



दिल्ली विश्वविद्यालय University of Delhi

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CNC-II/093/1/AC-1027/26/4

Dated: 27.07.2026

NOTIFICATION

Sub: Amendment to Ordinance V

(AC dated 24.07.2026)

Following addition be made to Annexure-II-A to the Ordinance V (2-A) of the Ordinances of the University;

Add the following:

The following syllabi of the Department of Environmental Science under the Faculty of Science based on Postgraduate Curriculum Framework 2024 are notified herewith for the information of all concerned:

Department	Syllabi	Annexure
Environment al Science	(i) PG Discipline Specific Elective Courses: Environmental Genetics; Ecology, Evolution and Biosystematics. (ii) UG Generic Electives.	1 & 2


REGISTRAR

Even Semester

DISCIPLINE SPECIFIC ELECTIVE COURSE - (DSE)

Environmental Genetics

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Environmental Genetics	4	3	0	1	UG	NA

Course Objectives

The course aims to:

- Introduce genetic and genomic tools used in environmental science.
- Explain how genetic variation supports adaptation, conservation, and ecosystem resilience.
- Train students in basic laboratory and data-analysis methods used in molecular ecology.
- Develop employable skills in DNA-based biodiversity monitoring, conservation genetics, and environmental reporting.

Learning Outcomes

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

- Explain key concepts of environmental genetics and molecular ecology.
- Assess genetic diversity, population structure, and adaptation in natural populations.
- Apply DNA barcoding, eDNA, and basic genomics in environmental monitoring.
- Perform simple laboratory and bioinformatics exercises related to environmental genetics.
- Prepare technical reports useful for research, consultancy, and conservation practice.

Course Syllabus

Theory: 45 Hours

Unit I: Principles of Environmental Genetics (11 Hours)

Genetic variation and its environmental importance; Alleles, genotypes, populations, and gene pools; Mutation, migration, drift, selection, and gene flow; Hardy –Weinberg principle; Genetic diversity and population fitness; Inbreeding, bottlenecks, founder effects, and habitat fragmentation.

Unit II: Molecular Ecology and Conservation Genetics (11 Hours)

Molecular markers: microsatellites, SNPs, mitochondrial DNA, chloroplast DNA; Population structure and connectivity; Phylogeography and evolutionary history; Conservation genetics of threatened species; Genetic rescue, captive breeding, reintroduction, and invasive species genetics.

Unit III: Environmental Genomics and Adaptation (11 Hours)

Ecological genomics and population genomics; Genomic responses to climate change, pollution, salinity, drought, and heat stress; Local adaptation; Ecotoxicogenomics and biomarkers; Epigenetic responses to environmental stress; Genomics in ecological restoration.

Unit IV: Environmental DNA, Bioinformatics and Employability Applications (12 Hours)

DNA barcoding and metabarcoding; Environmental DNA from water, soil, sediment, and air; eDNA in biodiversity monitoring, invasive species detection, pathogen surveillance, and environmental impact assessment; Introduction to sequence databases; Sequence alignment and analyses, diversity tables; Technical report writing and molecular ecology consultancy skills.

Suggested Practicals / Field Visits/Applied Exercises (30 hours)

- Isolation of genomic DNA from plant leaf tissue and soil microbial samples
- Isolation of DNA from water-filter samples for eDNA demonstration.
- Agarose gel electrophoresis for DNA quality checking.
- Quantification of DNA using a spectrophotometer or fluorometer.
- PCR amplification of a plant barcode gene such as *rbcL* or *matK*.
- PCR amplification of animal barcode gene *COI*, using available DNA samples.
- Gel documentation and interpretation of PCR products.
- Restriction digestion of DNA and fragment-pattern interpretation.
- DNA barcoding exercise using BLAST for species identification.
- Isozyme polymorphism in a population of target plant species
- Construction of a simple phylogenetic tree using barcode sequences.
- Calculation of allele frequency and heterozygosity from sample genetic data.
- Hardy–Weinberg equilibrium calculation using classroom genotype data.
- Preparation of a technical report on an eDNA or conservation genetics case study.

Essential Readings

- Allendorf, F. W., Funk, W. C., Aitken, S. N., Byrne, M., & Luikart, G. (2022). Conservation and the genomics of populations (3rd ed.). Oxford University Press.
- Beebe, T. J. C., & Rowe, G. (2017). An introduction to molecular ecology (3rd ed.). Oxford University Press.
- Frankham, R., Ballou, J. D., & Briscoe, D. A. (2010). Introduction to conservation genetics (2nd ed.). Cambridge University Press.
- Hahn, M. W. (2018). Molecular population genetics. Oxford University Press.
- Lowe, A., Harris, S., & Ashton, P. (2004). Ecological genetics: Design, analysis, and application. Blackwell Publishing.

Suggested Readings

- Avise, J. C. (2004). Molecular markers, natural history, and evolution (2nd ed.). Sinauer Associates.
- Freeland, J. R., Kirk, H., & Petersen, S. D. (2011). Molecular ecology (2nd ed.). Wiley-Blackwell.
- Hamilton, M. B. (2009). Population genetics. Wiley-Blackwell.
- Hartl, D. L., & Clark, A. G. (2007). Principles of population genetics (4th ed.). Sinauer Associates.
- Taberlet, P., Bonin, A., Zinger, L., & Coissac, E. (2018). Environmental DNA: For biodiversity research and monitoring. Oxford University Press.
- Waldvogel, A.-M., et al. (2020). Evolutionary genomics can improve prediction of species' responses to climate change. *Evolution Letters*, 4(1), 4–18.

