium, Eupatorium, Lantana, Eucalyptus, Acacia* | | | | | | | | |

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| **SUBMISSION 1** | |
| Report of the in depth study of a Reserve / Protected area regarding its administrative set up,  habitats, conservation activities & disaster management. | |
| **SUBMISSION 2** | |
| Brief report of involvement in a research or report of small observation or report of biodiversity  survey of an area. | |
| **QUESTION PATTERN: (50+50 MARKS)**  **External:** Major: 20, Minor: 10, Record: 5, Spotter: 15 (5 spotters each carry 3 marks).**Internal:**  Submission 1: 5 marks, Submission 2: 5 marks, Model practical: 30 marks, Record: 5 Marks,  Attendance: 5 marks. | |
| **TotalPractical Hours 30(Each Semester) x 2 = 60 Hours PerYear** | |
| **Text Book(s)** | |
| 1 | Lindenmayer, David and Burgman, Mark. (2005). *Practical Conservation Biology.*  10.1071/9780643093102. |
| 2 | Pawar P and Bharadwaj.(2005).*SDHandbookofPracticalforestry*,Agrobios  publications. |
|  | |
| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | |
| 1 | <https://www.mongabay.com/conservation-biology-for-all.html> |

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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** | M | S | L | L | M | S | M | M | M | M |
| **CO2** | S | L | M | M | S | M | S | S | S | S |
| **CO3** | M | M | S | M | M | M | M | M | S | S |

\*S-Strong; M-Medium; L-Low

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| **Course code** | | 63R | **GEO-INFORMATICS AND WILDLIFE**  **FORENSICS – PRACTICAL** | **L** | **T** | | **P** | **C** |
| **Core/Elective/ SBS** | | | **Elective Course V: Practical** | **0** | **0** | | **2** | **2** |
| **Pre-requisite** | | | Basic knowledge in geo-informatics and  Forensics |  | | **23** | | |
| **Course Objectives:** | | | | | | | | |
| 1. Train the students in GPS and geo-informatics 2. To train the students in basic forensic concepts forensic analysis | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | |
| 1 | Students will be able to read maps & GPS | | | | | | K3 | |
| 2 | Students will be able to use Q GIS | | | | | | K3 | |
| 3 | Students will be able to do Geo-referencing | | | | | | K2 | |
| 4 | Students will be able to identify carnivore scats | | | | | | K3 | |
| 5 | Students will be able to learn trichology | | | | | | K3 | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create | | | | | | | | |
|  | | | | | | | | |
| **MAJOR PRACTICAL** | | | | | | | | |
| 1. Given map is RF 1:50,000 or 1:25,000 top sheet, scan the image and convert it intoa GIS Map or three dimensional map. 2. Given is the scanned image of an area, convert the JPEG picture into a vector image by assigning the GPS values given and plot a grid inside. Over lay two different sets of GPS points as different symbols over the map. Prepare the map, print and submit. 3. Given is a survey GPS points, plot it on the given vector image and overlay the given two layers estimate the distance between the GPS points in Km and submit a printout of the map generated. | | | | | | | | |
| **MINOR PRACTICAL** | | | | | | | | |
| 1. Running of Presence Single season model using occupancy data provided. 2. Running Distance Software using the data provided. 3. Estimate the population using capture recapture theory (Concept: Population is closed, Capture animals are colored and reintroduced). 4. Read the six digit grid reference of the given two spots, calculate the altitude and estimate the distance between points based on a topographic sheet. 5. Convert the given contour line map draw hill shapes and mark the altitude represented by each line. 6. In the given Topographic sheet mark steep slopes, gentle slopes, highest peak and other details mentioned in question. | | | | | | | | |
| **SPOTTERS** | | | | | | | | |
| 1. **Comment on the Instrument**   Pedometer, Field compass, Range finder, Camera traps, GPS & Drone   1. **Identifying featuresof**   Scat of tiger, Leopard & Wild dog, Dung of Gaur, Pellet of Hare, Sambar Deer, Spotted Deer, Barking Deer, and Porcupine.   1. **Identify the Given hairsample**   Hair of Sambar Deer, Langur, Boar, Gaur, Spotted Deer.   1. **Identify the type of forest in Photograph or Projection**   Evergreen, Deciduous, Scrub Jungle, Shola-grassland, Mangroove | | | | | | | | |



