

# **UNDERGRADUATE PROGRAMME IN ENVIRONMENTAL SCIENCE**

**2025**

**(Based on the NEP-2020)**

*In accordance with the Manipur University's Ordinance for  
Four Year Undergraduate Programme (FYUP), 2025*



**MANIPUR UNIVERSITY**  
**DEPARTMENT OF ENVIRONMENTAL SCIENCE**  
**CANCHIPUR, IMPHAL – 795 003**

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## TABLE OF CONTENTS

| <b>Sl. No.</b> | <b>Content</b>   | <b>Page No.</b> |
|----------------|--|-----------------|
| 1.             | New Ordinance 2025   | 1-28            |
| 2.             | Preamble   | 29              |
| 3.             | Introduction   | 29-30           |
| 4.             | Qualification Descriptors for Undergraduate Programme in Environmental Science               | 31              |
| 5.             | Programme learning outcomes  | 31              |
| 6.             | Programme Specific Outcomes (included only major courses)                                    | 31-32           |
| 7.             | Course learning outcomes   | 32-33           |
| 8.             | Detailed Syllabus (MAJOR)  | 34-73           |
| 9.             | Detailed Syllabus (MINOR)  | 74-89           |
| 10.            | Detailed Syllabus (MDC)  | 90-95           |
| 11.            | Detailed Syllabus (SEC)  | 96-101          |
| 12.            | Detailed Syllabus (VAC)  | 102-105         |
| 13.            | Detailed Syllabus (DSE)  | 106-111         |
| 14.            | Detailed Syllabus (EXPERIENTIAL LEARNING)  | 112             |
| 15.            | Detailed Syllabus (DISSERTATION)   | 113-114         |
| 16.            | Course Teaching-Learning Process   | 115             |
| 17.            | Linkage between Programme Learning Outcomes (POs) and Course Learning Outcomes (COs)         | 115-116         |
| 18.            | Assessment Methods   | 116             |
| 19.            | Categories for some common foundational courses  | 116             |
| 20.            | Monitoring Mechanism for the Fourth Year Bachelor's Degree (Honours / Honours with Research) | 117-118         |

New Ordinance 2025

**MANIPUR UNIVERSITY**  
**CANCHIPUR, IMPHAL-795003**

**MANIPUR UNIVERSITY ORDINANCE FOR FOUR YEAR UNDERGRADUATE  
PROGRAMME (FYUP), 2025 BASED ON NEP-2020**  
[Under Section 31 of the Manipur University Act, 2005]

In exercise of the powers conferred by Section 31 and Statute 41 of the Manipur University Act, 2005, and in view of the National Education Policy 2020 of the Government of India; the University Grants Commission's Guidelines for the Learning Outcomes-based Curriculum Framework (LOCF); the National Higher Education Qualifications Framework (NHEQF) 2023; the National Credit Framework 2023; the Curriculum and Credit Framework for Undergraduate Programmes 2022 of the University Grants Commission; and the University Grants Commission (Minimum Standards of Instruction for the Grant of Undergraduate Degree and Postgraduate Degree) Regulations, 2025, the Manipur University hereby makes the following Ordinance titled *Manipur University Ordinance for Four Year Undergraduate Programmes, 2025*: -

**1. Short Title, Commencement and Scope:**

- 1.1. This Ordinance shall be called the **Manipur University Ordinance for Four Year Undergraduate Programme (FYUP), 2025** based on NEP 2020.
- 1.2. This Ordinance shall come into force with effect from the academic session 2025–26.
- 1.3. The Ordinance shall be applicable to students enrolled in the first semester of undergraduate courses offered by the Departments/Centres of Colleges/Institutes affiliated to Manipur University, as well as by the Departments or Institutes of Manipur University, from the academic session 2025–26 onward.
- 1.4. Students admitted to undergraduate programmes prior to the enforcement of this FUYP 2025 Ordinance shall continue to be governed by the provisions of the Manipur University Ordinance for Undergraduate Programmes in Science, Arts, and Commerce, 2022. Percentage conversion from CGPA shall be carried out in accordance with the provisions of the respective ordinances.

**2. Definitions:**

- 2.1. **National Education Policy 2020 (NEP 2020):** The NEP 2020 envisages a holistic and multidisciplinary education aimed at producing employable graduates with all-round development and strong personal and professional competencies. The policy envisions the undergraduate programme as a flexible 3- or 4-year structure, allowing multiple entry and exit options with appropriate certification at each stage. A Bachelor's Certificate may be awarded upon exit after the first year, a Bachelor's Diploma after the second year, and a Bachelor's Degree after the third year, subject to the fulfillment of minimum credit requirements at each level. The four-year programme leads to the award of either a Bachelor's Degree (Honours) or a Bachelor's Degree (Honours with Research) in a discipline, subject to fulfillment of the prescribed credit requirements. The Honours with Research degree additionally requires the completion of a rigorous research project or dissertation in the major area of study, as prescribed by the University.
- 2.2. **Academic Bank of Credit/APAAR:** Academic Bank of Credit (ABC) is a virtual/digital repository that records the credits earned by individual students throughout their academic journey. It enables students to create personal academic accounts and supports the flexibility of multiple entry and exit options across higher education institutions. The ABC system operates under the provisions of *The University Grants Commission (Establishment and Operation of Academic Bank of Credits in Higher Education) Regulations, 2021*. The APAAR (Automated Permanent Academic Account Registry) is a unique lifelong identifier assigned to students and teachers as part of the National Education Policy (NEP) 2020 initiative. The APAAR ID is issued and managed through the ABC platform and enables seamless integration, tracking, and retrieval of academic records across all levels of education within a unified digital framework.
- 2.3. **Multiple Entry and Exit Points:** Multiple entry and exit points refer to designated stages within academic programmes where students are allowed to enter or exit higher education institutions, with due recognition of earned

- credits. These options are an integral feature of the Four-Year Undergraduate Programme, introduced in alignment with the National Education Policy (NEP) 2020. This flexibility is enabled through the Academic Bank of Credits (ABC) and shall be exercised strictly within the framework of the *UGC Guidelines for Multiple Entry and Exit in Academic Programmes offered by Higher Education Institutions, 2021* and the *Curriculum and Credit Framework for Undergraduate Programmes, 2022* issued by the University Grants Commission.
- 2.4. **Learning Outcomes-based Curriculum Framework (LOCF):** This framework introduced by the UGC in 2018, is designed to revise and strengthen the CBCS curriculum by aligning it with clearly defined learning outcomes. This framework focuses on defining clear, measurable learning outcomes to guide curriculum design, teaching methods, and assessment practices, ensuring that students acquire both academic knowledge, conceptual understanding and practical skills relevant to their discipline and future careers.
  - 2.5. **Choice Based Credit System (CBCS):** This system introduced by the UGC in 2015, the Choice Based Credit System (CBCS) offers students the flexibility to choose from a range of prescribed courses, including core, elective, minor, and skill-based options. Under this system, the award of a certificate, diploma, or degree is based on the successful accumulation of a prescribed minimum number of credits.
  - 2.6. **Levels:** These refer to a series of sequential stages defined under the National Higher Education Qualifications Framework (NHEQF), represented by a range of learning outcomes against which standard qualifications are mapped.
  - 2.7. **Programme:** A *programme* refers to the complete course of study and examinations leading to the award of a Certificate, Diploma, or Degree. It encompasses the entire learning experience comprising a structured combination of core (compulsory) and choice-based (optional) courses, designed to meet a prescribed minimum credit requirement. Each programme shall be defined by clearly stated *Programme Learning Outcomes* and shall be assigned a unique programme code. The term '*programme*', hereinafter, shall denote any academic programme offered for the award of a qualification under this Ordinance.
  - 2.8. **Programme Learning Outcomes (PLOs):** Programme Learning Outcomes are statements that define the knowledge, skills, and competencies that students are expected to acquire upon successful completion of an academic programme. These outcomes must be achieved for the award of a Certificate, Diploma, or Degree in the respective field of study. While Programme Learning Outcomes (PLOs) form an essential part of the Learning Outcomes-based Curriculum Framework (LOCF), the term refers specifically to the outcomes expected from a particular academic programme, rather than the broader framework itself.
  - 2.9. **Course:** A *course* is a unit of subject matter to be covered within a semester and constitutes a component of a broader programme of study. Commonly referred to as a 'paper', a course may consist of one or more instructional methods such as lectures, tutorials, laboratory work, fieldwork, outreach activities, project work, vocational training, viva voce, seminars, term papers, assignments, presentations, or self-study, either individually or in combination. Each course shall have clearly stated measurable Course Learning Outcomes (CLOs) and shall be assigned a unique course code and course title.
  - 2.10. **Course Learning Outcomes (CLOs):** CLOs are specific statements that describe the knowledge, skills, and competencies a student is expected to acquire upon successful completion of a course. Each course shall have clearly defined CLOs that are appropriately aligned with the corresponding Programme Learning Outcomes (PLOs). The attainment of CLOs shall collectively contribute to the achievement of the PLOs. *Assessment tools, methods, and questions used for evaluating a course must be directly aligned with the respective CLOs to ensure outcome-based teaching and learning.*
  - 2.11. **Semester:** Unless otherwise specified, a *Semester* refers to an academic term comprising a minimum of 90 teaching days, structured as 15 weeks based on a six-day instructional week. The Odd Semester extends from July to December, and the Even Semester from January to June, both inclusive of end-semester examinations and semester breaks. The University reserves the right to modify the academic calendar or schedule as and when necessary.
  - 2.12. **Academic Year:** An '*Academic Year*' will consist of two semesters (odd semester and even semester).
  - 2.13. **College:** The term *College* refers to Colleges and Higher Education Institutes that are affiliated with or permitted by Manipur University to offer various academic programmes.
  - 2.14. **Department:** The term *Department* refers to a department either within Manipur University or within a College/Institute affiliated with or permitted by Manipur University.
  - 2.15. **Credit:** A *credit* is a unit that quantifies the academic workload based on the instructional time and student engagement required over a semester (15 weeks) to achieve defined learning outcomes. It reflects the volume of academic work undertaken, irrespective of the marks or grades allocated.
  - 2.16. **Audit Course:** An *Audit Course* is a course that a student opts to attend without earning academic credit or a grade contributing to the degree. It allows students to explore subject matter for personal or academic interest without the pressure of formal evaluation. Audit courses may appear on the grade sheet with a grade of 'P' (Pass) or 'F' (Fail), but they carry no credit weight and are not included in the calculation of the SGPA/CGPA.
  - 2.17. **Credit Point:** It is the value obtained by multiplying the grade point (GP) by the credit (Cr) of the course:  $CP = GP \times Cr$ .

- 2.18. **Grade:** *Grade* in a course refers to a letter symbol (O, A+, A, B+, B, C, P, F, Ab) that indicates the comparative level of a student’s performance in that course.
- 2.19. **Grade Point:** A Grade Point is a numerical value assigned to each letter grade, representing the quantitative measure of a student’s performance in a course. It serves as the numerical equivalent of the letter grade and is used in the computation of the Semester Grade Point Average (SGPA).
- 2.20. **Semester Grade Point Average (SGPA):** *The Semester Grade Point Average (SGPA)* is calculated by dividing the total credit points earned by a student in all courses taken during a semester by the total number of credits registered in that semester. The SGPA shall be rounded off to two decimal places.
- 2.21. **Cumulative Grade Point Average (CGPA):** *The Cumulative Grade Point Average (CGPA)* is calculated by dividing the total credit points earned by a student across all courses taken throughout the entire programme by the total number of credits registered. The CGPA shall be rounded off to two decimal places.
- 2.22. **Grade Sheet:** A *Grade Sheet* is an official academic record that presents the letter grades obtained by a student in each course of a semester, along with credit earned, Semester Grade Point Average (SGPA), Cumulative Grade Point Average (CGPA), and the overall academic performance.
- 2.23. **Credit transfer:** Credit transfer refers to the process of recognizing and accepting academic credits earned by a student at one institution or in one programme and applying them toward the requirements of another programme or institution. It enables academic mobility and is facilitated through the Academic Bank of Credits (ABC) in accordance with UGC regulations.

3. **Learning Outcome based Curriculum Framework (LOCF):** The LOCF specifies the academic standards and competencies that graduates are expected to achieve upon completion of a programme of study and the awarding of a qualification. The framework aims to enhance curriculum transparency, ensure accountability in teaching-learning processes, and promote student-centered education by clearly linking course content with expected outcomes. The LOCF plays a central role in facilitating the attainment of Graduate Attributes by aligning course content, pedagogy, and assessments with clearly articulated learning outcomes. Under LOCF, the learning outcomes of the programme are mapped against well-defined Course Learning Outcomes (CLOs).

4. **Graduate Attributes:** The National Higher Education Qualifications Framework (NHEQF) envisions that graduates demonstrate qualities appropriate to their programme of study, encompassing both discipline-specific and generic learning outcomes. These outcomes reflect the knowledge, skills, and competencies acquired in the chosen field(s). Graduate attributes comprise a set of capabilities that enable individuals to expand their knowledge, apply new skills, pursue further studies, succeed professionally, participate effectively in the economy, and contribute to society as responsible citizens. These attributes are developed through structured curricula, co-curricular activities, and the broader institutional environment. Graduate attributes are expected to be achieved by the end of the programme. They are broadly classified into two categories:

4.1. **Learning outcomes specific to disciplinary/interdisciplinary areas of learning.:** Graduates should be able to demonstrate the acquisition of:

- (i) Comprehensive and coherent understanding of the chosen disciplinary or interdisciplinary area within a broad multidisciplinary framework.
- (ii) Practical, professional, and procedural knowledge essential for performing skilled tasks or professional work in the chosen field.
- (iii) Specialized skills relevant to the area of study, applicable across diverse and multidisciplinary contexts.
- (iv) Ability to apply learned concepts to real-life and unfamiliar situations by extrapolating knowledge and competencies beyond the classroom.

4.2. **Generic Learning Outcomes:** Graduates should demonstrate a broad set of capabilities, including complex problem-solving, critical thinking, creativity, communication, and analytical reasoning. They should possess research skills, collaborate effectively, and be prepared for leadership roles. As self-directed learners, they should be proficient in digital tools, culturally aware, and inclusive in approach. Graduates are expected to uphold core values, act with autonomy and accountability, be environmentally conscious, engage in community service, and show empathy in diverse contexts.

5. **Qualification Levels and Credit Requirement:** In accordance with UGC nomenclature, the qualification titles for undergraduate programmes such as Bachelor’s Certificate, Bachelor’s Diploma, Bachelor’s Degree and Bachelor’s Degree (Honours/Honours with Research) are structured in a series of ascending levels, as outlined below:

| National Higher Education Qualification Framework (NHEQF) Levels | Qualification Title | Minimum Credit Requirement |
|--|---------------------|----------------------------|
|  |                     |                            |

| <b>National Higher Education Qualification Framework (NHEQF) Levels</b> | <b>Qualification Title</b>                        | <b>Minimum Credit Requirement</b> |
|---|---|-----------------------------------|
| Level 4.5   | Bachelor's Certificate                            | 40                                |
| Level 5.0   | Bachelor's Diploma                                | 80                                |
| Level 5.5   | Bachelor's Degree                                 | 120                               |
| Level 6.0   | Bachelor's Degree (Honours/Honours with Research) | 160                               |

- 6. Levels of the Courses:** Undergraduate courses are designed and assigned codes that reflect the progression in learning levels. The coding structure for undergraduate courses, in alignment with the level of learning, is as follows:
- 6.1. **Level 0–99(Pre-requisite courses):** These courses are designed to prepare students for introductory courses. These are non-credit, pass/fail courses that will replace the current informal bridge courses offered by some colleges and universities.
  - 6.2. **Level 100 (Foundations and Introductory):** The courses at this level are designed to provide students with basic knowledge and an initial understanding of various subjects, enabling them to identify areas of interest for further study. They may also serve as prerequisites for courses in the major discipline. The focus is on foundational theories, concepts, perspectives, principles, methods, and critical thinking skills, laying a broad base for more advanced learning.
  - 6.3. **Level 200 (Intermediate):** The courses at this level are subject-specific and are intended to fulfill credit requirements for major or minor areas of study. They build upon foundational knowledge and may serve as prerequisites for higher-level major courses. These courses deepen conceptual understanding and begin to introduce discipline-specific applications.
  - 6.4. **Level 300 (Higher Level):** The courses at this level are core requirements for students pursuing a major in a disciplinary or interdisciplinary area of study. They offer more specialized knowledge and skills necessary for the attainment of a degree and often include application-oriented content.
  - 6.5. **Level 400 (Advanced Level):** The courses at this level are advanced and involve intensive academic engagement. They typically include lecture-based components alongside practicum, seminar discussions, term papers, research methodology, advanced laboratory or software training, research projects, hands-on training, and internship or apprenticeship work. They are designed to prepare students for research, professional practice, or postgraduate study.
- 7. Eligibility of the UG Programme:** Senior Secondary School Leaving Certificate or Higher Secondary (12th Grade) Certificate, obtained upon successful completion of Grade 12 or its equivalent, shall correspond to Level 4 and serves as the minimum eligibility qualification for admission to Semester I of the undergraduate programme.
- 8. Course Enrolment:** At the beginning of each semester, all students shall be required to enroll in the courses prescribed for that semester as per the approved structure of the programme. The list of enrolled courses must be submitted by the respective departments and colleges to the University within the stipulated timeline. While course enrolment involves selecting specific courses, it also constitutes credit registration, since each course carries a defined credit value. The minimum and maximum number of credits that a student may register for in a given semester shall be in accordance with the Course Structure specified for the Single Major or Double Major undergraduate programmes.
- 8.1** Course Enrolment for Major and Minor: Students are required to formally enroll in both their major and minor subjects. The list of enrolled students, along with their subject choices, must be submitted to the Controller of Examinations prior to the commencement of the examination form fill-up process.
  - 8.2** Enrolment of MOOCs through SWAYAM or Other Platforms approved by UGC: Students may earn up to 40% of the total credits of a given semester through online learning courses offered via SWAYAM or any other platform recognized by the UGC, subject to the following conditions:
    - 8.2.1. The course content complies with the provisions of the *UGC (Credit Framework for Online Learning Courses through SWAYAM) Regulations, 2021*, including subsequent amendments, and is approved by the University.
    - 8.2.2. The course is not offered by the concerned College or University during the semester. Only courses classified under Multidisciplinary Courses (MDC), Ability Enhancement Courses (AEC), Skill Enhancement Courses (SEC) and Value-Added Courses (VAC) may be undertaken through MOOCs.
    - 8.2.3. The credit value of the approved MOOC shall be equivalent to or exceed the credit allocation of the corresponding course for which it is considered as a substitute.
    - 8.2.4. Students intending to earn credits through MOOCs offered via SWAYAM or any other UGC-recognized platform must declare their chosen courses before the semester begins. These courses must align with the credit structure and learning outcomes of the student's programme and require prior approval from the University. Manipur University will publish a list of approved MOOCs before the commencement of each academic session. The college shall submit the list of such students and their selected courses to the

Controller of Examinations before the examination form fill-up process.

9. **Course Categories:** The following types of courses and activities shall constitute the programme of study, each requiring a defined number of hours for classroom instruction, academic guidance, laboratory/studio/workshop sessions, field-based learning or projects, internships, and community engagement or service.
- 9.1. **Lecture courses:** Courses involving structured lectures delivered by experts or qualified personnel in a specific field of learning, work/vocation, or professional practice.
  - 9.2. **Tutorial courses:** Courses involving guided problem-solving, discussion, and clarification of concepts under the supervision of qualified personnel in the relevant field.
  - 9.3. **Practicum or Laboratory work:** Courses requiring students to engage in practical, project-based, or laboratory activities that apply previously acquired theoretical knowledge, supervised by qualified experts.
  - 9.4. **Seminar:** Courses requiring active student participation in structured discussions, debates, or presentations based on assigned readings, current issues, or shared experiences, guided by an expert in the discipline.
  - 9.5. **Internship:** Courses involving supervised work-based learning experiences with external organizations—such as industry, government, or NGOs—intended to induct students into real-world professional settings.
  - 9.6. **Studio activities:** Courses focused on creative or artistic expression where students actively engage in visual, performance, or design-based tasks to produce specific creative outcomes.
  - 9.7. **Field practice/projects:** Courses involving experiential learning through fieldwork or projects carried out under expert supervision, often in real-world or community settings.
  - 9.8. **Community engagement and service:** Courses involving student participation in community-based projects designed to address social or economic issues, integrating theoretical learning with hands-on experience in solving real-life problems under appropriate guidance.
  - 9.9. **Dissertation/Research Project:** A final-year requirement involving independent research under faculty supervision. The component includes identification of a research problem, review of literature, design and execution of methodology, data analysis, and presentation of results in a structured report, demonstrating academic rigour and relevance to the discipline.
10. **Credit hours per component:** Credit is a unit that quantifies the academic workload and instructional time required for coursework. Credits reflect the total instructional time and academic effort required by both students and teachers to complete the learning process. The allocation of credits is based on the nature and duration of engagement, as outlined below.
- 10.1. All contact hours involving direct engagement with teachers are translated into academic credits.
  - 10.2. The credit allocations are defined as follows
    - (a) 1 Credit = 1 hour of Theory instruction per week over a semester (totaling 15 hours per semester).
    - (b) 1 Credit = 1 hour of Tutorial per week over a semester (totaling 15 hours per semester).
    - (c) 1 Credit = 2 hours of Practical instruction/Lab Work per week over a semester (totaling 30 hours per semester).
    - (d) 1 Credit = 3 hours of experiential learning per week. Thus, internship, community engagement, apprenticeship, Project, Dissertation and similar activities including both on-site engagement and related academic activities will take 45 hours per semester.
  - 10.3. A course may include a combination of lecture, tutorial, and practicum components.
    - (a) 4-credit course (with practicum) = 3 credits for lectures + 1 credit for practicum → 45 hours (lectures) + 30 hours (practicum)
    - (b) 4-credit course (without practicum) = 3 credits for lectures + 1 credit for tutorial → 45 hours (lectures) + 15 hours (tutorial)
    - (c) 3-credit course (with practicum) = 2 credits for lectures + 1 credit for practicum → 30 hours (lectures) + 30 hours (practicum)
    - (d) 3-credit course (without practicum) = 2 credits for lectures + 1 credit for tutorial → 30 hours (lectures) + 15 hours (tutorial).
    - (e) 4-credit course (only practicum) = 120 hours of practical/lab work per semester.
11. **Curricular components of the undergraduate programme:** The curriculum comprises major stream courses, minor stream courses, and courses from other disciplines, along with language courses, skill enhancement courses, and a set of value-based and contemporary subjects such as Environmental Education, Understanding India, Digital and Technological Solutions, Health and Wellness, Yoga Education, and Sports and Fitness. The minor stream includes vocational courses designed to equip students with job-oriented skills, thereby enhancing their employability and practical competence.
- 11.1. **Disciplinary/interdisciplinary major (60/80 credits):** The major enables students to pursue in-depth study in a specific discipline. Students may change their major within the broad disciplinary area at the end of the second semester, after exploring interdisciplinary courses in the first year. In the fourth year, students will undertake advanced-level courses, including Research Methodology, and will engage in seminar presentations during the year. Students

enrolled in the Honours with Research track are required to work on a research project or dissertation, which must be completed and submitted within the same year. The dissertation may focus on a topic within the major discipline or an interdisciplinary area aligned with the programme's objectives.

**Discipline Specific Elective:** DSEs are courses that form part of the major discipline. Students choose them from a pool of specialized courses offered within their subject area. In the fourth year, DSEs are often opted in lieu of a dissertation, allowing students to broaden and deepen their knowledge through coursework if they choose not to undertake a research project.

**11.2. Disciplinary/interdisciplinary minors (24/32 credits):** Students may pursue disciplinary or interdisciplinary Minors, as well as skill-based courses aligned with a vocational stream of their interest. Upon earning the required number of approved credits outside their Major, they become eligible to declare a Minor, at the end of the second semester. Minor stream courses shall be at the 300 level or higher. At least 50% of the total credits for a Minor must be earned within the relevant discipline, while the remaining may be drawn from other disciplines, based on the student's academic plan and subject to institutional approval.

**Vocational Education and Training:** Vocational Education and Training will be an integral part of the undergraduate programme, combining practical skills with theoretical knowledge. A minimum of 12 credits may be allocated to the 'Minor' stream relating to Vocational Education and Training and these can be related to the major or minor discipline or choice of the student. These courses aim to enhance employability, especially for students who exit early, by providing job-relevant skills and experience.

**11.3. Courses from Other Disciplines (Multidisciplinary) (9 credits):** All undergraduate students must complete three introductory-level courses from the broad disciplines listed below to enhance intellectual breadth as part of a liberal arts and sciences education. Courses already studied at the 12th-grade (higher secondary school) level in the intended major or minor cannot be selected.

- **Natural and Physical Sciences:** Students may choose foundational courses from disciplines such as Biology, Botany, Zoology, Biotechnology, Biochemistry, Chemistry, Physics, Biophysics, Astronomy, Astrophysics, and Earth and Environmental Sciences. These courses introduce scientific methods and natural phenomena.
- **Mathematics, Statistics, and Computer Applications:** Courses in this category equip students with quantitative skills and analytical tools applicable across disciplines. They may include training in programming (e.g., Python, R, Java), and provide exposure to software applications for data analysis, statistical computing, database management, cloud computing, and scientific writing.
- **Library, Information, and Media Sciences:** These courses introduce students to the fundamentals of library science, performing arts, information management, and media studies, including journalism, mass communication, and emerging digital platforms.
- **Commerce and Management:** Courses include introductory subjects such as business management, accountancy, finance, financial institutions, fintech, and entrepreneurship, offering insights into economic and managerial systems.
- **Humanities and Social Sciences:** Courses in this category cover disciplines such as Anthropology, Economics, Education, Physical Education, Sports Science, History, Linguistics, Language, Political Science, Psychology, Sociology, Social Work, and Philosophy. They help students understand human behaviour, society, and culture. Interdisciplinary topics may include Gender Studies, Cognitive Science, Sustainable Development, and International Relations, etc.

**11.4. Ability Enhancement Courses (AEC) (08 credits):** The Modern Indian Language (MIL) and English courses aim to develop students' proficiency through critical reading, academic writing, and effective communication. Emphasis is placed on expressing ideas clearly, understanding the role of language in shaping knowledge and identity, and engaging with cultural and literary traditions. These courses also build skills in discussion, debate, and reflective interpretation to enhance overall linguistic competence. As part of these courses, students will take two papers: (a) Language and Communication Skills in either MIL or English in the first semester, and (b) Linguistics, Academic Writing and Professional Communication in either MIL or English in the second semester.

**11.5. Skills Enhancement Courses (SEC) (09 credits):** These courses are designed to provide practical skills, hands-on training, and soft skills to enhance students' employability. Manipur University will develop and offer such courses based on student needs and the available resources and will revise them from time to time to ensure continued relevance and effectiveness. Such courses or qualifications should be aligned with either the NHEQF or the NSQF.

**11.6. Value-Added Courses (VAC) Common to All UG Students (6 credits):**

- (a) **Understanding India:** This course aims to provide students with a comprehensive understanding of contemporary India, rooted in its historical evolution, national development goals, and constitutional framework. It emphasizes

constitutional values, fundamental rights and duties, and the founding ideals of the Indian republic. The course deepens students' understanding of the freedom struggle and the diverse contributions of various regions and communities, fostering appreciation of constitutional values and preparing them for active, responsible citizenship in a democratic society.

- (b) **Environmental science/education:** This course equips students with the knowledge, skills, values, and attitudes necessary to address environmental challenges such as pollution, climate change, and biodiversity loss. It emphasizes sustainable development, waste management, conservation of natural resources, and forest and wildlife protection. Students will also gain a holistic understanding of India's environment, its interactive ecological processes, and the long-term implications for quality of life and environmental sustainability.
- (c) **Digital and technological solutions:** This component introduces students to emerging and high-impact technologies such as Artificial Intelligence (AI), machine learning, big data analytics, 3D machining, drone technology, and deep learning. These courses aim to integrate such technologies into undergraduate education, enhancing students' practical knowledge and employability, particularly in domains related to health, environment, and sustainable living.
- (d) **Health & Wellness, Yoga education, sports, and fitness:** This course includes components of yoga, sports, and fitness aimed at holistic development. Yoga education covers physical postures, breathing techniques, and meditative practices to cultivate discipline and awareness. Sports and fitness modules, conducted beyond regular class hours, focus on developing physical and skill-related fitness—such as strength, endurance, speed, flexibility, and coordination—as well as fundamental motor and tactical skills. The course also includes training in essential life skills related to stress management and everyday functioning.
- (e) **Indian Knowledge Systems:** This course is designed to acquaint students with India's rich cultural, philosophical, scientific, and technological heritage, fostering an appreciation for traditional knowledge systems and their relevance in contemporary contexts.
- (f) **Contemporary Social Issues and Ethics:** This course explores key contemporary social issues to foster critical awareness, ethical reasoning, and responsible citizenship. Topics may include human rights, social ethics, gender equity, sustainable development, financial literacy, civic education, substance abuse, and social norms. Students will examine how these issues intersect in daily life and develop the analytical skills to engage with them constructively, promoting dialogue, empathy, and a commitment to an inclusive and sustainable society.

From time to time, Manipur University (MU) will introduce innovative, value-added courses, which may be discipline-specific or common to all undergraduate programmes.

**11.7. Experiential Learning Components (4 Credits):** The undergraduate curriculum integrates experiential learning to connect theory with practice. Through internships or apprenticeships, community engagement, and field-based projects, students gain practical skills, professional exposure, and a deeper understanding of societal contexts, enhancing their academic learning and career readiness. Students can take any of the following:

- (a) **Summer Internship /Apprenticeship:** A key feature of the new undergraduate programme is the integration of real-world experience through internships or apprenticeships. During the summer term, students may undertake work-based learning in approved firms, industries, or research institutions across sectors such as healthcare, governance, media, and local industries. A 4-credit internship is mandatory for students exiting after the 1st year (Bachelor's Certificate) or 2nd year (Bachelor's Diploma). In the 5<sup>th</sup> semester, a 4-credit internship is compulsory for all students. All host institutions providing internship must be approved by Manipur University to ensure quality and credibility.
- (b) **Community engagement and service:** This curricular component aims to expose students to real-world socio-economic issues, enabling them to apply theoretical knowledge to practical situations and contribute to solving real-life problems. Community engagement and service may be undertaken as part of the summer term activity or integrated into a major or minor course, depending on the student's chosen discipline.
- (c) **Field-based learning/minor project:** This component is designed to provide students with first-hand exposure to diverse socio-economic contexts through field-based learning or minor projects. It aims to deepen their understanding of development-related issues in both rural and urban settings. Students will observe and study real-world situations, gaining insights into the policies, regulations, organizational structures, and programmes that shape the development process. Through direct engagement, students will explore complex community-level socio-economic challenges and examine innovative practices for addressing them. This project may be undertaken during the summer term or integrated into a major or minor course, depending on the student's area of study.

**11.8. Research Project / Dissertation (12 credits):** Students pursuing the 4-Year Bachelor's degree (Honours with Research) are required to undertake a research project under the supervision of a regular faculty member. The project must be completed in the eighth semester. Research outcomes are encouraged to publish in peer-reviewed journals, presented at conferences/seminars, or considered for patenting.

**12. Curriculum Structures:** The undergraduate programme aims to equip students with competencies across the arts, humanities, languages, natural sciences, and social sciences; foster a strong ethic of social engagement; and develop essential soft skills such as complex problem-solving, critical and creative thinking, and effective communication—alongside rigorous specialization in a chosen disciplinary or interdisciplinary major and minor(s).

**12.1.1<sup>st</sup> Year (Semesters 1 & 2):** During the first two semesters, students will study courses in four broad areas: a major, a minor, and two multidisciplinary disciplines, such as Natural Sciences, Commerce, or Social Sciences. This structure offers foundational knowledge across fields and allows students to retain or revise their major and minor choices at the end of the second semester. They will also take courses in Ability Enhancement (language), Skill Enhancement, and Value-Added categories based on their interests.

*Change of Major:* At the end of the second semester, students may change their Major based on academic interest and performance, including switching the first-year Minor to the new Major, with all earned credits retained and the previous Major becoming the Minor. Students may also change their Major within the same broad discipline—such as Natural and Physical Sciences; Mathematical and Computational Sciences; Library and Information Sciences; Commerce and Management; or Humanities and Social Sciences. To support this flexibility, HEIs shall create 10% additional seats beyond the sanctioned intake. Vacant seats may also be utilized. Preference will be given to students with the highest CGPA and no arrears.

**12.2. 2<sup>nd</sup>Year (Semesters 3 & 4):** Students will select courses aligned with their academic and career interests in both the Major and Minor streams. In addition, they will pursue courses to enhance language proficiency, develop transferable skills, and undertake vocational training relevant to their chosen field.

**12.3. 3<sup>rd</sup>Year (Semesters 5 & 6):** In the fifth and sixth semesters, students will engage with higher-level courses in their Major and related courses in the Minor stream to deepen subject-specific knowledge. They will also continue to develop practical and work-related competencies through vocational education. The programme structure is designed to equip students with the knowledge and skills required to meet industry and societal demands.

**12.4. 4<sup>th</sup>Year (Semesters 7 & 8):** In the fourth and final year, students will undertake advanced-level courses in both Major and Minor streams to complete the Bachelor's Degree (Honours). They will also engage in research-oriented learning, including courses in Research Methodology, advanced theoretical and applied subjects, and seminar presentations. Students may be permitted to undertake a research project or dissertation, subject to the availability of necessary facilities and academic approval.

## Syllabus of Undergraduate Programme in Environmental Science | 2025

### Curriculum Structure (Single Major Scheme)

| Year   | Semester | Major (Credit)   | Minor (Credit)   | MDC (Credit)   | AEC (Credit)                             | SEC*/<br>Dissertation<br>(Credit)   | Experiential<br>Learning<br>(Credit) | VAC (Credit)  | Total<br>Credits | Additional<br>Summer<br>Internship  |
|--|----------|--|--|--|--|---|--------------------------------------|---|------------------|---|
| I  | I        | MJC45ENV101(T/P)<br>25: Introduction to<br>Environmental<br>Science (4)<br>(Level 100)   | MNC45ENV101(<br>T/P)25: Basics of<br>Environmental<br>Science (4)<br>(Level 100)               | MDC45ENV10<br>1(T)25:<br>Environmental<br>Awareness (3)                  | AEC – 1<br>(Communication<br>Skills) (4) | SEC45ENV101<br>(T)25:<br>Fundamentals<br>of Ecotourism<br>(3)                         |                                      | From the Pool<br>(*Choose any<br>one VAC - I as<br>approved by the<br>University) (2) | 20               | Additional<br>for<br>Bachelor's<br>Certificate (4)  |
|  | II       | MJC45ENV102(T/P)<br>25: Fundamentals<br>of Ecology (4)<br>(Level 100)  | MNC45ENV102(<br>T/P)25: Basics of<br>Ecology (4)<br>(Level 100)                                | MDC45ENV10<br>2(T)25:<br>Environment<br>and Society (3)                  | AEC – 2<br>(Academic<br>Writing) (4)     | SEC45ENV102<br>(T/P)25:<br>Composting of<br>Biomass (3)                               |                                      | From the Pool<br>(*Choose any<br>one VAC - I as<br>approved by the<br>University)(2)  | 20               |   |
| <b>I Year Credit</b>   |          |  |  |  |  |   |                                      |   | <b>40</b>        |   |
| Students exiting at 1 Year will be awarded <b>Bachelor's Certificate</b> after earning minimum credit in the concerned discipline provided the student earned additional <b>4 credits</b> in work-based vocational courses offered during the Summer internship or apprenticeship. |          |  |  |  |  |   |                                      |   |                  |   |
| II   | III      | MJC50ENV203(T/P)<br>25: Physical<br>Environment (4)<br>(Level 200)<br><br>MJC50ENV204(T/P)<br>25: Biological<br>Environment (4)<br>(Level 200)   | MNC50ENV203(<br>T/P)25:<br>Biophysical<br>Environment (4)<br>(Level 200&<br>above)             | MDC50ENV20<br>3(T)25:<br>Environment<br>and Traditional<br>Knowledge (3) |  | SEC50ENV203<br>(T/P)25: Skills<br>in<br>Environmental<br>Sampling and<br>Analysis (3) |                                      | From the Pool (2)   | 20               | Additional<br>for<br>Bachelor's<br>Diploma, if<br>not done in<br>1 <sup>st</sup> Year (4) |
|  | IV       | MJC50ENV205(T/P)<br>25: Environmental<br>Chemistry (4)<br>(Level 200)<br><br>MJC50ENV206(T/P)<br>25: Biodiversity<br>and Conservation<br>(4)<br>(Level 200)<br><br>MJC50ENV207(T)2<br>5: Environmental<br>Legislation and<br>Policy (4)<br>(Level 200) | MNC50ENV204(<br>T/P)25: Concepts<br>of Environmental<br>Chemistry (4)<br>(Level 200&<br>above) |  |  |   |                                      |   | 20               |   |

## Syllabus of Undergraduate Programme in Environmental Science | 2025

| Year   | Semester | Major (Credit)  | Minor (Credit)   | MDC (Credit) | AEC (Credit) | SEC*/<br>Dissertation<br>(Credit) | Experiential<br>Learning<br>(Credit)  | VAC (Credit) | Total<br>Credits | Additional<br>Summer<br>Internship |
|--|----------|---|--|--------------|--------------|-----------------------------------|---|--------------|------------------|------------------------------------|
|  |          | MJC50ENV208(T/P)<br>25: Energy and Environment (4)<br>(Level 200)   |  |              |              |                                   |   |              |                  |                                    |
| <b>II Year Credit</b>  |          |   |  |              |              |                                   |   |              | <b>80</b>        |                                    |
| Students exiting at 2 Year will be awarded <b>Bachelor's Diploma</b> after earning minimum credit in the concerned discipline provided the student earned additional <b>4 credits</b> in work-based vocational courses offered during first year or second year summer internship or apprenticeship. |          |   |  |              |              |                                   |   |              |                  |                                    |
| III  | V        | MJC55ENV309(T/P)<br>25: Air and Noise Pollution (4)<br>(Level 300)<br><br>MJC55ENV310(T/P)<br>25: Soil and Water Pollution (4)<br>(Level 300)<br><br>MJC55ENV311(T/P)<br>25: Solid Waste Management (4)<br>(Level 300)  | MNC55ENV205(T/P)<br>25: Environmental Pollution (4)<br>(Level 200 & above)     |              |              |                                   | INT55ENV301(J)<br>25: Experiential Learning – 1 (Internship / Community Engagement and Service / Field Project) (4) |              | 20               |                                    |
|  | VI       | MJC55ENV312(T/P)<br>25: Natural Hazards and Disaster Management (4)<br>(Level 300)<br><br>MJC55ENV313(T/P)<br>25: Wildlife Conservation and Management (4)<br>(Level 300)<br><br>MJC55ENV314(T/P)<br>25: Introduction to Climate Change (4)<br>(Level 300)<br><br>MJC55ENV315(T/P)<br>25: Environmental | MNC55ENV206(T)<br>25: Basics of Disaster Management (4)<br>(Level 200 & above) |              |              |                                   |   |              | 20               |                                    |

## Syllabus of Undergraduate Programme in Environmental Science | 2025

| Year  | Semester     | Major (Credit)   | Minor (Credit)   | MDC (Credit)     | AEC (Credit)     | SEC*/<br>Dissertation<br>(Credit)   | Experiential<br>Learning<br>(Credit) | VAC (Credit)     | Total<br>Credits | Additional<br>Summer<br>Internship |
|---|--------------|--|--|------------------|------------------|---|--------------------------------------|------------------|------------------|------------------------------------|
|   |              | Pollution & Human Health (4)<br>(Level 300)  |  |                  |                  |   |                                      |                  |                  |                                    |
|   | <b>Total</b> | <b>60 Credits</b>  | <b>24 Credits</b>  | <b>9 Credits</b> | <b>8 Credits</b> | <b>9 Credits</b>  | <b>4 Credits</b>                     | <b>6 Credits</b> | <b>120</b>       |                                    |
| Students who want to exit at 3-year will be awarded <b>Bachelor's Degree</b> in the relevant Discipline /Subject upon earning the required credit of 120 from 1 <sup>st</sup> , 2 <sup>nd</sup> and 3 <sup>rd</sup> year. |              |  |  |                  |                  |   |                                      |                  |                  |                                    |
| IV  | VII          | MJC60ENV416(T/P)25: Environmental Impact Assessment (4)<br>(Level 400)<br><br>MJC60ENV417(T/P)25: Environmental Biotechnology (4)<br>(Level 400)<br><br>MJC60ENV418(T/P)25: Research Methodology*** (4)<br>(Level 400)<br>(RM) | MNC60ENV307(T)25: Environmental Planning and Management (4)<br>(Level 300 & above) |                  |                  | For Honours with Research<br>DIS60ENV401(D)25:<br>Dissertation-1 (4 Credits)<br><br>For Honours students<br>DSE60ENV401(T)25:<br>Sustainable Development** (4)<br>(Level 300)<br>in lieu of Dissertation.   |                                      |                  | 20               |                                    |
|   | VIII         | MJC60ENV419(T/P)25: Remote Sensing and GIS (4)<br>(Level 400)<br><br>MJC60ENV420(T/P)25: Pollution Monitoring and Control Technology (4)<br>(Level 400)  | MNC60ENV308(T/P)25: Pollution Monitoring and Abatement (4)<br>(Level 300 & above)  |                  |                  | For Honours with Research<br>DIS60ENV402(D)25:<br>Dissertation-2 (8 Credits)<br><br>For Honours students<br>DSE60ENV402(T)25:<br>Environmental Conservation**<br>(4) (Level 400)<br><br>DSE60ENV403(T)25:<br>Environmental Instrumentation**<br>(4) (Level 400)<br>in lieu of Dissertation. |                                      |                  | 20               |                                    |
|   | <b>Total</b> | <b>80 Credits</b>  | <b>32 Credits</b>  | <b>9 Credits</b> | <b>8 Credits</b> |   |                                      | <b>6 Credits</b> | <b>160</b>       |                                    |
| Students will be awarded <b>Bachelor's Degree (Honours/Honours with Research)</b> in the relevant discipline after earning 160 credits  |              |  |  |                  |                  |   |                                      |                  |                  |                                    |

\*SEC should be major oriented.