Even Semester

DISCIPLINE SPECIFIC ELECTIVE COURSE - (DSE)

Ecology, Evolution and Biosystematics

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Ecology, Evolution and Biosystematics	4	3	0	1	UG	-

Course Objectives

The course aims to:

- Understand key concepts in ecology and evolution and bring quantitative methods (computing, morphological and molecular techniques) and biological concepts together to examine cutting-edge biological research problems
- Study how taxonomy and systematics provide the foundation for our understanding of biological diversity

Learning Outcomes

After the course, students will be able to:

- Examine fundamental concepts and theory, and their application to evolutionary ecology, conservation and biodiversity science.
- Apply taxonomic and systematic skills to diverse careers related to biodiversity and conservation.

Course Syllabus

Theory (45 hours)

Unit 1- Fundamental concepts in Ecology

(12 Hours)

Population Ecology: Life tables, survivorship curves and age structures, population growth models, metapopulation dynamics; Community Ecology: Species interactions, niche theory, guilds, and competitive exclusion, succession, biodiversity and the Theory of Island Biogeography; Ecosystem Ecology: Trophic levels, food webs, and ecological pyramids, primary and secondary productivity, biogeochemical cycles; Behavioral Ecology: Foraging theory, sensory ecology, sexual selection and mating systems, altruism and kin selection.

Unit II - Biosystematics & Taxonomy

(12 Hours)

Principles of Systematics: History of biological classification, alpha and beta taxonomy, phenetics vs. cladistics; Taxonomic Procedures: Species concepts, protocols for identification, preservation, and curation; Nomenclature: The International Code of Zoological Nomenclature (ICZN) and Botanical Nomenclature (ICN), operative principles, valid publication, and taxonomic ranks; Modern Trends: Chemotaxonomy, cytotaxonomy, and molecular systematics.

Unit III – Evolutionary Biology

(11 Hours)

History & Fundamentals: Evolutionary thought; mechanisms of genetic variation; Population Genetics: Hardy-Weinberg equilibrium; natural selection; genetic drift and gene flow; Speciation & Phylogenetics: Reproductive isolation, sympatric and allopatric speciation; constructing and interpreting phylogenetic trees; Macroevolution & Coevolution: Evolutionary arms races, adaptive radiation, and mass extinctions.

Unit IV- Computational Methods in Ecology and Evolution (10 Hours)

Ecological and Evolutionary Data Science; Mathematical Modeling in Ecology and Evolution; Advanced Data Science, including Machine learning and AI; Numerical taxonomy; Statistics in R.

Suggested Practicals/Field Components/Applied Exercises (30 hours)

- Specimen Collection and Curation: Field collection, pressing/preservation, and herbarium/museum management.
- Biosystematics Lab: Designing indented and bracketed taxonomic keys. Multivariate statistical analysis of morphometric data.
- Ecological Fieldwork: Field sampling techniques (quadrats, line transects), Diversity Assessment using R.
- Molecular Taxonomy and Phylogenetic Lab: DNA extraction, sequencing, and alignment; constructing phylogenetic trees using computational tools

Essential Readings

- Begon, M., & Townsend, C. R. (2021). *Ecology: From individuals to ecosystems* (5th ed.). Wiley.
- Borcard, D., Gillet, F., & Legendre, P. (2018). *Numerical ecology with R* (2nd ed.). Springer.
- Davies, N. B., Krebs, J. R., & West, S. A. (2012). *An introduction to behavioural ecology* (4th ed.). Wiley-Blackwell.
- Futuyma, D. J., & Kirkpatrick, M. (2022). *Evolution* (5th ed.). Oxford University Press.
- Holmes, S., & Huber, W. (2019). *Modern statistics for modern biology*. Cambridge University Press.
- Mittelbach, G. G., & McGill, B. J. (2019). *Community ecology* (2nd ed.). Oxford University Press.
- Wiley, E. O., & Lieberman, B. S. (2011). *Phylogenetics: Theory and practice of phylogenetic systematics* (2nd ed.). Wiley-Blackwell.
- Zachos, F. E. (2016). *Species concepts in biology: Historical development, theoretical foundations and practical relevance*. Springer.

Suggested Textbooks:

- Chesson, P. (2000). Mechanisms of maintenance of species diversity. *Annual Review of Ecology and Systematics*, 31, 343–366.
- Herron, J. C., & Freeman, S. (2014). *Evolutionary analysis* (5th ed.). Pearson.
- Kapli, P., Yang, Z., & Telford, M. J. (2020). Phylogenetic tree building in the genomic age. *Nature Reviews Genetics*, 21, 428–444.
- Krebs, C. J. (2013). *Ecology: The experimental analysis of distribution and abundance* (6th ed.). Pearson.
- Mittelbach, G. G., & McGill, B. J. (2019). *Community ecology* (2nd ed.). Oxford University Press.
- Pichler, M., & Hartig, F. (2023). Machine learning and deep learning—A review for ecologists. *Methods in Ecology and Evolution*, 14(4), 994–1016.
- Sneath, P. H. A., & Sokal, R. R. (1973). *Numerical taxonomy: The principles and practice of numerical classification*. W. H. Freeman.

Generic-Elective in Environmental Science at UG Level

Odd Semester

- (ii) *Society, Culture and Environment*
- (iii) *Nature and Indigenous Environmental Knowledge*
- (iv) *Climate-Smart Water Governance*
- (v) Climate Emotions, Resilience and Sustainability Action

Even Semester

- (ii) *Nature-Based Air Pollution Mitigation*
- (iii) Skills for Green Startups
- (iv) Environmental Law and Governance
- (v) Green Business and Sustainable Entrepreneurship

Generic-Elective in Environmental Science at UG Level

Odd Semester

- (i). *Society Culture and Environment*
- (ii). *Nature and Indigenous Environmental Knowledge*
- (iii). *Climate-Smart Water Governance*
- (iv). *Climate Emotions, Resilience and Sustainability Action*

GENERIC ELECTIVE COURSE - (GE-EVS)
Nature, Culture and Indigenous Environmental Knowledge

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Society, Culture and Environment	4	2	0	2	12 th Pass	NA

Course Objectives

The course aims to:

- Introduce sociological, cultural, political and developmental perspectives on environmental issues.
- Explain how population, urbanisation, industrialisation, consumption and development shape environmental change.
- Build understanding of environmental inequality, vulnerability, gender, health and justice.
- Develop awareness of community participation, civil society action and environmental governance.
- Strengthen students' skills in social surveys, stakeholder analysis, environmental communication and public engagement.