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| **5. Identify they type of given map**  Political map, Physical map, Topographic map, Climatic map, Road map, Climatic map & Resource map. | |
| **QUESTION PATTERN: (25 + 25 MARKS)**  **External:** Major: 10, Minor: 5, Record: 5, Spotter: 5 (5 spotters each carry 1 marks).**Internal:**Model practical: 15 marks, Record: 5 Marks, Attendance 5 marks. | |
| **TotalPractical Hours 30(Each Semester) x 2 = 60 Hours PerYear** | |
| **Text Book(s)** | |
| 1 | Kang-tsung. (2006).*Chang Introduction to Geographic Information Systems,* 9th edition  Mcgraw Higher Ed, NY. |
| 2 | Chipman LK. (2007).*Remote Sensing And Image Interpretation.* Publisers-Willey, US. |
|  | |
| **Reference Books** | |
| 1 | Elangovan K. (2006).*GIS: Fundamentals, Applications and Implementations,* New India  Publishing Agency |
|  | |
| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | |
| 1 | Q GIS User Guide Release 2.8. https://docs.qgis.org/2.8/pdf/en/QGIS-2.8-UserGuide-en.pdf. |
| 2 | Map Info Professional. https://en.wikipedia.org/wiki/MapInfo\_Professional. |
| 3 | ArcGIS https://en.wikipedia.org/wiki/ArcGIS. |

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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** | S | M | M | S | M | S | M | L | L | L |
| **CO2** | S | M | M | S | S | S | S | L | L | L |
| **CO3** | S | M | M | M | M | M | S | M | M | S |
| **CO4** | S | S | S | M | M | M | S | M | M | S |
| CO5 | M | M | M | M | M | M | S | M | S | S |

\*S-Strong; M-Medium; L-Low

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| **Course code** | | | | **TECHNOLOGY FOR WILDLIFE CONSERVATION AND CONFLICT MANAGEMENT** | | | **L** | **T** | | **P** | **C** | |
| **Core/Elective/ SBS** | | | | Elective Course | | |  |  | |  |  | |
| **Pre-requisite** | | | | Knowledge of ecology, conservation and basic technologies used to mitigate human-wildlife conflict | | |  | |  | | | |
| **Course Objectives:** | | | | | | | | | | | | |
| The main objectives of this course are to:   1. The course will give a status overview on wildlife conservation and human-wildlife-conflict 2. The course will also give an insight to the state of the art technologies for wildlife conservation and conflict management 3. The course will explain how the devices and tools are shaping the wildlife conservation efforts and minimizing the conflict | | | | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | | | | |
| On the successful completion of the course : | | | | | | | | | | | | |
| 1 | The student will acquire an overview on wildlife conservation and human-wildlife-conflict | | | | | | | | | K2 | | |
| 2 | The student will be able to explain the functionality and applications of wildlife conservation and conflict management technologies | | | | | | | | | K2 | | |
| 3 | The student will be able to analyse the impact of technology on wildlife conservation and human-wildlife-conflict management | | | | | | | | | K4 | | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create | | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| **Unit:1** | | | **INTRODUCTION TO WILDLIFE CONSERVATION AND CONFLICT** | | | | **15hours** | | | | | |
| *Historical out lines*: Wildlife conservation and conflict management with global and Indian context, *Challenges With Wildlife Conservation*: Habitat destruction, Deforestation, Over exploitation, Poaching, Trafficking, Culling, Pollution, Climate change; *Human-Wildlife-Conflict*: Causes, Classifications, Scale of conflict, Overview of non-technical and technical solutions | | | | | | | | | | | | |
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| **Unit:2** | | | **SENSOR BASED TOOLS AND TECHNIQUES** | | | | **14hours** | | | | | |
| Environmental and atmospheric sensors, Optical sensors, Thermal sensors, Radar, Acoustic sensors (active & passive), Sonar (active & passive), Vibration sensors, Position and motion sensors | | | | | | | | | | | | |
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| **Unit:3** | | | **FIXED, PORTABLE AND ANIMAL-BORNE DEVICES** | | |  | | | | | | |
| Optical cameras, Thermal imaging, Biologging and biotelemetry, Camera & Microphone (animal-borne), RFID and PIT tags, Radio collar, Devices on vehicles: Terrestrial and aquatic | | | | | | | | | | | | |
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| **Unit:4** | | **WILDLIFE TRACKING AND REMOTE SENSING** | | | **15hours** | | | | | | |
| Radio-frequency triangulation, Global navigation satellite system, Satellite-based tracking, Inertial sensors and dead reckoning, Harmonic radar, Acoustic triangulation, Virtual fencing, Unmanned aerial vehicles, Drones, Wireless sensor networks | | | | | | | | | | | |
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| **Unit:5** | | **COMPUTING AND ARTIFICIAL INTELLIGENCE** | | | **15hours** | | | | | | |
| Websites and online platforms, Mobile phones and apps, Artificial intelligence: Automation and autonomy, Landscape mapping tools, DNA marker technology for wildlife conservation | | | | | | | | | | | |
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| **Unit:6** | | **CONTEMPORARY ISSUES** | | | **2 hours** | | | | | | |
| Expert lectures, online seminars – webinars | | | | | | | | | | | |