\*\*DSE should be major oriented. These courses are offered in lieu of the Dissertation/Project.

\*\*\*Major-18 is Research Methodology, which is mandatory for both Honours and Honours with Research.

A minimum of 12 credits may be allocated to vocational education and training as part of the minor course component.

**13. Credit Allocation:** The standard distribution of credits among various categories of courses across all semesters is as follows:

| Course Type                | Details  | Credits allotted |        | Remarks   |
|----------------------------|--|------------------|--------|---|
|                            |  | 3-Year           | 4-Year |   |
| Major                      | Discipline Specific Courses to be specified by the concerned Board of Studies of the University      | 60               | 80     |   |
| Minor (Stream can be 2)    | Discipline Specific Courses to be specified by the concerned Board of Studies of the University      | 24               | 32     | May include skill based courses                   |
| Multidisciplinary Courses  | Courses to be proposed by the Dean of Undergraduate Studies in consultation with relevant BoS        | 09               | 09     |   |
| Ability Enhancement Course | Courses to be specified by the BoS of Management Studies and Language Departments of the University  | 08               | 08     |   |
| Value Added Course         | Courses to be specified by various BoS and moderated by the Dean of Undergraduate Studies            | 06               | 06     |   |
| Skill Enhancement Course   | Discipline-specific, major-oriented courses specified by the concerned BoS                           | 09               | 09     | Employability Skills, Soft Skills, or Life Skills |
| Internship                 | Supervised internship or field-based learning component  | 04               | 04     |   |
| Dissertation/DSE           | DSE courses specified by the concerned BoS; Dissertation topics to be peer-reviewed by expert panel. |                  | 12     |   |
| Total                      |  | 120              | 160    |   |

**14. Multiple Entry and Multiple Exit Options and Certifications:** In alignment with the National Education Policy (NEP) 2020 and the guidelines of the University Grants Commission (UGC), Manipur University and its affiliated colleges shall implement the Multiple Entry and Multiple Exit (MEME) scheme in their undergraduate programmes. This flexible framework allows students to enter, exit, and re-enter the programme at designated stages, with each stage linked to a corresponding academic certification, as per the prescribed credit requirements:

| Programme Exit             | Minimum Credits Requirement | Additional Requirement   | Certification          | Re-entry Options             |
|----------------------------|-----------------------------|--|------------------------|------------------------------|
| After 1st Year             | 40 Credits                  | Earning a 4-credit vocational course, internship, or apprenticeship (in addition to 6 credits from skill-based courses) during the summer internship of the 1st year.        | Bachelor's Certificate | Within three years from exit |
| After 2 <sup>nd</sup> Year | 80 Credits                  | Earning a 4-credit vocational course, internship, or apprenticeship (in addition to 6 credits from skill-based courses) during the summer internship of the 1st or 2nd year. | Bachelor's Diploma     | Within three years of exit   |
| After 3 <sup>rd</sup> Year | 120 Credits                 | Earning the minimum prescribed credits as per the programme structure.   | Bachelor's Degree      | Within three years of exit   |

| <b>Programme Exit</b>        | <b>Minimum Credits Requirement</b> | <b>Additional Requirement</b>  | <b>Certification</b>                               | <b>Re-entry Options</b> |
|------------------------------|------------------------------------|--|--|-------------------------|
| Completion of 4 Year Courses | 160 Credits                        | Earning the minimum prescribed credits as per the programme structure. | Bachelor's Degree (Honours/ Honours with Research) | NA                      |

A student enrolled in the Four-Year UG Programme, as per the existing ordinance, shall be eligible for the following certifications based on the point of exit or upon successful completion, whichever is applicable.

- 14.1. **Bachelor's Certificate:** Students who choose to exit after the successful completion of the first year and have earned a minimum of 40 credits shall be awarded a UG Certificate, provided they also complete a vocational course of 4 credits during the summer vacation following the first year. Such students may re-enter the degree programme within a period of three years.
- 14.2. **Bachelor's Diploma:** Students who choose to exit after the successful completion of the second year and have earned a minimum of 80 credits (40 from 1<sup>st</sup> Year and 40 from 2<sup>nd</sup> year) shall be awarded a UG Diploma, provided they also complete a vocational course of 4 credits during the summer vacation following the second year. Re-entry into the programme shall be permitted within three years.
- 14.3. **Three-Year Bachelor's Degree:** Students who complete three years of study, earn a minimum of 120 credits, and meet the minimum credit requirements in the major discipline shall be awarded a UG Degree in the respective major upon exit.
- 14.4. **Four-Year Bachelor's Degree (Honours):** A Four-Year UG Honours Degree in the major discipline shall be awarded to students who complete four years of study, earn a minimum of 160 credits, and fulfill the prescribed credit requirements. Students who do not undertake a research project/dissertation must complete three additional theory courses totaling 12 credits in lieu of the research component.
- 14.5. **Four-Year Bachelor's Degree (Honours with Research):** Students who secure 7.5 CGPA over the previous six semesters and choose to pursue research in the fourth year shall undertake a research project or dissertation under the supervision of a faculty member of the College. The research work must be within the major discipline. Students who complete 160 credits, including 12 credits from the research project/dissertation, shall be awarded a UG Degree (Honours with Research).
- 14.6. **UG Programme with Single Major:** To be awarded a Bachelor's Degree with a single major, a student must earn at least 50% of the total required credits from the major discipline.
  - For a 3-year UG programme (120 credits), a minimum of 60 credits must be from the major discipline.
  - For a 4-year UG programme (160 credits), a minimum of 80 credits must be from the major discipline.
 For example, a student of Physics earning the required minimum credits in the major will be awarded a Bachelor's Degree in Physics (Honours or Honours with Research, as applicable) with a single major.

*Illustration 1: The following illustration outlines the certification a student may receive based on the credit requirements fulfilled in different subjects during the programme duration.*

| <b>Credit Requirement and Selection of Courses</b>                 | <b>Name of the Certification</b> |
|--|----------------------------------|
| 60 Credit in A in 3-Year Programme                                 | Major in A                       |
| 80 Credit in A in 4-Year Programme                                 | Honours in A                     |
| 80 Credit in A with 12 credit Research Project in 4-Year Programme | Honours with Research in A       |

15. **Recognition of Prior Learning (RPL) Policy:** Manipur University will adopt the Recognition of Prior Learning (RPL) framework as recommended by the University Grants Commission (UGC), in accordance with the *Guidelines for Implementation of Recognition of Prior Learning in Higher Education* and the *UGC (Minimum Standards of Instruction for the Grant of Undergraduate Degree and Postgraduate Degree) Regulations, 2025*. RPL will enable the recognition of learning outcomes acquired outside formal education, including those gained through workplace training, professional experience, or community engagements, based on validation and assessment of the prior learning achievements. A dedicated RPL Committee constituted by Manipur University will formulate the detailed procedure, policy framework, validation criteria, assessment mechanisms, and guidelines for effective implementation of RPL across all programmes.

**16. Duration of the undergraduate programmes:**

- 16.1. Every student admitted to an undergraduate programme leading to a qualification from Level 4.5 to Level 6 shall be required to complete the whole programme within a maximum period of seven (7) years from the date of admission to the first semester.
- 16.2. If a student wishes to exit after a qualification level (Level 4.5 to Level 6), he/she shall be required to complete the programme within a period of 2 (two) years from the date of admission to the programme of each qualification level.

*The illustration below depicts the permissible timeline for course completion under the multiple entry and exit framework.*

| Exit Point   | Completion Limit from Entry | Permissible Year for Re-entry         | Completion Time After Re-entry |                    |                    |
|--------------|-----------------------------|---------------------------------------|--------------------------------|--------------------|--------------------|
|              |                             |                                       | 1 Year After Exit              | 2 Years After Exit | 3 Years After Exit |
| After Year 1 | 7 years from Entry 1        | Within 3 years from exit* (by Year 4) | –                              | –                  | –                  |
| After Year 2 | 6 years from Entry 2        | Within 3 years from exit (by Year 5)  | 5 years                        | 4 years            | 3 years            |
| After Year 3 | 5 years from Entry 3        | Within 3 years from exit (by Year 6)  | 4 years                        | 3 years            | 2 years            |
| After Year 4 | 4 years from Entry 4        | Within 3 years from exit (by Year 7)  | 3 years                        | 2 years            | 1 year             |

*\*The total duration for programme completion shall not exceed 7 years from the date of first admission (i.e., start of 1st semester).*

- 17. **Course Codes:** Courses shall be coded based on their learning outcomes, level of difficulty, and academic rigor. Each course offered under the undergraduate curriculum shall be assigned a unique alphanumeric code structured as:

**PPP-QL-SUB-CSN(C)-YY**

Where

| Code Segment | Description   |
|--------------|---|
| <b>PPP</b>   | <p><b>Programme Type Code</b> – Identifies the category of the course:</p> <ul style="list-style-type: none"> <li>• MJC = Major Discipline (including DSE)</li> <li>• MNC = Minor Discipline</li> <li>• MDC = Multidisciplinary Course</li> <li>• SEC = Skill Enhancement Course</li> <li>• AEC = Ability Enhancement Course</li> <li>• INT = Internship, community engagement, or other activities (mandatory)</li> <li>• VAC = Value Added Course</li> <li>• SIN – Summer Internship for Exit (optional)</li> </ul> |
| <b>QL</b>    | <p><b>Qualification Level</b> – indicates the academic progression stage of the course. For coding purposes, the level is represented as a two-digit number without a decimal point (e.g., 45 for Level 4.5). The corresponding academic levels are as follows</p> <ul style="list-style-type: none"> <li>• 4.5 – First Year</li> <li>• 5.0 – Second Year</li> <li>• 5.5 – Third Year</li> <li>• 6.0 – Fourth Year</li> </ul>   |
| <b>SUB</b>   | <p><b>Subject Code</b> – A three-letter abbreviation for the discipline/subject (e.g., BOT = Botany, PSC = Political Science)</p>   |
| <b>CSN</b>   | <p><b>Course Serial Number</b> – It is a unique three-digit code assigned to each course, indicating its position within the academic level and category. The number range reflects the progression of learning complexity, as outlined below.</p>  |

| Code Segment | Description  |
|--------------|--|
|              | <ul style="list-style-type: none"> <li>• 000-099 – Pre-requisite course</li> <li>• 100-199 - Foundation or introductory courses</li> <li>• 200-299 - Intermediate-level courses</li> <li>• 300-399 - Higher-level courses</li> <li>• 400-499 - Advanced courses</li> </ul> |
| (C)          | <p><b>Component Type</b> – Indicates the mode of delivery:</p> <ul style="list-style-type: none"> <li>• (T) = Theory</li> <li>• (P) = Practical</li> <li>• (D) = Dissertation</li> <li>• (F) = Field</li> <li>• (J) = Project</li> </ul>                                   |
| YY           | <b>Year of Implementation or Revision</b> – in last two figures  |

e.g. MJC45BOT101(T)25 – Major Course for 4.5 Level, Botany, Course Serial Number 101, Theory, 2025  
 AEC50ENG101(T)25 – AEC course for 5.0 Level, Communication Skill, Serial Number 101, Theory, 2025

**18. Evaluation of Learning Outcome:** Evaluation is mandatory for the creditisation of every course and it must determine whether the student has achieved the prescribed learning outcomes upon its completion. Therefore, the mode and system of assessment used for evaluation should be guided by these learning outcomes.

**18.1. Mark Structure of a Course:** For theory and practical courses, assessment shall be divided into 30% for Internal Assessment (IA) and 70% for the end-semester university examination. Students must secure a minimum of 40% in both IA and end-semester components separately to be declared as having passed.

Students shall be informed in advance about the nature and schedule of internal assessments. Attendance and participation in all internal assessments, including sessional tests, shall be mandatory. Failure to appear in these assessments will result in disqualification from the end-semester examination. In-semester examinations cannot be repeated; however, the department may arrange special in-semester assessments under exceptional circumstances, if deemed necessary. The breakup of internal assessment marks is as follows:

| Sl. No. | Details   | Marks |
|---------|---|-------|
| 1       | Seminar/Presentation/Assignment/Quiz/Unit Test, etc. in case of Theory examination and Seminar/Demonstration/Viva-Voce/Lab record, etc. in case of Practical examination. | 10    |
| 2       | In-Semester Written Test  | 15    |
| 3       | Attendance  | 5     |
|         | Total   | 30    |

Marks for attendance shall be awarded as per the following structure:

| Attendance Percentage | Marks |
|-----------------------|-------|
| Less than 75%         | 0     |
| 75% - 80%             | 1     |
| 80% - 85%             | 2     |
| 85% - 90%             | 3     |
| 90% – 95%             | 4     |
| 95% - 100%            | 5     |

If a student is awarded 0 marks in the attendance component of Internal Assessment, they shall not be permitted to appear in the end-semester examination.

**18.2. Credit Earning through MOOCs:** Only courses from the approved list shall be eligible for credit transfer and inclusion in the semester grade sheet. MOOC courses will be considered valid for credit transfer only if they are

completed and credits are earned during the concerned academic year. If a student fails an online course offered through SWAYAM or any other equivalent platform, they shall have the option to enroll in an equivalent course offered by the University. In such cases, it is the responsibility of the student to fulfill all academic requirements of the course to be eligible for the examination and to earn the requisite credits.

- 18.3. Internship Evaluation:** An internship is a course involving professional work experience or cooperative engagement with an external organization, typically supervised by an expert from outside the HEI. Colleges may design their internship programmes, and evaluation shall be conducted internally based on specified criteria. The approval of host institutions shall be granted by Manipur University.

| Activity                                | Marks | Evaluator                       |
|---|-------|---------------------------------|
| Workplace Regularity and Responsibility | 20    | Host Institute & College Mentor |
| Adherence to Internship Schedule        | 10    | Mentor/ Supervisor              |
| Presentation of the report              | 20    | Expert panel                    |
| Quality and Content of the Report       | 30    | Expert panel                    |
| Viva Voce                               | 20    | Expert panel                    |
| Total                                   | 100   |                                 |

- 19. Marks to Grade Point Conversion:** The following grading scale shall be used to represent students’ performance through letter grades and corresponding grade points. Percentage of marks shall be calculated up to two decimal places:

| Percentage (%) of Marks | Letter Grade | Grade Point | Grade Description |
|-------------------------|--------------|-------------|-------------------|
| 90 - 100                | O            | 10          | Outstanding       |
| 80 - 90                 | A+           | 9           | Excellent         |
| 70 - 80                 | A            | 8           | Very Good         |
| 60 - 70                 | B+           | 7           | Good              |
| 55 - 60                 | B            | 6           | Above Average     |
| 45 - 55                 | C            | 5           | Average           |
| 40 - 45                 | P            | 4           | Pass              |
| < 40                    | F            | 0           | Fail              |
| Absent                  | Ab           | 0           | Absent            |

The percentage-based grading system follows the Exclusive Class Interval Method, wherein each interval includes marks from the lower bound up to, but not including, the upper bound. For example, the interval '50 – <60' covers scores from 50.00% up to but not including 60.00%. A student scoring 59.99% falls within the '55 – <60' range and is awarded Grade B, while a student scoring exactly 60.00% falls within the '60 – <70' range and is awarded Grade B+.

- 20. CGPA and Final Grade:** The Cumulative Grade Point Average (CGPA) and the final course grade shall be determined based on the following table.

| CGPA         | Final Grade | Description   |
|--------------|-------------|---------------|
| 9.00 - 10.00 | O           | Outstanding   |
| 8.00 - 9.00  | A+          | Excellent     |
| 7.00 - 8.00  | A           | Very Good     |
| 6.00 - 7.00  | B+          | Good          |
| 5.50 - 6.00  | B           | Above Average |
| 4.50 - 5.50  | C           | Average       |
| 4.00 - 4.50  | P           | Pass          |
| < 4.00       | F           | Fail          |
| --           | F           | Fail          |

The above table is based on the Exclusive Class Interval Method. As per conventional classification, a letter grade of 'B+' and above is considered First Class, while a letter grade of 'B' is regarded as Second Class.

- 21. Computation of Semester Grade Point Average (SGPA):** SGPA is the weighted average of the grade points secured by a student in all credit courses registered during a semester. It is calculated on the UGC’s 10-point scale by dividing the sum of the products of the credits and the grade points earned in each course by the total number of credits registered in that

semester. The total number of registered credits is counted in the calculation, regardless of whether the student has passed or failed in the courses, i.e.

$$SGPA = \frac{\sum C_i \times G_i}{\sum C_i}$$

where  $C_i$  is the number of credits of the  $i^{\text{th}}$  course and  $G_i$  is the grade point scored by the student in the  $i^{\text{th}}$  course. SGPA shall be rounded off to 2 decimal points.

**Illustration 2: Example of Computation of SGPA where a candidate has not failed in any course (without practicum)**

| Semester              | Course       | Marks obtained | Total marks | PC  | Letter Grade | Grade Point | Credit        | Credit Point |
|-----------------------|--------------|----------------|-------------|-----|--------------|-------------|---------------|--------------|
| I                     | Major – 1(T) | 80             | 100         | 80% | A+           | 9           | 4             | 36           |
|                       | Minor – 1(T) | 80             | 100         | 80% | A+           | 9           | 4             | 36           |
|                       | MDC – 1(T)   | 80             | 100         | 80% | A+           | 9           | 3             | 27           |
|                       | AEC – 1 (T)  | 80             | 100         | 80% | A+           | 9           | 4             | 36           |
|                       | SEC – 1(T)   | 80             | 100         | 80% | A+           | 9           | 3             | 27           |
|                       | VAC - 1 (T)  | 40             | 50          | 80% | A+           | 9           | 2             | 18           |
| Total                 |              |                |             |     |              |             | 20            | 180          |
| <b>SGPA</b>           |              |                |             |     |              |             | <b>180/20</b> | <b>=9</b>    |
| <b>Credits earned</b> |              |                |             |     |              |             | <b>20</b>     |              |

In Illustration 2, the student earned 20 credits, which is the minimum credit requirement for the semester. The student has passed and is eligible for promotion to Semester II without any backlog. Similarly, if the student earns another 20 credits in Semester II, they can be promoted to Semester III, thereby completing the first year of the undergraduate programme with a total of 40 credits from Semesters I and II. However, the student is not yet eligible to receive the Undergraduate Certificate after earning only 40 credits. To qualify for the UG Certificate upon exit at the end of the first academic year, the student must earn an additional 4 credits through a Summer Internship, bringing the total to 44 credits.

**Illustration 3: Example of computation of SGPA where a candidate passed in all courses (with practicums in Major and Minor courses)**

| Semester              | Course        | Marks obtained | Total marks | PC  | Letter Grade | Grade Point | Credit        | Credit Point |
|-----------------------|---------------|----------------|-------------|-----|--------------|-------------|---------------|--------------|
| I                     | Major – 1 (T) | 80             | 100         | 80% | A+           | 9           | 3             | 27           |
|                       | Major – 1 (P) | 80             | 100         | 80% | A+           | 9           | 1             | 9            |
|                       | Minor – 1 (T) | 80             | 100         | 80% | A+           | 9           | 3             | 27           |
|                       | Minor – 1 (P) | 80             | 100         | 80% | A+           | 9           | 1             | 9            |
|                       | MDC – 1 (T)   | 80             | 100         | 80% | A+           | 9           | 3             | 27           |
|                       | AEC – 1 (T)   | 80             | 100         | 80% | A+           | 9           | 4             | 36           |
|                       | SEC – 1 (T)   | 80             | 100         | 80% | A+           | 9           | 3             | 27           |
|                       | VAC - 1 (T)   | 40             | 50          | 80% | A+           | 9           | 2             | 18           |
| Total                 |               |                |             |     |              |             | 20            | 180          |
| <b>SGPA</b>           |               |                |             |     |              |             | <b>190/20</b> | <b>=9</b>    |
| <b>Credits earned</b> |               |                |             |     |              |             | <b>20</b>     |              |

In Illustration 3, the student earned 20 credits and obtained an SGPA of 9.0. As in Illustration 1, the student is eligible for promotion to Semester II without any backlog.

A comparison of Illustrations 2 and 3 shows that although the total absolute marks and marks obtained differ across the two programmes, the SGPA remains the same, as it is calculated based on credit points rather than raw scores. This illustrates that the total marks allotted to a course (e.g., 40, 50, or 100) do not directly influence the SGPA. Instead, the marks obtained are first converted to a percentage, which is then mapped to a grade point. The SGPA is ultimately derived from these grade points weighted by course credits.

*Illustration 4: Example of computation of SGPA where a candidate has failed in one course:*

| Semester | Course        | Marks obtained | Total marks | PC  | Letter Grade | Grade Point | Credit                | Credit Point  |             |
|----------|---------------|----------------|-------------|-----|--------------|-------------|-----------------------|---------------|-------------|
| I        | Major – 1 (T) | 80             | 100         | 80% | A+           | 9           | 4                     | 36            |             |
|          | Minor – 1 (T) | 80             | 100         | 80% | A+           | 9           | 4                     | 36            |             |
|          | MDC – 1 (T)   | 80             | 100         | 80% | A+           | 9           | 3                     | 27            |             |
|          | AEC – 1 (T)   | 30             | 100         | 30% | F            | 0           | 4                     | 0             |             |
|          | SEC – 1 (T)   | 80             | 100         | 80% | A+           | 9           | 3                     | 27            |             |
|          | VAC - 1 (T)   | 40             | 50          | 80% | A+           | 9           | 2                     | 18            |             |
| Total    |               |                |             |     |              |             | 20                    | 144           |             |
|          |               |                |             |     |              |             | <b>SGPA</b>           | <b>144/20</b> | <b>=7.2</b> |
|          |               |                |             |     |              |             | <b>Credits earned</b> | <b>16</b>     |             |

In Illustration 4, the student failed in AEC–1 (Theory) and obtained an SGPA of 7.2. The student earned only 16 credits in the semester, which is below the mandatory requirement of 20 credits. As a result, the student is considered to have not passed Semester I but is permitted to be promoted to Semester II with a backlog in AEC–1. The student must appear for this backlog course in the next regular examination.

*Illustration 5: Example of computation of SGPA where a candidate passed in all courses (without practicum)*

| Semester | Course        | Marks obtained | Total marks | PC  | Letter Grade | Grade Point | Credit                | Credit Point |              |
|----------|---------------|----------------|-------------|-----|--------------|-------------|-----------------------|--------------|--------------|
| I        | Major – 1 (T) | 45             | 100         | 45% | C            | 5           | 4                     | 20           |              |
|          | Minor – 1 (T) | 45             | 100         | 45% | C            | 5           | 4                     | 20           |              |
|          | MDC – 1 (T)   | 45             | 100         | 45% | C            | 5           | 3                     | 15           |              |
|          | AEC – 1 (T)   | 45             | 100         | 45% | C            | 5           | 4                     | 20           |              |
|          | SEC – 1 (T)   | 45             | 100         | 45% | C            | 5           | 3                     | 15           |              |
|          | VAC - 1 (T)   | 22             | 50          | 44% | P            | 4           | 2                     | 8            |              |
| Total    |               |                |             |     |              |             | 20                    | 98           |              |
|          |               |                |             |     |              |             | <b>SGPA</b>           | <b>98/20</b> | <b>= 4.9</b> |
|          |               |                |             |     |              |             | <b>Credits earned</b> | <b>20</b>    |              |

In this illustration, the student has successfully passed all courses and earned 20 credits with an SGPA of 4.9. The student is eligible for promotion to Semester II without any backlog.

A comparison of Illustrations 4 and 5 reveals that the student in Illustration 4 failed despite achieving a higher SGPA, while the student in Illustration 5 passed with a lower SGPA. This demonstrates that credit earning—not SGPA alone—determines eligibility for certification and progression, provided the minimum credit requirements are fulfilled.

- 22. The Cumulative Grade Point Average (CGPA).** The CGPA of a student in a programme is the cumulative weighted average of the grade points secured in all credit courses registered across all semesters. It is calculated on the UGC’s 10 - point scale by dividing the sum of the products of the number of credits and the SGPA for each semester by the total number of credits earned across all semesters i.e.,

$$CGPA = \frac{\sum C_i \times S_i}{\sum C_i}$$

where  $S_i$  is the SGPA of the  $i^{th}$  semester and  $C_i$  is the total number of credits in that semester. The SGPA and CGPA shall be rounded off to two decimal points and reported in the transcripts.

*Illustration 5: Calculation of CGPA of a student who passed IV semester without any backlog*

| Semesters    | Credit    | SGPA | Credit X SGPA | CGPA        | Final Grade | Description      |
|--------------|-----------|------|---------------|-------------|-------------|------------------|
| Semester I   | 20        | 9    | 180           |             |             |                  |
| Semester II  | 20        | 8.5  | 170           |             |             |                  |
| Semester III | 20        | 8    | 160           |             |             |                  |
| Semester IV  | 20        | 9    | 180           |             |             |                  |
| <b>Total</b> | <b>80</b> |      | <b>690</b>    | <b>8.63</b> | <b>A+</b>   | <b>Excellent</b> |

In this illustration, the student earned a total of 80 credits with a CGPA of 8.63, which corresponds to an A+ grade

(Excellent). Under the conventional classification, the student would be considered to have passed with First Class.

- 23. Conversion of CGPA to percentage:** For conversion to percentage CGPA will be multiplied by 10 according to the following formula:

$$\text{Percentage of marks} = (\text{CGPA} \times 10)$$

**Illustration 6: Conversion of CGPA into percentage marks on the basis of illustration 5.**

$$\text{Percentage of marks} = 8.63 \times 10 = 86.3\%$$

- 24. Earning Credits:** A student is deemed to have earned the prescribed credits if they secure a letter grade other than 'F' (Failed) or 'Abs' (Absent/Incomplete). A student receiving an 'F' grade in any course must reappear for the course at the next legitimate opportunity. In the case of an 'F' grade in project work, dissertation, or assignment, the student must revise and resubmit the work. The result shall be declared along with the next regular batch.

If a student earns credit from multiple colleges under Manipur University, the degree shall be awarded by Manipur University, considering the academic records from the last college attended, subject to fulfilment of all degree requirements.

If a student has earned credits from institutions outside Manipur University, the awarding of the degree shall be mutually decided by Manipur University and the other institutions involved, subject to fulfilment of all degree requirements.

- 25. Accumulation of Credits:** Every student shall register with the Academic Bank of Credits (ABC), which will provide a unique ID and access to the Standard Operating Procedure (SOP). Credits earned by the student for courses completed at the University shall be deposited into their ABC account. The accumulation, validity (shelf life), and redemption of credits shall be governed by the provisions of the *UGC (Establishment and Operation of Academic Bank of Credits in Higher Education) Regulations, 2021*, and any subsequent amendments. The validity of earned credits shall be up to a maximum of seven years or as specified by the Academic Bank of Credits.

**26. Audit Courses:**

Departments or Boards of Studies may incorporate audit courses as deemed appropriate, provided they do not affect the total credit structure of the programme. Students offering these courses will be assessed on a pass/fail basis and must obtain a pass grade; however, the credits for these courses will not be counted towards their degree requirements.

**27. Promotion, Re-Appearence and Improvements in Examinations:**

**27.1. Promotion:** A student shall be promoted to the next semester upon earning the minimum academic credits from that semester. A student must complete all semester examinations within six (6) years for a three-year undergraduate programme, and within seven (7) years for a four-year undergraduate programme (Honours/Honours with Research), from the date of admission to the first semester, regardless of the number of examination attempts.

**27.2. Carryover Courses and Provisional Promotion:**

- (a) Promotion from the first to the sixth semester shall be allowed with carryover courses, subject to form fill-up and allotment of examination roll numbers. The student shall be provisionally promoted to the next higher semester, with the failed courses treated as carryover courses. Such students shall be eligible to appear for the carryover courses in the next regular examination cycle. If a student fails in any component of a course, they must reappear in the examination for both components.
- (b) A student who fails to fill the examination form for a particular semester shall not be permitted to be provisionally promoted to the next semester. Such a student must wait and appear in the examination during the next available cycle for that semester.
- (c) If a candidate passes the sixth semester examination without having cleared all the courses of the previous semesters, the result of the sixth semester shall be withheld. The final result shall be declared only after the candidate clears all pending courses from the earlier semesters.
- (d) A candidate who fails or is absent in one or more courses of the seventh semester examination shall be provisionally promoted to the eighth semester, with the failed course(s) treated as carryover. If the candidate passes the eighth semester examination before clearing all courses of the seventh semester, the result of the eighth semester shall be withheld and will be declared only after the candidate clears all pending courses of the seventh semester.
- (e) Promotion to the seventh semester shall be granted only upon successful completion of all credit courses from the first to sixth semesters.

- 27.3. Repetition of Project/Dissertation (Honours with Research):** A candidate who fails to complete, or fails in, the project or dissertation component in the fourth year of the UG Degree (Honours with Research) shall be granted only one opportunity to repeat the project work. Failure to complete or absence in this additional attempt shall render the candidate ineligible for the award of the respective Undergraduate Certificate, Diploma, or Degree.
- 27.4. Improvement Examination:** A student may choose to appear for an improvement examination to enhance their grade by repeating the course examination within seven years from the date of admission to the programme. This option is available only for theory courses and is limited to a single attempt per course. The grade obtained in the improvement examination shall be considered final, even if it is lower than the previously earned grade. The fee for improvement examinations shall be determined separately by the University and shall be distinct from the standard fee applicable for back or casual examinations.
- 28. Course Registration:** At the beginning of every Semester, all the students shall be required to register for the Courses specified for that semester of the programme in the Manipur University in the prescribed forms with payment of fees as prescribed by the University from time to time.
- 29. Transcript:** A transcript is an official document issued by the university that records a student's academic performance. A grade-sheet shall be issued after each term, detailing the student's academic record for that period. Upon completion of the programme, a consolidated (final) transcript shall be issued, reflecting the cumulative academic performance, including semester-wise SGPA, credits earned, and overall CGPA. In the transcript, the SGPA and CGPA shall be rounded off to two decimal places.
- 30. Admission and Examinations:** All other matters relating to admission and examinations for the Four-Year Undergraduate Programme, not specifically covered under this Ordinance, shall be governed by the Admission and Examination Regulations for the Four-Year Undergraduate Programmes of Manipur University, as may be prescribed. Such Regulations shall be consistent with the provisions of this Ordinance and shall not be in contravention thereof.
- 31. Power to remove Difficulties:** If any difficulty arises in giving effect to the provisions of this Ordinance, the Vice-Chancellor may, by order, make such provisions, not inconsistent with the Act, Statutes, Ordinances, or other Regulations, as may be necessary or expedient to remove the difficulty, subject to ratification by the appropriate University authorities.

**Course Components of the 4<sup>th</sup> Year Degree (VII and VIII Semesters)**

Manipur University is implementing the Fourth Year of the UG Degree (Honours/Honours with Research) as an integral component of the Four-Year Undergraduate Programme. The Fourth Year Undergraduate Degree Programmes has two distinct tracks –

**Honours Degree Track:** In the fourth year of the Four-Year Undergraduate Programme, students pursuing an Honours Degree may specialise in the Core subjects studied during the first three years. This enables the acquisition of in-depth knowledge and academic rigour in a chosen subject area. The curriculum includes advanced-level and skill-oriented courses designed to foster higher-order thinking.

**Honours with Research Track:** Students opting for the Honours with Research track are required to complete one Dissertation/Project Work of 12 credits. The main component of this track is the completion of an individual dissertation/research project within the student's chosen specialisation, enabling the development of research aptitude and independent inquiry.

**Curricular Component:**

1. There will be three Core Courses, each carrying 4 credits, in Semester VII. All these courses are compulsory for both Honours and Honours with Research students. One of the courses will be Research Methodology.
2. There will be two Core Courses, each carrying 4 credits, in Semester VIII. These courses are compulsory for both Honours and Honours with Research students.
3. A Dissertation/Project Work/Research carrying 12 credits will be compulsory for Honours with Research students, distributed across Semesters VII and VIII. It will consist of two parts: Dissertation/Project Work Part I (4 credits) in Semester VII, and Dissertation/Project Work Part II (8 credits) in Semester VIII.
4. Students enrolled in the Honours programme (without research) shall take three Discipline-Specific Elective (DSE) courses, each carrying 4 credits, in place of the Dissertation. One DSE will be taken in Semester VII and two in Semester VIII.

**Credit Components of Research Methodology:** The Research Methodology course is common to both Honours and Honours with Research programmes. Components on Research and Publication Ethics are also common across all disciplines. However, the discipline-based content of the Research Methodology course in Semester VII may vary across different groups of disciplines to reflect their specific focus areas. The following are the suggested course components for each group of disciplines.

**(A) Social Science and Commerce Disciplines**

- a. Conceptual and Theoretical Perspectives
- b. Observational and Empirical Perspectives
- c. Statistical Analysis Using Computer Packages for Research
- d. Introduction to Social Science Research
- e. Quantitative Approaches to Social Science Research

**(B) Mathematical Sciences (Statistics/Mathematics/Computer Science)**

- a. Conceptual and Theoretical Perspectives
- b. Observational and Empirical Perspectives
- c. Statistical Analysis Using Computer Packages for Research
- d. Advanced Interdisciplinary Methods in Mathematical Sciences
- e. (Discipline-Specific):
  - i. Advanced Statistical Methods for Data Analysis (for Statistics students)
  - ii. Advanced Topics in Computer Science (for Computer Science students)
  - iii. Advanced Mathematical Tools or Topics for Research (for Mathematics students)

**(C) Physical Sciences/Chemical Sciences**

- a. Conceptual and Theoretical Perspectives
- b. Observational and Empirical Perspectives
- c. Statistical Analysis Using Computer Packages for Research
- d. Advanced Theoretical Concepts/Models and Analytical Methods for Scientific Research
- e. Advanced Instrumentation and Characterization Techniques

- (D) Life and Environmental Science
- a. Conceptual and Theoretical Perspectives
  - b. Observational and Empirical Perspectives
  - c. Statistical Analysis using Computer Packages for Research Methodology
  - d. Advanced Laboratory Analytical Methods and Techniques
  - e. Advanced Field Techniques in Life and Environmental Sciences
- (E) Humanities
- a. Conceptual and Theoretical Perspectives
  - b. Observational and Empirical Perspectives
  - c. Statistical Analysis Using Computer Packages for Research
  - d. Discipline-Specific / Elective Courses
    - (i) Philosophical Inquiry and Methodological Reasoning (for Philosophy)
    - (ii) Approaches and Methods for Literary and Cultural Studies (for Language & Literature)
    - (iii) Research Methods in Linguistics: Fieldwork and Data Analysis (for Linguistics)
  - e. Advanced Methodological Course
    - (i) Hermeneutics (Theory and Methodology of Interpretation) and Critical Theory (Philosophy/Literature)
    - (ii) Translation Studies and Comparative Literature (Language)
    - (iii) Sociolinguistics and Language in Society (Linguistics)

**Credit Components and Distribution of Dissertation Components in Honours with Research:**

**I. Semester VII (4 Credits)**

- (i) Research proposal development
- (ii) Synopsis Writing
- (iii) Literature review and conceptual framework
- (iv) Finalization of research methodology
  - a. Science: experimental design, sampling, instrumentation
  - b. Social Sciences: surveys, interviews, case studies, fieldwork
  - c. Humanities: textual analysis, archival research, interpretative frameworks
- (v) Development of tools/instruments (if applicable)
- (vi) Ethics approval (if applicable)
- (vii) Pilot study or preliminary field/lab/library/archival work

**II. Semester VIII (8 Credits)**

- (a) Data/textual material collection and analysis
  - Science: lab/field data collection and analysis
  - Social Sciences: survey/interview data processing
  - Humanities: in-depth textual or archival analysis
- (b) Data analysis and interpretation
- (c) Incorporation of feedback from supervisor(s)
- (d) Drafting and finalizing the dissertation report
- (e) Supervisor evaluations and final submission
- (f) Presentation and/or viva voce

**Eligibility Criteria for Admission to the Fourth Year of the Four-Year Undergraduate Degree (Honours) Programme:**

- **Continuation within the Same Institution:** Eligible students who have successfully completed the first three years of the programme in a given college may be promoted to the fourth year in the same institution without requiring a new entrance examination.
- **Multiple Entry/Exit options in Fourth Year:** Students may choose to exit their current college after completing three years and apply for admission to the fourth year in another college under Manipur University. Such candidates may be required to qualify for an entrance test. Admission to the fourth year is also open to eligible candidates from other recognized universities. All multiple-entry options are subject to the availability of seats.

**Eligibility Criteria for Students to Pursue the Fourth Year of the Four-Year Honours with Research Degree:**

- **Minimum Academic Performance:** Students must secure a minimum of 7.5 CGPA from the previous six semesters.
- **Academic Completion:** Students must have successfully passed all courses from Semesters I to VI.

- **Admission and Entry Option:** Students enrolled in the same college have the option to continue into the fourth year of the Honours with Research programme. Students from other colleges under Manipur University or from other recognized universities may seek admission to the fourth year, subject to the availability of seats and successful completion of an admission test.
- **Mobility and Exit Option:** Students may choose to exit their current college after three years and pursue the fourth year of the Honours with Research Degree in:
  - Another college under Manipur University,
  - A college affiliated to another recognized university, or
  - A university department offering the fourth-year Honours with Research programme.
- Admission under any of these options is subject to the availability of vacancies in the receiving institution and compliance with applicable eligibility norms.