Learning Outcomes

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

- Explain the social and cultural dimensions of environmental problems.
- Identify environmental inequalities affecting vulnerable communities, including women, children, informal workers, urban poor and climate-affected groups.
- Conduct basic social surveys and stakeholder mapping related to local environmental issues.
- Communicate sustainability concerns through reports, presentations, campaigns and awareness materials.
- Design a simple community or campus sustainability action proposal.
- Identify green employability opportunities in social, communication and development sectors.

Course Syllabus – Theory: 30 Hours

Unit I: Culture and Human–Environment Relations — 6 Hours

Culture, society and environmental perception: cultural values, beliefs, symbols, norms, institutions and meanings of nature; Nature in Indian cultural imagination: rivers, forests, animals, seasons, landscapes, festivals, rituals and ideas simplicity and reverence for life in classical, folk and public culture; Sociological and anthropological approaches to human–environment relations: social construction of environmental problems, cultural meanings of risk, place and landscape.

Unit II: Development, Culture and Environmental Inequality — 8 Hours

Development and environmental change: modernisation, urban expansion, industrialisation, infrastructure, resource extraction and ecological degradation; Culture under environmental stress: loss of place, livelihood disruption, displacement, migration, changing community relations and cultural insecurity; Environmental inequality and vulnerability: unequal exposure to pollution, waste, disasters and climate risks; Environmental health and justice.

Unit III: Community Participation and Environmental Movements (8 Hours)

Environmental governance, democratic participation and community decision-making; public hearings, social audits and participatory planning; role of NGOs, youth, women's groups, RWAs and citizen collectives; Indian environmental movements on justice, displacement, conservation conflicts and rights, anti-pollution, anti-mining and urban campaigns; role of media, courts and civil society.

Unit IV: Culture of Sustainability, Behaviour Change and Green Employability — 8 Hours

Sustainability as cultural change: SDGs, responsible consumption, lifestyle transitions and everyday environmental practices in water, energy, food, mobility and waste; Indian cultural ethics for sustainability: non-violence, moderation, simplicity, self-restraint, community responsibility, Gandhian ideas of *swadeshi*, self-reliance and critique of excessive consumption; green careers in NGOs, CSR, ESG, environmental education, sustainability communication, social research and development; sustainability action planning.

Suggested Practicals / Field Component / Applied Exercises (60 hours)

- Conduct survey on local environmental problems and perceptions.
- Document traditional environmental knowledge and practices.
- Analyse environmental themes in films, media, or advertisements.
- Study environmental behaviour patterns among students/community.
- Prepare case study on environmental movement.
- Conduct stakeholder analysis of a local environmental issue.
- Visit NGO, biodiversity park, or urban village.
- Assess awareness regarding waste segregation or water conservation.
- Document role of women or indigenous communities in conservation.
- Prepare social map of environmental vulnerabilities.
- Analyse environmental conflicts using newspaper reports.
- Conduct behavioural audit related to sustainable lifestyles.
- Design environmental awareness campaign materials.
- Prepare reflective field diary on environmental experiences.
- Develop a community sustainability action proposal.

Essential Readings

- Baviskar, A. (2020). *Uncivil city: Ecology, equity and the commons in Delhi*. SAGE.
- Beck, U. (1992). *Risk society: Towards a new modernity*. Sage Publications.
- Gadgil, M., & Guha, R. (1995). *Ecology and equity: The use and abuse of nature in contemporary India*. Routledge.
- Guha, R. (2024). *Speaking with nature: The origins of Indian environmentalism*. Fourth Estate.
- Guha, R. (2014). *Environmentalism: A global history*. Penguin Books.
- Hannigan, J. (2022). *Environmental Sociology*. 4th ed., Routledge.
- Mallick, K. (2021). *Environmental movements of India: Chipko, Narmada Bachao Andolan, Navdanya*. Amsterdam University Press.
- Waite, M. (2024). *Sustainability at work: Careers that make a difference* (2nd ed.).

Routledge.

Suggested Readings

- Dryzek, J. S. (2013). *The politics of the earth: Environmental discourses* (3rd ed.). Oxford University Press.
- Escobar, A. (2011). *Encountering development: The making and unmaking of the Third World*. Princeton University Press.
- Guha, R. (2000). *The unquiet woods*. Oxford University Press.
- Guha, R. (2000). *The unquiet woods: Ecological change and peasant resistance in the Himalaya*. Oxford University Press.
- Merchant, C. (2020). *The anthropology of environmentalism*. Yale University Press.
- Natesh, S. (2025). *Iconic trees of India: 75 natural wonders*. Roli Books, New Delhi.
- UNEP. (2021). *Making peace with nature: A scientific blueprint to tackle the climate, biodiversity and pollution emergencies*. United Nations Environment Programme.

GENERIC ELECTIVE COURSE - (GE-EVS)
Nature and Indigenous Environmental Knowledge

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Nature and Indigenous Environmental Knowledge	4	2	0	2	12 th Pass	NA

Course Objectives

The course aims to:

- Understand the relationship between nature, culture, indigenous knowledge and environmental conservation.
- Examine Indian ecological traditions, including Pancha Mahabhutas, environmental ethics, sacred landscapes and community-based resource management.
- Analyse traditional practices related to water, agriculture, architecture, biodiversity conservation, medicine and land restoration.
- Evaluate the relevance, limitations and contemporary challenges of indigenous environmental knowledge.
- Understand policies, laws and global frameworks related to indigenous rights, biodiversity, traditional knowledge and intellectual property.