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|  | | | | **Total Lecture hours** | | | | | | | | **75hours** | | | | |
| **Text Book(s)** | | | | | | | | | | | | | | | | |
| 1 | | Serge A. Wich (Editor), Alex K. Piel, *Conservation Technology*, Publisher: OUP Oxford | | | | | | | | | | | | | | |
| 2 | | Singh S.K., Textbook of Wildlife Management, Publisher: CBS Publishers & Distributors | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| **Reference Books** | | | | | | | | | | | | | | | | |
| 1 | | Steven E. Franklin, Remote Sensing for Biodiversity and Wildlife Management: Synthesis and Applications, The McGraw-Hill Companies, Inc. | | | | | | | | | | | | | | |
| 2 | | Michael R. Conover, Denise O. Conover, Human-Wildlife Interactions: From Conflict to Coexistence, Published January 6, 2022 by CRC Press | | | | | | | | | | | | | | |
| 3 | | Charles D. Stutzenbaker (Author), Brenda J. Scheil (Author), Michael K. Swan (Author), at.el., Wildlife Management: Science & Technology, Publisher: Vero Media Inc | | | | | | | | | | | | | | |
| 4 | | James Cheshire (Author), Oliver Uberti (Author), Where the Animals Go: Tracking Wildlife with Technology in 50 Maps and Graphics, Publisher ‏ : ‎ W. W. Norton & Company; Illustrated edition | | | | | | | | | | | | | | |
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| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | | | | | | | | | | | | | |
| 1 | | National Digital Library of India https://ndl.iitkgp.ac.in/ | | | | | | | | | | | | | | |
| 2 | | NTPL <https://onlinecourses.nptel.ac.in/noc19_bt32/preview> | | | | | | | | | | | | | | |
| 3 | | Introduction to Wildlife Conservation <https://alison.com/course/introduction-to-wildlife-conservation> | | | | | | | | | | | | | | |
| 4 | | Ecology and Wildlife Conservation, University of Leeds, <https://www.classcentral.com/course/ecology-and-wildlife-conservation-13667> | | | | | | | | | | | | | | |
|  | **Mapping with Programme Outcomes** | | | | | | | | | | | | | |  |
| **COs** | | **PO1** | | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | | **PO9** | **PO10** |
| **CO1** | | S | | M | M | S | M | M | S | M | | M | M |
| **CO2** | | M | | M | M | M | M | M | M | M | | S | S |
| **CO3** | | M | | S | M | M | M | M | M | S | | S | S |
| **CO4** | | S | | M | M | S | M | M | S | M | | S | S |
| **CO5** | | M | | M | S | M | M | S | M | M | | M | M |