**Eligibility Criteria for Colleges to Offer the Fourth Year of the Four-Year Undergraduate Degree (Honours with Research) Programme**

- **Eligible Faculty:** Departments in a college with at least two Ph.D. supervisors of Manipur University are eligible to offer the Four-Year Undergraduate Programme (Honours with Research). If a recognized department loses its permanent Ph.D.-holding faculty, it shall no longer be eligible to offer the programme until requisite number of qualified faculty member with the required credentials is appointed.
- **Minimum Infrastructure and Resource Requirements:** The college must meet all infrastructure and faculty requirements as prescribed by Manipur University. Compliance with the university's standards for laboratories, libraries, classrooms, and qualified teaching staff is mandatory.
- **Total Intake Capacity:** The intake capacity for the Honours with Research programme in a department shall be proportionate to the number of eligible supervisors, with a maximum limit of 20 students per academic year. Only approved Ph.D. supervisors of Manipur

University are authorized to supervise the 12-credit Project Work/Dissertation. The student allocation per eligible supervisor is as follows:

- (b) **Professor** – 8 students
- (c) **Associate Professor** – 6 students
- (d) **Assistant Professor** – 4 students

The number of seats allocated for undergraduate dissertation/project work per faculty member is independent of the Ph.D. research scholar allocation limits assigned to supervisors.

- **Minimum Admission Requirement:** Colleges that have recorded an average enrolment exceeding 80% of the approved intake capacity over the last three academic years shall be eligible to offer the fourth year of the Four-Year Undergraduate Degree (Honours with Research) programme.
- **Vacancy Intimation and Admission of Students from Other Colleges:** Colleges shall declare available vacancies in their fourth-year Honours with Research programmes only after admitting their own eligible students to Manipur University. Colleges should admit the students from other colleges or universities in strict adherence to the reservation policy and merit-based selection criteria. Admissions shall commence only after the official declaration of the Sixth Semester results.
- **Submission and Ratification of Student Lists:** Colleges shall submit the list of students admitted to the fourth year of the Honours with Research programme to the Manipur university for formal ratification. Only ratified student lists will be considered valid for academic and administrative purposes. This process should be completed before the completion of VII Semester.

**Evaluation of Dissertation Components in Semester VII (4 Credits, Total 100 Marks):**

*Conducted by Internal Supervisor/Faculty Panel*

| Component  | Marks | Evaluator                    | Remarks   |
|--|-------|------------------------------|---|
| Research Proposal (including Literature Review, Conceptual Framework, and Synopsis) - written and presentation | 30    | Supervisor and Faculty Panel | Clarity of objectives, feasibility, articulation, relevance, depth, theoretical grounding |

| <b>Component</b>  | <b>Marks</b> | <b>Evaluator</b>             | <b>Remarks</b>   |
|---|--------------|------------------------------|--|
| Development of Research Methodology, Tools, and Protocol Design | 10           | Supervisor & Faculty Panel   | Appropriateness, ethical considerations, instrumentation/tools         |
| Progress Review and Interaction                                 | 10           | Supervisor                   | Timely submissions, meetings, initiative, quality                      |
| Preliminary Work (Pilot/Data collection)                        | 10           | Supervisor                   | Quality of pilot study or initial data collection; measurable outcomes |
| Term Paper (written and presentation)                           | 40           | Supervisor and Faculty Panel | Assessment based on written submission and academic quality            |
| <b>Total (Semester VII)</b>                                     | <b>100</b>   |                              |  |

**Evaluation of Dissertation Components in Semester VIII (8 Credits, Total 100 Marks):**

*Partially by Supervisor, mainly by External Examiner*

| <b>Component</b>   | <b>Marks</b> | <b>Evaluator</b>               | <b>Remarks</b>                                       |
|--|--------------|--------------------------------|--|
| Data Collection, Analysis & Findings                     | 10           | Supervisor                     | Depth, accuracy, interpretation                      |
| Progress Review and Interaction                          | 10           | Supervisor                     | Timely submissions, meetings, initiative, quality    |
| Preliminary Draft Submission & Compliance (Presentation) | 10           | Supervisor and Faculty Panel   | Timeliness, incorporation of feedback, draft quality |
| Final Dissertation Report                                | 50           | External Examiner + Supervisor | Structure, originality, referencing, academic rigour |
| Viva Voce / Oral Presentation                            | 20           | External Examiner              | Clarity, defence of research, communication skill    |
| <b>Total (Semester VIII)</b>                             | <b>100</b>   |                                |  |

The dissertation shall be checked for plagiarism and for AI-generated content using approved tools and must comply with the similarity and authenticity standards prescribed by the university.

**Template of Designing Syllabus for a Programme**

As per the Standard Operating Procedures for the Implementation of the National Higher Education Qualifications Framework (NHEQF), each course should provide clear and comprehensive information to enable students and prospective learners to make informed choices. This information should include:

- (a) Course Objectives
- (b) Learning Outcomes
- (c) NHEQF Level
- (d) Eligibility Criteria for Entry
- (e) Prerequisites, if any
- (f) Credits and Credit Distribution in terms of Lecture, Tutorial, and Practical/Practicum/Fieldwork components (i.e., L-T-P)
- (g) Skills and Practical Components integrated within the course
- (h) Potential Occupational Pathways the course may lead to, (if applicable)

The following templates should be used while designing the syllabus of each course - (a) Introductory Section, (b) Template for Theory Courses and (c) Template for Practical Courses.

**Template for designing Theory Course**

Learning outcomes and competencies must be framed from the perspective of what the student will be able to do upon completion of the course, clearly stating:

- The knowledge and understanding they will develop or be able to describe
- The practical or hands-on skills they will be able to demonstrate
- Where and how they will be able to apply the knowledge and skills acquired
- The types of analysis they will be able to perform
- Any new innovation they can create or develop using the knowledge and skills gained

*Note: Each course (paper) may not necessarily include all five attributes listed above.*

**Manipur University**  
**Academic Level < Level No.> and Semester<Semester No.>**  
**Syllabus for <Name of the Course> (Theory)**

|   |   |              |               |                |                  |
|---|---|--------------|---------------|----------------|------------------|
| Nature of Course                                | Major/ Minor/ MDC/ AEC/ SEC, etc.                                     |              |               |                |                  |
| Course Code                                     |   |              |               |                |                  |
| Course Title                                    |   |              |               |                |                  |
| Course Level                                    | Level 100/ Level 200/ Level 300/ Level 400                            |              |               |                |                  |
| Credit Details                                  | Total Credit  | Lecture/Week | Tutorial/Week | Practical/Week | Total Hours/Week |
|   |   |              |               |                |                  |
| Course Audience                                 |   |              |               |                |                  |
| Proposed by (for Non Core courses)              | Department of ..... / Board of Studies....., Manipur University, etc. |              |               |                |                  |
| Pre Requisites (if any)                         | 1.<br>2.  |              |               |                |                  |
| Skill Training Required (if any)                | 1.<br>2.  |              |               |                |                  |
| Pre-Requisite Course Required (if any)          | 1.<br>2.  |              |               |                |                  |
| Faculty Eligibility and Specialization (if any) |   |              |               |                |                  |

**Course Objective (Summary):** <Brief statement providing objective of the course, its scope, and relevance>

The objective of this course is to equip students with a comprehensive understanding of the natural environment, human-environment interactions, and the scientific, social, and policy dimensions of sustainability.

The scope of the course spans across fundamental ecological principles, environmental chemistry, geology, resource management, climate change, environmental laws, and sustainable development practices, offering an interdisciplinary perspective to address contemporary environmental issues.

Its relevance lies in preparing graduates to critically analyze environmental challenges, develop innovative solutions, and contribute to informed decision-making for conservation, sustainable resource use, and policy planning. By bridging science, society, and technology, this course empowers learners to become responsible stewards of the environment and active contributors to global sustainability goals.

**Course Learning Outcomes:** Upon completion of the course the learners will be able to

|    |  |
|----|--|
| 1. |  |
| 2. |  |
| 3. |  |
| 4. |  |
| 5. |  |

**Detailed Syllabus Content**

*(Provide only number of sessions per practical activity)*

| Sl. No | Detailed syllabus | No. of Sessions |
|--------|-------------------|-----------------|
| 1.     |                   |                 |
| 2.     |                   |                 |
| 3.     |                   |                 |
| 4.     |                   |                 |
| 5.     |                   |                 |

**Suggested readings:**

**Template for designing Practical Course**

**Manipur University**  
**Academic Level <Level No.> and Semester <Semester No.>**  
**Syllabus for <Name of the Course> (Practical)**

|                                    |  |               |                |                |                   |
|------------------------------------|--|---------------|----------------|----------------|-------------------|
| Nature of Course                   | Major/ Minor/ MDC/ AEC/ SEC, etc.          |               |                |                |                   |
| Course Code                        |  |               |                |                |                   |
| Course Title                       |  |               |                |                |                   |
| Course Level                       | Level 100/ Level 200/ Level 300/ Level 400 |               |                |                |                   |
| Credit Details                     | Total Credit                               | Lecture/ Week | Tutorial/ Week | Practical/Week | Total Hours/ Week |
|                                    |  |               |                |                |                   |
| Course Audience                    |  |               |                |                |                   |
| Associated Theory Courses (Topics) | 1.<br>2.<br>3.                             |               |                |                |                   |
| Skill Training Required (if any)   | 1.<br>2.                                   |               |                |                |                   |
| Pre-Requisite Course               | 1.   |               |                |                |                   |

|   |    |
|---|----|
| Required (if any)                               | 2. |
| Faculty Eligibility and Specialization (if any) |    |

**Course Description (Summary):** <Brief overview of the practical course and its relevance to theory and skill development>

**Course Learning Outcomes:** Upon completion of the course the learners will be able to

|    |  |
|----|--|
| 1. |  |
| 2. |  |
| 3. |  |
| 4. |  |
| 5. |  |

**Detailed Syllabus Content**

*(Provide only number of sessions per practical activity)*

| Sl. No. | List of Practicals | No. of Sessions |
|---------|--------------------|-----------------|
| 1.      |                    |                 |
| 2.      |                    |                 |
| 3.      |                    |                 |
| 4.      |                    |                 |
| 5.      |                    |                 |
|         |                    |                 |
|         |                    |                 |

**Suggested Readings**

- 1.
- 2.

**Additional Readings:**

- 1.
- 2.

**List of Essential Major Equipment**

- 1.
- 2.

**Major Laboratory Stores/Consumables Required**

- 1.
- 2.

**Essential Software (Licensed/Open-Source)**

- 1.
- 2.

**Student Activities**

1. Demonstration Notes/ Observation Notebooks:
2. Practical Records / Project Reports :

**Guidelines for Internship**

**Internship Report:** Upon completion of the internship, each student is required to submit a comprehensive report detailing observations, tasks undertaken, and learning outcomes from the training period. In consultation with the Organizational Supervisor and Faculty Mentor, students may be assigned specific topics or problem areas to focus on in their report. A daily diary must be maintained throughout the internship, documenting activities and reflections. The final report must be signed by the Organizational Supervisor, the Faculty Mentor, and the Head of the Institution.

The Internship Report will be evaluated based on the following criteria:

1. Originality of content
2. Relevance and clarity of write-up
3. Organization, structure, presentation (including drawings/sketches, formatting, and language)
4. Breadth and relevance of learning experiences
5. Practical applications and integration with theoretical concepts taught in the programme

**Monitoring and Evaluation of Internship**

Internship performance will be assessed in **three stages**:

- 1. Evaluation by the Host Organization:** The host organization will assess the student based on the following:
  - Punctuality and attendance
  - Enthusiasm and willingness to learn
  - Maintenance of the daily diary
  - Skills demonstrated
  - General remarks or observations
- 2. Monitoring by the Faculty Mentor:** The Faculty Mentor or Head of Institution may conduct an unannounced visit or call to the internship site to verify the student's attendance and engagement.
  - Unauthorized absence will lead to cancellation of the internship.
  - Students must notify both the Faculty Mentor and Organizational Supervisor at least one day in advance by email if they intend to take leave.
- 3. Seminar Presentation and Viva Voce at the HEI:** Students must present their internship experience before an **expert committee** constituted by the department. The evaluation will consider:
  - Quality of content presented
  - Planning and organization of the presentation
  - Effectiveness of delivery
  - Depth of knowledge and skills demonstrated

**Submission Guidelines**

- Students must submit five (5) copies of the Internship Report, each duly signed by the Organizational Supervisor, Faculty Mentor, and Head of the Institution.
- The internship certificate, supervisor's certificate, and institution head's certification must be included in the final report.
- A declaration of originality signed by the student must also be attached.
- The college shall forward a duly authenticated copy of the report to the Controller of Examinations, in compliance with university notification.

**Manipur University**  
**UG Programme in Environmental Science**

**Preamble**

Historically environment and conservation have been an integral part of India's ethical and spiritual values from ancient times. This is evident from the importance given to nature in the Vedic literature and epics the Ramayana and Mahabharata. Buddhism and Jainism have also given great importance to the conservation of natural resources and biodiversity. In more recent times, the value of flora and fauna has been documented by regimes of the Mughals and the British. The exploitation of our resources during British India required the introduction of formal educational processes to document India's biological resources. This tradition continued after independence as nature studies in school and college education.

The world got together to ensure preservation and enhancement of the human environment in Stockholm in 1972. Nations, irrespective of their economic status, have been facing newer environmental challenges of local, regional and global nature. Therefore, human beings needed to continue learning about the environment to appreciate the challenges and to find solutions. India has been quick to respond to the need and carefully added clauses in the Constitution of India to address the environmental concerns. Laws have been enacted as a commitment to the international community and to address Indian national concerns, and institutions like the Pollution Control Boards have been constituted. Consequently, over the years, Environmental Science has developed as an academic discipline and the need to create research base and technical manpower in the areas of Environmental Science has been felt world over.

By the 1970s, it was observed that current patterns of development and our population growth placed enormous impacts on natural resources. The degradation of our environment such as deforestation, pollution, the spread of wasteland etc. led to the need for placing environment education in curricula. The Honorable Supreme Court, in response to MC Mehta's PIL, introduced formal environment education as an infusion into school curricula in different subjects. In 1991, the UGC created a compulsory Core Module Undergraduate Course on Environmental Studies to be implemented in all subjects at the undergraduate level. This is now referred to as 'Ability Enhancement Compulsory Course (AECC)'. During the last few years, several universities have initiated their courses on the environment in response to growing societal and industrial needs. As these provide disparate inputs, it is difficult for job opportunity providers to judge the competence level of job seekers on a single platform. Thus there is a growing felt need for a standardize honours programme on the environment at the bachelor's level.

The undergraduate programme in Environmental Science programme and its **Four Year Undergraduate Programme (FYUP), 2025** based on NEP 2020 curriculum have been designed to attract young minds to choose a career in broad areas of Environmental Science and applications. This programme has also been envisaged to fill the requirement of technical manpower in various sectors in India and elsewhere.

**Introduction** (General Introduction to the Program)

Environmental Science has developed as a discipline of interdisciplinary nature. Therefore, explicit learning outcomes against the courses would provide a direction to the students and teachers to focus effectively on the subject. The recruiters would find it easier to visualize their internal needs and relate them to the available expertise of the graduates seeking jobs in this field. Thus, the **Four Year Undergraduate Programme (FYUP), 2025** based on NEP 2020 in Environmental Science has been envisaged to fill the gap that existed between the recruiters and academic institution, besides maintaining the standards of teaching-learning in the competitive world of today. The framework intends to bring in innovation in curriculum design and syllabus development, teaching-learning, and rational assessment of the students.

Since Environmental Science is an interdisciplinary subject, the candidates are expected to acquire skills in natural resource management, pollution control and social issues related to equitable use of resources. The SEC (Skill Enhancement Courses), VAC (Value Added Courses) and AEC (Ability Enhancement Courses) courses in greater detail provide with opportunities for hands-on relevant training, exposure visits, skill development and project work. Several courses may be supplemented by creating MOOCs through the e-Pathshala programme of the UGC.

As the environment and its studies are based on current and past scenarios, spatial and temporal aspects should become a part of a students' knowledge domain and acquired skills. This requires the student to have passed through a personal learning adventure into her/his environment and experiential learning, which is the foundation for critical and reflective learning.

The FYUP for Undergraduate Programme in Environmental Science has been prepared as per the structure provided by the UGC, keeping in mind the multidisciplinary nature of the subject and the field application of knowledge emphasized in detail.

**Aims for UG Degree in Environmental Science**

The aims of the Undergraduate Programme in Environmental Science are to:

- Provide students with the scope to develop knowledge base covering all attributes of the environment and enable them to attain scientific/technological capabilities to find answers to the fundamental questions before the society with regards to human action and environmental effects with due diligence.
- Enhance the ability to apply this knowledge and proficiency to find solutions relating to environmental concerns of varied dimensions of today.
- Provide with a direction and technical capability to carry on lifelong learning and show teamwork and collaborative endeavour, and decision making.
- Improve the employability of the graduates including the enhancement of self-employment and entrepreneurial aptitude, and fill the technical resource gap especially in the Indian context.
- Help graduates appreciate environmental needs to frame policy guidelines.
- Motivate graduates to appreciate that they are an integral stakeholder in the environmental management of India irrespective of their future jobs or working environments in accordance of the provisions vide Article 48A (Directive Principles of State Policy) and Article 51A (g) (Fundamental Duties) of the Constitution of India.
- Help graduates to understand the concerns related to Sustainable Development Goals (SDGs) and the Indian obligations.

**Attributes of a Graduate in Environmental Science**

- **Core Competency:** Develop sound knowledge and perception about group dynamics, recognize role of individuals in a group, take initiatives and leadership in collaborative-multidisciplinary and trans-disciplinary scientific research, demonstrate a capacity for self-management and teamwork, timely decision-making through openness and flexibility, constructive arguments and rational analysis for achieving common goals and objectives, motivate group members to address environmental issues with a scientific outlook and mitigation approach.
- **Communication Skills:** Communicate scientific/technological knowhow and new learning to the scientific community and the society at large with strong conviction and confidence so that humanity benefit from the knowledge and technological development. This can be achieved through sound technical proficiency of graphics, software, writing skill, in-depth subject specific knowledge, by maintaining appropriate standards, by the ability to render as well as receive comprehensible instructions.
- **Critical Thinking:** Demonstrate strong **critical thinking skills**, analyze complex environmental problems from multiple perspectives; assess the reliability of scientific data, interpret policy implications, and propose innovative, practical solutions to environmental challenges ensuring the capability of making informed, ethical, and forward-thinking decisions.
- **Psychological skills:** Possess well-developed **psychological skills**, which foster resilience, adaptability, and empathy in addressing environmental challenges; enhance the ability to work effectively in diverse teams, manage stress in various field and research settings, and engage empathetically with communities affected by environmental problems.
- **Problem-solving:** Address and solve scientific vis-a-vis environmental problems via rational and original thinking; keep updates of different solution avenues and select appropriate options considering public health, cultural, and societal factors.
- **Analytical reasoning:** Critically to address multifaceted scientific issues and environmental phenomenon, pertain independent decision for synchronizing information to formulate innovative and intellectual advances towards focused research over wider theoretical and practical domains
- **Research skills:** Demonstrate strong **research skills**, design and conduct scientific studies, methodologies, literature review, collect and analyze qualitative and quantitative data, analytical tools and interpret findings.
- **Teamwork:** Address environmental challenges, collaborative efforts, good communication, adaptability, sharing ideas and responsibilities, support collective goals.
- **Digital Literacy:** Select, learn and apply appropriate techniques, resources, sophisticated instruments, models for explaining different environmental consequences and mitigation activities with a thorough understanding of drawbacks.
- **Moral and ethical awareness:** Attain strong academic integrity, professional code of conduct, ethics of experimental research and scientific writings, contemplation of the impact of research findings on conventional practices, and a clear sense of responsibility towards societal needs and reaching the targets for attaining inclusive and sustainable development.
- **Leadership readiness:** Ability to inspire and motivate others, make informed and ethical decisions, be responsible, quick thinking, problem-solving attitude, and the ability to balance scientific evidence with social, economic, and policy considerations.

**Qualification Descriptors for undergraduate programme in Environmental Science**

The qualification descriptors for the Undergraduate Programme in Environmental Science shall be five learning attributes such as disciplined knowledge & understanding; skills & techniques; national and global competencies; communication; and application. The key qualification descriptor for Environmental Honours shall be the strong foothold of the basic scientific theories and principles as well as critical thinking and decision making. The major expected learning outcomes of the Undergraduate Programme in Environmental Science should include the following:

**1. Knowledge & Understanding**

- Demonstrate extensive and systematic acquaintance of the disciplinary foundation in the various areas of Environmental Science.
- Insightfully address the contemporary research and development at both national and international arena.
- Understand and engage in the field of Environmental Sciences and its allied areas.

**2. Skills & Techniques**

- Show the ability to apply scientific knowledge & experimental skills in a critical and organized manner for evaluation and elucidation of complex environmental problems and issues related to terrestrial ecosystems; physical environment; air, water, and soil.
- Contamination; human health hazards; biodiversity loss; food security and agricultural issues; solid waste management; and other specialized areas of electronics.
- Demonstrate the ability to identify the role of the scientific knowledge, experimental skills, scientific methods & tool in dealing with real-life case-specific issues and formulate sustainable solutions.
- Exhibit efficiency to model, simulates, and assesses the regional and global phenomenon and systems with both primary and secondary data sources.
- Demonstrate the ability to facilitate technocrats and manufacturers to design and develop eco-friendly products and processes towards accomplishment of the sustainable development goals.

**3. Competence**

- Communicate heterogeneous audience through his or her information, knowledge, and arguments effectively and professionally with write-ups and presentations in both national and international perspectives.
- Ability to work as a proactive and supportive member in a team through substantial contributions towards effective planning, management, and implementations of projects and/or tasks.
- Exhibit capability to think and execute independent research ventures/projects, interpret changes and fluctuations in the natural environment, predict or estimate probable environmental consequences of any process, evaluate research outcomes, and report in a conclusive and convincing manner.
- Capability to identify his or her strengths and limitations; develop an attitude to learn more; inculcate a lifelong learning practice; and grow as pragmatic knowledge seekers as well as knowledge creators.

**Programme (Learning) Outcomes**

|     |  |
|-----|--|
| PO1 | Ability to recognize the need for learning the topic and develop foundational knowledge on the topic.                              |
| PO2 | Ability to develop critical thinking and problem solving skills to solve interdisciplinary issues related to the topic.            |
| PO3 | Ability to understand the relationships between natural and man-made systems.  |
| PO4 | Ability to apply statistical methods, ICT and innovative techniques in classroom, field and laboratory to analyze scientific data. |
| PO5 | Ability to develop lifelong learning and professional skills.  |
| PO6 | Ability to design and execute a scientific project, write scientific reports, develop research and communication skills.           |
| PO7 | Ability to spread awareness about the environment around us, sustainable development and conduct outreach activities.              |
| PO8 | Ability to gain empirical knowledge on the topic and contribute in decision making processes.                                      |

**Programme Specific Outcomes (included only major courses)**

|     |   |
|-----|---|
| CO1 | MJC45ENV101(T/P)25: Introduction to Environmental Science |
| CO2 | MJC45ENV102(T/P)25: Fundamentals of Ecology               |

|      |   |
|------|---|
| CO3  | MJC50ENV203(T/P)25: Physical Environment                        |
| CO4  | MJC50ENV204(T/P)25: Biological Environment                      |
| CO5  | MJC50ENV205(T/P)25: Environmental Chemistry                     |
| CO6  | MJC50ENV206(T/P)25: Biodiversity and Conservation               |
| CO7  | MJC50ENV207(T)25 : Environmental Legislation and Policy         |
| CO8  | MJC50ENV208(T/P)25: Energy and Environment                      |
| CO9  | MJC55ENV309(T/P)25: Air and Noise Pollution                     |
| CO10 | MJC55ENV310(T/P)25: Soil and Water Pollution                    |
| CO11 | MJC55ENV311(T/P)25: Solid Waste Management                      |
| CO12 | MJC55ENV312(T/P)25: Natural Hazards and Disaster Management     |
| CO13 | MJC55ENV313(T/P)25: Wildlife Conservation and Management        |
| CO14 | MJC55ENV314(T/P)25: Introduction to Climate Change              |
| CO15 | MJC55ENV315(T/P)25: Environmental Pollution and Human Health    |
| CO16 | MJC60ENV416(T/P)25: Environmental Impact Assessment             |
| CO17 | MJC60ENV417(T/P)25: Environmental Biotechnology                 |
| CO18 | MJC60ENV418(T/P)25: Research Methodology                        |
| CO19 | MJC60ENV419(T/P)25: Remote Sensing and GIS                      |
| CO20 | MJC60ENV420(T/P)25: Pollution Monitoring and Control Technology |

**Course Learning Outcomes:** Upon completion of the course the learners will be able to

|     |  |
|-----|--|
| CO1 | <b>Introduction to the Environmental Science :</b> To obtain knowledge of the environment and the role of human beings in shaping the environment, understand various components of the environment and interfaces, understand the basic concepts of ecology, critically appreciate the environmental concerns of today, knowledge of basic experiments on environmental issues.   |
| CO2 | <b>Fundamentals of Ecology:</b> Understand the fundamental concepts and scope of ecology; demonstrate an understanding of ecosystem structure, the pathways of energy flow through food chains and food webs and ecological succession; knowledge of the characteristics, dynamics, and growth models of populations; proper understanding of the structural attributes of communities and the nature of species interactions; apply field methods to study abiotic and biotic components.   |
| CO3 | <b>Physical Environment:</b> Students will learn the overall concepts of physical environment including various theories that explain the possible process of origin and evolution of the Earth; they will learn about the lithosphere, rocks and minerals and soil formation concepts; learn about the earth heat budget, water budget and atmospheric equilibrium concept; global general circulation atmospheric processes such as atmospheric science and climatology.   |
| CO4 | <b>Biological Environment:</b> Understand the biosphere and biotic community; study the physiology of plants and animals, and relation with environment; understand the climatic factors, stress and physiology.   |
| CO5 | <b>Environmental Chemistry:</b> Students will learn about the basic chemistry of important environmental processes; learn about the chemical process leading to the generation of air and water pollutants (from sources) in the environment, the fate of these pollutants in the environment, and their important sink; learn about the important geo-hydro-chemical processes leading to environmental contamination and hazard; attain a proper understanding of a safe and sustainable production, ecosystem, and living environment through scientific processes. |
| CO6 | <b>Biodiversity and Conservation:</b> Systematically understand biodiversity and its vital role in ecosystem functions; appreciate the need of biodiversity conservation in the context of various developmental pathways and policy framework that the mankind has been undergoing; identify the importance of biodiversity in natural environments; critically examine biodiversity and human linkages, and help policy formulating for conservation; application of knowledge in general communication for public extension.  |
| CO7 | <b>Environmental Legislation and Policy:</b> Understand the Indian constitutional provisions with respect to environmental protection, division of powers, and fundamental rights; comprehensive understanding of pollution control laws (The Water Act, The Air Act and the Environment (Protection) Act of 1986), and rules; understanding of International Environmental laws (Treaties and Protocols), and Indian commitments.   |
| CO8 | <b>Energy and Environment:</b> Students will learn about the various energy sources and patterns of utilization; able to make a distinction between conventional and renewable energy sources; learn about the dependence of the present civilization on fossil fuel for energy and the pattern of energy consumption prevailing in different parts of the world; able to state how the consumption of fossil fuels and biomass leads to adverse impacts on health and the climate, plus become aware of the government's energy policy.                               |
| CO9 | <b>Air and Noise Pollution:</b> Students will learn about the sources of pollutants, both natural and anthropogenic, and their impact on the biota and environment; learn about the global environmental changes linked with air pollution, such as ozone layer depletion, acid rain, global warming, etc; understand how meteorological parameters moderate   |

|      |   |
|------|---|
|      | and aggravate problems of air pollution; learn about the sources, medium, propagation, health impacts, and mitigation measures of noise pollution.  |
| CO10 | <b>Soil and Water Pollution:</b> Students will learn about the basic concept of soil physical, chemical and biological properties of soil and the causes, and impacts of soil pollutions; students will learn about concept causes and impacts of physical, chemical and biological pollution of water; students will learn about concept of water quality parameters, standards, indicators and indices.   |
| CO11 | <b>Solid Waste Management:</b> Students could understand the concept of solid waste and its different types, and how it affects the environment; understand the concept of recycling; municipal waste management handling rules; learn about hazardous and Biomedical waste, E-waste, and their treatment and disposal guidelines; learn about the physico-chemical, biological, mechanical, and thermo-chemical treatment methods of solid waste.  |
| CO12 | <b>Natural Hazards and Disaster Management:</b> Students will be able to identify different types of natural and human-made hazards and understand their causes and effects; understand disaster management concepts, cycles, and key terms like risk, vulnerability, and capacity; better equipped to suggest preparedness and mitigation strategies for various hazards; basic knowledge of tools like GIS and remote sensing to understand and plan for disasters; students can analyze real-life disaster case studies and apply lessons learned to promote safer, sustainable communities.   |
| CO13 | <b>Wildlife Conservation and Management:</b> Articulate the fundamental concepts in wildlife conservation and management; apply understanding of cultural, historical, and current perspectives on the human-wildlife relationship to effectively address wildlife issues; understand the current threats to wildlife; be capable of assessing status of wildlife.  |
| CO14 | <b>Introduction to Climate Change:</b> Students will learn about the causal factors of global warming and climate change; understand how the climate of the Earth has changed in geological history; learn about various impacts of climate change on organisms, humans, and the ecosystem, plus the adaptation and mitigation technologies; learn about the policy response and mitigation strategies adopted at the national and international levels.  |
| CO15 | <b>Environmental Pollution and Human Health:</b> Knowledge on the types and the science of environmental health; understand the effect of pollution on human health; ability to develop pollution mitigation/abatement strategies   |
| CO16 | <b>Environmental Impact Assessment:</b> Students will learn about the history and development concept of EIA in the world and India; learn about fundamental approaches, guidelines and regulations on EIA in India and various types of EIA case studies on developmental projects, programs, plans and guidelines; learn about the types of developmental activities and associated impacts and mitigation measures; learn about the conceptual framework for EIA, public participation process and various methodologies for different environment component; learn about role of various stakeholders in EIA, Preparation of EIA report and Environment Clearance procedure.                |
| CO17 | <b>Environmental Biotechnology:</b> Knowledge on the scope of biotechnology; ability to apply molecular biological techniques in pollution management and industrial applications; Knowledge of advanced biotechnological applications, and biosafety in analytical procedures.   |
| CO18 | <b>Research Methodology:</b> Students will learn the fundamentals of environmental research and their scope and uses; learn basic concepts of statistical methods and their significance in environmental data analysis for both qualitative and quantitative research; learn basic concepts of data collection, presentation and interpretation of environmental data using statistical and computing software; learn the fundamental concepts of computer applications for various environmental research; learn the fundamental concepts of computer applications for various environmental research; concept parametric and non-parametric test of significance test and their application. |
| CO19 | <b>Remote Sensing and GIS :</b> Students will learn the basic concepts and principles of Remote sensing and GIS and their applicability in solving and addressing various environmental issues; develop skills for using the basic GIS tools & GPS for map preparation to address various environmental issues; learn to perform image analyses RS tools to identify and generate Landuse /landcover map, slope map, slope aspect map etc.; learn the basic concepts GPS, their uses and applicability in environmental research.   |
| CO20 | <b>Pollution Monitoring and Control Technology:</b> Understand the methodology of sampling, analysis, monitoring, and pollution control technologies of air; understand the methodology of sampling, analysis, monitoring, and pollution control technologies of water; understand the methodology of sampling, analysis, monitoring, and pollution control technologies of soil; understand the methodology of sampling, analysis, monitoring, and pollution control technologies of noise.  |

**DETAILED SYLLABUS (MAJOR)**

**MJC45ENV101(T)25: INTRODUCTION TO ENVIRONMENTAL SCIENCE**

**Credit: 03**  
**Contact hours: 45 h**

|   |  |              |               |                |                   |
|---|--|--------------|---------------|----------------|-------------------|
| Nature of Course                                | <b>MAJOR</b>   |              |               |                |                   |
| Course Code                                     | <b>MJC45ENV101(T)25</b>  |              |               |                |                   |
| Course Title                                    | <b>INTRODUCTION TO ENVIRONMENTAL SCIENCE</b>                       |              |               |                |                   |
| Course Level                                    | <b>Level 100</b>   |              |               |                |                   |
| Credit Details                                  | Total Credit   | Lecture/Week | Tutorial/Week | Practical/Week | Total Hours/ Week |
|   | 4  | 3            |               | 1              | 5                 |
| Course Audience                                 | Major students enrolled in the FYUGP in Environmental Science      |              |               |                |                   |
| Proposed by (for Non Core courses)              |  |              |               |                |                   |
| Pre Requisites (if any)                         |  |              |               |                |                   |
| Skill Training Required (if any)                |  |              |               |                |                   |
| Pre-Requisite Course Required (if any)          | 10+2 in Science  |              |               |                |                   |
| Faculty Eligibility and Specialization (if any) | MSc. Degree in Environmental Science with PhD or NET qualification |              |               |                |                   |

**Course Objective (Summary):** The course is aimed to highlight the basic concepts of Environment and its components to the beginners in the field. It will introduce the concepts of environmental issues in the society. The Course seeks the students to understand the basic knowledge of ecology.

**Course Learning Outcomes:**

|   |   |
|---|---|
| 1 | Knowledge of the environment and the role of human beings in shaping the environment. |
| 2 | Understand various components of the environment and interfaces.                      |
| 3 | Understand the basic concepts of ecology.   |
| 4 | Critically appreciate the environmental concerns of today.                            |
| 5 | Knowledge of basic experiments on environmental issues.                               |

**Detailed Syllabus Content:**

| Unit | Unit Name                 | Detailed Syllabus   | CH |
|------|---------------------------|---|----|
| I    | Environment               | Environment– Definition. Physical components, socio-economic and cultural components. Natural resources – definition and types, resource use and depletion.   | 11 |
| II   | Components of Environment | Atmosphere – structure and composition, physicochemical role of the atmosphere. Rocks and minerals -the rock cycle, biogeochemical cycles, soil- structure and types. Water resources, water bodies and water use, issues with water and conservation.  | 11 |
| III  | Ecosystem                 | Ecosystems – concepts and structure, concept and scope of ecology; organism and environment; ecological factors and variables. concepts of biomes, biodiversity.  | 11 |
| IV   | Environmental issues      | Environmental issues –Concepts of pollution of air, water, and land, urbanization and solid wastes, biodiversity loss, land degradation and desertification, ozone layer depletion, climate change. Environmental concerns – historical development of environmentalism and conservation on Indian perspective. | 12 |

**PRACTICAL**

**MJC45ENV101(P)25: INTRODUCTION TO ENVIRONMENTAL SCIENCE**

**Credit: 01  
Contact hours: 30 h**

|  |
|--|
| <b>Experiments</b>   |
| <ol style="list-style-type: none"> <li>1. Basic methods of water sampling.</li> <li>2. Basic methods of soil sampling.</li> <li>3. Measurement of frequency, density and abundance in a grassland ecosystem.</li> <li>4. Documentation of ecosystem services provided by various ecosystems.</li> <li>5. Case studies on natural resources exploitation and local environmental issues.</li> </ol> |

|  |
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| <b>List of Essential Major Equipment</b> |
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| <b>Major Laboratory Stores/Consumables Required</b>  |
| Wash bottles, tissue, carry bags, pen, pencil, notebooks, thread, quadrat, sampling bottles, sieves, mortar, trays, buckets etc. |

|  |
|--|
| <b>Essential Software (Licensed/Open-Source) NIL</b> |
|--|

|  |
|--|
| <b>Student Activities</b>  |
| Demonstration Notes/ Observation Notebooks. Practical Records / Project Reports. |

**Suggested Readings:**

1. Cunningham W.P., Cunningham M.A., Saigo B.W., Environmental Science: A global concern, McGrawHill2003.
2. Cunningham W.P., Cunningham M.A., Principles of Environmental Science: Seventh Edition, McGrawHill 2014.
3. Roosa S.A., Sustainable Development Handbook, CRC Press 2008.
4. Atkinson G., Dietz S., Neumayer E., Agarwala M, Handbook of Sustainable Development, Edward Elger, 2014.
5. RobbinsP.,HintzJ.,MooreS.A.,EnvironmentandSociety:Acriticalintroduction,WileyBlackwel2014.

**Cos/PSOs matrix:**

| COs / PSOs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|
| COs        | X   | X   | X   |     |     | X   | X   | X   |

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**MJC45ENV102(T)25: FUNDAMENTALS OF ECOLOGY**

**Credit: 03**  
**Contact hours: 45 h**

|                                      |   |              |               |                |                  |
|--------------------------------------|---|--------------|---------------|----------------|------------------|
| Nature of the Course                 | <b>MAJOR</b>  |              |               |                |                  |
| Course Code                          | <b>MJC45ENV102(T)25</b>   |              |               |                |                  |
| Course Title                         | <b>FUNDAMENTALS OF ECOLOGY</b>                                      |              |               |                |                  |
| Course Level                         | <b>Level 100</b>  |              |               |                |                  |
| Credit Details                       | Total Credit  | Lecture/Week | Tutorial/week | Practical/Week | Total hours/Week |
|                                      | 4   | 3            |               | 1              | 5                |
| Course Audience                      | Major students enrolled in the FYUGP in Environmental Science       |              |               |                |                  |
| Proposed by (for Non-Core Course)    |   |              |               |                |                  |
| Skill Training Required (if any)     |   |              |               |                |                  |
| Pre-requisite Course required        | 10+2 in Science   |              |               |                |                  |
| Faculty Eligibility & Specialization | MSc Degree in Environmental Science with a PhD or NET qualification |              |               |                |                  |

**Course Objective (Summary):** The course introduces fundamental concepts of ecology, covering ecological organization, ecosystem structure, energy flow, succession, population and community dynamics, and species interactions. It emphasizes practical skills through field-based measurements, population and community assessment, and analysis of ecological relationships, fostering the ability to understand, evaluate, and apply ecological principles for environmental study and management.

**Course Learning Outcomes:**

|   |   |
|---|---|
| 1 | Understand the fundamental concepts and scope of ecology.   |
| 2 | Demonstrate an understanding of ecosystem structure, the pathways of energy flow through food chains and food webs and ecological succession. |
| 3 | Knowledge of the characteristics, dynamics, and growth models of populations.   |
| 4 | Proper understanding of the structural attributes of communities and the nature of species interactions.                                      |
| 5 | Apply field methods to study abiotic and biotic components.   |

**Detailed Syllabus Content:**

| Unit | Unit Name                        | Detailed Syllabus  | CH |
|------|----------------------------------|--|----|
| I    | Introduction to Ecology          | Definition, scope, and significance of ecology; Relationship between organisms and their environment; Levels of ecological organization: individual, population, community, ecosystem, biome, and biosphere; Habitat and niche concepts          | 12 |
| II   | Ecosystem Structure and Function | Structure and components of ecosystems (biotic and abiotic); Types of ecosystems: terrestrial and aquatic; Energy flow in ecosystems – food chains, food webs, and ecological pyramids. Ecological succession – types, stages, and examples      | 11 |
| III  | Population Ecology               | Definition and scope of population ecology; Population characteristics: size, density, dispersion, age structure, sex ratio; Population growth patterns: exponential and logistic growth; Population interactions; Concept of carrying capacity. | 11 |
| IV   | Community Ecology                | Definition and scope of community ecology; Community structure; Ecological niche; Ecotone and edge effect; Species interactions within communities: mutualism, commensalism, competition, predation, parasitism; Community dynamics.             | 11 |

**PRACTICAL**

**MJC45ENV102(P)25: FUNDAMENTALS OF ECOLOGY**

**Credit: 01**  
**Contact hours: 30 h**

| <b>Experiments</b>  |
|---|
| 1. Study of the basic field and laboratory ecological tools- quadrat, soil thermometer, hygrometer, lux meter, Secchi disc etc.<br>2. Study of Abiotic Factors- Measurement of temperature and light intensity.<br>3. Measurement of water parameters - pH and transparency using the Secchi disc.<br>4. Determination of soil temperature and soil moisture in a selected habitat.<br>5. Determination of the minimum size of a quadrat.<br>6. Estimation of frequency, density and abundance of a grassland/pond ecosystem. |

| <b>List of Essential Major Equipment</b>  |
|---|
| Quadrats, hygrometer, lux meter, Secchi disc, pH meter, Hot air oven, Thermometer, Soil thermometer, Digital balance. |

| <b>Major Laboratory Stores/Consumables Required</b>   |
|---|
| Distilled water for sample preparation, pH buffers for calibration, Labels, marker pens, masking tape (for sample identification), Weighing machines for the measurements. Laboratory supplies include beakers, measuring cylinders, distilled water, and containers for sample collection. |

| <b>Essential Software (Licensed/Open-Source) NIL</b> |
|--|
|  |

| <b>Student Activities</b>   |
|---|
| Students will collect soil, water, and vegetation samples using quadrats; analyze vegetation through frequency, density, and abundance; measure soil and water parameters; Observation Notebooks & Practical Records. |

**Suggested Readings:**

1. Saha, T.K. 2013. Ecology and Environmental Biology. Books & Allied (P) Ltd. Kolkata.
2. Sharma, P.D. 2015. Ecology and Environment (13<sup>th</sup> Revised Edition). Rastogi Publication, Meerut.
3. Verma, P.S. 2008. Environmental Biology. (Principles of Ecology). S. Chand and Company Ltd., New Delhi.
4. Kormondy, E.J. 2009. Concepts of Ecology (4<sup>th</sup> Edition). PHI Learning Private Limited, New Delhi.
5. Singh, J.S., Singh, S.P. & Gupta, S.R. 2010. Ecology, Environment and Resource Conservation. Anamaya Publishers, New Delhi.
6. Ambasht, R.S. and Ambasht, N.K. 2006. A Text Book of Plant Ecology. CBS Publishers and Distributors.
7. Verma, P.S. 2008. Environmental Biology. (Principles of Ecology). S. Chand and Company Ltd., New Delhi.
8. Gupta, P.K. 2011. Methods in Environmental Analysis: Water, Soil, Air (2<sup>nd</sup> Edition) Vatsal Enterprises, New Delhi.
9. Michael, P. 1984. Ecological Methods for Field and Laboratory Investigations. Tata McGraw Hill, New Delhi.
10. Trivedi, R.K., Goel, P.K., and Trisal, C.L. 1987. Practical Methods in Ecology and Environmental Science. Enviro Media Publication, Karad (India).