Learning Outcomes

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

- Explain key concepts of nature, culture, environmental ethics and indigenous environmental knowledge.
- Assess the practical value of indigenous knowledge in water conservation, agriculture, architecture, biodiversity protection and ecosystem restoration.
- Critically compare ecocentric and anthropocentric approaches to development.
- Analyse issues such as biopiracy, intellectual property rights, community rights and biodiversity governance.
- Propose context-specific strategies for blending indigenous knowledge with modern scientific approaches.

Theory Syllabus (30 hours)

Unit 1: Introduction (7 hours)

Meaning and components of nature; nature in the Indian context; Pancha Mahabhutas and ecological balance; integration of nature and environment in Indian culture, traditions, religions and ancient texts; environmental ethics in Indian traditions; deep ecology and shallow ecology; ecocentric and anthropocentric development; scope of blending indigenous knowledge with modern science.

Unit 2: Indigenous Environmental Knowledge and Practices in India (8 Classes)

Traditional water conservation and management systems across India; climate-responsive traditional architecture with regional case studies; traditional agricultural practices including organic farming, zero-budget natural farming and jhum cultivation; tribal practices for environment and biodiversity conservation; sacred groves and community conservation; use of indigenous knowledge in restoring degraded landscapes, including biodiversity parks and similar examples.

Unit 3: Issues, Initiatives, Conventions, Policies and Acts (7 hours)

Indigenous knowledge and the Sustainable Development Goals; The UN Declaration on the Rights of Indigenous Peoples (UNDRIP) and the Convention on Biological Diversity; bioprospecting, biopiracy and intellectual property rights with case studies such as Basmati rice, neem and turmeric; India's Traditional Knowledge Digital Library (TKDL); People's Biodiversity Register; Forest Rights Act, 2006; Biological Diversity Act, 2002.

Unit 4: Case Studies from India and Worldwide (8 hours)

Traditional rainwater harvesting systems such as kui, tanka, johad, talaab and bawdi; indigenous medicinal knowledge based on environmental resources; conservation traditions of communities such as the Bishnois; community forest management; seed and soil conservation initiatives; Beej Bachao Andolan; environmental movements including Chipko and Appiko; selected global examples of indigenous ecological stewardship.

Suggested Practicals / Field Visits/Applied Exercises (60 hours)

- Document indigenous, cultural or religious practices in the student's village, town, district or state that support environmental conservation.
- Visit a traditional water conservation or management structure and prepare a field report.
- Visit an old rainwater harvesting structure, pond, lake or stepwell in Delhi, such as Agrasen ki Baoli or Hauz Khas Lake, and assess its present condition.
- Suggest ecological and community-based rejuvenation measures for a degraded traditional water body.
- Mark five tribal communities from different regions of India on a map and describe their environmental conservation practices.
- Visit a sacred grove or sacred natural site and document the associated cultural, religious and ecological practices.
- Visit a biodiversity park and identify how indigenous knowledge and modern science have been combined in landscape restoration.
- Study the structure and functioning of a People's Biodiversity Register.
- Identify five common Indian kitchen spices and prepare notes on their medicinal and ecological significance.
- Visit an organic or natural farm and report on its benefits, limitations and challenges.
- Prepare a case study on any one traditional rainwater harvesting system such as johad, tanka, bawdi, zabo, ahar-pyne or surangam.
- Interview an elder, farmer, healer, crafts person or community knowledge-holder about local ecological knowledge.
- Compare one traditional environmental practice with a modern technological alternative and evaluate their strengths and limitations.
- Conduct a group discussion on biopiracy using the neem, turmeric or Basmati rice case.
- Develop a small project proposal for integrating indigenous knowledge with modern science for local environmental conservation.

Essential Readings

- Berkes, F. (2018). Sacred Ecology: Learning from Indigenous Knowledge and Stewardship. 4th ed., Routledge.
- Baidur, M. (2015). Nature in Indian Philosophy and Cultural Traditions. Springer.
- Guha, R. (2000). The Unquiet Woods: Ecological Change and Peasant Resistance in the Himalaya. University of California Press.
- Jnandev, Y. (2021). Pancha Mahabhutas: The elemental building blocks of our existence. Design Marque.
- Longkumer, I. S. (2009). Panca Mahabhutas: An ecological reading in the Vedas and Vedanta. Punthi Pustak.
- Mishra, A. (2022). Aaj Bhi Khare Hain Talaab / The Ponds Are Still Alive. National Book Trust/Gandhi Peace Foundation, recent NBT

Suggested Readings

- Franco, F. M. (2022). Case Studies in Biocultural Diversity from Southeast Asia: Traditional Ecological Calendars, Folk Medicine and Folk Names. Springer,

- Gadgil, M., and Guha, R. (1992). *This Fissured Land: An Ecological History of India*. Oxford University Press.
- Saikia, A. (2019). *The unquiet river: A biography of the Brahmaputra*. Oxford University Press.

GENERIC ELECTIVE COURSE - (GE-EVS)

Skills for Green Startups

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Climate-Smart Water Governance	4	2	0	2	12 th Pass	NA

Course Objectives

The course aims to:

- Introduce water governance in the context of climate change.
- Explain water risks such as floods, droughts, scarcity, and unequal access.
- Build skills in water-use assessment, stakeholder mapping, and local planning.
- Develop employability skills for water, CSR, governance, and sustainability sectors.

Learning Outcomes

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

- Explain links between climate change and water security.
- Identify local water-governance problems and stakeholders.
- Interpret basic water-use, access, and risk information.
- Prepare simple water-conservation and resilience plans.
- Communicate water-governance solutions for communities and institutions.