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| **Value Added Course** | | **TIGER MONITORING** | **L** | **T** | | **P** | **C** |
| **Value Added Course -** I |  |  | |  |  |
| **Pre-requisite** | | Basic knowledge in Biology |  | |  | | |
| **Course Objectives:** | | | | | | | |
| 1. To train students as Biologists in reserves | | | | | | | |
|  | | | | | | | |
| **Expected Course Outcomes:** | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | |
| 1 | Well trained to be Biologists in reserves | | | | | K3 | |
| 2 | Gain knowledge about Monitoring and Assessment of habitats of animals. | | | | | K4 | |
| 3 | Understand and apply techniques in identifying dung pellets, scats and sampling. | | | | | K3 | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create | | | | | | | |
| **MODULE 10 X 2 = 2=Hours** | | | | | | | |
| Module 1.Methods of Sign Survey Module 2. Survey in line transects Module 3. Monitoring the preypopulation Module 4. Assessment of Habitat Quality  Module 5. Monitoring of Tiger and co-predators using camera trapping Module 6. Recognizing the tigers using stripping patterns.  Module 7. Occupancy modeling for tiger and co-predators & use of co-variates Module 8. Concepts and estimation of Capture Mark and re capture techniques. Module 9. Estimation of Density**.**  Module 10. Tracing of pugmarks**.** | | | | | | | |
| **PRACTICAL 5 X 2 =Hours** | | | | | | | |
| 1. Identification of carnivorescats 2. Identification of herbivore Dungpellets 3. Usage of CameraTraps 4. Usage of Fieldcompass 5. Transect laying and quadratesampling | | | | | | | |
| **REFERENCE BOOKS** | | | | | | | |
| 1.Karanth KU and Nichols JD Edited. (2002). Monitoring tigers and their prey: A manual for  wildlife researchers, managers and conservationists in tropical Asia, Publishers Central for Wildlife Studies. | | | | | | | |
| 2. [UllasKaranth](https://www.amazon.in/s/ref%3Ddp_byline_sr_book_1?ie=UTF8&field-author=K.%2BUllas%2BKaranth&search-alias=stripbooks)K and James D Nichols Editor. (2017). Methods For Monitoring Tiger And Prey,  Publishers Springer. | | | | | | | |

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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **Cos** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** | L | S | S | S | M | S | S | M | S | M |
| **CO2** | L | S | S | S | S | M | M | M | S | M |
| **CO3** | L | S | S | M | M | S | S | M | S | M |