**Cos/PSOs matrix:**

| COs / PSOs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|
| <b>COs</b> | X   | X   | X   |     |     | X   | X   | X   |

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**MJC50ENV203(T)25: PHYSICAL ENVIRONMENT**

**Credit: 03**  
**Contact hours: 45 h**

|                                      |   |              |               |                |                  |
|--------------------------------------|---|--------------|---------------|----------------|------------------|
| Nature of the Course                 | <b>MAJOR</b>  |              |               |                |                  |
| Course Code                          | <b>MJC50ENV203(T)25</b>   |              |               |                |                  |
| Course Title                         | <b>PHYSICAL ENVIRONMENT</b>   |              |               |                |                  |
| Course Level                         | <b>Level 200</b>  |              |               |                |                  |
| Credit Details                       | Total Credit  | Lecture/Week | Tutorial/week | Practical/Week | Total hours/Week |
|                                      | 4   | 3            |               | 1              | 5                |
| Course Audience                      | Major students enrolled in the FYUGP in Environmental Science       |              |               |                |                  |
| Proposed by (for Non-Core Course)    |   |              |               |                |                  |
| Skill Training Required (if any)     |   |              |               |                |                  |
| Pre-requisite Course required        | 10+2 in Science   |              |               |                |                  |
| Faculty Eligibility & Specialization | MSc Degree in Environmental Science with a PhD or NET qualification |              |               |                |                  |

**Course Objective (Summary):** The course aims to highlight the basic concepts of Physical Environment and its components to beginners. It will introduce the concepts of physical environment and their significance in environmental science. The course seeks to help students to understand the basic knowledge of physical environmental components like the lithosphere, hydrosphere, and atmosphere and its role in overall environmental process.

**Course Learning Outcomes:**

|   |  |
|---|--|
| 1 | The student will learn the overall concepts of physical environment including various theories that explain the possible process of origin and evolution of the Earth                                  |
| 2 | They will learn about the lithosphere, rocks and minerals and soil formation concepts  |
| 3 | Students will learn about the earth heat budget, water budget and atmospheric equilibrium concept  |
| 4 | Students will learn about global general circulation atmospheric processes such as atmospheric science and climatology   |
| 5 | In the practical classes, they will learn about the geological maps, identification of common rocks and minerals and their properties, determination and analysis of various meteorological parameters |

**Detailed Syllabus Content:**

| Unit | Unit Name           | Detailed Syllabus  | CH |
|------|---------------------|--|----|
| I    | Origin of earth     | Origin and evolution of the earth; Plate tectonics; Weathering of rocks - physical, chemical and biological; Mass-wasting; Erosion, Transportation and deposition of earth's materials by running water, wind and glaciers; Development of landforms; Earthquakes, Volcanoes and Tsunamis.                                   | 11 |
| II   | Lithosphere         | Rocks and Minerals- types and formation of rocks; Minerals- formation and classification; Soil - formation, composition, and classification; soil profile; Water budget of the earth atmospheric system, Glaciers- physical and chemical aspects, mass balance.  | 11 |
| III  | Atmosphere          | Atmosphere-origin, composition and structure; insolation and heat budget; temperature and pressure distribution, humidity and wind; Atmospheric Equilibrium-stability, instability, temperature lapse rate and inversion; Scales in meteorology; Nucleation of water vapour and condensation, structure and types of clouds. | 11 |
| IV   | General Circulation | General circulation air pressure and wind systems; Atmospheric disturbances-cyclones, anticyclones and tropical disturbances; ENSO, El-Nino, La-Nina; Elements of weather systems and Climate; Climatic Classifications-types and distribution; Air masses and fronts; Monsoons-origin and distribution.                     | 12 |

**PRACTICAL**

**MJC50ENV203(P)25: PHYSICAL ENVIRONMENT**

**Credit: 01**  
**Contact hours: 30 h**

| <b>Experiments</b>  |
|---|
| 1. Determination of meteorological parameters-Atmospheric pressure, Relative Humidity, wind speed, wind direction.<br>2. Analysis of meteorological data (Rainfall, Runoff, Evaporation, Evapotranspiration).<br>3. Determination of Rainfall using rain gauges for measuring station rainfall.<br>4. Estimation of mass curve and hyetograph analysis using time series data;<br>5. Measurement of Insolation and light intensity (Lux meter).<br>6. Basic identification of soil types, their textural classification and soil profiles<br>7. Basic identification of common Rocks and Minerals and their properties. |

| <b>List of Essential Major Equipment</b>  |
|---|
| Thermometer, Barometer, Psychrometer, Lux meter, Rain gauges, Anemometers, Wind vane, Mohr’s scale, Soil siever, Soil Auger, Geological hammer. |

| <b>Major Laboratory Stores/Consumables Required</b> |
|---|
|   |

| <b>Essential Software (Licensed/Open-Source) NIL</b> |
|--|
|  |

| <b>Student Activities</b>   |
|---|
| Visit to different local locations for measurement of local meteorological parameters, Collection and identification of different types of soil, rocks, and minerals, writing their Observation in notebooks & maintenance of practical Records book. |

**Suggested Readings:**

1. Byers, H.R. (1974). *General Meteorology.*, McGraw-Hill
2. Lal, D.S. (2011). *Climatology.* Sharda Pustak Bhawan
3. Pal Arya, S(1988). *Introduction to Micrometeorology.* Academic Press
4. Keller, E. A. (2012). *Introduction to environmental geology.* Prentice Hall
5. Hamblin (2003) (8th Ed.). *Earths Dynamic Systems.* Prentice Hall
6. Valdiya, K.S. (1987). *Environmental Geology.* Tata McGraw-Hill
7. Wallace J.M. & Hobbs, P.V. (1977). *Atmospheric Science – An Introductory Survey.* Academic Press
8. Tarbuck, E.J., et. al. (2014). *Earth: An introduction to Physical Geology* (11th Ed.). Pearson

**Cos/PSOs matrix:**

| <b>COs / PSOs</b> | <b>PO1</b> | <b>PO2</b> | <b>PO3</b> | <b>PO4</b> | <b>PO5</b> | <b>PO6</b> | <b>PO7</b> | <b>PO8</b> |
|-------------------|------------|------------|------------|------------|------------|------------|------------|------------|
| <b>COs</b>        | X          | X          | X          |            |            | X          |            | X          |

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**MJC50ENV204(T)25: BIOLOGICAL ENVIRONMENT**

**Credit: 03**  
**Contact hours: 45 h**

|   |  |              |               |                |                   |
|---|--|--------------|---------------|----------------|-------------------|
| Nature of Course                                | <b>MAJOR</b>   |              |               |                |                   |
| Course Code                                     | <b>MJC50ENV204(T)25</b>  |              |               |                |                   |
| Course Title                                    | <b>BIOLOGICAL ENVIRONMENT</b>                                      |              |               |                |                   |
| Course Level                                    | <b>Level 200</b>   |              |               |                |                   |
| Credit Details                                  | Total Credit   | Lecture/Week | Tutorial/Week | Practical/Week | Total Hours/ Week |
|   | 4  | 3            |               | 1              | 5                 |
| Course Audience                                 | Major students enrolled in the FYUGP in Environmental Science      |              |               |                |                   |
| Proposed by (for Non Core courses)              |  |              |               |                |                   |
| Pre Requisites (if any)                         |  |              |               |                |                   |
| Skill Training Required (if any)                |  |              |               |                |                   |
| Pre-Requisite Course Required (if any)          | 10+2 in Science  |              |               |                |                   |
| Faculty Eligibility and Specialization (if any) | MSc. Degree in Environmental Science with PhD or NET qualification |              |               |                |                   |

**Course Objective (Summary):** The course will introduce the concepts associated with biosphere, its components and various cycles. It will help in understanding the basic nature of life and its complexity. The portions will deal with the study of behaviors of plants and animals and their adaptations.

**Course Learning Outcomes:**

|   |  |
|---|--|
| 1 | Understand the biosphere and biotic community.                             |
| 2 | Study the physiology of plants and animals, and relation with environment. |
| 3 | Understand the climatic factors, stress and physiology.                    |

**Detailed Syllabus Content:**

| Unit | Unit Name                          | Detailed Syllabus   | CH |
|------|------------------------------------|---|----|
| I    | Biosphere                          | Definition, origin, components, resources, cycles, and changes with the present environmental modifications.  | 11 |
| II   | Understanding Bio complexity       | Problems faced by living organisms residing at different habitats and their way of interactions with the environment; India's common flora and fauna; Strategies adopted by plants, animals, fungi, bacteria and archaea to adjust with their habitats.   | 11 |
| III  | Animal behaviour and physiology    | Understanding how animals behave and adapt to external environments; Environmental change that favours or disfavours behaviours and physiologies of animals.  | 11 |
| IV   | Plant physiology and ecophysiology | Key concepts on how plants capture energy and transform it in the ecosystems. Productivity of plants in the field (ecophysiology); their influence on water, carbon, nutrient and energy cycles; comparative ecophysiology of plants in contrasting environments; ecophysiology of global forest. | 12 |

**PRACTICAL**

**MJC50ENV204(P)25: BIOLOGICAL ENVIRONMENT**

**Credit: 01**  
**Contact hours: 30 h**

|  |
|--|
| <b>Experiments</b>   |
| <ol style="list-style-type: none"> <li>1. Physiology of plant, animal and microorganisms.</li> <li>2. Species identification, biological imaging and photography.</li> <li>3. Measuring growth parameters – plants and animals.</li> <li>4. Influence of acid rain on ecosystem - plants, microbes and aquatic ecosystem.</li> <li>5. Field visits: Reporting relationships within plants and animals in the ecosystem.</li> </ol> |

|  |
|--|
| <b>List of Essential Major Equipment</b> |
| Microscope, Digital camera.              |

|   |
|---|
| <b>Major Laboratory Stores/Consumables Required</b>   |
| Wash bottles, tissue, carry bags, pen, pencil, notebooks, sampling bottles, beakers, test tubes, slides, covers, etc. |

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| <b>Essential Software (Licensed/Open-Source) NIL</b> |
|--|

|  |
|--|
| <b>Student Activities</b>  |
| Demonstration Notes/ Observation Notebooks. Practical Records / Project Reports. |

**Suggested Readings:**

1. Saradhi P.P., Biophysical processes in living systems, Oxford & IBH Publishing, 2008.
2. Ladd P. C., (Ed.) Comparative Animal Physiology, fourth edition, Wiley Liss, New York, 1991.
3. Calver M., et al (Eds) , Environmental Biology, Cambridge University Press.
4. Bhatia A. L., Text book of Environmental Biology, I K International Publishing House (March 27, 2010).

**Cos/PSOs matrix:**

| COs / PSOs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|
| COs        | X   | X   | X   |     | X   | X   |     | X   |

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**MJC50ENV205(T)25: ENVIRONMENTAL CHEMISTRY**

**Credit: 03**  
**Contact hours: 45 h**

|                                      |   |              |               |                |                  |
|--------------------------------------|---|--------------|---------------|----------------|------------------|
| Nature of the Course                 | <b>MAJOR</b>  |              |               |                |                  |
| Course Code                          | <b>MJC50ENV205(T)25</b>   |              |               |                |                  |
| Course Title                         | <b>ENVIRONMENTAL CHEMISTRY</b>                                      |              |               |                |                  |
| Course Level                         | <b>Level 200</b>  |              |               |                |                  |
| Credit Details                       | Total Credit  | Lecture/Week | Tutorial/week | Practical/Week | Total hours/Week |
|                                      | 4   | 3            |               | 1              | 5                |
| Course Audience                      | Major students enrolled in the FYUGP in Environmental Science       |              |               |                |                  |
| Proposed by (for Non-Core Course)    |   |              |               |                |                  |
| Skill Training Required (if any)     |   |              |               |                |                  |
| Pre-requisite Course required        | 10+2 in Science   |              |               |                |                  |
| Faculty Eligibility & Specialization | MSc Degree in Environmental Science with a PhD or NET qualification |              |               |                |                  |

**Course Objective (Summary):** The course on environmental chemistry provided an overall view of the diverse chemical phenomena occurring in the environment. It aims to understand the chemical composition of the natural environment and man-made substances, pollutants, and contaminants, their sources, chemical processes, and interactions with substances, transport, fates of chemicals, and their impacts on the biotic and abiotic components of the environment. The course content highlighted a proper understanding of a safe and sustainable production, ecosystem, and living environment through scientific processes and practical applications.

**Course Learning Outcomes:**

|   |  |
|---|--|
| 1 | The students will learn about the basic chemistry of important environmental processes   |
| 2 | They will learn about the chemical process leading to the generation of air and water pollutants (from sources) in the environment, the fate of these pollutants in the environment, and their important sink. |
| 3 | They will learn about the important geo-hydro-chemical processes leading to environmental contamination and hazard   |
| 4 | Attain a proper understanding of a safe and sustainable production, ecosystem, and living environment through scientific processes   |
| 5 | The experiments conducted in the practical classes will let them learn about the various techniques used for analysing pollutants in soil, water and air.  |

**Detailed Syllabus Content:**

| Unit | Unit Name               | Detailed Syllabus  | CH |
|------|-------------------------|--|----|
| I    | Environmental Chemistry | Concept and scope; Acid-base reactions, common ion effect, buffer solutions, oxidation and reduction, chemical equilibrium; chemical speciation, concept of green chemistry.   | 12 |
| II   | Atmospheric Chemistry   | Chemical composition of the atmosphere; Photochemical reactions, Acid rain, Ozone depletion; Aerosols, Greenhouse gases; Gasoline and additives, Antiknock compounds, Lubricants, Polycyclic aromatic hydrocarbons, Polychlorinated Biphenyls. | 11 |
| III  | Water Chemistry         | Physical and chemical properties of fresh and marine water; Chemical species in water; Cleaning agents: Bleaching agents; Chemistry of colloids; chemical fertilizers.   | 11 |
| IV   | Geochemistry            | Chemical composition of earth, earth's crust, Geochemical classification of elements, Chemistry of trace elements, Rare earth elements (REE); Radioactivity-decay, radioactive dating.   | 11 |

**PRACTICAL**

**MJC50ENV205(P)25: ENVIRONMENTAL CHEMISTRY**

**Credit: 01**  
**Contact hours: 30 h**

|                    |
|--------------------|
| <b>Experiments</b> |
|--------------------|

- |   |
|---|
| <ol style="list-style-type: none"> <li>1. Estimation of physico-chemical parameters of soil (pH, EC, Moisture, Bulk density, temperature).</li> <li>2. Estimation of physico-chemical parameters of water (pH, EC, TDS, alkalinity, acidity &amp; hardness).</li> <li>3. Measurement of air pollutants – dust fall, sources of pollutants in the locality.</li> </ol> |
|---|

|  |
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| <b>List of Essential Major Equipment</b> |
|--|

|   |
|---|
| pH meter, EC/TDS meter, Hot air oven, Soil thermometer. |
|---|

|   |
|---|
| <b>Major Laboratory Stores/Consumables Required</b> |
|---|

|   |
|---|
| Key consumables include standard reagents for titration (e.g., EDTA, HCl), indicator solutions, distilled water for sample preparation, pH buffers for calibration, Mechanical grinders and sieves for sample preparation, and a variety of filters and weighing machines for measurement of dustfall. Laboratory supplies include beakers, measuring cylinders, distilled water, and containers for sample collection. |
|---|

|  |
|--|
| <b>Essential Software (Licensed/Open-Source) NIL</b> |
|--|

|                           |
|---------------------------|
| <b>Student Activities</b> |
|---------------------------|

|  |
|--|
| Visit to different local environmental settings and sampling of soil, water, and air samples; Analysis of the collected samples; Observation Notebooks & Practical Records |
|--|

**Suggested Readings:**

1. Anderson, J.M. (1991). *Environmental Science*, Arnold Publications, Delhi.
2. Baird. C. and Cann, M. (2012) *Environmental Chemistry*. W.H. Freeman & Company, New York
3. Santra, S.C. (2000). *Textbook of Environmental Science*, New Central Book Publishers.
4. De, A.K. (2001). *Environmental Chemistry*, Wiley Eastern India Ltd.
5. Manhan, S.E. (2000). *Environmental Chemistry*, Amazon publisher.

**CO-PSO mapping matrix**

| COs/PSOs | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 | PSO8 |
|----------|------|------|------|------|------|------|------|------|
| CO       | X    | X    | X    | X    |      | X    |      | X    |

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**MJC50ENV206(T)25: BIODIVERSITY AND CONSERVATION**

**Credit: 03**  
**Contact hours: 45 h**

|                                      |   |              |               |                |                  |
|--------------------------------------|---|--------------|---------------|----------------|------------------|
| Nature of the Course                 | <b>MAJOR</b>  |              |               |                |                  |
| Course Code                          | <b>MJC50ENV206(T)25</b>   |              |               |                |                  |
| Course Title                         | <b>BIODIVERSITY AND CONSERVATION</b>                                |              |               |                |                  |
| Course Level                         | <b>Level 200</b>  |              |               |                |                  |
| Credit Details                       | Total Credit  | Lecture/Week | Tutorial/week | Practical/Week | Total hours/Week |
|                                      | 4   | 3            |               | 1              | 5                |
| Course Audience                      | Major Students enrolled in the FYUGP in Environmental Science       |              |               |                |                  |
| Proposed by (for Non-Core Course)    |   |              |               |                |                  |
| Skill Training Required (if any)     |   |              |               |                |                  |
| Pre-requisite Course required        | 10+2 in Science   |              |               |                |                  |
| Faculty Eligibility & Specialization | MSc Degree in Environmental Science with a PhD or NET qualification |              |               |                |                  |

**Course Objective (Summary):** The course is aimed to highlight the concept of Biodiversity its value and importance. It focuses on various threats and need for conservation approaches. It will introduce students to know the impact given by climate change. The Course provides the students to understand the conservation strategies and help to policy formulation and legal aspects.

**Course Learning Outcomes:**

|   |  |
|---|--|
| 1 | Systematically understand biodiversity and its vital role in ecosystem functions.  |
| 2 | Appreciate the need of biodiversity conservation in the context of various developmental pathways and policy framework that the mankind has been undergoing. |
| 3 | Identify the importance of biodiversity in natural environments.   |
| 4 | Critically examine biodiversity and human linkages, and help policy formulating for conservation.  |
| 5 | Application of knowledge in general communication for public extension.  |

**Detailed Syllabus Content:**

| Unit | Unit Name                        | Detailed Syllabus   | CH |
|------|----------------------------------|---|----|
| I    | Concept of Biodiversity          | Concept and definition, Levels of organization, Dimension of biodiversity, Common flora and fauna of India, endangered and endemic species. Values of Biodiversity and ecosystem services.  | 11 |
| II   | Threats to Biodiversity          | Biodiversity threats; Conservation approaches and management: Megadiverse countries, Biodiversity hotspots. National Parks, Wildlife Sanctuary, Conservation reserves, Community Reserves, Conservation and management practices. In situ and ex situ strategy.                             | 11 |
| III  | Biodiversity and climate changes | Impacts of climate change on biodiversity, Climate change and threats to species and ecosystems, Distribution and adaptation pattern of plants and animals.   | 11 |
| IV   | Conservation of Biodiversity     | Biodiversity conservation approaches, Legal Instruments Relevant to Biological Diversity in India; Convention on Migratory Species, Convention on International Trade in Endangered Species, Ramsar Convention, World Heritage Convention. Traditional ecological knowledge, Sacred Groves. | 12 |

**PRACTICAL**

**MJC50ENV206(P)25: BIODIVERSITY AND CONSERVATION**

**Credit: 01**  
**Contact hours: 30 h**

|   |
|---|
| <b>Experiments</b>  |
| 1. Measurement of species diversity (calculation of diversity indices from data collected on plant species from the field).<br>2. Estimation of Biodiversity parameters and indices: Frequency, Density, abundance, Relative abundance.<br>3. Field study and identification of biodiversity in different habitats.<br>4. Biodiversity observation in protected area/National parks/wildlife sanctuaries. |

|  |
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| <b>List of Essential Major Equipment</b> |
|--|

|   |
|---|
| <b>Major Laboratory Stores/Consumables Required</b> |
| Quadrat, Threads, Nails, Measuring scales etc.      |

|  |
|--|
| <b>Essential Software (Licensed/Open-Source) NIL</b> |
|--|

|  |
|--|
| <b>Student Activities</b>  |
| Visit to different local environmental settings and habitats-National Parks/Wild Life Sanctuaries etc.; Observation Notebooks & Practical Records. |

**Suggested Readings:**

1. Gaston K.J. and Spicer Biodiversity – An Introduction, Blackwell Publishing, 2004.
2. Krishnamurthy K. V. Textbook of Biodiversity, CRC Press. 2003.
3. Krishnamurthy K. V. An Advanced Textbook on Biodiversity: principles and Practice, Oxford & IBH Pub. Co. Pvt. Ltd. 2008.
4. Schulze E-D., Harold M., (Eds.) Biodiversity and Ecosystem Function. Springer-Verlag, London. (1994)
5. Khan T. I., Global Biodiversity and environmental Conservation. Pointer Publisher. Jaipur. 2001.
6. Magurran A. E., Measuring Biological Diversity. Wiley-Blackwell, Pp-264. 2003.
7. Magurran A. E., and McGill B.J.(Eds.) Biological Diversity Frontiers in Measurement and Assessment. Oxford University Press(2010)

**Cos/PSOs matrix:**

| COs / PSOs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|
| COs        | X   | X   | X   |     |     | X   | X   | X   |

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**MJC50ENV207(T)25: ENVIRONMENTAL LEGISLATION AND POLICY**

**Credit: 04**  
**Contact hours: 60 h**

|   |  |              |               |                |                   |
|---|--|--------------|---------------|----------------|-------------------|
| Nature of Course                                | <b>MAJOR</b>   |              |               |                |                   |
| Course Code                                     | <b>MJC50ENV207(T)25</b>  |              |               |                |                   |
| Course Title                                    | <b>ENVIRONMENTAL LEGISLATION AND POLICY</b>                        |              |               |                |                   |
| Course Level                                    | <b>Level 200</b>   |              |               |                |                   |
| Credit Details                                  | Total Credit   | Lecture/Week | Tutorial/Week | Practical/Week | Total Hours/ Week |
|   | 4  | 4            |               |                | 4                 |
| Course Audience                                 | Major students enrolled in the FYUGP in Environmental Science      |              |               |                |                   |
| Proposed by (for Non Core courses)              |  |              |               |                |                   |
| Pre Requisites (if any)                         |  |              |               |                |                   |
| Skill Training Required (if any)                |  |              |               |                |                   |
| Pre-Requisite Course Required (if any)          | 10+2 in Science  |              |               |                |                   |
| Faculty Eligibility and Specialization (if any) | MSc. Degree in Environmental Science with PhD or NET qualification |              |               |                |                   |

**Course Objective (Summary):** The course highlights the constitutional provisions available in India for the protection of the environment, the rights and the duties. It introduces various domestic laws which are meant for environmental conservation. Further, a number of international agreements and treaties are introduced to the students that will solve various environmental issues.

**Course Learning Outcomes:**

|   |   |
|---|---|
| 1 | Understand the Indian constitutional provisions with respect to environmental protection, division of powers, and fundamental rights.       |
| 2 | Comprehensive understanding of pollution control laws (The Water Act, The Air Act and the Environment (Protection) Act of 1986), and rules. |
| 3 | Understanding of International Environmental laws (Treaties and Protocols), and Indian commitments.   |

**Detailed Syllabus Content:**

| Unit | Unit Name                        | Detailed Syllabus  | CH |
|------|----------------------------------|--|----|
| I    | Constitutional provisions        | The Constitution of India and its provisions: Article 48A; Article 51A(g); Directive Principles of State Policy; Fundamental Duties; Article 21A; The right to a Wholesome Environment; Division of power between the Centre and the States in matters of issues related to the environment. | 12 |
| II   | Forest and Wildlife laws         | The Indian Forest Act 1927; The Wildlife (Protection) Act 1972; The Forests (Conservation) Act 1980; The Biological Diversity Act 2002; The Forest Rights Act 2006.  | 12 |
| III  | Laws for pollution control       | The Water (Prevention and Control of Pollution) Act 1974; The Air (Prevention and Control of Pollution) Act 1981; The Environment (Protection) Act 1986; The Noise Pollution (Regulation and Control) Rules 2000.  | 12 |
| IV   | Laws to control waste            | The Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016; The Bio-Medical Waste Management Rules, 2016; The Solid Waste Management Rules, 2016; The Plastic Waste Management Rules, 2016.  | 12 |
| V    | International environmental laws | The Stockholm Conference 1972; Montreal protocol 1987; Basel Convention 1989; The Rio Earth Summit 1992; Kyoto Protocol 1997; The Paris Agreement 2015; UN Sustainable Development Goals 2015.   | 12 |

**Suggested Readings:**

1. Divan S. & Rosencranz A., Environmental Law and Policy in India. OUP, 2001.
2. Naseem M., Environmental Law in India Mohammad. Kluwer Law, 2011 International.
3. Sands P., Peel J., Principles of International Environmental Law, CUP 2018.
4. Abraham C.M. Environmental Jurisprudence in India. Kluwer Law International. 1999.
5. Venkat A. Environmental Law and Policy. PHI, 2011.

**Cos/PSOs matrix:**

| <b>COs / PSOs</b> | <b>PO1</b> | <b>PO2</b> | <b>PO3</b> | <b>PO4</b> | <b>PO5</b> | <b>PO6</b> | <b>PO7</b> | <b>PO8</b> |
|-------------------|------------|------------|------------|------------|------------|------------|------------|------------|
| <b>COs</b>        | X          | X          | X          |            | X          |            | X          | X          |

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**MJC50ENV208(T)25: ENERGY AND ENVIRONMENT**

**Credit: 03**  
**Contact hours: 45 h**

|                                      |   |              |               |                |                  |
|--------------------------------------|---|--------------|---------------|----------------|------------------|
| Nature of the Course                 | <b>MAJOR</b>  |              |               |                |                  |
| Course Code                          | <b>MJC50ENV208(T)25</b>   |              |               |                |                  |
| Course Title                         | <b>ENERGY AND ENVIRONMENT</b>                                       |              |               |                |                  |
| Course Level                         | <b>Level 200</b>  |              |               |                |                  |
| Credit Details                       | Total Credit  | Lecture/Week | Tutorial/week | Practical/Week | Total hours/Week |
|                                      | 4   | 3            |               | 1              | 5                |
| Course Audience                      | Major students enrolled in the FYUGP in Environmental Science       |              |               |                |                  |
| Proposed by (for Non-Core Course)    |   |              |               |                |                  |
| Skill Training Required (if any)     |   |              |               |                |                  |
| Pre-requisite Course required        | 10+2 in Science   |              |               |                |                  |
| Faculty Eligibility & Specialization | MSc Degree in Environmental Science with a PhD or NET qualification |              |               |                |                  |

**Course Objective (Summary):** The prime objectives of the course are to understand the multiple linkages between the present-day pattern of conventional energy consumption and the related environmental problems, ranging from the local to the global scale. It will help in exploring alternative and sustainable energy sources, reduce carbon footprint, improve energy efficiency, energy security, energy equity, reduce pollution, minimise health impacts on humans and the environment.

**Course Learning Outcomes:**

|   |   |
|---|---|
| 1 | The students will learn about the various energy sources and patterns of utilization.   |
| 2 | Should be able to make a distinction between conventional and renewable energy sources.   |
| 3 | They will also learn about the dependence of the present civilization on fossil fuel for energy and the pattern of energy consumption prevailing in different parts of the world. |
| 4 | Should be able to state how the consumption of fossil fuels and biomass leads to adverse impacts on health and the climate, plus become aware of the government's energy policy.  |
| 5 | The experiments conducted in the practical classes will make them learn how alternative energy can be generated from locally available materials.                                 |

**Detailed Syllabus Content:**

| Unit | Unit Name                 | Detailed Syllabus   | CH |
|------|---------------------------|---|----|
| I    | Energy Resources          | Sources of energy and their classification; Energy forms and transformation; Sun as a source of energy, Global energy balance, Renewable and non-renewable energy; Energy and environment; Energy use patterns.                             | 12 |
| II   | Fossil and biomass energy | Environmental problems associated with energy use; Biomass energy; Biomass conversion processes; Energy plantation; Energy from municipal solid waste and agricultural wastes; Improved Chula; Prospects and constraints of biomass energy. | 11 |
| III  | Nuclear energy            | Nuclear fission and fusion, Nuclear reactors; Mining and processing of Uranium, radioactive wastes and environmental implications; Solar Energy: Solar thermal application; Solar photovoltaic system.                                      | 11 |
| IV   | Other Alternative energy  | Wind energy; Hydroelectric power, Environmental impacts due to hydropower generation, Magneto-hydrodynamics power; Geothermal energy; Tidal and wave energy; Ocean thermal energy conversion.   | 11 |

**PRACTICAL**

**MJC50ENV208(P)25: ENERGY AND ENVIRONMENT**

**Credit: 01**  
**Contact hours: 30 h**

|  |
|--|
| <b>Experiments</b>   |
| <ol style="list-style-type: none"> <li>1. Evaluation of the biomethanation potential of locally available biowastes.</li> <li>2. Estimation of the energy consumption potential in households, institutions, and industries.</li> <li>3. Case studies on energy consumption patterns in rural and urban areas.</li> <li>4. Survey on the health impacts of energy consumption.</li> <li>5. Plotting of the major renewable energy potential/plants in India – hydropower, geothermal, wind, tidal energy.</li> </ol> |

|  |
|--|
| <b>List of Essential Major Equipment</b>     |
| Water bath and anaerobic digestion chambers. |

|  |
|--|
| <b>Major Laboratory Stores/Consumables Required</b>  |
| Locally available biowaste feedstocks ( <i>e.g.</i> , agricultural waste, municipal organic waste, animal dung), anaerobic digestion chambers, and burettes for use in the measurement of gas generation through the saline water displacement method. Questionnaire for survey of estimation of the energy consumption potential in households, institutions, and industries, and Case studies on energy consumption patterns in rural and urban areas. Map of India for plotting renewable energy potential. |

|  |
|--|
| <b>Essential Software (Licensed/Open-Source) NIL</b> |
|--|

|   |
|---|
| <b>Student Activities</b>   |
| Visit to institutions and industries; Questionnaire survey of households; Observation Notebooks & Practical Records . |

**Suggested Readings:**

1. Fowler, J. M. (1984). Energy and Environment, McGraw-Hill. USA.
2. Dunderdale J., (1990) Energy and Environment (Royal Society of Chemistry).
3. Chaturvedi, P. (1995). Bio-Energy Resources: Planning, Production and Utilization, Concept Pub.
4. Agarwal, S. K. (2003). Nuclear Energy-Principles, practice and prospects, APH Publishing Corporation
5. Devins D. W., (1982) Energy and its Physical Impact on Environment (John Wiley & Sons).

**CO-PSO mapping matrix**

| COs/PSOs | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 | PSO8 |
|----------|------|------|------|------|------|------|------|------|
| CO       | X    | X    | X    |      | X    | X    | X    | X    |

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**MJC55ENV309(T)25: AIR AND NOISE POLLUTION**

**Credit: 03**  
**Contact hours: 45 h**

|                                      |   |              |               |                |                  |
|--------------------------------------|---|--------------|---------------|----------------|------------------|
| Nature of the Course                 | <b>MAJOR</b>  |              |               |                |                  |
| Course Code                          | <b>MJC55ENV309(T)25</b>   |              |               |                |                  |
| Course Title                         | <b>AIR AND NOISE POLLUTION</b>                                      |              |               |                |                  |
| Course Level                         | <b>Level 300</b>  |              |               |                |                  |
| Credit Details                       | Total Credit  | Lecture/Week | Tutorial/week | Practical/Week | Total hours/Week |
|                                      | 4   | 3            |               | 1              | 5                |
| Course Audience                      | Major students enrolled in the FYUGP in Environmental Science       |              |               |                |                  |
| Proposed by (for Non-Core Course)    |   |              |               |                |                  |
| Skill Training Required (if any)     |   |              |               |                |                  |
| Pre-requisite Course required        | 10+2 in Science   |              |               |                |                  |
| Faculty Eligibility & Specialization | MSc Degree in Environmental Science with a PhD or NET qualification |              |               |                |                  |

**Course Objective (Summary):** The course aims to highlight the sources, extent, and health and environmental impacts of air and noise pollution. The course intends to provide an understanding of the contributing factors of air and noise pollution, characterizing, analyzing, quantifying, and evaluating health and environmental effects, thereby formulating effective strategies to control, abate, and mitigate the pollution, plus promote awareness of the harmful effects.

**Course Learning Outcomes:**

|   |  |
|---|--|
| 1 | The students will learn about the sources of pollutants, both natural and anthropogenic, and their impact on the biota and environment.                    |
| 2 | Learn about the global environmental changes linked with air pollution, such as ozone layer depletion, acid rain, global warming, etc.                     |
| 3 | Come to understand how meteorological parameters moderate and aggravate problems of air pollution.   |
| 4 | Learn about the sources, medium, propagation, health impacts, and mitigation measures of noise pollution.  |
| 5 | The experiments conducted in the practical classes will make them familiar with the various emerging techniques used in analysing air and noise pollution. |

**Detailed Syllabus Content:**

| Unit | Unit Name                               | Detailed Syllabus   | CH |
|------|---|---|----|
| I    | Air pollution                           | Atmosphere-origin, composition and structure; Air pollution, sources; Particulate matter; Gaseous pollutants, PAH, Odour pollution.   | 11 |
| II   | Impact of air pollution                 | Impact on local and global scale; Acid rain; Global warming, Ozone layer depletion, Sinks of atmospheric gases; Fly ash; Indoor air pollution; Health effects, Air sampling and monitoring, control devices; Air quality standards. | 12 |
| III  | Meteorological aspects and Case studies | Air pollution dispersion, temperature lapse rate and inversion; stack plumes, Gaussian Plume model; Fugitive emissions; Bhopal Gas Tragedy, London Smog, Donora Smog. Air pollution from industries and thermal power plants.       | 11 |
| IV   | Noise Pollution                         | Basic properties of sound waves; Sources, noise exposure levels; Noise standards; Noise Indices, Noise sampling methods; Human health effects; Noise Zones; Noise control and abatement measures.                                   | 11 |

**PRACTICAL**  
**MJC55ENV309(P)25: AIR AND NOISE POLLUTION**

**Credit: 01**  
**Contact hours: 30 h**

| <b>Experiments</b>  |
|---|
| 1. Measurement of Particulates and gaseous pollutants(Sox and NOx) using a high-volume air sampler..<br>2. Measurement of meteorological parameters – Relative humidity, rainfall, Maximum-minimum temperature of a day, wind speed.<br>3. Measurement of indoor and outdoor noises using noise level meters.<br>4. Noise zonation and mapping. |

| <b>List of Essential Major Equipment</b>  |
|---|
| High volume air sampler, Noise level meters, Psychrometer, Rain gauge, thermometer, Lux meter, Wind vane. |

| <b>Major Laboratory Stores/Consumables Required</b>   |
|---|
| Air sampling consumables such as absorption media for gaseous pollutants; high-volume air samplers, filters for particulate matter; sound level meters and calibrators for noise pollution; and equipment for temperature, humidity, wind speed/direction, and solar radiation measurement. |

| <b>Essential Software (Licensed/Open-Source) NIL</b> |
|--|
| NIL  |

| <b>Student Activities</b>                  |
|--|
| Observation Notebooks & Practical Records. |

**Suggested Readings:**

1. Trivedi R.K. (2003) An Introduction to Air Pollution, DVS Publication.
2. Arya, S.P. (1999) Air Pollution Meteorology and Dispersion, Oxford University Press.
3. Bell, J.N.B. (2002) Air Pollution and Plant Life (2nd edition), John Wiley and Sons.
4. ISO (1978). Guidelines of micro meteorological technique in air pollution studies.
5. Lodge, J.P. Jr. (edt). (1989) Methods of Air Sampling and Analysis, Lewis Publishers.
6. Bhatia, S.C. (2023) Textbook of Noise Pollution and Its Control. Atlantic Publishers and Distributors (P) Ltd.

**CO-PSO mapping matrix**

| COs/PSOs | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 | PSO8 |
|----------|------|------|------|------|------|------|------|------|
| CO       | x    | x    | x    |      |      | x    | x    | x    |

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**MJC55ENV310(T)25: SOIL AND WATER POLLUTION**

**Credit: 03**  
**Contact hours: 45 h**

|                                      |   |              |               |                |                  |
|--------------------------------------|---|--------------|---------------|----------------|------------------|
| Nature of the Course                 | <b>MAJOR</b>  |              |               |                |                  |
| Course Code                          | <b>MJC55ENV310(T)25</b>   |              |               |                |                  |
| Course Title                         | <b>SOIL AND WATER POLLUTION</b>                                     |              |               |                |                  |
| Course Level                         | <b>Level 300</b>  |              |               |                |                  |
| Credit Details                       | Total Credit  | Lecture/Week | Tutorial/week | Practical/Week | Total hours/Week |
|                                      | 4   | 3            |               | 1              | 5                |
| Course Audience                      | Major students enrolled in the FYUGP in Environmental Science       |              |               |                |                  |
| Proposed by (for Non-Core Course)    |   |              |               |                |                  |
| Skill Training Required (if any)     |   |              |               |                |                  |
| Pre-requisite Course required        | 10+2 in Science   |              |               |                |                  |
| Faculty Eligibility & Specialization | MSc Degree in Environmental Science with a PhD or NET qualification |              |               |                |                  |

**Course Objective (Summary):** The course is aimed to highlight the basic concepts of soil and water properties and its components to the beginners. It will introduce the concepts of soil pollution and water pollution causes and impacts in the environment. The course seeks the students to understand the basic knowledge of soil and water pollution and their mitigation measures.