Course Syllabus

Theory: 30 Hours

Unit I: Water, Society and Climate Change (7 Hours)

Water as a social, economic, ecological, and cultural resource; Climate impacts on rainfall, floods, droughts, groundwater, water quality, and health; Water scarcity and water stress; Water inequality and vulnerable groups; Urban and rural water challenges.

Unit II: Principles of Water Governance (8 Hours)

Meaning of governance; Institutions, rules, rights, responsibilities, and participation; Stakeholders in water governance; Gender and water; Traditional water systems; Community-based water management; Conflict and cooperation over water.

Unit III: Climate-Smart Water Management (8 Hours)

Water conservation; Rainwater harvesting; Greywater reuse; Watershed management; Demand management; Flood preparedness; Drought planning; Nature-based water solutions; Wetlands, lakes, rivers, and groundwater recharge.

Unit IV: Water Policy, Planning and Employability (7 Hours)

Water laws and policies in simple terms; SDG 6; Water budgeting; Water audits; Public campaigns; Role of municipalities, panchayats, RWAs, NGOs, CSR, and industries; Water entrepreneurship; Preparing a local water-governance action plan.

Suggested Practicals / Field Component / Applied Exercises (60 hours)

- Identify major water sources used by households, campus, or community.
- Prepare a simple water-use profile for a selected site.
- Map stakeholders involved in local water supply and management.
- Identify climate-related water risks in a neighbourhood or institution.
- Document local experiences of flood, drought, scarcity, or waterlogging.
- Assess household or campus awareness of water conservation.
- Prepare a basic water-budget estimate for a household or institution.
- Identify opportunities for rainwater harvesting at a selected site.
- Assess possibilities for greywater reuse in a home, hostel, or campus.
- Map visible water wastage points in a selected locality or institution.
- Compare water access among different user groups.
- Document a traditional or community-based water-management practice.
- Prepare a drought-preparedness checklist for households or communities.
- Construct a flood-preparedness checklist for a vulnerable locality.
- Develop a climate-smart water-governance action plan.

Essential Readings

- Brears, R. C. (2018). Climate resilient water resources management. Palgrave Macmillan.
- Hurlbert, M. A. (2017). Adaptive governance of disaster: Drought and flood in rural areas. Springer.
- Pahl-Wostl, C. (2015). Water governance in the face of global change: From understanding to transformation. Springer.
- Rodina, L. (2023). Water resilience: Management and governance in times of change. Cambridge University Press.

Suggested Readings

- Barua, A., Narain, V., & Vij, S. (2018). Climate change governance and adaptation: Case studies from South Asia. Routledge.
- Brears, R. C. (2017). Urban water security. Wiley.
- Schmidt, J. J., & Matthews, N. (2017). Global challenges in water governance: Environments, economies, societies. Palgrave Macmillan.

GENERIC ELECTIVE COURSE - (GE-EVS)

Climate Emotions, Resilience and Sustainability Action

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Climate Emotions, Resilience and Sustainability Action	4	2	0	2	12 th Pass	NA

Course Objectives

The course aims to:

- Develop a basic understanding of climate change and its social impacts.
- Help students transform climate concern into informed action.
- Promote sustainable lifestyle, campus, and community practices.
- Build green employability skills through communication, auditing, and action planning.

Learning Outcomes

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

- Explain climate change in simple scientific and social terms.
- Identify climate-related risks in daily life, cities, and communities.
- Design small sustainability actions for home, campus, or workplace.
- Communicate climate solutions through reports, campaigns, and presentations.
- Develop basic skills relevant to green jobs, ESG, CSR, NGOs, and sustainability communication.

Course Syllabus

Theory: 30 Hours

Unit I: Understanding Climate Change and Climate Emotions (7 Hours)

Weather and climate; Greenhouse effect and global warming; Human activities causing climate change; Climate change impacts on water, food, health, cities, livelihoods, and vulnerable groups; Climate anxiety, eco-grief, hope, responsibility, and collective action; Role of youth in climate response.

Unit II: Sustainable Living and Responsible Consumption (8 Hours)

Carbon footprint and ecological footprint; Sustainable food, water, energy, mobility, clothing, and digital habits; Waste reduction and circular economy; Minimalism, repair, reuse, sharing economy, and conscious consumption; Sustainable festivals, events, and campuses.

Unit III: Climate Resilience in Communities and Institutions (7 Hours)

Climate risks in urban and rural areas; Heat waves, floods, droughts, air pollution, and public health; Disaster preparedness and community resilience; Nature-based solutions for climate adaptation; Role of local governments, schools, colleges, NGOs, and citizen groups.

Unit IV: Climate Action, Communication and Green Employability (8 Hours)

Climate action plans at individual, campus, and community levels; Sustainable Development Goals; ESG, CSR, green entrepreneurship, climate communication, and environmental volunteering; Campaign design, behaviour change, sustainability reporting, and green career pathways; Preparing a basic sustainability action proposal.

Suggested Practicals / Field Visits/Applied Exercises

- Identify major climate emotions such as anxiety, anger, grief, guilt, hope, and responsibility.
- Document personal perceptions of climate change through reflective writing.
- Analyse how media messages influence climate anxiety, denial, rage, hope, or action.
- Transform eco-rage into peaceful civic and community-based climate action.
- Examine examples of climate hope through interviews with local change-makers.
- Assess climate-risk perception among different social or student groups.
- Identify misinformation and misleading claims related to climate change.
- Map local climate stressors such as heat, flooding, water scarcity, and air pollution.
- Observe the effects of heat stress on comfort, mood, productivity, and well-being.
- Design positive climate communication material for awareness and action.
- Understand climate conflicts through stakeholder role-play and dialogue.
- Practice one sustainable lifestyle change and evaluate its behavioural impact.
- Prepare a community checklist for climate preparedness and resilience.
- Develop a collective care plan for coping with eco-anxiety and climate distress.
- Prepare a climate action portfolio integrating emotion, risk, communication, and sustainability action.