\*S-Strong; M-Medium; L-Low

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| **Value Added Course** | | **DATA MINING** | **L** | **T** | | **P** | **C** |
| **Value Added Course -** II |  |  | |  |  |
| **Pre-requisite** | | Basic knowledge in Biology |  | |  | | |
| **Course Objectives:** | | | | | | | |
| The main objectives of this course are to:  1. To train students as data analysist | | | | | | | |
|  | | | | | | | |
| **Expected Course Outcomes:** | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | |
| 1 | Find job as data analysis. | | | | | K3 | |
| 2 | Able to analysis and apply various tool and techniques. | | | | | K3 | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create | | | | | | | |
| **MODULE 5 X 3 = 15Hours** | | | | | | | |
| 1. Introduction – Concepts, Challenges and issues 2. Types of data, Quality of data, pre-processing of data 3. Decision tree induction - Rule based classifiers - Nearest neighbor classifiers -Bayesian classifiers-Artificial neural networks -Support vector machine -Ensemble methods - Model evaluation 4. Association analysis: Problem definition, Frequent item set generation, Rule generation, Challenges, Interestingness measures, Generalization of association patterns 5. Cluster analysis: Similarity and distance - Density - Center based clustering techniques - Hierarchical clustering -Density based clustering, Other clustering techniques, Scalable clustering algorithms, Cluster evaluation. | | | | | | | |
| **PRACTICAL 5 Hours** | | | | | | | |
| Data visualization – Training on various visualization techniques | | | | | | | |
| **REFERENCE BOOKS** | | | | | | | |
| [1.Charu C. Aggarwal.](https://www.amazon.in/Charu-C-Aggarwal/e/B00E6PGCPM/ref%3Ddp_byline_cont_book_1) (2016).Data Mining: The Textbook, Publisher: Springer. | | | | | | | |
| 2.[Jiawei Han](https://www.google.co.in/search?hl=en&q=Jiawei%2BHan&stick=H4sIAAAAAAAAAONgVuLUz9U3SDfLTq94xGjCLfDyxz1hKe1Ja05eY1Tl4grOyC93zSvJLKkUEudig7J4pbi5ELp4FrFyeWUmlqdmKngk5gEAE-eJolEAAAA), [Micheline Kamber,](https://www.google.co.in/search?hl=en&q=Micheline%2BKamber&stick=H4sIAAAAAAAAAONgVuLSz9U3qDQxMU7JesRoyi3w8sc9YSmdSWtOXmNU4-IKzsgvd80rySypFJLgYoOy-KR4uJC08SxiFfDNTM5IzcnMS1XwTsxNSi0CAL9JHY5ZAAAA)Jian Pei . (2011).Data Mining: Concepts and techniques Publisher:[Elsevier Science.](https://www.google.co.in/search?hl=en&gbpv=1&printsec=frontcover&q=inpublisher%3A%22Elsevier%2BScience%22&tbm=bks&sa=X&ved=2ahUKEwjOyeqRr7PrAhXKT30KHY8SDeIQmxMoADAIegQIBBAC) | | | | | | | |

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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **Cos** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** | L | L | L | M | L | M | S | S | S | S |
| **CO2** | L | L | L | M | L | M | S | S | S | S |

\*S-Strong; M-Medium; L-Low

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| **Value Added Course** | | | **ECONOMICS OF CONSERVATION** | **L** | **T** | | **P** | **C** |
| **Value Added Course-III** |  |  | |  |  |
| **Pre-requisite** | | | Basic knowledge in life sciences |  | |  | | |
| **Course Objectives:** | | | | | | | | |
| 1. To create basic awareness about conservation 2. To create awareness to students explore biodiversity for new product development. 3. To create awareness to understand the economics aspects of Biodiversity | | | | | | | | |
|  | | | | | | | | |
| **Expected Course Outcomes:** | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | |
| 1 | | Explore nature in search of new biodiversity products in field of medicine and  Agriculture. | | | | | K3 | |
| 2 | | Able to understand the significance and need of conserving resources | | | | | K3 | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create | | | | | | | | |
| **MODULE** | | | **15 x 2 = 30Hours** | | | | |  |
| Module 1. Concept of Biodiversity  Module 2. Ecosystems and Community structure Module 3. Spatial and temporal aspects of biodiversity Module 4. Causes of the global loss of biodiversity  Module 5. Invasive species and their impact on ecosystems and biodiversity Module 6. Conservation biology: policy and management  Module 7. Ecosystem services and their importance for human societies Module 8. Biodiversity products  Module 9. Economics of marine resources Module 10. Biodiversity products from Animals. Module 11. Biodiversity products from plants.  Module 12.Biotechnology in Biodiversity  Module 13.Isolation, identification and patenting Biodiversity Products Module 14.Biodiversity as Career  Module 15. Eco tourism and possibilities. | | | | | | | | |
| **Reference Books** | | | | | | | | |
| 1 | Anderson J and Slater D L.(1981).*Catalogue of Mammals,* Vol. I and II. Cosmo  Publications, New Delhi. | | | | | | | |
| 2 | Hosetti BB, Ramkrishna S. (2016).*Biodiversity* : *Concepts and Conservation*, 1st edition,  Aavishkar Publishers, Distributors, Jaipur | | | | | | | |
| 3 | Prater S H. (1988). *The Book of Indian Animals*,Bombay Natural History Society, Bombay | | | | | | | |
| 4 | Young J Z. (1950). *The Life of Vertebrates,*Clarendon Press, Oxford. | | | | | | | |