**Course Learning Outcomes:**

|   |   |
|---|---|
| 1 | The students will learn about the basic concept of soil physical, chemical and biological properties of soil and the causes, and impacts of soil pollutions   |
| 2 | The students will learn about concept causes and impacts of physical, chemical and biological pollution of water  |
| 3 | The students will learn about concept of water quality parameters, standards, indicators and indices  |
| 4 | From the practical component they will learn soil and water sampling techniques, estimation of soil and water quality parameters using volumetric, turbidimetric, potentiometric and photometric estimation |

**Detailed Syllabus Content:**

| Unit | Unit Name       | Detailed Syllabus  | CH |
|------|-----------------|--|----|
| I    | Basic of Soil   | Soil composition; Soil forming rocks and minerals, Factors of soil formation; Soil forming processes- Profile development; Soil physical, Chemical and Biological properties and their significance; Soil sampling and monitoring.   | 11 |
| II   | Soil Pollution  | Soil Pollution: Sources and causes; Impacts of Soil pollution from chemical residues on soil pesticides, fertilizers, heavy metals, Industrial effluents, Sewage; Soil salinity and alkalinity, and radionuclide; soil erosion and land degradation;                                     | 11 |
| III  | Basic of Water  | Physicochemical properties of fresh and marine water, Major water quality (physico-chemical and bacteriological) parameters and their applications; Water quality objectives and water uses; Contaminant behaviour in water environment; Water quality standards, indicators and indices | 11 |
| IV   | Water Pollution | Water pollution– Concepts and types; Physical, chemical and biological contamination of water; Major contaminant groups and natural pathways in water (heavy metals, trace elements, radionuclide water chemistry); Eutrophication, surface and groundwater pollution; Marine pollution  | 12 |

**PRACTICAL**

**MJC55ENV310(P)25: SOIL AND WATER POLLUTION**

**Credit: 01**  
**Contact hours: 30 h**

| <b>Experiments</b>   |
|--|
| 1. Basic methods of soil and water sampling.<br>2. Determination of basic soil physical parameters (Soil moisture, Soil texture, soil composition, bulk density, porosity, WHC, Particle size of soil by hydrometer method etc.)<br>3. Determination of Soil pH, EC, CEC. pH, EC, Temperature, soil respiration and soil microbes.<br>4. Determination of soil basic chemical parameters (Organic Carbon, Nitrogen, Phosphorus, Potassium)<br>5. Determination of Basic Water Physical parameters (Colour, Temperature, Suspended Solids, etc.)<br>6. Determination of basic chemical parameters (pH, TDS, DO, Hardness, Alkalinity, Salinity, Acidity, BOD, COD). |

| <b>List of Essential Major Equipment</b>  |
|---|
| pH meter, EC meter, TDS meter, Salinity meter, Flame Photometer, BOD incubator, Soil Siever, Hydrometer, Soil Auger, Laboratory Hot air oven, Hot plate, Soil Shaker. |

| <b>Major Laboratory Stores/Consumables Required</b>  |
|--|
| Basic consumables include standard reagents for titration (e.g., EDTA, HCl), indicator solutions, distilled water for sample preparation, pH buffers for calibration. Laboratory supplies include beakers, measuring cylinders, distilled water, and containers for sample collection. |

| <b>Essential Software (Licensed/Open-Source) NIL</b> |
|--|
|  |

| <b>Student Activities</b>  |
|--|
| Visit to institutions and industries; Different Soil and Water Pollution Sites for sampling and making observations, and recording them in notebooks & maintaining the practical records |

**Suggested Readings:**

1. Anderson, J.M. (1991) *Environmental science*, Arnold Publications, Delhi.
2. Summer, M.E. (2000) *Handbook of soil sciences*. CRC Press LLC, Florida, USA.
3. Moran, Wiersma (1993) *Environmental science, managing biological and physical resources*. W.M.C. Brown Publishers, Oxford, England
4. Manhan, S.E. (2000) *Environmental chemistry*, Amazon publisher.
5. Buckman & Brady, (1984) *The nature and properties of soil*. Nataraj Publication, Dehra Dun
6. Negi, S.S. (1985) *Soil conservation*, Nataraj Publication, Dehradun
7. Droste, R.L. (2005) *Theory & practice of water and wastewater treatment*, John Willey Sons Publication.
8. Peavy, H.S., Tchobanoglous, G. and Rowe's D.R (2000) *Environmental engineering*, Tata McGraw-Hill Publication.

**CO-PSO mapping matrix**

| <b>COs/PSOs</b> | <b>PSO1</b> | <b>PSO2</b> | <b>PSO3</b> | <b>PSO4</b> | <b>PSO5</b> | <b>PSO6</b> | <b>PSO7</b> | <b>PSO8</b> |
|-----------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| <b>CO</b>       | X           | X           | X           |             |             | X           | X           | X           |

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**MJC55ENV311(T)25: SOLIDWASTE MANAGEMENT**

**Credit: 03**  
**Contact hours: 45 h**

|                                      |   |              |               |                |                  |
|--------------------------------------|---|--------------|---------------|----------------|------------------|
| Nature of the Course                 | <b>MAJOR</b>  |              |               |                |                  |
| Course Code                          | <b>MJC55ENV311(T)25</b>   |              |               |                |                  |
| Course Title                         | <b>SOLID WASTE MANAGEMENT</b>                                       |              |               |                |                  |
| Course Level                         | <b>Level 300</b>  |              |               |                |                  |
| Credit Details                       | Total Credit  | Lecture/Week | Tutorial/week | Practical/Week | Total hours/Week |
|                                      | 4   | 3            |               | 1              | 5                |
| Course Audience                      | Major students enrolled in the FYUGP in Environmental Science       |              |               |                |                  |
| Proposed by (for Non-Core Course)    |   |              |               |                |                  |
| Skill Training Required (if any)     |   |              |               |                |                  |
| Pre-requisite Course required        | 10+2 in Science   |              |               |                |                  |
| Faculty Eligibility & Specialization | MSc Degree in Environmental Science with a PhD or NET qualification |              |               |                |                  |

**Course Objective (Summary):** The prime objective of the course is to impart knowledge on the types and sources of solid wastes produced in the rural and urban areas, their generation pattern, pollution, and health and environmental impacts due to improper management. The students will learn about the linkages between human behaviour and consumerism, and the quantity and quality of waste generated. The goal is to introduce them to the concept of circular economy, principles of Rs, resource conservation, and proper treatment and disposal strategies to achieve a sustainable and healthy environment.

**Course Learning Outcomes:**

|   |   |
|---|---|
| 1 | Students could understand the concept of solid waste and its different types, and how it affects the environment.   |
| 2 | Understand the concept of recycling; municipal waste management handling rules.   |
| 3 | They will also learn about hazardous and Biomedical waste, E-waste, and their treatment and disposal guidelines.  |
| 4 | Students could also learn about the physico-chemical, biological, mechanical, and thermo-chemical treatment methods of solid waste.   |
| 5 | The practical component of this paper can explain to the students the composition of solid waste and also acquaint them with the composting technologies – aerobic, anaerobic, and vermicomposting. |

**Detailed Syllabus Content:**

| Unit | Unit Name             | Detailed Syllabus  | CH |
|------|-----------------------|--|----|
| I    | Solid wastes          | Concept of waste management; Waste sources, types, characterization, Waste Management and 4R principle; Municipal Solid Waste management.  | 11 |
| II   | Hazardous wastes      | Definition, sources, categorization, treatment, disposal guidelines; Biomedical wastes; Hazardous waste landfills; Management of leachate and landfill gas; E-wastes and their management. | 11 |
| III  | Environmental impacts | Contaminants arising from improper waste management, human health effects, ecosystem damage, air quality, water quality, and soil quality.   | 11 |
| IV   | Wastes treatment      | Physico-chemical and biological methods; Mechanical and Thermo-chemical methods - pyrolysis, gasification, and incineration; Refuse-derived fuel.  | 12 |

**PRACTICAL**

**MJC55ENV311(P)25: SOLIDWASTE MANAGEMENT**

**Credit: 01**  
**Contact hours: 30 h**

|  |
|--|
| <b>Experiments</b>   |
| <ol style="list-style-type: none"> <li>1. Characterization of Municipal Solid Waste, bulk density, etc.</li> <li>2. Determination of the generation pattern of household waste, institutional e-waste, and bio-medical waste.</li> <li>3. Field visit to solid-waste management sites.</li> <li>4. Survey of persons involved in waste management – rag pickers, <i>safaikarmacharis</i>.</li> </ol> |

|   |
|---|
| <b>List of Essential Major Equipment</b>  |
| Weighing machine, instruments to measure nutrient content in the compost – spectrophotometer, EC, pH meter. |

|  |
|--|
| <b>Major Laboratory Stores/Consumables Required</b>  |
| Essential consumables for managing the composting process include gloves as well as basic safety gear like masks and hand sanitizer. Key consumables include standard reagents for nutrient content analysis of the compost. |

|  |
|--|
| <b>Essential Software (Licensed/Open-Source) NIL</b> |
|--|

|  |
|--|
| <b>Student Activities</b>                  |
| Observation Notebooks & Practical Records. |

**Suggested Readings:**

1. White P.R. et al, (1989) *Integrated Solid Waste Management*, Lewis Publisher
2. David L.H.F. and Liptak D.G. (2000) *Hazardous waste and solid waste*, Lewis Publisher,2000.
3. Tchobanoglous, G. and Kreith, F. (2002). *Handbook of Solid Waste Management*. McGraw-Hill.
4. Hester, R.E. & Harrison, R.M. (2002). *Environmental and Health Impact of Solid Waste Management Activities*. Royal Society of Chemistry.
5. Ministry of Urban Development, (2000). *Manual on Municipal Solid Waste Management*. CPHEEO, Ministry of Urban Development, GoI, New Delhi.

**CO-PSO mapping matrix**

| COs/PSOs | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 | PSO8 |
|----------|------|------|------|------|------|------|------|------|
| CO       | X    | X    |      |      | X    | X    | X    | X    |

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**MJC55ENV312(T)25: NATURAL HAZARDS AND DISASTER MANAGEMENT**

**Credit: 03**  
**Contact hours: 45 h**

|                                      |   |              |               |                |                  |
|--------------------------------------|---|--------------|---------------|----------------|------------------|
| Nature of the Course                 | <b>MAJOR</b>  |              |               |                |                  |
| Course Code                          | <b>MJC55ENV312(T)25</b>   |              |               |                |                  |
| Course Title                         | <b>NATURAL HAZARDS AND DISASTER MANAGEMENT</b>                      |              |               |                |                  |
| Course Level                         | <b>Level 300</b>  |              |               |                |                  |
| Credit Details                       | Total Credit  | Lecture/Week | Tutorial/week | Practical/Week | Total hours/Week |
|                                      | 4   | 3            |               | 1              | 5                |
| Course Audience                      | Major students enrolled in the FYUGP in Environmental Science       |              |               |                |                  |
| Proposed by (for Non-Core Course)    |   |              |               |                |                  |
| Skill Training Required (if any)     |   |              |               |                |                  |
| Pre-requisite Course required        | 10+2 in Science   |              |               |                |                  |
| Faculty Eligibility & Specialization | MSc Degree in Environmental Science with a PhD or NET qualification |              |               |                |                  |

**Course Objective (Summary):** This course will help students understand different natural and human-made hazards, their causes, impacts, and management. It introduces disaster management concepts, tools, and strategies, including preparedness, mitigation, and community participation. Students will learn real-world case studies and practical approaches to reduce risks, protect communities, and promote sustainable, disaster-resilient development.

**Course Learning Outcomes:**

|   |  |
|---|--|
| 1 | The students will be able to identify different types of natural and human-made hazards and understand their causes and effects. |
| 2 | Students will understand disaster management concepts, cycles, and key terms like risk, vulnerability, and capacity.             |
| 3 | Students will be better equipped to suggest preparedness and mitigation strategies for various hazards.                          |
| 4 | Basic knowledge of tools like GIS and remote sensing to understand and plan for disasters.                                       |
| 5 | Students can analyze real-life disaster case studies and apply lessons learned to promote safer, sustainable communities.        |

**Detailed Syllabus Content:**

| Unit | Unit Name                                       | Detailed Syllabus  | CH |
|------|---|--|----|
| I    | Natural Hazards                                 | Natural hazards: hydrological, atmospheric & geological hazards; earthquake, seismic waves, epicenter; volcanoes; flood; landslides, drought, cyclone & hurricanes; tsunamis: coastal erosion, sea level changes and its impact on coastal areas and coastal zone management.  | 11 |
| II   | Anthropogenic Hazards                           | Impacts of anthropogenic activities such as urbanization, deforestation, mangrove destruction; large-scale developmental projects like dams and nuclear reactors; nature and impact of wildfires and biophysical hazards; Case studies of Bhopal gas tragedy, Minamata, and Chernobyl disasters.   | 11 |
| III  | Fundamentals of Disaster Management             | Definition, concepts, and types of disasters; Disaster management cycle; Risk, hazard, vulnerability, and capacity assessment; Institutional frameworks for disaster management in India (NDMA, SDMA, DDMA); GIS, and remote sensing in disaster planning and response.  | 12 |
| IV   | Disaster Preparedness and Mitigation Strategies | Early warning systems and communication in disaster management; Community-based disaster preparedness and capacity building; Structural and non-structural mitigation measures; Case studies of major disasters in India and lessons learned; Integration of disaster management with sustainable development and climate change adaptation. | 11 |

**PRACTICAL**

**MJC55ENV312(P)25: NATURAL HAZARDS AND DISASTER MANAGEMENT**

**Credit: 01  
Contact hours: 30 h**

| <b>Experiments</b>   |
|--|
| 1. Plotting of earthquake-prone areas on an outline map of India.<br>2. Plotting of flood-prone areas on an outline map of India.<br>3. To study the distribution of major wind patterns on the world map.<br>4. To study the impacts of wildfires/landslides prone areas in NE India.<br>5. Detailed field report on a recent disaster (natural or anthropogenic), covering causes, impacts, response, and lessons learned. |

| <b>List of Essential Major Equipment</b>   |
|--|
| GPS device / Mobile GPS apps (for location marking); Camera/Smartphone (for photographic documentation); Measuring tape (for small-scale measurements in field, e.g., landslide scar width); Binoculars (for observing inaccessible slopes/forest areas); Laptop/desktop with internet access (for secondary data collection, satellite images, official reports); Printer & scanner (for report maps, figures, photographs); Voice recorder / mobile recorder (for interviews with local people during field survey). |

| <b>Major Laboratory Stores/Consumables Required</b>   |
|---|
| For Map Plotting (Earthquake, Flood, Wind Patterns, Wildfire/Landslide zones); Outline maps (India & World – political/physical base maps, preferably A4 size); Atlas/Geographical reference maps; Tracing sheets & graph paper; Coloured pencils/markers (for hazard zone marking); Map templates with latitude/longitude grids. |

|  |
|--|
| <b>Essential Software (Licensed/Open-Source) NIL</b> |
|--|

| <b>Student Activities</b>  |
|--|
| Students will plot earthquake, flood, and wind patterns on maps, and identify wildfire- and landslide-prone areas. They will conduct field observations using GPS, photography, and interviews, documenting causes, impacts, and responses. Finally, they will prepare a concise disaster report highlighting key findings, management strategies, and lessons for future resilience; Observation Notebooks & Practical Records. |

**Suggested Readings:**

1. Pine, J.C. 2009. *Natural Hazards Analysis: Reducing the Impact of Disasters*. CRC Press, Taylor and Francis Group.
2. Schneid, T.D. & Collins, L. 2001. *Disaster Management and Preparedness*. Lewis Publishers, New York, NY.
3. Smith, K. 2001. *Environmental Hazards: Assessing Risk and Reducing Disaster*. Routledge Press.
4. Coppola, D.P. 2007. *Introduction to International Disaster Management*. Butterworth Heinemann.
5. Cutter, S.L. 2012. *Hazards Vulnerability and Environmental Justice*. EarthScan, Routledge Press.
6. Keller, E.A. 1996. *Introduction to Environmental Geology*. Prentice Hall, Upper Saddle River, New Jersey.
7. Wallace, J.M. & Hobbs, P.V. 1977. *Atmospheric Science: An Introductory Survey*. Academic Press, New York.

**CO-PSO mapping matrix**

| COs/PSOs | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 | PSO8 |
|----------|------|------|------|------|------|------|------|------|
| CO       | X    | X    | X    |      | X    | X    | X    | X    |

\*\*\*

**MJC55ENV313(T)25: WILDLIFE CONSERVATION AND MANAGEMENT**

**Credit: 03**  
**Contact hours: 45 h**

|   |  |              |               |                |                   |
|---|--|--------------|---------------|----------------|-------------------|
| Nature of Course                                | <b>MAJOR</b>   |              |               |                |                   |
| Course Code                                     | <b>MJC55ENV313(T)25</b>  |              |               |                |                   |
| Course Title                                    | <b>WILDLIFE CONSERVATION AND MANAGEMENT</b>                        |              |               |                |                   |
| Course Level                                    | <b>Level 300</b>   |              |               |                |                   |
| Credit Details                                  | Total Credit   | Lecture/Week | Tutorial/Week | Practical/Week | Total Hours/ Week |
|   | 4  | 3            |               | 1              | 5                 |
| Course Audience                                 | Major students enrolled in the FYUGP in Environmental Science      |              |               |                |                   |
| Proposed by (for Non Core courses)              |  |              |               |                |                   |
| Pre Requisites (if any)                         |  |              |               |                |                   |
| Skill Training Required (if any)                |  |              |               |                |                   |
| Pre-Requisite Course Required (if any)          | 10+2 in Science  |              |               |                |                   |
| Faculty Eligibility and Specialization (if any) | MSc. Degree in Environmental Science with PhD or NET qualification |              |               |                |                   |

**Course Objective (Summary):** The course introduces the concepts of wildlife, the threats to wildlife and the issues associated with wildlife conservation and management in the country. The paper highlights the need for wildlife education to conserve the remaining populations of wild organisms thriving in the jungles of India.

**Course Learning Outcomes:**

|   |  |
|---|--|
| 1 | Articulate the fundamental concepts in wildlife conservation and management.   |
| 2 | Apply understanding of cultural, historical, and current perspectives on the human-wildlife relationship to effectively address wildlife issues. |
| 3 | Understand the current threats to wildlife.  |
| 4 | Be capable of assessing status of wildlife.  |

**Detailed Syllabus Content:**

| Unit | Unit Name                              | Detailed Syllabus   | CH |
|------|--|---|----|
| I    | Wildlife                               | Definition of wildlife (instrumental, intrinsic, ecocentric, religious, conservational); Indian wildlife; keystone species; endemism; extinction; IUCN threatened categories.   | 11 |
| II   | Threats to wildlife                    | Habitat destruction, poaching, habitat fragmentation, exotic species and invasives, illegal wildlife trade, pollution; island biogeography; endemic and endangered species and vulnerability to extinction.   | 11 |
| III  | Human wildlife conflict                | Definition, causal factors; some examples - Elephant-man conflict; Rhino-man conflict; River dolphin-man conflict; Tiger-man conflict; Leopard-man conflict; Conflict management and shifting from extraction to preservation; Response system.   | 11 |
| IV   | Current issue in wildlife conservation | Protected Areas Networks (PAN) in India; legal instruments; biodiversity within and outside protected areas; community based conservation; climate change and wildlife movement; ecological services of wildlife; ecotourism and wildlife; habitat fragmentation and wildlife corridors; sustainability in wildlife management: collaborative partnership for sustainable wildlife management; education and awareness-raising. | 12 |

**PRACTICAL**

**MJC55ENV313(P)25: WILDLIFE CONSERVATION AND MANAGEMENT**

**Credit: 01**  
**Contact hours: 30 h**

| <b>Experiments</b>  |
|---|
| 1. Orientation to field biology and natural history.<br>2. Observations and collection of study material, wildlife signs and evidences.<br>3. Exercise on wildlife population parameters and census methods for various species.<br>4. Estimation of frequency, density, abundance of species.<br>5. Field tour designed to examine wildlife conservation issues in a variety of ecological situations in a bio-geographic zone of India. |

| <b>List of Essential Major Equipment</b> |
|--|
|  |

| <b>Major Laboratory Stores/Consumables Required</b>  |
|--|
| Wash bottles, tissue, carry bags, pen, pencil, notebooks, thread, quadrat, sampling bottles etc. |

| <b>Essential Software (Licensed/Open-Source) NIL</b> |
|--|
|  |

| <b>Student Activities</b>  |
|--|
| Demonstration Notes/ Observation Notebooks. Practical Records / Project Reports. |

**Suggested Readings:**

1. Saha, G.K., and Majumdar, S. Wildlife Biology: An Indian Perspective, Prentice Hall of India.2017.
2. Rangaraj, M. India’s Wildlife History: An Introduction, Oxford Press,2006.
3. Rangaraj, M. and Sivaramakrishna, K. Shifting Ground: People, Animals and Mobility in India's Environmental History, Oxford Press,2014.
4. Bindra, P.S. The Vanishing: India’s Wildlife Crisis, Penguin Books.2017.
5. Sinha, S. Handbook on Wildlife Law Enforcement in India, WWF Press.2011.

**CO-PSO mapping matrix**

| <b>COs/PSOs</b> | <b>PSO1</b> | <b>PSO2</b> | <b>PSO3</b> | <b>PSO4</b> | <b>PSO5</b> | <b>PSO6</b> | <b>PSO7</b> | <b>PSO8</b> |
|-----------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| <b>CO</b>       | X           | X           | X           |             |             | X           | X           | X           |

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**MJC55ENV314(T)25: INTRODUCTION TO CLIMATE CHANGE**

**Credit: 03**  
**Contact hours: 45 h**

|                                      |   |              |               |                |                  |
|--------------------------------------|---|--------------|---------------|----------------|------------------|
| Nature of the Course                 | <b>MAJOR</b>  |              |               |                |                  |
| Course Code                          | <b>MJC55ENV314(T)25</b>   |              |               |                |                  |
| Course Title                         | <b>INTRODUCTION TO CLIMATE CHANGE</b>                               |              |               |                |                  |
| Course Level                         | <b>Level 300</b>  |              |               |                |                  |
| Credit Details                       | Total Credit  | Lecture/Week | Tutorial/week | Practical/Week | Total hours/Week |
|                                      | 4   | 3            |               | 1              | 5                |
| Course Audience                      | Major students enrolled in the FYUGP in Environmental Science       |              |               |                |                  |
| Proposed by (for Non-Core Course)    |   |              |               |                |                  |
| Skill Training Required (if any)     |   |              |               |                |                  |
| Pre-requisite Course required        | 10+2 in Science   |              |               |                |                  |
| Faculty Eligibility & Specialization | MSc Degree in Environmental Science with a PhD or NET qualification |              |               |                |                  |

**Course Objective (Summary):** The course aims to equip learners with a comprehensive understanding of the natural and anthropogenic factors driving the present climate change, identify evidence, recognize the social, economic, and environmental consequences, and educate on the mitigation strategies. The course also focuses on human behavioural change, developing skills, mitigation technologies, adaptation strategies, climate change assessment tools, plus relevant policies promoting a sustainable future.

**Course Learning Outcomes:**

|   |   |
|---|---|
| 1 | The students will learn about the causal factors of global warming and climate change.  |
| 2 | Understand how the climate of the Earth has changed in geological history.  |
| 3 | Learn about various impacts of climate change on organisms, humans, and the ecosystem, plus the adaptation and mitigation technologies.   |
| 4 | Learn about the policy response and mitigation strategies adopted at the national and international levels.   |
| 5 | The practicum component will give the students basic ideas about how to collect atmospheric data and link the information to understand and resolve the problems of climate change. |

**Detailed Syllabus Content:**

| Unit | Unit Name                 | Detailed Syllabus  | CH |
|------|---------------------------|--|----|
| I    | General introductory      | Weather and climate; Climate change, Natural and human-induced climate change. Global warming; Earth’s climatic history; Milankovitch Cycle.   | 11 |
| II   | Impacts and vulnerability | Impact of climate change on organisms, ecosystems, agriculture, and food security; Sea level rise; Coral bleaching; Extinction risk of temperature-sensitive species; Melting of snow, ice, and glaciers; Extreme weather events; Climate change vulnerability.  | 11 |
| III  | Mitigation and adaptation | Climate Change mitigation strategies; Carbon capture and storage; Climate change adaptation and resilience; Carbon credit, Carbon trading, carbon sequestration, CDM; Clean energy options; CFCs – uses and trends; Reducing Carbon footprint; Net-zero emissions; Ecological based adaptation mechanisms. | 12 |
| IV   | Policy and governance     | Policy response and mitigation strategies; Climate Change Conventions, UNFCCC, Kyoto Protocol, Implementation of the Paris Agreement; International Climate Change Negotiations.   | 11 |

**PRACTICUM**

**MJC55ENV314(P)25: INTRODUCTION TO CLIMATE CHANGE**

**Credit: 01**  
**Contact hours: 30 h**

|  |
|--|
| <b>Experiments</b>   |
| <ol style="list-style-type: none"> <li>1. Fieldwork and on-site survey, data collection, and analysis of areas affected by extreme weather events and climate change.</li> <li>2. Visit the meteorological stations; Collection of meteorological data and their analysis.</li> <li>3. Research projects, or internships with organizations working on climate solutions.</li> </ol> |

|  |
|--|
| <b>List of Essential Major Equipment</b> |
| Computer.                                |

|   |
|---|
| <b>Major Laboratory Stores/Consumables Required</b> |
|---|

|  |
|--|
| <b>Essential Software (Licensed/Open-Source) NIL</b> |
|--|

|   |
|---|
| <b>Student Activities</b>                                       |
| Observation Notebooks & Compilation of Research project report. |

**Suggested Readings:**

1. Archer, D. (2007). *Global Warming: Understanding the Forecast*. Blackwell Publication.
2. Bahadur (2004). *Himalayan Snow and Glaciers*, Concept Pub.
3. Dash, S. K. (2007). *Climate change: An Indian Perspective*. CEE, Ahmedabad.
4. Lal, D.S. (2004). *Climatology*, Chaitanya Publishing House, Allahabad.
5. Pal Arya, S. (1988). *Introduction to Micrometeorology*, Academic Press.
6. Thomas E.L., and Hannah L.J. (2006). *Climate change and Biodiversity*. Yale University Press.

**CO-PSO mapping matrix**

| COs/PSOs  | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 | PSO8 |
|-----------|------|------|------|------|------|------|------|------|
| <b>CO</b> | X    | X    |      |      | X    | X    | X    | X    |

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**MJC55ENV315(T)25: ENVIRONMENTAL POLLUTION AND HUMAN HEALTH**

**Credit: 03**  
**Contact hours: 45 h**

|   |  |              |               |                |                   |
|---|--|--------------|---------------|----------------|-------------------|
| Nature of Course                                | <b>MAJOR</b>   |              |               |                |                   |
| Course Code                                     | <b>MJC55ENV315(T)25</b>  |              |               |                |                   |
| Course Title                                    | <b>ENVIRONMENTAL POLLUTION AND HUMAN HEALTH</b>                    |              |               |                |                   |
| Course Level                                    | <b>Level 300</b>   |              |               |                |                   |
| Credit Details                                  | Total Credit   | Lecture/Week | Tutorial/Week | Practical/Week | Total Hours/ Week |
|   | 4  | 3            |               | 1              | 5                 |
| Course Audience                                 | Major students enrolled in the FYUGP in Environmental Science      |              |               |                |                   |
| Proposed by (for Non Core courses)              |  |              |               |                |                   |
| Pre Requisites (if any)                         |  |              |               |                |                   |
| Skill Training Required (if any)                |  |              |               |                |                   |
| Pre-Requisite Course Required (if any)          | 10+2 in Science  |              |               |                |                   |
| Faculty Eligibility and Specialization (if any) | MSc. Degree in Environmental Science with PhD or NET qualification |              |               |                |                   |

**Course Objective (Summary):** The course is aimed to highlight the basic concepts of environmental health. The paper covers the diseases caused by air, water, noise and soil pollution. It also highlights the occupational diseases associated with the normal day to day jobs in the human population.

**Course Learning Outcomes:**

|   |   |
|---|---|
| 1 | Knowledge on the types and the science of environmental health. |
| 2 | Understand the effect of pollution on human health.             |
| 3 | Ability to develop pollution mitigation/abatement strategies.   |

**Detailed Syllabus Content:**

| Unit | Unit Name                | Detailed Syllabus   | CH |
|------|--------------------------|---|----|
| I    | Environmental health     | Definition, basics principle of environmental health; Ecotoxicology & Epidemiology; toxicants; degradable and non-degradable toxic substances; major classes of environmental pollutants.   | 11 |
| II   | Air and Noise pollution  | Air pollution - history of air pollution episodes, effects on human health, air pollution source apportionment, regulation, and mitigation; Noise pollution - noise effects on human health, effects on child development, effects on pregnancy, control of noise pollution and regulation. | 12 |
| III  | Soil and Water pollution | Soil pollution – impact on human health, land management practices; Water pollution - sources of water pollutants, sanitation and drinking water, various waterborne diseases, wastewater treatment.  | 11 |
| IV   | Occupational health      | Occupational health – definition, occupational health hazards; human health impacts of the hazards; occupational diseases – silicosis, asbestosis, pesticide poisoning; occupational health and safety administration.  | 11 |

**PRACTICAL**

**MJC55ENV315(P)25: ENVIRONMENTAL POLLUTION AND HUMAN HEALTH**

**Credit: 01**

**Contact hours: 30 h**

| <b>Experiments</b>  |
|---|
| 1. Analyses of biochemical responses in living organisms to contaminants.<br>2. Determination of fate of toxicants in living organisms or environment.<br>3. Potable water quality assessment.<br>4. Understanding and comparing noise levels of localities.<br>5. Visit to a local polluted site urban/Rural/Industrial/Agricultural, sampling, analysis and reporting.<br>6. Visit to industry having air-pollution control measures and reporting.<br>7. Bioindicators of water, soil and air pollution. |

| <b>List of Essential Major Equipment</b>   |
|--|
| Spectrophotometer, pH meter, EC meter, Flame photometer, Turbidity meter, Sound Level Meter (SLM) etc. |

| <b>Major Laboratory Stores/Consumables Required</b>   |
|---|
| Wash bottles, tissue, carry bags, pen, pencil, notebooks, sampling bottles, sieves, mortar, trays, buckets etc. |

| <b>Essential Software (Licensed/Open-Source) NIL</b> |
|--|
| NIL  |

| <b>Student Activities</b>  |
|--|
| Demonstration Notes/ Observation Notebooks. Practical Records / Project Reports. |

**Suggested Readings:**

1. Shaw I.C. and Chadwick J., Principles of Environmental Toxicology, Taylor& Francis,2008.  
Elaine M.A. and Bugyi G.(Eds.), Impact of Water Pollution on Human Health and Environmental
2. Sustainability, Information ScienceRef.
3. Gurjar B. R., Molina L.T., Ojha C.S.P. (Eds.), Air Pollution: Health and Environmental Impacts, CRCPress.
4. Manahan S.E., Environmental Chemistry, Lewis,1994.
5. De A. K., Environmental Chemistry, Wiley Eastern Limited,2000.

**CO-PSO mapping matrix**

| COs/PSOs | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 | PSO8 |
|----------|------|------|------|------|------|------|------|------|
| CO       | X    | X    | X    |      |      | X    | X    | X    |

\*\*\*

**MJC60ENV416(T)25: ENVIRONMENTAL IMPACT ASSESSMENT**

**Credit: 03**  
**Contact hours: 45 h**

|                                      |   |              |               |                |                  |
|--------------------------------------|---|--------------|---------------|----------------|------------------|
| Nature of the Course                 | <b>MAJOR</b>  |              |               |                |                  |
| Course Code                          | <b>MJC60ENV416(T)25</b>   |              |               |                |                  |
| Course Title                         | <b>ENVIRONMENTAL IMPACT ASSESSMENT</b>                              |              |               |                |                  |
| Course Level                         | <b>Level 400</b>  |              |               |                |                  |
| Credit Details                       | Total Credit  | Lecture/Week | Tutorial/week | Practical/Week | Total hours/Week |
|                                      | 4   | 3            |               | 1              | 5                |
| Course Audience                      | Minor Students enrolled in the FYUGP in Environmental Science       |              |               |                |                  |
| Proposed by (for Non-Core Course)    |   |              |               |                |                  |
| Skill Training Required (if any)     |   |              |               |                |                  |
| Pre-requisite Course required        | 10+2 in Science   |              |               |                |                  |
| Faculty Eligibility & Specialization | MSc Degree in Environmental Science with a PhD or NET qualification |              |               |                |                  |

**Course Objective (Summary):** The course is aimed to highlight the basic concepts of Environment Impact Assessment (EIA), their history and development to the beginners in the field. It will introduce the concepts of environmental impacts assessment, various issues and EIA guidelines for the developmental projects, planning, programmes and guidelines. The Course seeks the students to understand the basic about preparation of EIA for Environmental Clearance (EC) and public participations processes.

**Course Learning Outcomes:**

|   |  |
|---|--|
| 1 | The students will learn about the history and development concept of EIA in the world and India.   |
| 2 | Students will learn about fundamental approaches, guidelines and regulations on EIA in India and various types of EIA case studies on developmental projects, programs, plans and guidelines |
| 3 | Students will learn about the types of developmental activities and associated impacts and mitigation measures.  |
| 4 | Students will learn about the conceptual framework for EIA, public participation process and various methodologies for different environment component.                                      |
| 5 | The students will learn about role of various stakeholders in EIA, Preparation of EIA report and Environment Clearance procedure.  |

**Detailed Syllabus Content:**

| Unit | Unit Name            | Detailed Syllabus  | CH |
|------|----------------------|--|----|
| I    | Basic concept of EIA | Environmental impact assessment (EIA): definitions, introduction, concepts, needs and scope of EIA; rationale and historical development of EIA; Components of EIA; EIA of developmental projects and process of Environmental Clearance, EIA Guidelines in India and world.   | 11 |
| II   | Components of EIA    | The EIA methodologies; role of project proponents, project developers and consultants; Terms of Reference; Impact Identification and Prediction; Baseline data collection; Public Participation (PP) in EIA, Environmental Impact Statement (EIS).   | 11 |
| III  | EIA Methodologies    | Environmental Impacts, their significance, Framework for Prediction and Assessment of Air, Surface Water, Groundwater and Soil, Noise, Biological, Socio-economically and Cultural Environment; Standards and guidelines; Prediction and determination of impact-Risk Prediction and Assessment and mitigation measures for environmental impacts. | 11 |
| IV   | SIA and LCA          | Strategic EIA; Social Impact Assessment (SIA); Cost-Benefit analysis; Life cycle assessment; Public participation (PP) in Environmental decision making; Evaluation of alternatives and Trade-off Analysis; Decision making and Environmental Clearance; Environmental Management Plan (EMP).  | 12 |

**PRACTICAL**

**MJC60ENV416(P)25: ENVIRONMENTAL IMPACT ASSESSMENT**

**Credit: 01**  
**Contact hours: 30 h**

| <b>Experiments</b>   |
|--|
| <ol style="list-style-type: none"> <li>1. Prediction and Assessments of Air Quality of Developmental Project sites or locations.</li> <li>2. Prediction and Assessments of Water Quality for any Developmental Projects.</li> <li>3. Prediction and Assessments Noise Environment of Developmental Projects/Traffic noise/Commercial/residential noise</li> <li>4. Assessment and prediction of the biological environment for any developmental project and report preparation</li> <li>5. Assessment of Socio-economic and Cultural Environment of any Developmental projects using questionnaire methods</li> <li>6. EIA Case studies of Power Plants, Industries, Transportation, and Communication projects, Mining and Explorations, Infrastructure development projects, etc.)</li> <li>7. Case Studies of EIA and Environmental Clearance (EC) in India and Report Preparation.</li> </ol> |

| <b>List of Essential Major Equipment</b>   |
|--|
| pH meter, EC/TDS meter, Salinity meter, Hot air oven, Soil thermometer, Flame Photometer, UV-Spectrophotometer, BOD incubator, Soil Siever, Hydrometer, Soil Auger, Laboratory Hot air oven, Hot plate, Soil Shaker, Sound Level Meter (SLM), GPS, Anemometer, Wind vane, Psychrometer, etc. |

| <b>Major Laboratory Stores/Consumables Required</b>   |
|---|
| Key consumables include standard reagents for titration (e.g., EDTA, HCl), indicator solutions, distilled water for sample preparation, pH buffers for calibration, Mechanical grinders and sieves for sample preparation, and a variety of filters and weighing machines for measurement of dust fall. Laboratory supplies include beakers, measuring cylinders, distilled water, a Conical flask, a burette, a pipette, and containers for sample collection. |

| <b>Essential Software (Licensed/Open-Source)</b>                                     |
|--|
| GIS software (Q-GIS, ArcGIS, ERDAS etc.) and Computing software (MS Excel, SPSS etc) |

| <b>Student Activities</b>   |
|---|
| Visit to different developmental project sites, study the local environmental settings, soil, air, water sampling in in-situ condition, sampling and sample collection, questionnaire data collection, analysis of the collected samples, observation and maintenance of practical records. |

**Suggested Readings:**

1. Anjaneyulu, Y. and Manickam, W. (2010) *Environmental Impact Assessment Methodologies*, BSP Books Pvt, Ltd., Hyderabad.
2. Canter, L. (1996) *Environmental Impact Assessment*, McGraw-Hill, New Delhi.
3. Eccleston, C. H., (2011) *Environmental Impact Assessment*, CRC Press, New York
4. Glasson, J., Therival, R., Chadwick, A. (1994) *Introduction to Environmental Impact Assessment- Principles and Procedures, Process, Practice and Prospects*, Research Press, New Delhi.
5. Glasson, T. and Chadwick (1999) *An Introduction to Environmental Impact Assessment*, UCLCA, Los Angeles.
6. Lawrence, D.P. (2003) *Environmental Impact Assessment: Practical, Solutions to Recurrent Problems*, John Wiley and Sons, New Delhi.
7. Morris P. and Therivel, R. (2001) *Methods of Environmental Impact Assessment*, 2nd edition, Spon Press, New York.
8. Srivastava, A. K. (2003) *Environmental impact assessment*, APH publishing Corporation.

**CO-PSO mapping matrix**

| <b>COs/PSOs</b> | <b>PSO1</b> | <b>PSO2</b> | <b>PSO3</b> | <b>PSO4</b> | <b>PSO5</b> | <b>PSO6</b> | <b>PSO7</b> | <b>PSO8</b> |
|-----------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| <b>CO</b>       | X           | X           | X           | X           | X           | X           | X           | X           |

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**MJC60ENV417(T)25: ENVIRONMENTAL BIOTECHNOLOGY**

**Credit: 03**  
**Contact hours: 45 h**

|   |  |              |               |                |                   |
|---|--|--------------|---------------|----------------|-------------------|
| Nature of Course                                | <b>MAJOR</b>   |              |               |                |                   |
| Course Code                                     | <b>MJC60ENV417(T)25</b>  |              |               |                |                   |
| Course Title                                    | <b>ENVIRONMENTAL BIOTECHNOLOGY</b>                                 |              |               |                |                   |
| Course Level                                    | <b>Level 400</b>   |              |               |                |                   |
| Credit Details                                  | Total Credit   | Lecture/Week | Tutorial/Week | Practical/Week | Total Hours/ Week |
|   | 4  | 3            |               | 1              | 5                 |
| Course Audience                                 | Major students enrolled in the FYUGP in Environmental Science      |              |               |                |                   |
| Proposed by (for Non Core courses)              |  |              |               |                |                   |
| Pre Requisites (if any)                         |  |              |               |                |                   |
| Skill Training Required (if any)                |  |              |               |                |                   |
| Pre-Requisite Course Required (if any)          | 10+2 in Science  |              |               |                |                   |
| Faculty Eligibility and Specialization (if any) | MSc. Degree in Environmental Science with PhD or NET qualification |              |               |                |                   |

**Course Objective (Summary):** The course highlights the application of biotechnology for pollution control. It covers the concepts of molecular genetics and rDNA technology. It deals with various remediation mechanisms that treat pollution using living organisms in nature.