Essential Readings

- Gates, B. (2021). How to avoid a climate disaster: the solutions we have and the breakthroughs we need. Vintage.
- Hawken, P. (2017). Drawdown: The most comprehensive plan ever proposed to reverse global warming. Penguin Books.
- Klein, N. (2014). This changes everything: Capitalism vs. the climate. Simon & Schuster.
- Mann, M. E. (2021). The new climate war: The fight to take back our planet. PublicAffairs.
- Marvel, K. (2026). Human nature: Nine ways to feel about our changing planet. Ecco.HarperCollins.
- Salamon, M. K. (2023). Facing the climate emergency: How to transform yourself with climate truth (2nd ed.). New Society Publishers.

Suggested Readings

- Bednarek, S. (2024). Climate, psychology, and change: Reimagining psychotherapy in an era of global disruption and climate anxiety. North Atlantic Books.
- Goodall, J., Abrams, D., & Hudson, G. (2021). The book of hope: A survival guide for trying times. Celadon Books.
- Kalmus, P. (2017). Being the change: Live well and spark a climate revolution. New Society Publishers.
- Mason, P. (2010). How big is your food footprint?. Marshall Cavendish.
- Raworth, K. (2017). Doughnut economics: Seven ways to think like a 21st-century economist. Random House Business.
- Ray, S. J., & Nasedkin, A. (2020). A field guide to climate anxiety: How to keep your cool on a warming planet (p. 19). Oakland: University of California Press.

Even Semester

- (i) Nature-Based Air Pollution Mitigation
- (ii) Skills for Green Startups
- (iii) Environmental Law and Governance
- (iv) Green Business and Sustainable
Entrepreneurship

GENERIC ELECTIVE COURSE - (GE-EVS)

Nature-Based Air Pollution Mitigation

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Nature-Based Air Pollution Mitigation	4	2	0	2	12 th Pass	NA

Course Objectives

The course aims to:

- Introduce air pollution, its causes, impacts, and solutions in simple terms.
- Explain the role of trees, greenspaces, wetlands, and urban design in reducing pollution exposure.
- Develop practical skills in air-quality awareness, community surveys, and green-space assessment.
- Build employability skills related to urban sustainability, CSR, ESG, public health, and environmental planning.

Learning Outcomes

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

- Identify major air pollutants, sources, and health impacts.
- Explain how nature-based solutions can reduce air-pollution exposure.
- Assess local green spaces for pollution-mitigation potential.
- Prepare simple air-pollution awareness and mitigation plans.
- Contribute to green-campus, urban-greening, CSR, and sustainability projects.

Course Syllabus

Theory: 30 Hours

Unit I: Air Pollution and Human Well-being (8 Hours)

Meaning and types of air pollution; Major pollutants: particulate matter, sulphur dioxide, nitrogen oxides, carbon monoxide, ozone, volatile organic compounds, and indoor air pollutants; Sources of pollution: transport, industry, construction, waste burning, household fuel, and dust; Health, economic, social, and environmental impacts of air pollution.

Unit II: Nature-Based Solutions for Cleaner Air (7 Hours)

Meaning of nature-based solutions; Role of trees, shrubs, grasses, wetlands, green roofs, green walls, and urban forests; Pollution capture, dust reduction, shade, cooling, and microclimate regulation; Benefits and limitations of vegetation-based pollution mitigation; Importance of biodiversity in urban greening.

Unit III: Planning Green Spaces for Pollution Reduction (8 Hours)

Roadside plantations, buffer zones, parks, institutional campuses, residential areas, and industrial green belts; Selection of plant species for pollution tolerance and local suitability; Native species and urban biodiversity; Green infrastructure for heat and pollution reduction; Community participation in urban greening.

Unit IV: Policy, Public Awareness and Green Employability (7 Hours)

Air-quality index and public information systems; Citizen science and low-cost monitoring; National and local air-pollution control programmes; Role of municipalities, schools, colleges, RWAs, NGOs, CSR, and industries; Behaviour change for reducing exposure; Preparing a nature-based air-pollution mitigation plan.

Suggested Practicals / Field Component / Applied Exercises (60 hours)

- Identify and map major local sources of air pollution.
- Interpret Air Quality Index data and relate it to local activities and weather.
- Compare dust deposition on leaves of different plant species.
- Observe leaf traits that support dust capture and pollution tolerance.
- Assess the effectiveness of roadside vegetation as a pollution barrier.
- Design a green buffer for reducing air-pollution exposure at a selected site.
- Prepare a campus tree inventory for air-pollution mitigation potential.
- Compare microclimatic conditions between green and non-green spaces.
- Identify major sources of indoor air pollution in homes, classrooms, or offices.
- Map vulnerable groups exposed to roadside air pollution.
- Identify greener and less polluted routes for walking or cycling.
- Select suitable plant species for pollution-prone urban areas.
- Assess public awareness of air pollution, health risks, and nature-based solutions.
- Analyse a case study of an urban forest, green belt, park, or green roof.
- Prepare a site-specific nature-based air-pollution mitigation plan.

Essential Readings

- Brears, R. C. (2020). Nature-based solutions to 21st century challenges (2nd ed.). Routledge.
- Griffin, R. D. (2016). Principles of air quality management. CRC Press.
- Fuller, G. (2018). The invisible killer: The rising global threat of air pollution—and how we can fight back. Melville House.
- Jacobson, M. Z. (2023). No miracles needed: How today's technology can save our climate and clean our air. Cambridge University Press.
- Zhang, Y. (2005). Indoor air quality engineering (pp. 6-7). Boca Raton, FL, USA:: CRC press.
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Suggested Readings

- Brimblecombe, P. (2012). The big smoke: A history of air pollution in London since medieval times. Routledge.
- Hill, M. K. (2020). Understanding environmental pollution (4th ed.). Cambridge University Press.
- Kuo, J. F. (2026). Air pollution control engineering for environmental engineers (2nd ed.). CRC Press.