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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **Cos** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** | S | S | S | M | M | M | M | L | L | L |
| **CO2** | S | S | S | S | M | M | M | L | L | L |

\*S-Strong; M-Medium; L-Low

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| **Value Added Course** | | **INTELLECTUAL PROPERTY RIGHT** | **L** | **T** | | **P** | **C** |
| **Value Added Course-IV** |  |  | |  |  |
| **Pre-requisite** | | Basic knowledge to aware about IPR |  | |  | | |
| **Course Objectives:** | | | | | | | |
| 1. To introduce fundamental aspects of Intellectual property Rights to students who are going to play a major role in development and management of innovative projects in industries. 2. To disseminate knowledge on patents, patent regime in India and abroad and registration aspects 3. To disseminate knowledge on copyrights and its related rights and registration aspects 4. To disseminate knowledge on trademarks and registration aspects 5. To disseminate knowledge on Design, Geographical Indication (GI), Plant Variety and Layout Design Protection and their registration aspects 6. To aware about current trends in IPR and Govt. steps in fostering IPR | | | | | | | |
| **Expected Course Outcomes:** | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | |
| 1 | The students once they complete their academic projects, shall get an adequate knowledge on patent and copyright for their innovative research works | | | | | K2 | |
| 2 | During their research career, information in patent documents provide useful insight on novelty of their idea from state-of-the art search. This provide further way for developing their idea or innovations | | | | | K3 | |
| 3 | Pave the way for the students to catch up Intellectual Property(IP) as an career :  a. R&D IP Counsel, Patent Examiner, Patent and Trademark agent, Entrepreneur | | | | | K4 | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create | | | | | | | |
| **MODULE 15 x 2 = 30Hours** | | | | | | | |
| Module 1. Introduction and the need for intellectual property right (IPR)  Module2. Kinds of Intellectual Property Rights: Patent, Copyright, Trade Mark, Design, Geographical Indication, Plant Varieties.  Module 3. Layout Design and Genetic Resources. Module 4. Traditional Knowledge and Trade Secret. Module 5. IPR in India.  Module 6. Patents - Elements of Patentability: Novelty, Non Obviousness.  Module 7. Patent office and Appellate Board, Registration Procedure, Remedies and Penalties. Module 8. Nature of Copyright, Registration Procedure, Ownership and licence of copyright. Module 9. Related Rights - Distinction between related rights and copyrights Module10.Concept and Kinds of Trademarks (brand names, logos, signatures, symbols).  Module 11. Registration of Trademarks - Rights of holder. Module 12. Design: Meaning and concept of Novel and Original.  Module 13.Geographical indication: Meaning, Difference between GI and trademarks. Module 14. Plant variety protection: Meaning Benefit sharing and farmers’ rights.  Module 15. Layout Design protection: Meaning, Procedure and Effect of registration. | | | | | | | |

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| **Text Book(s)** | |
| 1 | . Nithyananda, K V. (2019). *Intellectual Property Rights: Protection and Management*. India, IN: Cengage Learning India Private Limited. |
| 2 | 2. Neeraj, P., &Khusdeep, D. (2014). *Intellectual Property Rights*. India, IN: PHI learning Private Limited. |
| **Reference Books** | |
| 1 | Ahuja V K. (2017). *Law relating to Intellectual Property Rights*. India, IN: Lexis Nexis. |
|  | **E-resources:** |
| 2 | Subramanian, N., &Sundararaman, M. (2018). *Intellectual Property Rights – An Overview*. Retrieved from <http://www.bdu.ac.in/cells/ipr/docs/ipr-eng-ebook.pdf> |
| 3 | World Intellectual Property Organisation. (2004). *WIPO Intellectual property Handbook*. Retrieved from <https://www.wipo.int/edocs/pubdocs/en/intproperty/489/wipo_pub_489.pdf> |
| 3 | Journal of Intellectual Property Rights (JIPR): NISCAIR |
|  | **Related Online Contents** |
| 1 | Cell for IPR Promotion and Management [(http://cipa](http://cipam.gov.in/))m[.gov.in/)](http://cipam.gov.in/)) |
| 2 | World Intellectual Property Organisation (http[s://www.wipo.int/about](http://www.wipo.int/about-ip/en/))-[ip/en/)](http://www.wipo.int/about-ip/en/)) |
| 3 | Office of the Controller General of Patents, Designs & Trademarks [(http://www.ipIndia.nic.in/)](http://www.ipindia.nic.in/)) |