**Course Learning Outcomes:**

|   |   |
|---|---|
| 1 | Knowledge on the scope of biotechnology.  |
| 2 | Ability to apply molecular biological techniques in pollution management and industrial applications. |
| 3 | Knowledge of advanced biotechnological applications, and biosafety in analytical procedures.          |

**Detailed Syllabus Content:**

| Unit | Unit Name                   | Detailed Syllabus  | CH |
|------|-----------------------------|--|----|
| I    | Environmental Biotechnology | Environmental Biotechnology: definition, scope and history; Biotechnology – definition, scope and applications.  | 11 |
| II   | Molecular Genetics          | Pioneer experiments leading to the development of molecular genetics, Structure of nucleic acids: Concepts of gene; Gene expression - DNA replication: Transcription of DNA, protein synthesis.  | 12 |
| III  | GMOs                        | Genetic Engineering or rDNA technology - definition, scope, significance and history; steps involved in the production of GMOs, advantages and disadvantages; issues and controversies; biosafety. GM crops in India.                    | 11 |
| IV   | Bioremediation              | Bioremediation - Need, scope, constraints and advantages, types of bioremediation; Biotechnological application of microbes and plants in pollution abatement; Degradation of xenobiotics in environment; Heavy metals bio-accumulation. | 11 |

**PRACTICAL**

**MJC60ENV417(P)25: ENVIRONMENTAL BIOTECHNOLOGY**

**Credit: 01**  
**Contact hours: 30 h**

| <b>Experiments</b>   |
|--|
| 1. Preparation of different culture media, sterilization of media, pour plate techniques, solid media in test tubes.<br>2. Microbial culture, inoculation techniques, streaking and spreading.<br>3. Microbial cell counting by serial dilution technique and pour plate technique.<br>4. Identification of microorganisms through biochemical tests (bacteria/fungi/virus).<br>5. Bioremediation of polluted water and soil using microorganisms and plants.<br>6. Experiments on composting and vermicomposting. |

| <b>List of Essential Major Equipment</b>   |
|--|
| Microscope, Autoclave, laminar air flow, BOD incubator, Growth chamber, Spectrophotometer, Flame photometer etc. |

| <b>Major Laboratory Stores/Consumables Required</b>   |
|---|
| Wash bottles, tissue, carry bags, pen, pencil, notebooks, sampling bottles, sieves, trays, buckets etc. |

| <b>Essential Software (Licensed/Open-Source) NIL</b> |
|--|
|  |

| <b>Student Activities</b>  |
|--|
| Demonstration Notes/ Observation Notebooks. Practical Records / Project Reports. |

**Suggested Readings:**

1. Jördening, H.J. and Winter, J. eds., Environmental biotechnology: concepts and applications. John Wiley & Sons, 2005.
2. Elliott, W.H., Elliott, D.C. and Jefferson, J.R., Biochemistry and molecular biology (Vol. 2001, p. 586). Oxford: Oxford University Press, 1997.
3. Wang, L.K., Ivanov, V., Tay, J.H. and Hung, Y.T. eds., Environmental biotechnology (Vol. 10). Springer Science & Business Media, 2010.
4. Rittmann, B.E. and McCarty, P.L., Environmental biotechnology: principles and applications. Tata McGraw-Hill Education, 2012.
5. Lehninger, A.L., Nelson, D.L., Cox, M.M., Lehninger principles of biochemistry. Macmillan, 2005.

**Cos/PSOs matrix:**

| COs / PSOs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|
| COs        | X   | X   | X   | X   |     | X   |     | X   |

\*\*\*

**MJC60ENV418(T)25: RESEARCH METHODOLOGY**

**Credit: 03**  
**Contact hours: 45 h**

|                                      |   |              |               |                |                  |
|--------------------------------------|---|--------------|---------------|----------------|------------------|
| Nature of the Course                 | <b>MAJOR</b>  |              |               |                |                  |
| Course Code                          | <b>MJC60ENV418(T)25</b>   |              |               |                |                  |
| Course Title                         | <b>RESEARCH METHODOLOGY</b>   |              |               |                |                  |
| Course Level                         | <b>Level 400</b>  |              |               |                |                  |
| Credit Details                       | Total Credit  | Lecture/Week | Tutorial/week | Practical/Week | Total hours/Week |
|                                      | 4   | 3            |               | 1              | 5                |
| Course Audience                      | Major students enrolled in the FYUGP in Environmental Science       |              |               |                |                  |
| Proposed by (for Non-Core Course)    |   |              |               |                |                  |
| Skill Training Required (if any)     |   |              |               |                |                  |
| Pre-requisite Course required        | 10+2 in Science   |              |               |                |                  |
| Faculty Eligibility & Specialization | MSc Degree in Environmental Science with a PhD or NET qualification |              |               |                |                  |

**Course Objective (Summary):** The course is aimed to highlight the basic concepts of Environmental Research. Student are expected to learn the basic components sample, population, sample design and sampling methods for qualitative and quantitative research. It will introduce the concepts of environmental research using various issues in the of environments, hypothesis testing and drawing inferences of environmental data.

**Course Learning Outcomes:**

|   |  |
|---|--|
| 1 | Students will learn the fundamentals of environmental research and their scope and uses  |
| 2 | Students will learn basic concepts of statistical methods and their significance in environmental data analysis for both qualitative and quantitative research |
| 3 | Students will learn basic concepts of data collection, presentation and interpretation of environmental data using statistical and computing software          |
| 4 | Students will learn the fundamental concepts of computer applications for various environmental research   |
| 5 | Concept parametric and non-parametric test of significance test and their application  |

**Detailed Syllabus Content:**

| Unit | Unit Name              | Detailed Syllabus   | CH |
|------|------------------------|---|----|
| I    | Environmental Research | Basic Concepts and fundamentals of research and research design; Environmental data – types, methods, collection and classification; tabulation and presentation of data; scope of qualitative and quantitative research; communication of research findings; Research ethics | 11 |
| II   | Sample design          | Population and Sample, Sample design- techniques; Measure of central values; Measure of dispersion; Correlation & Regression; Time series analysis- Components, measurement of trend and models.  | 11 |
| III  | Hypothesis testing     | Basics of concepts of probability-Probability distribution functions; Fitting of probability distributions; Sampling distribution and test of significance; Concept of Null hypothesis and uses; Parametric and non-parametric test; Standard error and its uses              | 11 |
| IV   | Test of Significance   | Test of significance of small and large samples ( <i>t</i> - test, F-test, $\chi^2$ -test etc.) and their applications; Analysis of Variance (ANOVA)- types, basic assumptions, and their applications  | 12 |

**PRACTICAL**

**MJC60ENV418(P)25: RESEARCH METHODOLOGY**

**Credit: 01**  
**Contact hours: 30 h**

| <b>Experiments</b>   |
|--|
| 1. Computer fundamentals and application software; Concept & working knowledge of Spreadsheet, excel, and other computing Software;  |
| 2. Practical on methods of collection, data presentation & Interpretation of Environmental data using computing software             |
| 3. Calculation of environmental data using measures of central values, measures of dispersion, Correlation, and Regression analysis. |
| 4. Calculation and estimation or trend analysis of time series data (rainfall, temperature, humidity etc),                           |
| 5. Calculation of and estimation of trends for Parametric test using <i>t-test</i> , F-test, ANOVA one-way and two-way               |
| 6. Calculation of and estimation of non-parametric tests such as $\chi^2$ -test, MW test.  |

| <b>List of Essential Major Equipment</b> |
|--|
| Computer.                                |

| <b>Major Laboratory Stores/Consumables Required</b> |
|---|
|   |

| <b>Essential Software (Licensed/Open-Source)</b>                    |
|---|
| MS -Excel, Licensed software such as SPSS, Statistica, Origin, etc. |

| <b>Student Activities</b>  |
|--|
| Data collection, data arrangement, data analysis using manual calculation and computing software, data interpretation, and maintenance of Practical Records. |

**Suggested Readings:**

1. Aho, A.V. and Ullman, J.D. (1992). *Foundation of Computer Science*, W.H. Freeman.
2. Aslam Mahmood (1976). *Statistical Methods in Geographical Studies*, Rajesh Publications, N. Delhi
3. Gupta. S.C. (1995). *Statistical Methods*, S. Chand & Co.
4. Gupta. S.C. and Kapoor V. K. (1995). *Fundamentals of Mathematical Statistics*, S. Chand & Co.
5. Medhi, J. (2013). *Statistical Methods: Introductory Text*, New Age International Ltd. Publishers.
6. Ranjan, V. (1997). *Fundamentals of Computer*, Prentice Hall of India, New Delhi.
7. Rosener, B. (1999). *Fundamentals of Biostatistics*, Duxbury Press.
8. Singh, D. (2003). *Practical Statistics (vol 1&2)*, Atlantic Publishers.

**Cos/PSOs matrix:**

| <b>COs / PSOs</b> | <b>PO1</b> | <b>PO2</b> | <b>PO3</b> | <b>PO4</b> | <b>PO5</b> | <b>PO6</b> | <b>PO7</b> | <b>PO8</b> |
|-------------------|------------|------------|------------|------------|------------|------------|------------|------------|
| <b>COs</b>        |            |            |            | X          | X          | X          | X          | X          |

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**MJC60ENV419(T)25: REMOTE SENSING AND GIS**

**Credit: 03**  
**Contact hours: 45 h**

|                                      |   |              |               |                |                  |
|--------------------------------------|---|--------------|---------------|----------------|------------------|
| Nature of the Course                 | <b>MAJOR</b>  |              |               |                |                  |
| Course Code                          | <b>MJC60ENV419(T)25</b>   |              |               |                |                  |
| Course Title                         | <b>REMOTE SENSING AND GIS</b>                                       |              |               |                |                  |
| Course Level                         | <b>Level 400</b>  |              |               |                |                  |
| Credit Details                       | Total Credit  | Lecture/Week | Tutorial/week | Practical/Week | Total hours/Week |
|                                      | 4   | 3            |               | 1              | 5                |
| Course Audience                      | Major students enrolled in the FYUGP in Environmental Science       |              |               |                |                  |
| Proposed by (for Non-Core Course)    |   |              |               |                |                  |
| Skill Training Required (if any)     |   |              |               |                |                  |
| Pre-requisite Course required        | 10+2 in Science   |              |               |                |                  |
| Faculty Eligibility & Specialization | MSc Degree in Environmental Science with a PhD or NET qualification |              |               |                |                  |

**Course Objective (Summary):** The course is aimed to highlight the basic concepts of Environment and its components to the beginners in the field. It will introduce the concepts of environmental issues in the society. The Course seeks the students to understand the basic knowledge of ecology.

**Course Learning Outcomes:**

|   |  |
|---|--|
| 1 | The students will learn the basic concepts and principles of Remote sensing and GIS and their applicability in solving and addressing various environmental issues |
| 2 | They will develop skills for using the basic GIS tools & GPS for map preparation to address various environmental issues   |
| 3 | The students learn to perform image analyses RS tools to identify and generate Landuse /landcover map, slope map, slope aspect map etc.                            |
| 4 | The students will learn the basic concepts GPS, their uses and applicability in environmental research   |

**Detailed Syllabus Content:**

| Unit | Unit Name               | Detailed Syllabus  | CH |
|------|-------------------------|--|----|
| I    | Basic of Remote Sensing | Introduction to Remote Sensing (RS): definition and scope; Physics of RS and Electromagnetic Radiation (EMR); Interaction with matter and spectral regions; Spectral characteristics of surface features (rocks, soils, vegetation, water)   | 11 |
| II   | Types of Remote Sensing | Types of Remote Sensing; Remote sensing regions and bands; Platforms and Sensors; Resolutions; Types of RS data; Aerial photography; stereoscopy; ortho photographs; stereoscopic parallax; relief displacement; Indian and foreign RS Satellites;   | 11 |
| III  | Image Interpretation    | Image Interpretation and Analysis - elements of visual interpretation, Digital Image Processing (DIP), Classification accuracy assessment; Available software and Tools, Application of RS in environmental science.   | 11 |
| IV   | GIS/GPS                 | Geographical Information System (GIS): Basic principles, Raster and vector data, Map projection, Topology, overlay analysis, Data structure and Digital cartography, Development of GIS database for decision making, Global Positioning System (GPS): Basic principles and concept, applications in environmental studies; software and tools of GIS and GPS in addressing environmental issues and their management. | 12 |

**PRACTICAL**

**MJC60ENV419(P)25: REMOTE SENSING AND GIS**

**Credit: 01**  
**Contact hours: 30 h**

| <b>Experiments</b>  |
|---|
| <ol style="list-style-type: none"> <li>1. Experiments related to measurements on aerial photographs, use of simple instruments like stereoscopes, stereo meters, and digital planimeters.</li> <li>2. Interpretation of aerial photographs for preparation of land use (LULC) and vegetation maps using google earth maps and GIS software.</li> <li>3. Digital Map Preparation (slope, slope aspect, etc) from satellite imagery for environmental.</li> <li>4. Identification, delineation and mapping of environmental hazards on satellite imagery.</li> <li>5. Conduct GIS and GPS survey and use these applications in environmental survey and monitoring .</li> </ol> |

| <b>List of Essential Major Equipment</b>                   |
|--|
| Aerial Photographs, Stereo-meter, digital planimeters, GPS |

| <b>Major Laboratory Stores/Consumables Required</b> |
|---|
|   |

| <b>Essential Software (Licensed/Open-Source)</b>  |
|---|
| Open-Source GIS software, such as QGS software, and Licensed version GIS software, such as ArcGIS software, ERDAS software, ENVI, etc.) |

| <b>Student Activities</b>  |
|--|
| GPS survey, plotting and preparation of maps, preparation of thematic maps, cadastral maps, etc., maintenance of a practical notebook and records. |

**Suggested Readings:**

1. Jense J. R., Remote Sensing of the Environment – An earth resource perspective. Pearson Education, 2<sup>nd</sup> Edition, 2013.
2. Barrett, E. C. & Curtis, L. F. (1992). *Introduction to Environmental Remote Sensing*. Routledge, Taylor and Francis, New York.
3. Burrough, P.A., McDonnell, R.A., and Llyod, C.D. (2015). *Principles of Geographical Information Systems* (3rd Ed.). Oxford University Press, Oxford
4. Campbell, J.B. (2002). *Introduction to Remote Sensing* (3rd Ed.). The Guilford Press, USA.
5. Chang, K. (2007). *Introduction to Geographic Information System*. McGraw-Hill, USA.
6. Jensen, J. R. (2015). *Introductory Digital Image Processing: A Remote Sensing Perspective* (4th Ed.). (Pearson series in geographic information science), Pearson. ISBN-10: 0-1340-5816-X, ISBN-13: 978-0-134-05816-0
7. Lavender, S., Lavender, A. (2016). *Practical Handbook of Remote Sensing*. CRC Press, Taylor and Francis Group, New York
8. Lillesand, T.M.; R.W. Kiefer, and J.W. Chipman (2015). *Remote Sensing and Image Interpretation* (7th Ed.). John Wiley, New York

**Cos/PSOs matrix:**

| <b>COs / PSOs</b> | <b>PO1</b> | <b>PO2</b> | <b>PO3</b> | <b>PO4</b> | <b>PO5</b> | <b>PO6</b> | <b>PO7</b> | <b>PO8</b> |
|-------------------|------------|------------|------------|------------|------------|------------|------------|------------|
| <b>COs</b>        |            |            |            | X          | X          | X          | X          | X          |

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**MJC60ENV420(T)25: POLLUTION MONITORING AND CONTROL TECHNOLOGY**

**Credit: 03**  
**Contact hours: 45 h**

|                                      |   |              |               |                |                  |
|--------------------------------------|---|--------------|---------------|----------------|------------------|
| Nature of the Course                 | <b>MAJOR</b>  |              |               |                |                  |
| Course Code                          | <b>MJC60ENV420(T)25</b>   |              |               |                |                  |
| Course Title                         | <b>POLLUTION MONITORING AND CONTROL TECHNOLOGY</b>                  |              |               |                |                  |
| Course Level                         | <b>Level 400</b>  |              |               |                |                  |
| Credit Details                       | Total Credit  | Lecture/Week | Tutorial/week | Practical/Week | Total hours/Week |
|                                      | 4   | 3            |               | 1              | 5                |
| Course Audience                      | Major students enrolled in the FYUGP in Environmental Science       |              |               |                |                  |
| Proposed by (for Non-Core Course)    |   |              |               |                |                  |
| Skill Training Required (if any)     |   |              |               |                |                  |
| Pre-requisite Course required        | 10+2 in Science   |              |               |                |                  |
| Faculty Eligibility & Specialization | MSc Degree in Environmental Science with a PhD or NET qualification |              |               |                |                  |

**Course Objective (Summary):** The primary objective of the course is to equip students with the knowledge and skills to understand, assess, and mitigate pollution across various environmental settings. The course also aims to develop practical skills in sampling techniques, handling instruments, pollution monitoring, data interpretation and analysis, and the application of pollution control technologies.

**Course Learning Outcomes:**

|   |  |
|---|--|
| 1 | Understand the methodology of sampling, analysis, monitoring, and pollution control technologies of air.   |
| 2 | Understand the methodology of sampling, analysis, monitoring, and pollution control technologies of water.   |
| 3 | Understand the methodology of sampling, analysis, monitoring, and pollution control technologies of soil   |
| 4 | Understand the methodology of sampling, analysis, monitoring, and pollution control technologies of noise.   |
| 5 | The experiments conducted in the practical classes will make them familiar with the various emerging techniques used in analysing air, water, soil, and noise pollution. |

**Detailed Syllabus Content:**

| Unit | Unit Name                  | Detailed Syllabus  | CH |
|------|----------------------------|--|----|
| I    | Air pollution monitoring   | Air pollution sampling methods: Sampling from point sources, ambient sampling methods. Online and offline sampling instruments for gaseous and particulate air pollutants. Air pollution control methods: industrial source control technology: Cyclone, Electrostatic Precipitator, Bag house Filter, Venturi Scrubber – principle and use, its limitations.                  | 11 |
| II   | Water pollution monitoring | Water and wastewater sampling; Physical, chemical, and biological processes for monitoring and pollution control; Analytical Techniques, spectroscopy, chromatography, and electrochemical. Use of online and remote sensing resources in water quality monitoring.  | 11 |
| III  | Soil pollution             | Soil sampling methods; Soil testing to assess soil health; Chemical (AAS), geophysical (e.g., electrical conductivity, magnetic susceptibility), and biological methods (e.g., microorganisms, plants) for detecting contaminants. Control and remediation techniques, source reduction, proper waste management, bioremediation, and physical and chemical treatment of soil. | 11 |
| IV   | Noise pollution            | Sound power, sound intensity, and sound pressure levels; plane, point, and line sources, multiple sources; Noise standards; Noise indices; Noise sampling methods; noise instrumentation and monitoring procedure. Noise control methods and abatement measures, Noise Zones.  | 12 |

**PRACTICAL**

**MJC60ENV420(P)25: POLLUTION MONITORING AND CONTROL TECHNOLOGY**

**Credit: 01**  
**Contact hours: 30 h**

|   |
|---|
| <b>Experiments</b>  |
| <ol style="list-style-type: none"> <li>1. Sampling of air (SPM, SO<sub>x</sub> &amp; NO<sub>x</sub>), water, soil, and noise.</li> <li>2. Measurement of air, water, soil, and noise.</li> <li>3. Pollution abatement and mitigation control techniques.</li> <li>4. Field visit to nearby industries for studying different pollution control technologies.</li> </ol> |

|  |
|--|
| <b>List of Essential Major Equipment</b>   |
| High volume air sampler, spectrophotometer, EC, pH meter, Mortar and pestle, soil sieve, Noise level meter, BOD incubator, COD analyzer. |

|   |
|---|
| <b>Major Laboratory Stores/Consumables Required</b>   |
| Key consumables include standard reagents for air, water and soil analysis. Air sampling consumables such as absorption media for gaseous pollutants; high-volume air samplers, filters for particulate matter; sound level meters and calibrators for noise pollution. |

|  |
|--|
| <b>Essential Software (Licensed/Open-Source) NIL</b> |
|--|

|   |
|---|
| <b>Student Activities</b>                                       |
| Observation Notebooks & Practical Records, Field visit reports. |

**Suggested Readings:**

1. Trivedi R.K. (2003) An Introduction to Air Pollution, DVS Publication.
2. Arya, S.P. (1999) Air Pollution Meteorology and Dispersion, Oxford University Press.
3. Droste, R.L. (2005) *Theory & practice of water and wastewater treatment*, John Wiley Sons Publication.
4. Summer, M.E. (2000) Handbook of soil sciences. CRC Press LLC, Florida, USA.
5. Bhatia, S.C. (2023) Textbook of Noise Pollution and Its Control. Atlantic Publishers and Distributors (P) Ltd.

**Cos/PSOs matrix:**

| COs / PSOs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|
| COs        | X   | X   | X   | X   | X   | X   | X   | X   |

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**DETAILED SYLLABUS (MINOR)**

**MNC45ENV101(T)25: BASICS OF ENVIRONMENTAL SCIENCE**

**Credit: 03**  
**Contact hours: 45 h**

|   |  |              |               |                |                   |
|---|--|--------------|---------------|----------------|-------------------|
| Nature of Course                                | <b>MINOR</b>   |              |               |                |                   |
| Course Code                                     | <b>MNC45ENV101(T)25</b>  |              |               |                |                   |
| Course Title                                    | <b>BASICS OF ENVIRONMENTALSCIENCE</b>                              |              |               |                |                   |
| Course Level                                    | <b>Level 100</b>   |              |               |                |                   |
| Credit Details                                  | Total Credit   | Lecture/Week | Tutorial/Week | Practical/Week | Total Hours/ Week |
|   | 4  | 3            |               | 1              | 5                 |
| Course Audience                                 | Minor students enrolled in the FYUGP in Environmental Science      |              |               |                |                   |
| Proposed by (for Non Core courses)              |  |              |               |                |                   |
| Pre Requisites (if any)                         |  |              |               |                |                   |
| Skill Training Required (if any)                |  |              |               |                |                   |
| Pre-Requisite Course Required (if any)          | 10+2 in Science  |              |               |                |                   |
| Faculty Eligibility and Specialization (if any) | MSc. Degree in Environmental Science with PhD or NET qualification |              |               |                |                   |

**Course Objective (Summary):** The course is aimed to highlight the basic concepts of Environment and its components to the beginners in the field. It will introduce the concepts of environmental issues in the society. The Course seeks the students to understand the basic knowledge of ecology.

**Course Learning Outcomes:**

|   |   |
|---|---|
| 1 | Knowledge of the environment and the role of human beings in shaping the environment. |
| 2 | Understand various components of the environment and interfaces.                      |
| 3 | Understand the basic concepts of ecology.   |
| 4 | Critically appreciate the environmental concerns of today.                            |
| 5 | Knowledge of basic experiments on environmental issues.                               |

**Detailed Syllabus Content:**

| Unit | Unit Name                 | Detailed Syllabus   | CH |
|------|---------------------------|---|----|
| I    | Environment               | Environment– Definition. Physical components, socio-economic and cultural components. Natural resources – definition and types, resource use and depletion.   | 11 |
| II   | Components of Environment | Atmosphere – structure and composition, physicochemical role of the atmosphere. Rocks and minerals -the rock cycle, biogeochemical cycles, soil- structure and types. Water resources, water bodies and water use, issues with water and conservation.  | 11 |
| III  | Ecosystem                 | Ecosystems – concepts and structure, concept and scope of ecology; organism and environment; ecological factors and variables. concepts of biomes, biodiversity.  | 11 |
| IV   | Environmental issues      | Environmental issues –Concepts of pollution of air, water, and land, urbanization and solid wastes, biodiversity loss, land degradation and desertification, ozone layer depletion, climate change. Environmental concerns – historical development of environmentalism and conservation on Indian perspective. | 12 |

**PRACTICAL**

**MNC45ENV101(P)25: BASICS OF ENVIRONMENTAL SCIENCE**

**Credit: 01**  
**Contact hours: 30 h**

|  |
|--|
| <b>Experiments</b>   |
| <ol style="list-style-type: none"> <li>1. Basic methods of water sampling.</li> <li>2. Basic methods of soil sampling.</li> <li>3. Measurement of frequency, density and abundance in a grassland ecosystem.</li> <li>4. Documentation of ecosystem services provided by various ecosystems.</li> <li>5. Case studies on natural resources exploitation and local environmental issues.</li> </ol> |

|  |
|--|
| <b>List of Essential Major Equipment</b> |
|--|

|  |
|--|
| <b>Major Laboratory Stores/Consumables Required</b>  |
| Wash bottles, tissue, carry bags, pen, pencil, notebooks, thread, quadrat, sampling bottles, sieves, mortar, trays, buckets etc. |

|  |
|--|
| <b>Essential Software (Licensed/Open-Source) NIL</b> |
|--|

|   |
|---|
| <b>Student Activities</b>   |
| <ol style="list-style-type: none"> <li>3. Demonstration Notes/ Observation Notebooks.</li> <li>4. Practical Records / Project Reports.</li> </ol> |

**Suggested Readings:**

1. Cunningham W.P., Cunningham M.A., Saigo B.W., Environmental Science: A global concern, McGrawHill2003.
2. Cunningham W.P., Cunningham M.A, Principles of Environmental Science: Seventh Edition, McGrawHill 2014.
3. Roosa S.A., Sustainable Development Handbook, CRC Press 2008.
4. Atkinson G., Dietz S., Neumayer E., Agarwala M, Handbook of Sustainable Development, Edward Elger, 2014.
5. RobbinsP.,HintzJ.,MooreS.A.,EnvironmentandSociety:Acriticalintroduction,Wiley Blackwel2014.

**Cos/PSOs matrix:**

| COs / PSOs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|
| <b>COs</b> | X   | X   | X   |     |     | X   | X   | X   |

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**MNC45ENV102(T)25: BASICS OF ECOLOGY**

**Credit: 03**

**Contact hours: 45 h**

|                                      |   |              |               |                |                  |
|--------------------------------------|---|--------------|---------------|----------------|------------------|
| Nature of the Course                 | <b>MINOR</b>  |              |               |                |                  |
| Course Code                          | <b>MNC45ENV102(T)25</b>   |              |               |                |                  |
| Course Title                         | <b>BASICS OF ECOLOGY</b>  |              |               |                |                  |
| Course Level                         | <b>Level 100</b>  |              |               |                |                  |
| Credit Details                       | Total Credit  | Lecture/Week | Tutorial/week | Practical/Week | Total hours/Week |
|                                      | 4   | 3            |               | 1              | 5                |
| Course Audience                      | Minor Students enrolled in the FYUGP in Environmental Science       |              |               |                |                  |
| Proposed by (for Non-Core Course)    |   |              |               |                |                  |
| Skill Training Required (if any)     |   |              |               |                |                  |
| Pre-requisite Course required        | 10+2 in Science   |              |               |                |                  |
| Faculty Eligibility & Specialization | MSc Degree in Environmental Science with a PhD or NET qualification |              |               |                |                  |

**Course Objective (Summary):** The course introduces fundamental concepts of ecology, covering ecological organization, ecosystem structure, energy flow, succession, population and community dynamics, and species interactions. It emphasizes practical skills through field-based measurements, population and community assessment, and analysis of ecological relationships, fostering the ability to understand, evaluate, and apply ecological principles for environmental study and management.

**Course Learning Outcomes:**

|   |   |
|---|---|
| 1 | Understand the fundamental concepts and scope of ecology.   |
| 2 | Demonstrate an understanding of ecosystem structure, the pathways of energy flow through food chains and food webs and ecological succession. |
| 3 | Knowledge of the characteristics, dynamics, and growth models of populations.   |
| 4 | Proper understanding of the structural attributes of communities and the nature of species interactions.                                      |
| 5 | Apply field methods to study abiotic and biotic components.   |

**Detailed Syllabus Content:**

| Unit | Unit Name                        | Detailed Syllabus  | CH |
|------|----------------------------------|--|----|
| I    | Introduction to Ecology          | Definition, scope, and significance of ecology; Relationship between organisms and their environment; Levels of ecological organization: individual, population, community, ecosystem, biome, and biosphere; Habitat and niche concepts          | 12 |
| II   | Ecosystem Structure and Function | Structure and components of ecosystems (biotic and abiotic); Types of ecosystems: terrestrial and aquatic; Energy flow in ecosystems – food chains, food webs, and ecological pyramids. Ecological succession – types, stages, and examples      | 11 |
| III  | Population Ecology               | Definition and scope of population ecology; Population characteristics: size, density, dispersion, age structure, sex ratio; Population growth patterns: exponential and logistic growth; Population interactions; Concept of carrying capacity. | 11 |
| IV   | Community Ecology                | Definition and scope of community ecology; Community structure; Ecological niche; Ecotone and edge effect; Species interactions within communities: mutualism, commensalism, competition, predation, parasitism; Community dynamics.             | 11 |

**PRACTICAL**

**MNC45ENV102(P)25: BASICS OF ECOLOGY**

**Credit: 01**  
**Contact hours: 30 h**

| <b>Experiments</b>  |
|---|
| <ol style="list-style-type: none"> <li>1. Study of the basic field and laboratory ecological tools- quadrat, soil thermometer, hygrometer, lux meter, Secchi disc etc.</li> <li>2. Study of Abiotic Factors- Measurement of temperature and light intensity.</li> <li>3. Measurement of water parameters - pH and transparency using the Secchi disc.</li> <li>4. Determination of soil temperature and soil moisture in a selected habitat.</li> <li>5. Determination of the minimum size of a quadrat.</li> <li>6. Estimation of frequency, density and abundance of a grassland/pond ecosystem.</li> </ol> |

| <b>List of Essential Major Equipment</b>  |
|---|
| Quadrats, hygrometer, lux meter, Secchi disc, pH meter, Hot air oven, Thermometer, Soil thermometer, Digital balance. |

| <b>Major Laboratory Stores/Consumables Required</b>   |
|---|
| Distilled water for sample preparation, pH buffers for calibration, Labels, marker pens, masking tape (for sample identification), Weighing machines for the measurements. Laboratory supplies include beakers, measuring cylinders, distilled water, and containers for sample collection. |

| <b>Essential Software (Licensed/Open-Source) NIL</b> |
|--|
|  |

| <b>Student Activities</b>   |
|---|
| Students will collect soil, water, and vegetation samples using quadrats; analyze vegetation through frequency, density, and abundance; measure soil and water parameters; Observation Notebooks & Practical Records. |

**Suggested Readings:**

1. Saha, T.K. 2013. Ecology and Environmental Biology. Books & Allied (P) Ltd. Kolkata.
2. Sharma, P.D. 2015. Ecology and Environment (13<sup>th</sup> Revised Edition). Rastogi Publication, Meerut.
3. Verma, P.S. 2008. Environmental Biology. (Principles of Ecology). S. Chand and Company Ltd., New Delhi.
4. Kormondy, E.J. 2009. Concepts of Ecology (4<sup>th</sup> Edition). PHI Learning Private Limited, New Delhi.
5. Singh, J.S., Singh, S.P. & Gupta, S.R. 2010. Ecology, Environment and Resource Conservation. Anamaya Publishers, New Delhi.
6. Ambasht, R.S. and Ambasht, N.K. 2006. A Text Book of Plant Ecology. CBS Publishers and Distributors.
7. Verma, P.S. 2008. Environmental Biology. (Principles of Ecology). S. Chand and Company Ltd., New Delhi.
8. Gupta, P.K. 2011. Methods in Environmental Analysis: Water, Soil, Air (2<sup>nd</sup> Edition) Vatsal Enterprises, New Delhi.

**Cos/PSOs matrix:**

| COs / PSOs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|
| COs        | X   | X   | X   |     |     | X   | X   | X   |

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**MNC50ENV203(T)25: BIO-PHYSICAL ENVIRONMENT**

**Credit: 03**  
**Contact hours: 45 h**

|   |  |              |               |                |                   |
|---|--|--------------|---------------|----------------|-------------------|
| Nature of Course                                | <b>MINOR</b>   |              |               |                |                   |
| Course Code                                     | <b>MNC50ENV203(T)25</b>  |              |               |                |                   |
| Course Title                                    | <b>BIO-PHYSICAL ENVIRONMENT</b>                                    |              |               |                |                   |
| Course Level                                    | <b>Level 200</b>   |              |               |                |                   |
| Credit Details                                  | Total Credit   | Lecture/Week | Tutorial/Week | Practical/Week | Total Hours/ Week |
|   | 4  | 3            |               | 1              | 5                 |
| Course Audience                                 | Minor students enrolled in the FYUGP in Environmental Science      |              |               |                |                   |
| Proposed by (for Non Core courses)              |  |              |               |                |                   |
| Pre Requisites (if any)                         |  |              |               |                |                   |
| Skill Training Required (if any)                |  |              |               |                |                   |
| Pre-Requisite Course Required (if any)          | 10+2 in Science  |              |               |                |                   |
| Faculty Eligibility and Specialization (if any) | MSc. Degree in Environmental Science with PhD or NET qualification |              |               |                |                   |

**Course Objective (Summary):** The course will introduce the concepts associated with biosphere, its components and various cycles. It will help in understanding the basic nature of life and its complexity. It will highlight the basic concepts of physical environment and its components to beginners. It will introduce their significance in environmental science.

**Course Learning Outcomes:**

|   |  |
|---|--|
| 1 | Understand the biosphere and biotic community.   |
| 2 | Study the physiology of plants and animals, and relation with environment.             |
| 3 | The student will learn the overall concepts of physical environment.                   |
| 4 | They will learn about the lithosphere, rocks and minerals and soil formation concepts. |

**Detailed Syllabus Content:**

| Unit | Unit Name                    | Detailed Syllabus   | CH |
|------|------------------------------|---|----|
| I    | Biosphere                    | Definition, origin, components, resources, cycles, and changes with the present environmental modifications.  | 11 |
| II   | Understanding Bio complexity | Problems faced by living organisms residing at different habitats and their way of interactions with the environment; India's common flora and fauna; Strategies adopted by plants, animals, fungi, bacteria and archaea to adjust with their habitats.   | 11 |
| III  | Origin of earth              | Origin and evolution of the earth; plate tectonics; weathering of rocks - physical, chemical and biological; mass-wasting; erosion, transportation and deposition of earth's materials by running water, wind and glaciers; development of landforms; earthquakes, volcanoes and tsunamis.  | 11 |
| IV   | Lithosphere and Atmosphere   | Rocks and Minerals- types and formation of rocks; soil - formation, composition, and classification; soil profile; atmosphere-origin, composition and structure; insolation and heat budget; temperature and pressure distribution, humidity and wind; hydrostatic balance and atmospheric equilibrium-stability, instability, temperature lapse rate and inversion; scales in meteorology. | 12 |

**PRACTICAL**

**MNC50ENV203(P)25: BIO-PHYSICAL ENVIRONMENT**

**Credit: 01**  
**Contact hours: 30 h**

| <b>Experiments</b>  |
|---|
| 1. Basic understanding on plant and animal physiology- growth, development and metabolism.<br>2. Field visit and reporting: recording bio-complexity at field level (relationships within plants, animals and between plants and animals in the ecosystem).<br>3. Determination of meteorological parameters- atmospheric pressure, relative Humidity, wind speed, wind direction.<br>4. Analysis of meteorological data.<br>5. Identification of common rocks and minerals and their properties.<br>6. Basic identification of soil types, their textural classification and soil profiles |

| <b>List of Essential Major Equipment</b>   |
|--|
| Thermometer, Barometer, Psychrometer, Lux meter, Rain gauges, Anemometers, Wind vane, Mohr’s scale, Soil siever, Soil Auger etc. |

| <b>Major Laboratory Stores/Consumables Required</b>   |
|---|
| Wash bottles, tissue, carry bags, pen, pencil, notebooks, sampling bottles, sieves, mortar, trays, buckets etc. |

| <b>Essential Software (Licensed/Open-Source) NIL</b> |
|--|
|  |

| <b>Student Activities</b>   |
|---|
| Visit to different local locations for measurement of local meteorological parameters, Collection and identification of different types of soil, rocks, and minerals, writing their Observation in notebooks & maintenance of practical Records book. |

**Suggested Readings:**

1. Saradhi P.P., Biophysical processes in living systems, Oxford & IBH Publishing,2008.
2. Ladd P. C., (Ed.) Comparative Animal Physiology, fourth edition, Wiley Liss, New York,1991.
3. Calver M., et al (Eds) , Environmental Biology, Cambridge University Press.
4. Tarbuck,E.J, et. al. (2014). Earth: An introduction to Physical Geology (11th Ed.). Pearson.
5. Hamblin (2003) (8th Ed.). Earths Dynamic Systems. Prentice Hall.

**Cos/PSOs matrix:**

| <b>COs / PSOs</b> | <b>PO1</b> | <b>PO2</b> | <b>PO3</b> | <b>PO4</b> | <b>PO5</b> | <b>PO6</b> | <b>PO7</b> | <b>PO8</b> |
|-------------------|------------|------------|------------|------------|------------|------------|------------|------------|
| <b>COs</b>        | X          | X          | X          |            | X          | X          |            | X          |

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**MNC50ENV204(T)25: CONCEPTS OF ENVIRONMENTAL CHEMISTRY**

**Credit: 03**  
**Contact hours: 45 h**

|                                      |   |              |               |                |                  |
|--------------------------------------|---|--------------|---------------|----------------|------------------|
| Nature of the Course                 | <b>MINOR</b>  |              |               |                |                  |
| Course Code                          | <b>MNC50ENV204(T)25</b>   |              |               |                |                  |
| Course Title                         | <b>CONCEPTS OF ENVIRONMENTAL CHEMISTRY</b>                          |              |               |                |                  |
| Course Level                         | <b>Level 200</b>  |              |               |                |                  |
| Credit Details                       | Total Credit  | Lecture/Week | Tutorial/week | Practical/Week | Total hours/Week |
|                                      | 4   | 3            |               | 1              | 5                |
| Course Audience                      | Minor Students enrolled in the FYUGP in Environmental Science       |              |               |                |                  |
| Proposed by (for Non-Core Course)    |   |              |               |                |                  |
| Skill Training Required (if any)     |   |              |               |                |                  |
| Pre-requisite Course required        | 10+2 in Science   |              |               |                |                  |
| Faculty Eligibility & Specialization | MSc Degree in Environmental Science with a PhD or NET qualification |              |               |                |                  |

**Course Objective (Summary):** The course provided an overall view of the diverse chemical phenomena occurring in the environment. It aims to understand the chemical composition of the natural environment, man-made substances, pollutants, their sources, chemical processes, interactions with substances, transport, fates of chemicals, and their impacts on the biotic and abiotic components. It highlights a proper understanding of a safe and sustainable living environment through scientific processes and chemical applications.

**Course Learning Outcomes:**

|   |  |
|---|--|
| 1 | The students will learn about the basic chemistry of important environmental processes   |
| 2 | They will learn about the chemical process leading to the generation of air and water pollutants in the environment, the fate of these pollutants in the environment, and their sinks. |
| 3 | They will learn about the important geo-hydro-chemical processes leading to environmental contamination and hazards.   |
| 4 | Attain a proper understanding of a safe and sustainable production, ecosystem, and living environment through scientific processes.  |
| 5 | The experiments conducted in the practical classes will let them learn about the various techniques used for analysing pollutants in soil, biota, water, and air.                      |

**Detailed Syllabus Content:**

| Unit | Unit Name               | Detailed Syllabus  | CH |
|------|-------------------------|--|----|
| I    | Environmental Chemistry | Concept and scope; Acid-base reactions, common ion effect, buffer solutions, oxidation and reduction, chemical equilibrium; chemical speciation, concept of green chemistry.   | 12 |
| II   | Atmospheric Chemistry   | Chemical composition of the atmosphere; Photochemical reactions, Acid rain, Ozone depletion; Aerosols, Greenhouse gases; Gasoline and additives, Antiknock compounds, Lubricants, Polycyclic aromatic hydrocarbons, Polychlorinated Biphenyls. | 11 |
| III  | Water Chemistry         | Physical and chemical properties of fresh and marine water; Chemical species in water; Cleaning agents: Bleaching agents; Chemistry of colloids; chemical fertilizers.   | 11 |
| IV   | Geochemistry            | Chemical composition of earth, earth's crust, Geochemical classification of elements, Chemistry of trace elements, Rare earth elements (REE); Radioactivity-decay, radioactive dating.   | 11 |

**PRACTICAL**

**MNC50ENV204(P)25: CONCEPTS OF ENVIRONMENTAL CHEMISTRY**

**Credit: 01**  
**Contact hours: 30 h**

|   |
|---|
| <b>Experiments</b>  |
| <ol style="list-style-type: none"> <li>1. Estimation of physico-chemical parameters of soil – pH, EC, Moisture content, temperature.</li> <li>2. Estimation of physico-chemical parameters of water – pH, EC, TDS, alkalinity, acidity &amp; hardness.</li> <li>3. Measurement of air pollutants – dust fall, sources of pollutants in the locality.</li> </ol> |

|   |
|---|
| <b>List of Essential Major Equipment</b>                |
| pH meter, EC/TDS meter, Hot air oven, Soil thermometer. |

|   |
|---|
| <b>Major Laboratory Stores/Consumables Required</b>   |
| Key consumables include standard reagents for titration (e.g., EDTA, HCl), indicator solutions, distilled water for sample preparation, pH buffers for calibration, Mechanical grinders and sieves for sample preparation, and a variety of filters and weighing machines for measurement of dustfall. Laboratory supplies include beakers, measuring cylinders, distilled water, and containers for sample collection. |

|  |
|--|
| <b>Essential Software (Licensed/Open-Source) NIL</b> |
|--|

|   |
|---|
| <b>Student Activities</b>   |
| Visit to different local environmental settings and sampling of soil, water, and air samples; Analysis of the collected samples; Observation Notebooks & Practical Records. |

**Suggested Readings:**

1. Anderson, J.M. (1991). *Environmental Science*, Arnold Publications, Delhi.
2. Baird. C. and Cann, M. (2012) *Environmental Chemistry*. W.H. Freeman & Company, New York
3. Santra, S.C. (2000). *Textbook of Environmental Science*, New Central Book Publishers.
4. De, A.K. (2001). *Environmental Chemistry*, Wiley Eastern India Ltd.
5. Manhan, S.E. (2000). *Environmental Chemistry*, Amazon publisher.