GENERIC ELECTIVE COURSE - (GE-EVS)

Skills for Green Startups

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Skills for Green Startups	4	2	0	2	12 th Pass	NA

Course Objectives

The course aims to:

- Introduce green entrepreneurship and sustainable business ideas.
- Build skills for identifying environmental problems as startup opportunities.
- Train students in green business models, pitching, and impact communication.
- Develop employability skills for startups, CSR, ESG, and sustainability sectors.

Learning Outcomes

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

- Explain the concept of green startups and sustainable entrepreneurship.
- Identify local environmental problems with business potential.
- Prepare a basic green business model and value proposition.
- Communicate environmental and social impact to stakeholders.
- Develop a simple pitch deck for a green startup idea.

Course Syllabus

Theory: 30 Hours

Unit I: Green Entrepreneurship and Sustainability (7 Hours)

Meaning of entrepreneurship and green entrepreneurship; Environmental problems as business opportunities; Green economy, circular economy, low-carbon economy, and social innovation; Types of green startups: waste, water, energy, food, mobility, fashion, biodiversity, and climate services.

Unit II: Green Business Models and Market Understanding (8 Hours)

Problem identification; Customer discovery; Value proposition; Sustainable business model canvas; Revenue models; Cost structure; Green consumer behaviour; Market gaps; Affordability, accessibility, and inclusiveness in green products and services.

Unit III: Finance, Impact and Compliance (7 Hours)

Basics of startup finance; Bootstrapping, grants, incubation, crowdfunding, CSR, and impact investment; Measuring environmental and social impact; Carbon, waste, water, and resource indicators; Greenwashing and ethical communication; Basic legal and regulatory awareness.

Unit IV: Pitching, Communication and Startup Practice (8 Hours)

Pitch deck preparation; Storytelling for sustainability; Branding and communication; Team building; Partnerships with NGOs, local bodies, institutions, and businesses; Prototype demonstration; Startup failure and learning; Career pathways in green enterprises and sustainability consulting.

Suggested Practicals / Field Component / Applied Exercises (60 hours)

- Identify local environmental problems that can become green startup opportunities.
- Prepare a problem statement for a selected sustainability challenge.
- Conduct a basic customer-discovery survey for a green product or service.
- Prepare a value proposition for a green startup idea.
- Design a sustainable business model canvas.
- Compare two existing green startups and analyse their business models.
- Estimate basic costs and possible revenue streams for a green idea.
- Identify potential partners such as NGOs, municipalities, colleges, or CSR units.
- Design a low-cost prototype or service model for a green solution.
- Prepare simple environmental impact indicators for a startup idea.
- Identify possible risks, barriers, and ethical concerns in a green startup.
- Detect examples of greenwashing in advertisements or product claims.
- Prepare a branding message for a sustainability-oriented product or service.
- Prepare a short pitch deck for a green startup idea.
- Present a green startup pitch before peer and faculty evaluators.

Essential Readings

- Dutta, A. (2023). Sustainable entrepreneurship. Lincoln University College Publications.
- Ekanem, I. (2024). Principles of innovation, entrepreneurship and sustainability. Routledge.
- Jones, G. (2017). Profits and sustainability: A history of green entrepreneurship. Oxford University Press.
- Omrane, A., Kassmi, K., Akram, V., Khanna, A., & Mostafiz, M. I. (2023). Sustainable entrepreneurship, renewable energy-based projects and digitalization. Routledge.
- Pinna, M. (2020). Sustainable entrepreneurship: A systematic review of academic research. Springer.

Suggested Readings

- Belz, F.-M., & Peattie, K. (2012). Sustainability marketing: A global perspective (2nd ed.). Wiley.
- Berchicci, L. (2008). Innovating for sustainability: green entrepreneurship in personal mobility. Routledge.
- Osterwalder, A., & Pigneur, Y. (2013). Business model generation: a handbook for visionaries, game changers, and challengers. John Wiley & Sons.

GENERIC ELECTIVE COURSE - (GE-EVS)

Environmental Law and Governance

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Environmental Law and Governance	4	2	0	2	12 th Pass	NA

Course Objectives

The course aims to:

- Introduce students to the basics of environmental law and governance.
- Explain constitutional provisions, environmental rights, and major environmental legislations.
- Develop awareness about environmental justice, public participation, and citizen responsibility.
- Build practical skills related to environmental compliance, reporting, advocacy, and governance.

Learning Outcomes

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

- Explain the role of laws and institutions in environmental protection.
- Identify major environmental legislations and policies in India.
- Understand environmental rights, duties, and public participation mechanisms.
- Analyse environmental conflicts and legal case studies.
- Prepare simple environmental awareness and compliance reports.

Course Syllabus – Theory: 30 Hours

Unit I: Foundations of Environmental Law and Governance (7 Hours)

Meaning and scope of environmental law; Environment and sustainable development; Environmental ethics and justice; Constitutional provisions related to environment; Fundamental Rights, Directive Principles, and Fundamental Duties; Environmental governance and role of institutions. **Article 48A** (State Directive), **Article 51A(g)** (Citizen Duty), and **Article 21** (Fundamental Right).

Unit II: Major Environmental Legislations and Policies (8 Hours)

The Environment (Protection) Act, 1986; Air Act, 1981; Water Act, 1974; Wildlife Protection Act, 1972; Forest Conservation Act and forest policy, 1980; Biodiversity Act, 2002; Environmental Impact Assessment; National Green Tribunal; Pollution Control Boards, NAPCCC, Waste management rules

Unit III: Environmental Rights, Justice and Public Participation (7 Hours)

Environmental rights and human rights; Public Interest Litigation; Environmental movements in India; Access to information and environmental awareness; Role of NGOs, media, and citizen groups; Indigenous communities and environmental governance; Gender and environment.