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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **Cos** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** | L | L | L | M | M | L | M | S | M | S |
| **CO2** | L | L | L | M | M | L | M | S | S | M |
| **CO3** | L | L | L | M | L | M | S | S | S | S |

\*S-Strong; M-Medium; L-Low

**GUIDELINES FOR CONDUCTING VALUE ADDED COURSES**

# Course Structure

* 1. The request for approval of by the concerned authorities is mandatory at least 15 days before the date of commencement of the course. The (15/30 hours), Schedule and the Details of Faculty handling the course approved by the Departmental Committee and forwarded by Head of the Department should been closed.
     1. The course offered should not be the same as any course listed in the curriculum of the respective programme/ or any other programme offered in University/Colleges.
     2. The value added courses may be also conducted during week ends / vacation period.
     3. The course can be offered any semester in the PG Programmes.
     4. Industry experts / eminent academicians from other Institutes are also eligible to offer the value added course.
     5. The course can be offered only if there are atleast 10 students opting forit.
     6. The students may be allowed to take value added courses offered by other departments after obtaining permission from Head of the Department offering the course.

# Duration

* 1. The duration of value added courses is 15 (30) periods of theory or a maximum of theory and Laboratory courses and the course can have a maximum of three hours per day.

For the one (two) credit courses either 15 (30) periods of theory or a combination of theory and Laboratory may be offered.

Where, **2 periods** of laboratory = **1 period** of theory

# Evaluation

The value added courses shall carry 100 marks and shall be evaluated through

# Internal assessments only.

* + 1. Two Assessments shall be conducted preferably one in the middle and the other at the end of the course by the Department concerned.
    2. The duration of assessment is one hour each.
    3. The total marks obtained in the tests shall be reduced to 100 marks and rounded to the nearest integer.
    4. The Head of the Department may identify a faculty member as coordinator for the course. A committee consisting of the Head of the Department, staff handling the course (if available), coordinator and a senior Faculty member nominated by the Head of the Department shall monitor the evaluation process. The grades shall be assigned to the students by the above committee based on their relative performance.
    5. The coordinator for the course is responsible for maintaining and processing the records with regard to assessment marks and results.

# Passing Requirement and Grading

* 1. The passing requirement for value added courses shall be 50% of the marks prescribed for the course **(Internal assessment only)**
     1. The grades O, A+, A, B+, B obtained for the one/two credit shall figure in the Mark sheet under the title **‘Value Added Courses’**. The other grades RA, SA **will not figure in the mark sheet.**
     2. e credits earned through value added courses shall not be considered for calculating GPA and CGPA.
     3. The credits earned through value added courses shall not be considered for classification of degree.
     4. If the course is offered during any semester, it will appear in that semester's mark sheet. However if the course is offered in summer / winter vacations, the course will be included in the grade sheet of the subsequent semester.

# Maximum Number of Courses

* 1. A student can earn a maximum of 3 credits during the entire programme of study by attending value added courses which would be over and above the required maximum number of credits for the award of the degrees.

# Financial Commitment

* + 1. The expenditure to be incurred for the conduct of value added courses should be met from nominal fees collected from the students at a rate fixed by the University. However any additional expenditure may be supported by the funds of the Department