**Cos/PSOs matrix:**

| COs / PSOs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|
| <b>COs</b> | X   | X   | X   | X   |     | X   |     | X   |

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**MNC55ENV205(T)25: ENVIRONMENTAL POLLUTION**

**Credit: 03**  
**Contact hours: 45 h**

|                                      |   |              |               |                |                  |
|--------------------------------------|---|--------------|---------------|----------------|------------------|
| Nature of the Course                 | <b>MINOR</b>  |              |               |                |                  |
| Course Code                          | <b>MNC55ENV205(T)25</b>   |              |               |                |                  |
| Course Title                         | <b>ENVIRONMENTAL POLLUTION</b>                                      |              |               |                |                  |
| Course Level                         | <b>Level 200</b>  |              |               |                |                  |
| Credit Details                       | Total Credit  | Lecture/Week | Tutorial/week | Practical/Week | Total hours/Week |
|                                      | 4   | 3            |               | 1              | 5                |
| Course Audience                      | Minor students enrolled in the FYUGP in Environmental Science       |              |               |                |                  |
| Proposed by (for Non-Core Course)    |   |              |               |                |                  |
| Skill Training Required (if any)     |   |              |               |                |                  |
| Pre-requisite Course required        | 10+2 in Science   |              |               |                |                  |
| Faculty Eligibility & Specialization | MSc Degree in Environmental Science with a PhD or NET qualification |              |               |                |                  |

**Course Objective (Summary):** The course is aimed to highlight the basic concepts of environmental pollution to the beginners. It will introduce the concepts of air, water, soil, solid waste and noise pollution concepts specifically with focus on causes and impacts in the environment. The Course seeks the students to understand the basic knowledge of environmental pollution and its overall impacts.

**Course Learning Outcomes:**

|   |   |
|---|---|
| 1 | The students will learn about the basic concept of different types of environmental pollution and their causes and impacts  |
| 2 | The students will learn about specific concepts on air, water and soil pollution with their causes and impacts  |
| 3 | The students will learn about various impacts of noise pollution, Soild waste pollution and their causes and impacts  |
| 4 | From the practical component they will learn environmental sampling (air, water soil, Soild waste, noise) techniques, and estimation using volumetric, turbidimetric, potentiometric and photometric estimation |

**Detailed Syllabus Content:**

| Unit | Unit Name                        | Detailed Syllabus   | CH |
|------|----------------------------------|---|----|
| I    | Basic of Environmental Pollution | Environmental pollution – definition, types and causes and consequences, Environmental pollution at local, regional and global scale and their implications on human health and physical and biological environment; Emerging regional and global issues related to environmental pollution.  | 11 |
| II   | Air Pollution                    | Air Pollution: Introduction, air pollutants, types and sources, history of air pollution episodes, air pollution and effects on human health, Air pollution source apportionment, regulation, and mitigation; Noise pollution: Introduction, noise categories, Noise pollution impacts on human health, surrounding environment and biodiversity. | 11 |
| III  | Water Pollution                  | Water pollution-introduction, sources of water pollutants, Agriculture and Water pollution, Problems of pesticides and chemical fertilizers, Sanitation and Drinking Water, waterborne diseases, Wastewater Treatment and Water Reuse, Implications on health, Case studies of Minamata disease, blue baby syndrome etc.                          | 11 |
| IV   | Soil Pollution                   | Soil pollution: sources, causes and consequences, MSW – characterization, and impact on public health, emission from waste dumping sites, leaching, biomagnification, Agriculture and land pollution.   | 12 |

**PRACTICUM**

**MNC55ENV205(P)25: ENVIRONMENTAL POLLUTION**

**Credit: 01**  
**Contact hours: 30 h**

| <b>Experiments</b> |   |
|--------------------|---|
| 1.                 | Measurement of particulate matter (PM10 & PM2.5) in air by grab sampling and gravimetric method and dust fall estimation. |
| 2.                 | Measurement of levels of gaseous pollution (Sox, Nox) in ambient air.   |
| 3.                 | Sampling and analysis of basic physical, chemical, and biological parameters of water samples .                           |
| 4.                 | Understanding and comparing noise levels of localities using a sound level meter .  |
| 5.                 | Visit to a local polluted site-Urban/Rural/Industrial/Agricultural, sampling, analysis, and reporting.                    |
| 6.                 | Visit to an industry having air-pollution control measures and reporting.   |

| <b>List of Essential Major Equipment</b>   |  |
|--|--|
| pH meter, EC/TDS meter, Salinity meter, Hot air oven, Soil thermometer, Flame Photometer, UV-Spectrophotometer, BOD incubator, Soil Siever, Hydrometer, Soil Auger, Laboratory Hot air oven, Hot plate, Soil Shaker, Sound Level Meter (SLM), GPS, Anemometer, Wind vane, Psychrometer, etc. |  |

| <b>Major Laboratory Stores/Consumables Required</b>  |  |
|--|--|
| Basic consumables include standard reagents for titration (e.g., EDTA, HCl), indicator solutions, distilled water for sample preparation, pH buffers for calibration. Laboratory supplies include beakers, measuring cylinders, distilled water, and containers for sample collection. |  |

| <b>Essential Software (Licensed/Open-Source) NIL</b> |  |
|--|--|
|  |  |

| <b>Student Activities</b>   |  |
|---|--|
| Visit to institutions and industries; Different Soil and Water Pollution Sites for sampling and making observations, and recording them in notebooks & and maintaining the practical records. |  |

**Suggested Readings:**

1. Anderson, J.M. (1991) *Environmental science*, Arnold Publications, Delhi.
2. Shaw I.C. and Chadwick J., *Principles of Environmental Toxicology*, Taylor& Francis, 2008
3. Manahan S.E., *Environmental Chemistry*, Lewis, 1994
4. De A. K., *Environmental Chemistry*, Wiley Eastern Limited, 2000
5. Moore J. W., *Inorganic Contaminants of Surface Water*, Springer-Verlag
6. Gurjar B. R., Molina L.T., Ojha C.S.P. (Eds.), *Air Pollution: Health and Environmental Impacts*, CRC Press
7. Buckman & Brady, (1984) *The nature and properties of soil*. Nataraj Publication, Dehra Dun
8. Negi, S.S. (1985) *Soil conservation*, Nataraj Publication, Dehradun
9. Droste, R.L. (2005) *Theory & practice of water and wastewater treatment*, John Willey Sons Publication.
10. Peavy, H.S., Tchobanoglous, G. and Rowe's D.R (2000) *Environmental engineering*, Tata McGraw-Hill Publication.

**Cos/PSOs matrix:**

| COs / PSOs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|
| COs        | X   | X   | X   |     |     | X   | X   | X   |

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**MNC55ENV206(T)25: BASICS OF DISASTER MANAGEMENT**

**Credit: 04**  
**Contact hours: 60 h**

|                                      |   |              |               |                |                  |
|--------------------------------------|---|--------------|---------------|----------------|------------------|
| Nature of the Course                 | <b>MINOR</b>  |              |               |                |                  |
| Course Code                          | <b>MNC55ENV206(T)25</b>   |              |               |                |                  |
| Course Title                         | <b>BASICS OF DISASTER MANAGEMENT</b>                                |              |               |                |                  |
| Course Level                         | <b>Level 200</b>  |              |               |                |                  |
| Credit Details                       | Total Credit  | Lecture/Week | Tutorial/week | Practical/Week | Total hours/Week |
|                                      | 4   | 4            |               |                | 4                |
| Course Audience                      | Minor Students enrolled in the FYUGP in Environmental Science       |              |               |                |                  |
| Proposed by (for Non-Core Course)    |   |              |               |                |                  |
| Skill Training Required (if any)     |   |              |               |                |                  |
| Pre-requisite Course required        | 10+2 in Science   |              |               |                |                  |
| Faculty Eligibility & Specialization | MSc Degree in Environmental Science with a PhD or NET qualification |              |               |                |                  |

**Course Objective (Summary):** The course aims to provide foundational knowledge of disaster management, covering types of hazards, key concepts, and the disaster management cycle. It emphasizes preparedness, mitigation, response, and recovery strategies, integrating technology, community participation, and case studies to develop skills for reducing risks, managing emergencies, and promoting sustainable, disaster-resilient development.

**Course Learning Outcomes:**

|   |   |
|---|---|
| 1 | Understanding of disaster management and its importance.      |
| 2 | Recognize different types of natural and human-made hazards.  |
| 3 | Learn ways to prepare for and reduce the impact of disasters. |
| 4 | Use tools like GIS and remote sensing to plan for disasters.  |
| 5 | Study real disasters to find better, safer solutions.         |

**Detailed Syllabus Content:**

| Unit | Unit Name                            | Detailed Syllabus   | CH |
|------|--------------------------------------|---|----|
| I    | Introduction to Disaster Management  | Definition, scope, and importance of disaster management; Types of disasters: natural, anthropogenic, and complex emergencies; Key concepts: hazard, risk, vulnerability, capacity, and resilience; Disaster management cycle: prevention, mitigation, preparedness, response, recovery.                                    | 15 |
| II   | Natural and Anthropogenic            | Hazards- Geological hazards: earthquakes, volcanoes, landslides; Hydrometeorological hazards: floods, droughts, cyclones, tsunamis; Environmental hazards: climate change impacts, coastal erosion, sea-level rise; Anthropogenic hazards: industrial accidents, urbanization impacts, deforestation, large-scale projects. | 15 |
| III  | Disaster Preparedness and Mitigation | Early warning systems and communication networks; Community-based disaster risk reduction and capacity building; Structural and non-structural mitigation measures; Role of education, awareness, and simulation exercises in preparedness.   | 15 |
| IV   | Disaster Response and Recovery       | Institutional frameworks in India: NDMA, SDMA, DDMA; Role of technology, GIS, and remote sensing in disaster management; Relief, rehabilitation, and reconstruction strategies; Case studies of major disasters in India and lessons learned.   | 15 |

**Suggested Readings:**

1. Pine, J.C. 2009. *Natural Hazards Analysis: Reducing the Impact of Disasters*. CRC Press, Taylor and Francis Group.
2. Schneid, T.D. & Collins, L. 2001. *Disaster Management and Preparedness*. Lewis Publishers, New York, NY.
3. Coppola, D.P. 2007. *Introduction to International Disaster Management*. Butterworth Heinemann.
4. Gupta, H.K., & Rajendran, K. 2013. *Disaster Management*. National Book Trust, India.

5. Coppola, D.P. 2020. *Introduction to International Disaster Management* (4th ed.). Butterworth-Heinemann.
6. Sharma, V.K. 2001. *Disaster Management*. National Centre for Disaster Management, Indian Institute of Public Administration.
7. Kapoor, S. 2019. *Environmental Hazards and Disaster Management*. S. Chand Publishing

**Cos/PSOs matrix:**

| <b>COs / PSOs</b> | <b>PO1</b> | <b>PO2</b> | <b>PO3</b> | <b>PO4</b> | <b>PO5</b> | <b>PO6</b> | <b>PO7</b> | <b>PO8</b> |
|-------------------|------------|------------|------------|------------|------------|------------|------------|------------|
| <b>COs</b>        | X          | X          | X          |            | X          | X          | X          | X          |

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**MNC60ENV307(T)25: ENVIRONMENTAL PLANNING AND MANAGEMENT**

**Credit: 04**  
**Contact hours: 60 h**

|                                      |   |              |               |                |                  |
|--------------------------------------|---|--------------|---------------|----------------|------------------|
| Nature of the Course                 | <b>MINOR</b>  |              |               |                |                  |
| Course Code                          | <b>MNC60ENV307(T)25</b>   |              |               |                |                  |
| Course Title                         | <b>Environmental Planning and Management</b>                        |              |               |                |                  |
| Course Level                         | <b>Level 300</b>  |              |               |                |                  |
| Credit Details                       | Total Credit  | Lecture/Week | Tutorial/week | Practical/Week | Total hours/Week |
|                                      | 4   | 4            |               |                | 4                |
| Course Audience                      | Minor Students enrolled in the FYUGP in Environmental Science       |              |               |                |                  |
| Proposed by (for Non-Core Course)    |   |              |               |                |                  |
| Skill Training Required (if any)     |   |              |               |                |                  |
| Pre-requisite Course required        | 10+2 in Science   |              |               |                |                  |
| Faculty Eligibility & Specialization | MSc Degree in Environmental Science with a PhD or NET qualification |              |               |                |                  |

**Course Objective (Summary):** The course will deliver an understanding of environmental planning and management principles, tools, and global and national initiatives. It covers Environmental Management Systems, assessment methods, and the role of organizations and conventions, enabling students to analyze, plan, and implement effective strategies for sustainable environmental protection and resource management.

**Course Learning Outcomes:**

|   |   |
|---|---|
| 1 | Understand what environmental planning and management mean and why they are important.            |
| 2 | Learn how Environmental Management Systems (EMS) and ISO 14001 work.                              |
| 3 | Use tools like EIA, SEA, LCA, GIS, and remote sensing for environmental planning.                 |
| 4 | Know the role of major global conventions and organizations in protecting the environment.        |
| 5 | Learn about important national programs and organizations working for environmental conservation. |

**Detailed Syllabus Content:**

| Unit | Unit Name   | Detailed Syllabus   | CH |
|------|---|---|----|
| I    | Introduction to Environmental Planning and Management | Definition, scope, and importance of environmental planning and management; Key features and appropriate content of an effective Environmental Management System (EMS) based on the requirements of ISO 14001.                                  | 15 |
| II   | Environmental Planning Tools and Approaches           | Environmental Impact Assessment (EIA): concepts, process, and significance; Strategic Environmental Assessment (SEA) and Life Cycle Assessment (LCA); Role of GIS and remote sensing in environmental planning.                                 | 15 |
| III  | International efforts for environmental management    | Global Conventions like Stockholm Conference, Rio Summit, Rio+10, Brundtland Commission, Rio+20, Montreal Protocol, Kyoto Protocol, Copenhagen Summit; Global Organizations like IPCC, UNEP, IUCN, WWF; Intellectual Property Rights, Eco-mark. | 15 |
| IV   | National efforts for Environmental management         | National Organizations like ATREE, BNHS, BSI, CEE, CSE, NEERI, NCF, PETA, SACON, TERI, WII, ZSI (objectives, salient features, major activities and achievements only); Ganga Action Plan, NEAC, National River Conservation Plan.              | 15 |

**Suggested Readings:**

- Cunningham, W.P., & Cunningham, M.A. 2020. Environmental Science: A Global Concern (15th ed.). McGraw-Hill Education.
- Randall, J.M. 2016. Environmental Management and Development. Routledge.
- Nath, B. Hens, I., Compton, P. And Devuyt, D. (1998). Environmental Management in Practice, Vol. I, Routledge, London and New York.

4. Cascio, J 1996. The ISO 14000 Handbook: The New International Environmental Management Standards, McGraw Hill Professional.
5. ISO 14001 - Environmental management systems: Specifications with guidance for use (ISO 14001: 1996b (E), International Organization for standardization –Switzerland.
6. Pallister, J. 2017. Environmental Management. Oxford University Press, London
7. Negi, S.S. 2008. A Hand Book of Environmental Science. M/S Bishen Singh Mahendra Pal Singh, Dehradun.
8. Krishnamoorthy, B. 2017. Environmental Management: Text and Cases, Prentice Hall of India, New Delhi.
9. Sankar, A. 2015. Environmental Management. Oxford University Press, New Delhi.
10. Kubba, S. 2010. LEED Practices, Certification, and Accreditation Handbook, Elsevier, Whitelaw, K. 2004. ISO 14001 Environmental Systems Handbook, Elsevier, Amsterdam.

**Cos/PSOs matrix:**

| <b>COs / PSOs</b> | <b>PO1</b> | <b>PO2</b> | <b>PO3</b> | <b>PO4</b> | <b>PO5</b> | <b>PO6</b> | <b>PO7</b> | <b>PO8</b> |
|-------------------|------------|------------|------------|------------|------------|------------|------------|------------|
| <b>COs</b>        | X          | X          | X          | X          |            | X          |            | X          |

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**MNC60ENV308(T)25: POLLUTION MONITORING AND ABATEMENT**

**Credit: 03**  
**Contact hours: 45 h**

|                                      |   |              |               |                |                  |
|--------------------------------------|---|--------------|---------------|----------------|------------------|
| Nature of the Course                 | <b>MINOR</b>  |              |               |                |                  |
| Course Code                          | <b>MNC60ENV308(T)25</b>   |              |               |                |                  |
| Course Title                         | <b>POLLUTION MONITORING AND ABATEMENT</b>                           |              |               |                |                  |
| Course Level                         | <b>Level 300</b>  |              |               |                |                  |
| Credit Details                       | Total Credit  | Lecture/Week | Tutorial/week | Practical/Week | Total hours/Week |
|                                      | 4   | 3            |               | 1              | 5                |
| Course Audience                      | Minor students enrolled in the FYUGP in Environmental Science       |              |               |                |                  |
| Proposed by (for Non-Core Course)    |   |              |               |                |                  |
| Skill Training Required (if any)     |   |              |               |                |                  |
| Pre-requisite Course required        | 10+2 in Science   |              |               |                |                  |
| Faculty Eligibility & Specialization | MSc Degree in Environmental Science with a PhD or NET qualification |              |               |                |                  |

**Course Objective (Summary):** The primary objective of the course is to equip students with the knowledge and skills to understand, assess, and mitigate pollution across various environmental settings. The course also aims to develop practical skills in sampling techniques, handling instruments, pollution monitoring, data interpretation and analysis, and the application of pollution control technologies.

**Course Learning Outcomes:**

|   |  |
|---|--|
| 1 | Understand the methodology of sampling, analysis, monitoring, and pollution control technologies of air.   |
| 2 | Understand the methodology of sampling, analysis, monitoring, and pollution control technologies of water.   |
| 3 | Understand the methodology of sampling, analysis, monitoring, and pollution control technologies of soil   |
| 4 | Understand the methodology of sampling, analysis, monitoring, and pollution control technologies of noise.   |
| 5 | The experiments conducted in the practical classes will make them familiar with the various emerging techniques used in analysing air, water, soil, and noise pollution. |

**Detailed Syllabus Content:**

| Unit | Unit Name                  | Detailed Syllabus   | CH |
|------|----------------------------|---|----|
| I    | Air pollution monitoring   | Air pollution sampling methods: Sampling from point sources, ambient sampling methods. Online and offline sampling instruments for gaseous and particulate air pollutants. Air pollution control methods: industrial source control technology: Cyclone, Electrostatic Precipitator, Bag house Filter, Venturi Scrubber – principle and use, its limitations.                 | 11 |
| II   | Water pollution monitoring | Water and wastewater sampling; Physical, chemical, and biological processes for monitoring and pollution control; Analytical Techniques, spectroscopy, chromatography, and electrochemical. Use of online and remote sensing resources in water quality monitoring.   | 11 |
| III  | Soil pollution             | Soil sampling methods; Soil testing to assess soil health; Chemical (AAS), geophysical(e.g., electrical conductivity, magnetic susceptibility), and biological methods (e.g., microorganisms, plants) for detecting contaminants. Control and remediation techniques, source reduction, proper waste management, bioremediation, and physical and chemical treatment of soil. | 11 |
| IV   | Noise pollution            | Sound power, sound intensity, and sound pressure levels; plane, point, and line sources, multiple sources; Noise standards; Noise indices; Noise sampling methods; noise instrumentation and monitoring procedure. Noise control methods and abatement measures, Noise Zones.   | 12 |

**PRACTICAL**

**MNC60ENV308(P)25: POLLUTION MONITORING AND ABATEMENT**

**Credit: 01**  
**Contact hours: 30 h**

|  |
|--|
| <b>Experiments</b>   |
| <ol style="list-style-type: none"> <li>1. Sampling of air (SPM, Sox &amp; NO<sub>x</sub>), water, soil, and noise.</li> <li>2. Measurement of air, water, soil, and noise.</li> <li>3. Pollution abatement and mitigation control techniques.</li> <li>4. Field visit to nearby industries for studying different pollution control technologies.</li> </ol> |

|   |
|---|
| <b>List of Essential Major Equipment</b>  |
| High volume air sampler, spectrophotometer, EC, pH meter, Motar and pestle, soil sieve, Noise level meter, BOD incubator, COD analyzer. |

|   |
|---|
| <b>Major Laboratory Stores/Consumables Required</b>   |
| Key consumables include standard reagents for air, water and soil analysis. Air sampling consumables such as absorption media for gaseous pollutants; high-volume air samplers, filters for particulate matter; sound level meters and calibrators for noise pollution. |

|  |
|--|
| <b>Essential Software (Licensed/Open-Source) NIL</b> |
|--|

|   |
|---|
| <b>Student Activities</b>                                       |
| Observation Notebooks & Practical Records, Field visit reports. |

**Suggested Readings:**

1. Trivedi R.K. (2003) An Introduction to Air Pollution, DVS Publication.
2. Arya, S.P. (1999) Air Pollution Meteorology and Dispersion, Oxford University Press.
3. Droste, R.L. (2005) *Theory & practice of water and wastewater treatment*, John Willey Sons Publication.
4. Summer, M.E. (2000) Handbook of soil sciences. CRC Press LLC, Florida, USA.
5. Bhatia, S.C. (2023) Textbook of Noise Pollution and Its Control. Atlantic Publishers and Distributors (P) Ltd.

**Cos/PSOs matrix:**

| COs / PSOs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|
| COs        | X   | X   | X   | X   | X   | X   | X   | X   |

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**DETAILED SYLLABUS (MDC)**

**MDC45ENV101(T)25: ENVIRONMENTAL AWARENESS**

**Credit: 03**  
**Contact hours: 45 h**

|   |  |              |               |                |                  |
|---|--|--------------|---------------|----------------|------------------|
| Nature of Course                                | <b>MDC</b>   |              |               |                |                  |
| Course Code                                     | <b>MDC45ENV101(T)25</b>  |              |               |                |                  |
| Course Title                                    | <b>ENVIRONMENTAL AWARENESS</b>                                     |              |               |                |                  |
| Course Level                                    | <b>Level 100</b>   |              |               |                |                  |
| Credit Details                                  | Total Credit   | Lecture/Week | Tutorial/Week | Practical/Week | Total Hours/Week |
|   | 3  | 3            |               |                | 3                |
| Course Audience                                 | Major students enrolled in the FYUGP in Environmental Science      |              |               |                |                  |
| Proposed by (for Non Core courses)              |  |              |               |                |                  |
| Pre Requisites (if any)                         |  |              |               |                |                  |
| Skill Training Required (if any)                |  |              |               |                |                  |
| Pre-Requisite Course Required (if any)          | 10+2 in Science  |              |               |                |                  |
| Faculty Eligibility and Specialization (if any) | MSc. Degree in Environmental Science with PhD or NET qualification |              |               |                |                  |

**Course Objective (Summary):** The course is aimed to highlight the impact of human activities on Environment. It will introduce the concept of Environmental awareness and the role played by Government, NGOs and media. It will also help students to know the environmental movements in India. The Course provides the students to understand National and international organizations in environmental conservation and campaign.

**Course Learning Outcomes:**

|   |  |
|---|--|
| 1 | The students will learn the basic concepts and importance of environmental awareness.  |
| 2 | They will also learn about the environmental priorities and the crisis in India, role played by the government, NGOs and media to promote and enhance the environmental awareness in the public. |
| 3 | Besides, they will also learn about various environmental movements and activities of national/international organizations to conserve the environment.  |

**Detailed Syllabus Content:**

| Unit | Unit Name  | Detailed Syllabus   | CH |
|------|--|---|----|
| I    | Man and Environment                                    | Human activities and its impacts- local, regional and global; short-term and long-term impacts on environment; Socio-economic and cultural dimensions of environment, Concepts of carrying capacity; Environmental priorities in India and Environmental crisis.              | 11 |
| II   | Environmental Awareness                                | Definitions and concepts of Environmental Awareness, role of Government, NGOs and media, Biosphere and socioeconomic and cultural environment and their interactions; Environment awareness programme in Northeast India with special emphasis on Manipur.                    | 11 |
| III  | Natural Resources and Conservation                     | Resource conservation; Ecological security, Common Property Resources (CPR), Environmental movements in India-Chipko, Apiko, Silent Valley, Tehri Dam, Narmada Dam.   | 11 |
| IV   | Organizations of National and International importance | National and international organizations involved in environmental conservation and campaigns Green Peace, WWF, WHO, IUCN, FAO, UNEP and UNESCO; Conventions and Summits on Environment; Carbon trading and sequestration, Clean Development Mechanism (CDM), Kyoto protocol. | 12 |

**Suggested Readings:**

1. Meenakshi, P. (2005) Elements of Environmental Engineering. Eastern Economy Edition, Prentice Hall, India.
2. Patil, R.B. (2009) Environment in Indian Society- Problem and Prospects. Mittal Publications, Daryaganj, New Delhi.
3. Ramakrishnan, P.S. (2002) Sustainable Development. UNESCO, New Delhi.
4. Senapati, T. and Sahoo, R.K. (2009) Environmental Education and Pollution Control. Mittal Publications, Daryaganj, New Delhi.
5. Thomas A. et al. (1995) Trading with the Environment Ecology: Economics, Institutions and Policy. Earthscan, UK.
6. Uberoi, N.K. (2004) Environmental Management. Excel Books, New Delhi.
7. Viji, J. Norman and Axelrod (1999) The Global Environment, Institutions, Law and Policy. Earthscan Publishers Ltd, UK.

**Cos/PSOs matrix:**

| <b>COs / PSOs</b> | <b>PO1</b> | <b>PO2</b> | <b>PO3</b> | <b>PO4</b> | <b>PO5</b> | <b>PO6</b> | <b>PO7</b> | <b>PO8</b> |
|-------------------|------------|------------|------------|------------|------------|------------|------------|------------|
| <b>COs</b>        | X          | X          | X          |            |            | X          | X          | X          |

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**MDC45ENV102(T)25: ENVIRONMENT AND SOCIETY**

**Credit: 03**  
**Contact hours: 45 h**

|   |  |              |               |                |                   |
|---|--|--------------|---------------|----------------|-------------------|
| Nature of Course                                | <b>MDC</b>   |              |               |                |                   |
| Course Code                                     | <b>MDC45ENV102(T)25</b>  |              |               |                |                   |
| Course Title                                    | <b>ENVIRONMENT AND SOCIETY</b>                                     |              |               |                |                   |
| Course Level                                    | <b>Level 100</b>   |              |               |                |                   |
| Credit Details                                  | Total Credit   | Lecture/Week | Tutorial/Week | Practical/Week | Total Hours/ Week |
|   | 3  | 3            |               |                | 3                 |
| Course Audience                                 | Major students enrolled in the FYUGP in Environmental Science      |              |               |                |                   |
| Proposed by (for Non Core courses)              |  |              |               |                |                   |
| Pre Requisites (if any)                         |  |              |               |                |                   |
| Skill Training Required (if any)                |  |              |               |                |                   |
| Pre-Requisite Course Required (if any)          | 10+2 in Science  |              |               |                |                   |
| Faculty Eligibility and Specialization (if any) | MSc. Degree in Environmental Science with PhD or NET qualification |              |               |                |                   |

**Course Objective (Summary):** The course is aimed to highlight the role of society in environmental conservation and management. The significant environmental events in the historical timeline of the country are highlighted to give a glimpse of the nation’s conservation efforts.

**Course Learning Outcomes:**

|   |   |
|---|---|
| 1 | Understand the human surrounding and the role of human being in shaping the surrounding.  |
| 2 | Ability to understand the need to address current environmental issues.                   |
| 3 | Knowledge on the role of Indian traditions and culture in environment and its priorities. |

**Detailed Syllabus Content:**

| Unit | Unit Name                               | Detailed Syllabus  | CH |
|------|---|--|----|
| I    | Human beings and environment            | Current environmental issues: pollution, biodiversity loss and climate change. Role of the society: interest groups, awareness and conservation. Rights and duties: the Constitutional provisions – Article 48A and Article 51A(g). Common Property Resources; the Tragedy of Commons. | 12 |
| II   | Environmental movements                 | Bishnoi movement, Chipko movement, Appiko movement, Silent Valley movement, Narmada Bachao Andolan; Role of Environmental NGOs in India; Public Interest Litigations for environmental protection.   | 11 |
| III  | Gender and Environment                  | Sustainable development and Women; Ecofeminism- conceptual and theoretical perspectives; Feminist environmentalism; gender debates; Role of Manipuri women in conservation.  | 11 |
| IV   | Environmental issues in Northeast India | Modern agriculture and its impacts; Water scarcity; Forest loss; Wetland degradation; Sacred groves; Biodiversity and Wildlife issues; Pollution. Social unrest and environmentalism.  | 11 |

**Suggested Readings:**

1. Pouloupoulos, S. G., and Inglezakis V.J., Eds. Environment and Development: Basic Principles, Human Activities, and Environmental Implications. Elsevier, 2016.

2. Harper, C. and Snowden M. Environment and society: Human perspectives on environmental issues. Routledge,2017.
3. Barr, S. Environment and society: Sustainability, policy and the citizen. Routledge,2016.
4. Agarwal, A. and Narain, S. eds. Dying Wisdom: Rise, fall and potential of India's traditional water harvesting systems. Centre for Science and Environment,1997.

**Cos/PSOs matrix:**

| <b>COs / PSOs</b> | <b>PO1</b> | <b>PO2</b> | <b>PO3</b> | <b>PO4</b> | <b>PO5</b> | <b>PO6</b> | <b>PO7</b> | <b>PO8</b> |
|-------------------|------------|------------|------------|------------|------------|------------|------------|------------|
| <b>COs</b>        | X          | X          | X          |            |            | X          | X          | X          |

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**MDC50ENV203(T)25: ENVIRONMENT AND TRADITIONAL KNOWLEDGE**

**Credit: 03**  
**Contact hours: 45 h**

|                                      |   |              |               |                |                  |
|--------------------------------------|---|--------------|---------------|----------------|------------------|
| Nature of the Course                 | <b>MDC</b>  |              |               |                |                  |
| Course Code                          | <b>MDC50ENV203(T)25</b>   |              |               |                |                  |
| Course Title                         | <b>ENVIRONMENT AND TRADITIONAL KNOWLEDGE</b>                        |              |               |                |                  |
| Course Level                         | <b>Level 200</b>  |              |               |                |                  |
| Credit Details                       | Total Credit  | Lecture/Week | Tutorial/week | Practical/Week | Total hours/Week |
|                                      | 3   | 3            |               |                | 3                |
| Course Audience                      | Major students enrolled in the FYUGP in Environmental Science       |              |               |                |                  |
| Proposed by (for Non-Core Course)    |   |              |               |                |                  |
| Skill Training Required (if any)     |   |              |               |                |                  |
| Pre-requisite Course required        | 10+2 in Science   |              |               |                |                  |
| Faculty Eligibility & Specialization | MSc Degree in Environmental Science with a PhD or NET qualification |              |               |                |                  |

**Course Objective (Summary):** The course aims at imparting basic principles of Traditional Knowledge Systems connecting society and nature. The course focuses on introduction to Indian Knowledge System and different traditional knowledge of ethnic tribes of Manipur, its use in environmental conservation. The aim will be to introduce the students to important concepts from the diverse intellectual traditions of India and aware its implications in conservation and protection of biodiversity.

**Course Learning Outcomes:**

|   |  |
|---|--|
| 1 | To introduce the concept and domains of indigenous knowledge systems                   |
| 2 | To expose the students to the diverse ways of living and knowing its values and worth. |
| 3 | To explain the relevance of indigenous knowledge and environmental conservation.       |
| 4 | To familiarize the students with the indigenous knowledge of tribes in India           |

**Detailed Syllabus Content:**

| Unit | Unit Name   | Detailed Syllabus  | CH |
|------|---|--|----|
| I    | Introduction to Traditional knowledge Systems         | Traditional Indigenous Knowledge – Definitions, Scope and Importance, Characteristics, and Examples; kinds of traditional knowledge; Indigenous Knowledge (IK) and characteristics.  | 11 |
| II   | Protection of Traditional Knowledge                   | Traditional knowledge of tribes in northeast India; examples of traditional knowledge of different ethnic tribes of Manipur. Indigenous and traditional concept of health and well being, disease and illness and cure.                    | 11 |
| III  | Biodiversity and Traditional knowledge                | Biodiversity-conservation and culture, Traditional knowledge and its use in the conservation of environment; sacred groves, traditional water conservation methods, homegardens, wildlife protection, pest management.                     | 11 |
| IV   | Indigenous Knowledge and Intellectual Property Rights | Impact of social change on the traditional knowledge systems, conflicts between indigenous knowledge and scientific knowledge. Policies and measures for the protection of traditional knowledge, Intellectual Property Rights, Biopiracy. | 12 |

**Suggested Readings:**

1. Amit Jha. Traditional Knowledge System in India, 2009.
2. Ellen, Roy, Peter Parkes and Allan Bicker (eds), Indigenous Environmental Knowledge and its Transformations: Critical

- Anthropological Perspectives. Harwood Academic Publishers, Amsterdam, 2000.
3. Misra, Kamal K. (ed.), Traditional Knowledge in Contemporary Societies: Challenges and Opportunities, Indira Gandhi Rashtriya Manav Sangrahalaya, Bhopal & Pratibha Prakashan, Delhi, 2007.
  4. Bicker, Alan, Paul Sillitoe and Johan Pottier (eds), Development and Local Knowledge: New approaches to issues in natural resources management, conservation and agriculture, London: Routledge, 2004
  5. Sillitoe, Paul, Alan Bicker and Johan Pottier (eds), Participating in Development: Approaches to indigenous knowledge, Routledge, London, 2002.

**Cos/PSOs matrix:**

| <b>COs / PSOs</b> | <b>PO1</b> | <b>PO2</b> | <b>PO3</b> | <b>PO4</b> | <b>PO5</b> | <b>PO6</b> | <b>PO7</b> | <b>PO8</b> |
|-------------------|------------|------------|------------|------------|------------|------------|------------|------------|
| <b>COs</b>        | X          | X          | X          |            |            | X          | X          | X          |

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**DETAILED SYLLABUS (SEC)**

**SEC45ENV101(T)25: FUNDAMENTALS OF ECOTOURISM**

**Credit: 03**  
**Contact hours: 45 h**

|   |  |              |               |                |                   |
|---|--|--------------|---------------|----------------|-------------------|
| Nature of Course                                | <b>SEC</b>   |              |               |                |                   |
| Course Code                                     | <b>SEC45ENV101(T)25</b>  |              |               |                |                   |
| Course Title                                    | <b>FUNDAMENTALS OF ECOTOURISM</b>                                  |              |               |                |                   |
| Course Level                                    | <b>Level 100</b>   |              |               |                |                   |
| Credit Details                                  | Total Credit   | Lecture/Week | Tutorial/Week | Practical/Week | Total Hours/ Week |
|   | 3  | 3            |               |                | 3                 |
| Course Audience                                 | Major students enrolled in the FYUGP in Environmental Science      |              |               |                |                   |
| Proposed by (for Non Core courses)              |  |              |               |                |                   |
| Pre Requisites (if any)                         |  |              |               |                |                   |
| Skill Training Required (if any)                |  |              |               |                |                   |
| Pre-Requisite Course Required (if any)          | 10+2 in Science  |              |               |                |                   |
| Faculty Eligibility and Specialization (if any) | MSc. Degree in Environmental Science with PhD or NET qualification |              |               |                |                   |

**Course Objective (Summary):** The course is aimed to highlight the impact of tourism on Environment. It will introduce the concept of sustainable tourism which promotes development and sustainability in an inclusive manner. It will help students to know the issues related with tourism in India.

**Course Learning Outcomes:**

|   |  |
|---|--|
| 1 | Appreciate the concepts of ecotourism and its management.                                |
| 2 | Understand values of wildlife and minimizing impact on natural ecosystem due to tourism. |
| 3 | Learn basic concepts of ecotourism facility management and hospitality needs.            |
| 4 | Appreciate sustainability in ecotourism.   |

**Detailed Syllabus Content:**

| Unit | Unit Name                  | Detailed Syllabus   | CH |
|------|----------------------------|---|----|
| I    | Introduction to Ecotourism | Ecotourism: definitions; evolution and characteristics of ecotourism; Ecotourism guidelines; Tourism bill of rights; code for environmentally responsible tourism; World Ecotourism Summit.         | 11 |
| II   | Impacts of tourism         | Tourism impacts: economic, social, political and environmental impacts; Ecotourism development – prospects and challenges; Economic, social, and economic impacts of ecotourism.                    | 12 |
| III  | Ecotourism in India        | Role of ecotourism in promoting biodiversity hotspots and conservation; National parks, Sanctuaries and Biosphere reserves; Potential sites for development of ecotourism in Manipur: Case studies. | 11 |
| IV   | Community based Ecotourism | Significances and prospects; Importance of ecotourism planning, carrying capacity and development; Resource management; Examples of peoples’ initiatives on Ecotourism: Case studies.               | 11 |

**Suggested Readings:**

1. Holden A. Environment and Tourism, Routledge, London, 2008.
2. Sharma S.P., Tourism and Environment, Kanishka, New Delhi, 2006.
3. Weaver D. Eco-Tourism, John Wiley and sons Australia Ltd, 2008.
4. Wood M., Eco Tourism – Principles, Practices and Policies for Sustainability, UNEP and TIES.
5. Beddard F.E., A text book of Zoogeography, BiblioLife.

**Cos/PSOs matrix:**

| <b>COs / PSOs</b> | <b>PO1</b> | <b>PO2</b> | <b>PO3</b> | <b>PO4</b> | <b>PO5</b> | <b>PO6</b> | <b>PO7</b> | <b>PO8</b> |
|-------------------|------------|------------|------------|------------|------------|------------|------------|------------|
| <b>COs</b>        | X          | X          | X          |            |            | X          | X          | X          |

**SEC45ENV102(T)25:COMPOSTING OF BIOMASS**

**Credit: 02**  
**Contact hours: 30 h**

|                                      |   |              |               |                |                  |
|--------------------------------------|---|--------------|---------------|----------------|------------------|
| Nature of the Course                 | <b>SEC</b>  |              |               |                |                  |
| Course Code                          | <b>SEC45ENV102(T)25</b>   |              |               |                |                  |
| Course Title                         | <b>COMPOSTING OF BIOMASS</b>  |              |               |                |                  |
| Course Level                         | <b>Level 100</b>  |              |               |                |                  |
| Credit Details                       | Total Credit  | Lecture/Week | Tutorial/week | Practical/Week | Total hours/Week |
|                                      | 3   | 2            |               | 1              | 4                |
| Course Audience                      | Many students enrolled in the FYUGP in Environmental Science        |              |               |                |                  |
| Proposed by (for Non-Core Course)    |   |              |               |                |                  |
| Skill Training Required (if any)     |   |              |               |                |                  |
| Pre-requisite Course required        | 10+2 in Science   |              |               |                |                  |
| Faculty Eligibility & Specialization | MSc Degree in Environmental Science with a PhD or NET qualification |              |               |                |                  |

**Course Objective (Summary):** The prime objective of the course is to provide the students with the practical skills on the bioconversion of biomass through various composting aerobic, anaerobic, and vermicomposting techniques. Key objectives include understanding the scientific principles of composting, demonstrating how to set up and manage vermicomposting systems, applying compost for soil health and agricultural benefits, and exploring opportunities for waste-to-resource entrepreneurship and sustainable waste management. Learn how to design and implement composting technologies at home and on a large-scale community level to address local needs and contribute to food security and environmental sustainability.