Unit IV: Environmental Compliance, Policy and Employability (8 Hours)

Environmental audits and compliance; Corporate environmental responsibility; ESG and sustainability reporting; International environmental agreements; Climate governance; Green careers in law, policy, NGOs, CSR, and sustainability sectors; Preparing a local environmental governance plan.

Suggested Practicals / Field Component / Applied Exercises (60 hours)

- Identify environmental issues in the local area requiring legal intervention.
- Analyse newspaper reports related to environmental litigation.
- Study selected landmark environmental judgments in India.
- Conduct awareness survey on environmental rights and duties.
- Visit Pollution Control Board, biodiversity park, or waste-management facility.
- Prepare a mock environmental complaint or RTI application.
- Conduct stakeholder mapping for a local environmental conflict.
- Analyse environmental provisions in institutional policies.
- Debate environmental-development conflicts through role-play.
- Prepare a simple environmental compliance checklist for campus/community.
- Document environmental campaigns run by NGOs or citizen groups.
- Study implementation of plastic-ban or waste-management rules locally.
- Examine role of social media in environmental advocacy.
- Prepare a case study on environmental justice movement.
- Develop a local environmental governance action plan.

Essential Readings

- Divan, S., & Rosencranz, A. (2022). Environmental law and policy in India (4th ed.). Oxford University Press.
- Leelakrishnan, P. (2019). Environmental law in India (5th ed.). LexisNexis.
- Sands, P., Peel, J., Fabra, A., & MacKenzie, R. (2018). Principles of international environmental law (4th ed.). Cambridge University Press.
- Singh, J. S., Singh, S. P., & Gupta, S. R. (2014). Ecology, environmental science & conservation. S. Chand Publishing.

Suggested Readings

- Cullet, P. (2015). Water law, poverty, and development: Water sector reforms in India . Oxford University Press.
- Gadgil, M., & Guha, R. (1995). Ecology and equity: The use and abuse of nature in contemporary India. Routledge.
- Birnie, P., Boyle, A., & Redgwell, C. (2009). International law and the environment (3rd ed.). Oxford University Press.
- Singh, G. (2020). Environmental governance and sustainable development. Sage Publications.

GENERIC ELECTIVE COURSE - (GE-EVS)

Green Business and Sustainable Entrepreneurship

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Green Business and Sustainable Entrepreneurship	4	2	0	2	12 th Pass	NA

Course Objectives

The course aims to:

- Introduce sustainability concepts in business and enterprise.
- Explain ESG, CSR, green finance, and sustainable business models.
- Build entrepreneurial skills for environmentally responsible enterprises.
- Develop employability skills for sustainability consulting, ESG reporting, and green startups.

Learning Outcomes

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

- Explain principles of sustainable business and ESG.
- Identify environmental risks and opportunities in business sectors.
- Prepare basic green business and sustainability plans.
- Understand responsible production and consumption practices.
- Develop entrepreneurial and sustainability communication skills.

Course Syllabus

Theory: 30 Hours

Unit I: Environment, Economy and Sustainable Business (7 Hours)

Environment and economy linkages; Sustainable development and green economy; Circular economy; Responsible consumption and production; Environmental footprint of industries; Business and climate change; Sustainable supply chains.

Unit II: ESG, CSR and Sustainable Finance (8 Hours)

Meaning and importance of ESG; Corporate Social Responsibility; Sustainability reporting; Carbon disclosure; Green finance and ethical investment; Greenwashing; Sustainable Development Goals and business; Environmental risk management.

Unit III: Green Entrepreneurship and Innovation (7 Hours)

Green startups and eco-enterprises; Renewable energy businesses; Waste-to-wealth enterprises; Sustainable tourism, food, and mobility sectors; Social entrepreneurship; Innovation and sustainable technologies; Business ethics and sustainability leadership.

Unit IV: Sustainable Business Planning and Employability (8 Hours)

Market analysis and customer discovery; Sustainable business model canvas; Branding and sustainability communication; Environmental impact indicators; Incubation and startup ecosystem; Career opportunities in ESG, CSR, consulting, and sustainability sectors; Preparing a sustainable business proposal.

Suggested Practicals / Field Component / Applied Exercises (60 hours)

- Identify environmentally unsustainable business practices in daily life.
- Compare the sustainability initiatives of two companies.
- Analyse ESG or CSR reports of selected organizations.
- Conduct a survey on green consumer behaviour.
- Prepare a sustainable business model canvas.
- Identify local environmental problems with enterprise potential.
- Detect examples of greenwashing in advertisements.
- Estimate the environmental footprint of selected products/services.
- Visit a startup incubator, recycling unit, or social enterprise.
- Prepare branding material for a green product.
- Conduct a waste audit of a market or institution.
- Prepare a basic sustainability report for campus activities.
- Design a low-cost green business idea.
- Develop a pitch deck for a sustainable enterprise.
- Present a sustainable business proposal.

Essential Readings

- Belz, F.-M., & Peattie, K. (2012). Sustainability marketing: A global perspective (2nd ed.). Wiley.
- Elkington, J. (2018). 25 years of triple bottom line: Why it's time to rethink sustainability. Harvard Business Review Press.
- Raworth, K. (2017). Doughnut economics: Seven ways to think like a 21st-century economist. Random House Business.
- Wells, P. E. (2013). Business models for sustainability. Edward Elgar Publishing.

Suggested Readings

- Dutta, A. (2023). Sustainable entrepreneurship. Lincoln University College Publications.
- Hawken, P. (2017). Drawdown: The most comprehensive plan ever proposed to reverse global warming. Penguin Books.
- Omrane, A., Kassmi, K., Akram, V., Khanna, A., & Mostafiz, M. I. (2023). Sustainable entrepreneurship, renewable energy-based projects and digitalization. Routledge.
- Anderson, R. (2011). Business lessons from a radical industrialist. St. Martin's Press.