**Course Learning Outcomes:**

|   |  |
|---|--|
| 1 | Provide practical experience through hands-on activities on the scientific principles and practical techniques for composting, such as aerobic, anaerobic, and vermicomposting |
| 2 | Understand how to manage and recycle organic waste efficiently, and apply composting to improve soil health.   |
| 3 | Develop the skills to monitor and control composting processes, maintain compost facilities, and understand regulatory frameworks for waste management.                        |
| 4 | Learn to identify and arrange necessary resources, such as appropriate earthworms and site locations, to set up and run a composting unit.                                     |
| 5 | Understand the scope and opportunities for to develop basic entrepreneurial activities for small-scale composting units.   |

**Detailed Syllabus Content:**

| Unit | Unit Name                   | Detailed Syllabus  | CH |
|------|-----------------------------|--|----|
| I    | Introduction to Composting  | Composting as a technique for waste management, energy generation, and organic farming. Benefits of using compost: Soil conditioner, Cation exchange capacity, and soil health; Nutrient enrichment of compost.  | 10 |
| II   | Aerobic and Vermicomposting | Composting processes; Factors affecting composting – inoculants, pH, moisture content, temperature, C: N ratio, aeration, pre-treatment. Composting systems – Indore, Bangalore, Coimbatore, NADEP methods; Windrow composting; Vermicompost – selection of species, factors affecting vermicomposting, preparation of vermin bed, organic layering, harvesting of vermicompost. | 10 |
| III  | Anaerobic composting        | Microbial processes of anaerobic digestion; Popular biogas plants in India; Parameters affecting methane generation – pH, temperature, C:N ratio, feedstock, Organic loading rate, hydraulic retention time, Solid concentrations, nutrients; Uses of biogas and digested slurry.  | 10 |

**PRACTICAL**

**SEC45ENV102(P)25: COMPOSTING OF BIOMASS**

**Credit: 01**  
**Contact hours: 30 h**

| <b>Experiments</b>  |
|---|
| <ol style="list-style-type: none"> <li>1. Characterization of bio-wastes – bulk density, moisture content, pH, EC.</li> <li>2. Conduct experiments on aerobic, anaerobic, and vermicomposting of biowastes.</li> <li>3. Analyze the nutrient content and characteristics of mature compost.</li> <li>4. Field visit to solid-waste management sites and composting facilities.</li> </ol> |

| <b>List of Essential Major Equipment</b>   |
|--|
| Composting pit, vermicomposting shed, anaerobic digestion chamber, implements for aeration, turning, and maintaining moisture, water bath, and instruments to measure nutrient content in the compost – spectrophotometer, EC, pH meter. |

| <b>Major Laboratory Stores/Consumables Required</b>   |
|---|
| Essential consumables for managing the composting process include gloves, mixing tools, thermometers, and large containers for holding the compost, as well as basic safety gear like masks and hand sanitizer. Key consumables include standard reagents for nutrient content analysis of the compost. |

|  |
|--|
| <b>Essential Software (Licensed/Open-Source)</b> NIL |
|--|

| <b>Student Activities</b>   |
|---|
| Visit to composting facilities in the local area; Collection of biomass and conduct aerobic, anaerobic, and vermicomposting; Observation Notebooks & Practical Records. |

**Suggested Readings:**

1. White P.R. et al, (1989) *Integrated Solid Waste Management*, Lewis Publisher
2. David L.H.F. and Liptak D.G. (2000) *Hazardous waste and solid waste*, Lewis Publisher, 2000.
3. Tchobanoglous, G. and Kreith, F. (2002). *Handbook of Solid Waste Management*. McGraw-Hill.
4. Hester, R.E. & Harrison, R.M. (2002). *Environmental and Health Impact of Solid Waste Management Activities*. Royal Society of Chemistry.
5. Ministry of Urban Development, (2000). *Manual on Municipal Solid Waste Management*. CPHEEO, Ministry of Urban Development, GoI, New Delhi.

**Cos/PSOs matrix:**

| COs / PSOs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|
| COs        | X   | X   | X   |     | X   | X   |     | X   |

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**SEC50ENV203(T)25: SKILLS IN ENVIRONMENTAL SAMPLING AND ANALYSIS**

**Credit: 02**  
**Contact hours: 30 h**

|                                      |   |              |               |                |                  |
|--------------------------------------|---|--------------|---------------|----------------|------------------|
| Nature of the Course                 | <b>SEC</b>  |              |               |                |                  |
| Course Code                          | <b>SEC50ENV203(T)25</b>   |              |               |                |                  |
| Course Title                         | <b>SKILLS IN ENVIRONMENTAL SAMPLING AND ANALYSIS</b>                |              |               |                |                  |
| Course Level                         | <b>Level 200</b>  |              |               |                |                  |
| Credit Details                       | Total Credit  | Lecture/Week | Tutorial/week | Practical/Week | Total hours/Week |
|                                      | 3   | 2            |               | 1              | 4                |
| Course Audience                      | Major students enrolled in the FYUGP in Environmental Science       |              |               |                |                  |
| Proposed by (for Non-Core Course)    |   |              |               |                |                  |
| Skill Training Required (if any)     |   |              |               |                |                  |
| Pre-requisite Course required        | 10+2 in Science   |              |               |                |                  |
| Faculty Eligibility & Specialization | MSc Degree in Environmental Science with a PhD or NET qualification |              |               |                |                  |

**Course Objective (Summary):** The course is aimed towards skill enhancement through learning and understanding the various techniques of environmental sampling and their analysis. The course focuses on hands on training involving environmental instruments for students who wish to enhance their skills and get into industries related to environmental sector as trainees, research assistants, laboratory assistants, field assistants etc. and gain work experience as well as generate income.

**Course Learning Outcomes:**

|   |  |
|---|--|
| 1 | To learn the various techniques of environmental sampling  |
| 2 | To get hands on experience of various instruments used in environmental sample analysis  |
| 3 | To understand the concept of quality assurance and quality control (QA/QC), learn laboratory protocols and maintain practical record books |

**Detailed Syllabus Content:**

| Unit | Unit Name  | Detailed Syllabus  | CH |
|------|--|--|----|
| I    | Air and Noise sampling and analysis                            | Air pollution sampling methods: Sampling from point sources (Stack Monitoring, vehicles), Ambient sampling methods (PM <sub>2.5</sub> , PM <sub>10</sub> ). Determination of meteorological parameters; Indoor/outdoor Noise sampling                                  | 10 |
| II   | Water and soil sampling and analysis                           | Method of sampling for water and soil: analysis for physico-chemical parameters (pH, EC, turbidity, TDS), soil moisture, soil texture, soil bulk density, chemical parameters (hardness, chlorides), biological and microbiological parameters in water (DO, BOD, MPN) | 10 |
| III  | Ecological & Environmental Biotechnology sampling and analysis | Estimation of Biodiversity parameters and indices; field observations: bird count survey method in a wetland area (point count); Microbial estimation techniques; Experiments on composting and vermicomposting.   | 10 |

**PRACTICAL**

**SEC50ENV203(P)25: SKILLS IN ENVIRONMENTAL SAMPLING AND ANALYSIS**

**Credit: 01**  
**Contact hours: 30 h**

| <b>Experiments</b>  |
|---|
| <ol style="list-style-type: none"> <li>1. Water analysis- Estimation of physico-chemical parameters of water – pH (pH meter), EC, TDS (EC/TDS meter), alkalinity &amp; hardness (titration).</li> <li>2. Soil analysis- Estimation of physico-chemical parameters of soil – pH (pH meter), EC ((EC meter), Moisture content (gravimetric method), texture (sieve), bulk density (cylinder method).</li> <li>3. Measurement of air pollutants – dust fall, sources of pollutants in the locality.</li> <li>4. Determination of meteorological parameters – intensity of rainfall (rain gauge), relative humidity (Hygrometer/Psychrometer).</li> <li>5. Noise sampling- Estimate the indoor and outdoor noise levels (using sound level meter).</li> <li>6. Ecological and Environmental Biotechnology analysis- Estimation of Biodiversity parameters using quadrat method, bird count survey method in a wetland area (point count); experiment on vermicomposting.</li> </ol> |

| <b>List of Essential Major Equipment</b>   |
|--|
| pH meter, EC/TDS meter, Hot air oven, Soil thermometer, Sound level meters, Rain gauge, Hygrometer/Psychrometer, weighing balance, Conical flask, burette, pipette, pestle and mortar for grinding soil. |

| <b>Major Laboratory Stores/Consumables Required</b>   |
|---|
| Key consumables include standard reagents for titration (e.g., EDTA), acids (HCl, HNO <sub>3</sub> , H <sub>2</sub> SO <sub>4</sub> ), indicator solutions, distilled water for sample preparation, pH buffers for calibration, Mechanical grinders and sieves for sample preparation, and a variety of filters and weighing machines for measurement of dustfall. Laboratory supplies include beakers, measuring cylinders, Burette stand, pipettes, glass funnel, glass rod, dropper, distilled water, containers for sample collection, Whatman filter paper, gloves, measuring tape, nails, hammer. |

|  |
|--|
| <b>Essential Software (Licensed/Open-Source) NIL</b> |
|--|

| <b>Student Activities</b>   |
|---|
| Visit to different sites for sample collection of water, soil, and air samples; Estimate different ecological parameters, Analysis of the collected samples; Observation Notebooks & Practical Records. |

**Suggested Readings:**

1. Trivedi R.K. (2003) An Introduction to Air Pollution, DVS Publication.
2. ISO (1978). Guidelines of micro meteorological technique in air pollution studies.
3. Lodge, J.P. Jr. (edt). (1989) Methods of Air Sampling and Analysis, Lewis Publishers.
4. Bhatia, S.C. (2023) Textbook of Noise Pollution and Its Control. Atlantic Publishers and Distributors (P) Ltd.
5. De, A.K. (2001). Environmental Chemistry, Wiley Eastern India Ltd.
6. Droste, R.L. (2005) Theory & practice of water and wastewater treatment, John Willey Sons Publication.
7. Negi, S.S. (1985) Soil conservation, Nataraj Publication, Dehra Dun

**Cos/PSOs matrix:**

| COs / PSOs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|
| COs        | x   | x   | x   |     | x   | x   |     | x   |

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**DETAILED SYLLABUS (DSE)**

**DSE60ENV401(T)25: SUSTAINABLE DEVELOPMENT**

**Credit: 04**  
**Contact hours: 60 h**

|                                      |   |              |               |                |                  |
|--------------------------------------|---|--------------|---------------|----------------|------------------|
| Nature of the Course                 | <b>DSE</b>  |              |               |                |                  |
| Course Code                          | <b>DSE60ENV401(T)25</b>   |              |               |                |                  |
| Course Title                         | <b>SUSTAINABLE DEVELOPMENT</b>                                      |              |               |                |                  |
| Course Level                         | <b>Level 300</b>  |              |               |                |                  |
| Credit Details                       | Total Credit  | Lecture/Week | Tutorial/week | Practical/Week | Total hours/Week |
|                                      | 4   | 4            |               |                | 4                |
| Course Audience                      | Major students enrolled in the FYUGP in Environmental Science       |              |               |                |                  |
| Proposed by (for Non-Core Course)    |   |              |               |                |                  |
| Skill Training Required (if any)     |   |              |               |                |                  |
| Pre-requisite Course required        | 10+2 in Science   |              |               |                |                  |
| Faculty Eligibility & Specialization | MSc Degree in Environmental Science with a PhD or NET qualification |              |               |                |                  |

**Course Objective (Summary):** The course introduces the basic concepts of Sustainable Development and its importance towards environmental conservation covering historical perspectives, sustainability indicators, sustainability science concept, its scope and future applications. The course seeks to help students to understand and appreciate the principles of Sustainable Development, goals, challenges and pathways. They will be able to understand approaches, planning and management towards Sustainable Development, understand social responsibility, importance of green technology, eco-centric approaches.

**Course Learning Outcomes:**

|   |  |
|---|--|
| 1 | Students will understand the concept of Sustainable Development, scope and future of sustainability science  |
| 2 | They will appreciate the principles of Sustainable Development   |
| 3 | Students will learn about different approaches to Sustainable Development, goals, challenges and pathways  |
| 4 | Students will understand the relation between development and the environment, planning and management   |
| 5 | They will learn about the application of sustainability towards human society, climate change, lifestyle, environmental awareness, biodiversity issues |

**Detailed Syllabus Content:**

| Unit | Unit Name                           | Detailed Syllabus  | CH |
|------|-------------------------------------|--|----|
| I    | Concept of sustainable development  | Overview of sustainable development, Historical perspectives, Sustainability indicators, sustainability science and its importance, the scope and future of sustainability science.  | 15 |
| II   | Principles, pathways and challenges | Principles of Sustainable Development; goals and dimensions of Sustainable Development, Millennium Development Goals; global challenges and different pathways to Sustainable Development; limits to growth, carrying capacity.  | 15 |
| III  | Approaches, planning and management | Approaches to Sustainable Development; Natural Resource Management, Landscape Ecology, Watershed Management; Participation in policy and planning; Integrated Natural Resource Management, Participatory NRM – new interface of NRM, gender and NRM, Sustainability in NRM.  | 15 |
| IV   | Sustainability application          | Human society and sustainability; unsustainable lifestyle; eco-friendly lifestyle; global change and sustainability issues: climate change, biological invasion, biodiversity issues; ecology, economics, ethics, education and environmental awareness; Green Technology; eco-philosophy: eco-centric, human centric views. | 15 |

**Suggested Readings:**

1. Blewitt, J. (2017) Understanding Sustainable Development, Routledge, 3<sup>rd</sup> edition.
2. Ramakrishnan, P.S. (2002). Sustainable Development. UNESCO, New Delhi
3. Klee G.A., Conservation of Natural Resources. Prentice Hall College Div., 1991.
4. Rai G. D., Non-conventional Energy sources. Khanna Publishers, New Delhi.
5. Lynch D.R., Sustainable Natural Resource Management: For Scientists and Engineers.
6. Fulekar, M.H., Pathak, B., Kale, R.K. (2014). Environment and Sustainable Development, Springer, New Delhi.

**Cos/PSOs matrix:**

| <b>COs / PSOs</b> | <b>PO1</b> | <b>PO2</b> | <b>PO3</b> | <b>PO4</b> | <b>PO5</b> | <b>PO6</b> | <b>PO7</b> | <b>PO8</b> |
|-------------------|------------|------------|------------|------------|------------|------------|------------|------------|
| <b>COs</b>        | X          | X          | X          |            |            | X          | X          | X          |

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**DSE60ENV402(T)25: ENVIRONMENTAL CONSERVATION**

**Credit: 04**  
**Contact hours: 60 h**

|   |  |              |               |                |                   |
|---|--|--------------|---------------|----------------|-------------------|
| Nature of Course                                | <b>DSE</b>   |              |               |                |                   |
| Course Code                                     | <b>DSE60ENV402(T)25</b>  |              |               |                |                   |
| Course Title                                    | <b>ENVIRONMENTAL CONSERVATION</b>                                  |              |               |                |                   |
| Course Level                                    | <b>Level 400</b>   |              |               |                |                   |
| Credit Details                                  | Total Credit   | Lecture/Week | Tutorial/Week | Practical/Week | Total Hours/ Week |
|   | 4  | 4            |               |                | 4                 |
| Course Audience                                 | Major students enrolled in the FYUGP in Environmental Science      |              |               |                |                   |
| Proposed by (for Non Core courses)              |  |              |               |                |                   |
| Pre Requisites (if any)                         |  |              |               |                |                   |
| Skill Training Required (if any)                |  |              |               |                |                   |
| Pre-Requisite Course Required (if any)          | 10+2 in Science  |              |               |                |                   |
| Faculty Eligibility and Specialization (if any) | MSc. Degree in Environmental Science with PhD or NET qualification |              |               |                |                   |

**Course Objective (Summary):** The course highlights the values of environmental conservation and the various approaches to achieve the goals of sustainable development and protect the interests of future generations. It covers the need of environmental education and ethics. The paper also incorporates various green technologies.

**Course Learning Outcomes:**

|   |   |
|---|---|
| 1 | Enlighten the students with the knowledge of conservation.          |
| 2 | Knowledge of environmental awareness.                               |
| 3 | Knowledge on the importance and significance of green technologies. |

**Detailed Syllabus Content:**

| Unit | Unit Name                          | Detailed Syllabus   | CH |
|------|------------------------------------|---|----|
| I    | Environmental conservation         | Definition, scope and significance; concepts of environment and biodiversity; Conservation Biology – definition, need and scope.  | 15 |
| II   | Environmental education and ethics | Environmental education: definition, goals and objectives; methods - formal and non-formal education; International norms guiding environmental education; current scenario of EE in India; major challenges; Environmental ethics: concept; eco-philosophy: eco-centric and anthropocentric world views; relevance of environmental ethics in the present day society. | 15 |
| III  | Conservation Methods               | History – international and national; methods of conservation - <i>In situ</i> (Biosphere reserves, National Parks, Sanctuaries, World heritage Sites and Ecologically Sensitive Areas) & <i>ex situ</i> (Botanical gardens, Zoological gardens, Gene banks, Pollen, seed and seedling banks ,tissue culture and DNA banks) modes of conservation.                      | 15 |
| IV   | Green technologies                 | Introduction, history, concept and current scenario of green technology; green technology and sustainability; Examples - hydro-energy, solar energy, bioenergy, green design, building and infrastructure; green technologies and ecological footprint and eco-labelling.   | 15 |

**Suggested Readings:**

1. Schulze E-D., Harold M., (Eds.) Biodiversity and Ecosystem Function. Springer-Verlag, London.(1994).
2. Khan T. I., Global Biodiversity and environmental Conservation. Pointer Publisher. Jaipur.2001.
3. Patil,R.B.(2009).EnvironmentinIndianSociety-Problem andProspects,MittalPublications,Daryaganj,NewDelhi.
4. Blewitt,J.(2017)UnderstandingSustainableDevelopment,Routledge,3<sup>rd</sup>edition.
5. Wilson,E.O.(1993).DiversityofLife.HarvardUniversityPress,Cambridge,MA.

**Cos/PSOs matrix:**

| <b>COs / PSOs</b> | <b>PO1</b> | <b>PO2</b> | <b>PO3</b> | <b>PO4</b> | <b>PO5</b> | <b>PO6</b> | <b>PO7</b> | <b>PO8</b> |
|-------------------|------------|------------|------------|------------|------------|------------|------------|------------|
| <b>COs</b>        | X          | X          | X          |            |            | X          | X          | X          |

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**DSE60ENV403(T)25: ENVIRONMENTAL INSTRUMENTATION**

**Credit: 04**  
**Contact hours: 60 h**

|                                      |   |              |               |                |                  |
|--------------------------------------|---|--------------|---------------|----------------|------------------|
| Nature of the Course                 | <b>DSE</b>  |              |               |                |                  |
| Course Code                          | <b>DSE60ENV403(T)25</b>   |              |               |                |                  |
| Course Title                         | <b>ENVIRONMENTAL INSTRUMENTATION</b>                                |              |               |                |                  |
| Course Level                         | <b>Level 400</b>  |              |               |                |                  |
| Credit Details                       | Total Credit  | Lecture/Week | Tutorial/week | Practical/Week | Total hours/Week |
|                                      | 4   | 4            |               |                | 4                |
| Course Audience                      | Major students enrolled in the FYUGP in Environmental Science       |              |               |                |                  |
| Proposed by (for Non-Core Course)    |   |              |               |                |                  |
| Skill Training Required (if any)     |   |              |               |                |                  |
| Pre-requisite Course required        | 10+2 in Science   |              |               |                |                  |
| Faculty Eligibility & Specialization | MSc Degree in Environmental Science with a PhD or NET qualification |              |               |                |                  |

**Course Objective (Summary):** The course aims to understand the basic concept of environmental sampling and instrumentation. It will highlight the basic principles of analytical instruments, various techniques for air, soil and water sampling. The course seeks to help students to understand the laboratory protocols, quality assurance and quality control as well.

**Course Learning Outcomes:**

|   |   |
|---|---|
| 1 | Students will learn about the various sampling techniques for environmental parameters like air, water, soil and gain knowledge of analytical instrumentations. |
| 2 | They will understand basic and working principles of various instruments.   |
| 3 | Students will learn to measure environmental sample analysis, understand contamination, and laboratory protocols.   |

**Detailed Syllabus Content:**

| Unit | Unit Name                                 | Detailed Syllabus  | CH |
|------|---|--|----|
| I    | Basic principles of analytical techniques | Introduction to instrumentation and analytical techniques, Basics principles of analytical techniques, sampling techniques to measure environmental contamination in air, water, soils, and food. Safe Laboratory Practices, Quality assurance and Quality control.  | 15 |
| II   | Spectroscopy                              | Spectroscopy: Introduction, basic principles, Types of spectroscopy, Absorption spectrum, Emission spectra, Electromagnetic radiation, Beer-Lambert's law. UV-Visible spectroscopy, Fluorescence spectroscopy, IR/Raman spectroscopy, Flame Photometry, Atomic Absorption Spectroscopy, NMR Spectroscopy and Mass spectroscopy.  | 15 |
| III  | X-ray diffraction, Electron microscopy    | X-ray diffraction: X- ray spectra, Bragg's law, XRD techniques. Scanning electron microscopy (SEM) and Transmission electron microscopy (TEM): Introduction, basic principles, instrumentation.  | 15 |
| IV   | Chromatography                            | Gas Chromatography: Principle, carrier gas, stationery phase, instrumentation, sample injection, column detectors (TCD, FID, ECD), effect of temperature on retention<br>High Performance Liquid Chromatography: Principle, instrumentation, column, sample injection, detectors (absorbance, refractive index, electrochemical), mobile phase selection, ion pair chromatography. | 15 |

**Suggested Readings:**

1. Skoog D. A. and Crouch S. R., Principles of Instrumental Analysis (7th Edition).
2. Ewing G. R., Instrumental Methods of Chemical Analysis (5th Ed.), McGrawHill.
3. Rouessac F., Rouessac A., Chemical Analysis: Modern Instrumentation Methods and Techniques, Wiley.

4. Kemp W., Organic Spectroscopy, Palgrave Macmillan, 1991.
5. Fellenberg, G. (1999) Chemistry of Pollution, John Wiley and Sons.
6. Lodge, J.P. Jr. (edt.).(1989) Methods of Air Sampling and Analysis, Lewis Publishers.
7. Droste, R.L. (2005) Theory & practice of water and wastewater treatment, John Wiley Sons Publication.
8. Peavy, H.S., Tchobanoglous, G. and Rowe's D.R. (2000) Environmental Engineering. Tata McGraw-Hill.
9. Negi, S.S.(1985) Soil Conservation, Nataraj Publication, Dehradun.

**Cos/PSOs matrix:**

| <b>COs / PSOs</b> | <b>PO1</b> | <b>PO2</b> | <b>PO3</b> | <b>PO4</b> | <b>PO5</b> | <b>PO6</b> | <b>PO7</b> | <b>PO8</b> |
|-------------------|------------|------------|------------|------------|------------|------------|------------|------------|
| <b>COs</b>        | X          | X          | X          |            |            | X          | X          | X          |

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**DETAILED SYLLABUS (EXP. LEARNING)**

**INT55ENV301(J)25: EXPERIENTIAL LEARNING - 1**

**Credit: 04**  
**Contact hours: 180 h**

|                                      |   |              |               |                |                  |
|--------------------------------------|---|--------------|---------------|----------------|------------------|
| Nature of the Course                 | <b>EXPERIENTIAL LEARNING</b>  |              |               |                |                  |
| Course Code                          | <b>INT55ENV301(J)25</b>   |              |               |                |                  |
| Course Title                         | <b>EXPERIENTIAL LEARNING - 1</b>                                    |              |               |                |                  |
| Course Level                         | <b>Level 300</b>  |              |               |                |                  |
| Credit Details                       | Total Credit  | Lecture/Week | Tutorial/week | Practical/Week | Total hours/Week |
|                                      | 4   |              |               | 12             | 12               |
| Course Audience                      | Major students enrolled in the FYUGP in Environmental Science       |              |               |                |                  |
| Proposed by (for Non-Core Course)    |   |              |               |                |                  |
| Skill Training Required (if any)     |   |              |               |                |                  |
| Pre-requisite Course required        | 10+2 in Science   |              |               |                |                  |
| Faculty Eligibility & Specialization | MSc Degree in Environmental Science with a PhD or NET qualification |              |               |                |                  |

**Course Objective (Summary):** The undergraduate curriculum integrates experiential learning to connect theory with practice. Through internships or apprenticeships, community engagement, and field-based projects, students gain practical skills, professional exposure, and a deeper understanding of societal contexts, enhancing their academic learning and career readiness.

**Detailed Syllabus Content:** Students can take any of the following:

**(a) Summer Internship /Apprenticeship:** A key feature of the new undergraduate programme is the integration of real-world experience through internships or apprenticeships. During the summer term, students may undertake work-based learning in approved firms, industries, or research institutions across sectors such as healthcare, governance, media, and local industries. A 4-credit internship is mandatory for students exiting after the 1st year (Bachelor’s Certificate) or 2nd year (Bachelor’s Diploma). In the 5<sup>th</sup> semester, a 4-credit internship is compulsory for all students. All host institutions providing internship must be approved by Manipur University to ensure quality and credibility.

**(b) Community engagement and service:** This curricular component aims to expose students to real-world socio-economic issues, enabling them to apply theoretical knowledge to practical situations and contribute to solving real-life problems. Community engagement and service may be undertaken as part of the summer term activity or integrated into a major or minor course, depending on the student’s chosen discipline.

**(c) Field-based learning/minor project:** This component is designed to provide students with first-hand exposure to diverse socio-economic contexts through field-based learning or minor projects. It aims to deepen their understanding of development-related issues in both rural and urban settings. Students will observe and study real-world situations, gaining insights into the policies, regulations, organizational structures, and programmes that shape the development process. Through direct engagement, students will explore complex community-level socio-economic challenges and examine innovative practices for addressing them. This project may be undertaken during the summer term or integrated into a major or minor course, depending on the student’s area of study.

**Cos/PSOs matrix:**

| COs / PSOs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|
| <b>COs</b> | X   | X   | X   |     |     | X   | X   | X   |

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**DETAILED SYLLABUS (DISSERTATION)**

**DIS60ENV401(D)25: DISSERTATION - 1**

**Credit: 04**  
**Contact hours: 180 h**

|                                      |   |              |               |                |                  |
|--------------------------------------|---|--------------|---------------|----------------|------------------|
| Nature of the Course                 | <b>DISSERTATION</b>   |              |               |                |                  |
| Course Code                          | <b>DIS60ENV401(D)25</b>   |              |               |                |                  |
| Course Title                         | <b>DISSERTATION - 1</b>   |              |               |                |                  |
| Course Level                         | <b>Level 300</b>  |              |               |                |                  |
| Credit Details                       | Total Credit  | Lecture/Week | Tutorial/week | Practical/Week | Total hours/Week |
|                                      | 4   |              |               | 12             | 12               |
| Course Audience                      | Major students enrolled in the FYUGP in Environmental Science       |              |               |                |                  |
| Proposed by (for Non-Core Course)    |   |              |               |                |                  |
| Skill Training Required (if any)     |   |              |               |                |                  |
| Pre-requisite Course required        | 10+2 in Science   |              |               |                |                  |
| Faculty Eligibility & Specialization | MSc Degree in Environmental Science with a PhD or NET qualification |              |               |                |                  |

**Course Objective (Summary):** The course is aimed to highlight the basic concepts of Environmental Research. Students are expected to learn the basic components such as sample, population, sample design and sampling methods for qualitative and quantitative research. It will introduce the concepts of environmental research using various issues in the environment, hypothesis testing and drawing inferences of environmental data.

**Course Learning Outcomes:**

|   |  |
|---|--|
| 1 | Students will learn the fundamentals of environmental research and their scope and uses.   |
| 2 | Students will learn basic concepts of data collection, presentation and interpretation of environmental data using statistical and computing software. |
| 3 | Students will learn the knowledge of scientific research.  |

**Detailed Syllabus Content:**

| Unit | Unit Name         | Detailed Syllabus  | CH  |
|------|-------------------|--|-----|
| I    | Dissertation work | Dissertation work: Introduction. Review, Methodology (Synopsis). | 180 |

**Cos/PSOs matrix:**

| COs / PSOs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|
| COs        | X   | X   | X   |     |     | X   | X   | X   |

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**DIS60ENV402(D)25: DISSERTATION - 2**

**Credit: 08**  
**Contact hours: 360 h**

|                                      |   |              |               |                |                  |
|--------------------------------------|---|--------------|---------------|----------------|------------------|
| Nature of the Course                 | <b>DISSERTATION</b>   |              |               |                |                  |
| Course Code                          | <b>DIS60ENV402(D)25</b>   |              |               |                |                  |
| Course Title                         | <b>DISSERTATION - 2</b>   |              |               |                |                  |
| Course Level                         | <b>Level 400</b>  |              |               |                |                  |
| Credit Details                       | Total Credit  | Lecture/Week | Tutorial/week | Practical/Week | Total hours/Week |
|                                      | 8   |              |               | 24             | 24               |
| Course Audience                      | Major students enrolled in the FYUGP in Environmental Science       |              |               |                |                  |
| Proposed by (for Non-Core Course)    |   |              |               |                |                  |
| Skill Training Required (if any)     |   |              |               |                |                  |
| Pre-requisite Course required        | 10+2 in Science   |              |               |                |                  |
| Faculty Eligibility & Specialization | MSc Degree in Environmental Science with a PhD or NET qualification |              |               |                |                  |

**Course Objective (Summary):** The course is aimed to highlight the basic concepts of Environmental Research. Students are expected to learn the basic components such as sample, population, sample design and sampling methods for qualitative and quantitative research. It will introduce the concepts of environmental research using various issues in the environment, hypothesis testing and drawing inferences of environmental data.

**Course Learning Outcomes:**

|   |  |
|---|--|
| 1 | Students will learn the fundamentals of environmental research and their scope and uses.   |
| 2 | Students will learn basic concepts of data collection, presentation and interpretation of environmental data using statistical and computing software. |
| 3 | Students will learn the knowledge of scientific research.  |

**Detailed Syllabus Content:**

| Unit | Unit Name         | Detailed Syllabus   | CH  |
|------|-------------------|---|-----|
| I    | Dissertation work | Dissertation work: Thesis writing: Experimentation, Results, Discussion and Conclusion. Thesis submission and viva. | 360 |

**Cos/PSOs matrix:**

| COs / PSOs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|
| <b>COs</b> | X   | X   | X   |     |     | X   | X   | X   |

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**Course Teaching-Learning Process:**

The important relevant teaching and learning processes involved in this course are;

- Class lectures
- Seminars
- Tutorials
- Group discussions and Workshops
- Question framing
- Short answer type questions
- Long answer type questions
- Objective type questions
- Multiple choice questions
- Statement, reasoning and explanation
- Project-based learning
- Field-based learning
- Practical component and experiments
- Quizzes
- Presentations through Posters and power point
- Internship in industry and research institutional

**Linkage between Programme Learning Outcomes (POs) and Course Learning Outcomes (COs)**

| Sem | Course Learning Outcomes (COs)                            | PO1: Ability to recognize then feed for learning the topic and develop foundational knowledge on the topic | PO2: Ability to develop critical thinking and problem solving skills to solve inter disciplinary issue related to the topic | PO3: Ability to understand the relationships between natural and man-made systems | PO4: Ability to apply statistical methods, ICT and innovative techniques in classroom, field and laboratory to analyze scientific data | PO5: Ability to develop lifelong learning and professional skills | PO6: Ability to design and execute a scientific project, write Scientific reports, develop research and communication skills | PO7: Ability to spread awareness about the environment around us, sustainable development and conduct outreach activities | PO8: Ability to gain empirical knowledge on the topic and contribute in decision making processes |
|-----|---|--|---|---|--|---|--|---|---|
| I   | MJC45ENV101(T/P)25: Introduction to Environmental Science | X  | X   | X   |  |   | X  | X   | X   |
| II  | MJC45ENV102(T/P)25: Fundamentals of Ecology               | X  | X   | X   |  |   | X  | X   | X   |
| III | MJC50ENV203(T/P)25: Physical Environment                  | X  | X   | X   |  |   | X  |   | X   |
| III | MJC50ENV204(T/P)25: Biological Environment                | X  | X   | X   |  | X   | X  |   | X   |
| IV  | MJC50ENV205(T/P)25: Environmental Chemistry               | X  | X   | X   | X  |   | X  |   | X   |
| IV  | MJC50ENV206(T/P)25: Biodiversity and Conservation         | X  | X   | X   |  |   | X  | X   | X   |
| IV  | MJC50ENV207(T)25: Environmental Legislation and Policy    | X  | X   | X   |  | X   |  | X   | X   |
| IV  | MJC50ENV208(T/P)25: Energy and Environment                | X  | X   | X   |  | X   | X  | X   | X   |
| V   | MJC55ENV309(T/P)25: Air and Noise Pollution               | X  | X   | X   |  |   | X  | X   | X   |
| V   | MJC55ENV310(T/P)25: Soil and Water Pollution              | X  | X   | X   |  |   | X  | X   | X   |
| V   | MJC55ENV311(T/P)25: Solid Waste Management                | X  | X   |   |  | X   | X  | X   | X   |
| VI  | MJC55ENV312(T/P)25: Natural Hazards                       | X  | X   | X   |  | X   | X  | X   | X   |

|      |   |   |   |   |   |   |   |   |   |
|------|---|---|---|---|---|---|---|---|---|
|      | and Disaster Management   |   |   |   |   |   |   |   |   |
| VI   | MJC55ENV313(T/P)25: Wildlife Conservation and Management        | X | X | X |   |   | X | X | X |
| VI   | MJC55ENV314(T/P)25: Introduction to Climate Change              | X | X |   |   | X | X | X | X |
| VI   | MJC55ENV315(T/P)25: Environmental Pollution and Human Health    | X | X | X |   |   | X | X | X |
| VII  | MJC60ENV416(T/P)25: Environmental Impact Assessment             | X | X | X | X | X | X | X | X |
| VII  | MJC60ENV417(T/P)25: Environmental Biotechnology                 | X | X | X | X |   | X |   | X |
| VII  | MJC60ENV418(T/P)25: Research Methodology                        |   |   |   | X | X | X | X | X |
| VII  | MJC60ENV419(T/P)25: Remote Sensing and GIS                      |   |   |   | X | X | X | X | X |
| VIII | MJC60ENV420(T/P)25: Pollution Monitoring and Control Technology | X | X | X | X | X | X | X | X |

**Assessment Methods:**

- Oral and written examinations
- Closed-book and open-book tests,
- Problem-solving exercises,
- Practical assignments and laboratory reports,
- Observation of practical skills,
- Individual and group project reports,
- Seminar and presentations,
- Interactive sessions.

**Annexure – IV**

**Categories for some common foundational courses (to be discussed)**

| Course Types               | Course  | Course Code      |
|----------------------------|---|------------------|
| Ability Enhancement Course | Language and Communication Skills in English                            | AEC45ENG100(T)   |
|                            | Language and Communication Skills in Manipuri                           | AEC45MAN100(T)   |
|                            | Language and Communication Skills in Hindi                              | AEC45HIN100(T)   |
|                            | Linguistics, Academic Writing and Professional Communication in English | AEC45ENG101(T)   |
|                            | Linguistics ,Academic Writing and Professional Communication in English | AEC45MAN101(T)   |
|                            | Linguistics, Academic Writing and Professional Communication in English | AEC45HIN101(T)   |
| Multidisciplinary Courses  | .....course under Natural and Physical Science                          | MDC45NPS.....(T) |
|                            | ..... course under Mathematics, Statistics and Computer Science         | MDC45MSC.....(T) |
| Value Added Course         | ..... course under Indian Knowledge System                              | VAC45IKS.....(T) |
|                            |   |                  |

**Monitoring Mechanism for the Fourth Year Bachelor's Degree (Honours / Honours with Research)**

To ensure academic quality, rigour, and compliance with programme objectives, the following multi-tiered monitoring mechanism may be adopted for the fourth year of the Bachelor's Degree (Honours / Honours with Research):

- (a) **Online Academic Tracker:** An online academic tracker **may** be developed and maintained by the University to monitor the fourth-year Bachelor's Degree (Honours / Honours with Research) programmes. Each affiliated college offering these courses shall be provided with a secure login facility. The Principal and the IQAC Coordinator of each college shall be responsible for monthly submission of data, including credit delivery status, student attendance, assessment records, project/dissertation progress, and mentoring activities. The tracker will serve as a centralized system for ensuring academic compliance, transparency, and timely reporting to the University.
- (b) **Periodic Field Visits:** The University **may** conduct periodic field visits to colleges offering the fourth-year Bachelor's Degree (Honours / Honours with Research) programmes. These visits, carried out by designated academic monitoring teams, shall include interactions with faculty and students, classroom observations, and verification of teaching-learning processes, infrastructure, and project supervision practices. Field visit reports shall be submitted to the University for review and necessary follow-up to ensure academic standards are maintained.
- (c) **Academic Audit:** An academic audit of the fourth-year Bachelor's Degree (Honours / Honours with Research) programmes may be conducted by an external team or third-party group, designated or approved by the University. The audit team shall include a University nominee to ensure alignment with academic standards and regulatory compliance. The audit shall evaluate syllabus coverage, internal assessments, project supervision, credit completion, and documentation practices. The audit report shall be submitted to the University for review and necessary follow-up action.

**Minimum Monitoring Criteria for the Fourth Year Bachelor's Degree (Honours / Honours with Research)**

*(For Online Tracking, Field Visits, and Academic Audit)*

**1. Curriculum Delivery and Academic Engagement**

- Timely commencement and structured delivery of fourth-year courses as per the approved syllabus and credit plan.
- Adherence to weekly teaching plans, with clear linkage to Programme Outcomes (POs) and Course Outcomes (COs).
- Use of research-integrated pedagogy, seminars, and supervised tutorials aligned to advanced-level learning.

**2. Project/Dissertation Supervision and Research Progress**

- Allocation of research supervisors approved by the Departmental Research Committee (DRC).
- Approved research/project titles with clear objectives, methodology, and timelines.
- Regular supervisor–student interaction records (minimum once every two weeks).
- Monitoring of research progress via milestone tracking: proposal approval, review submissions, draft reports, and final submission.
- Plagiarism check reports and adherence to research ethics.

**3. Credit Completion and Academic Performance**

- Tracking of credit distribution and fulfilment (including dissertation/project credits).
- Submission and verification of Internal Assessment (IA) and project marks.

**4. Assessment and Evaluation Practices**

- Timely conduct of assessments (written exams, project presentations, viva voce).
- Rubrics or guidelines used for evaluation of project/dissertation work.
- Maintenance of marks registers and assessment documentation.
- Review of internal moderation procedures and quality assurance in evaluation.

**5. Online Tracker Compliance**

- Monthly data upload by Principal/IQAC Coordinator on academic progress, credit delivery, attendance, assessment completion, and project supervision.
- Upload of relevant supporting documents (project outlines, progress reports, etc.).  
Upload of geotagged and timestamped photographic documentation

**6. Infrastructure and Research Facilities**

- Availability of infrastructure for advanced-level courses and project/dissertation work.
- Access to laboratories, libraries, software tools, internet, and relevant databases for research.
- Support mechanism provided for data collection, fieldwork, and research publication.

**7. Student Mentoring and Support**

- Academic mentoring provided for project planning and execution.
- Availability of faculty for guidance on research methodology, literature review, data analysis, and writing.

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