



Deccan Education Society's

**Fergusson College (Autonomous)
Pune**

Learning Outcomes-Based Curriculum
for 3/4 years B. Sc. / B. Sc. (Honours) Programme

as per guidelines of

NEP-2020

for

S. Y. B. Sc. (Environmental Science)

With effect from Academic Year

2024-2025

Deccan Education Society's Fergusson College (Autonomous), Pune

S.Y.B.Sc. Environmental Science (Pattern 2023)

Under NEP-CBCS Pattern (2023) Effective from June 2024

Semester	Paper Code	Paper Title	Credits
I	EVS-200 (Major)	Environmental Science Practical-3 (based on 201)	2
	EVS-201 (Major)	Natural resources management and sustainability	4
	EVS-211(Minor)	Ecology and Ecosystems	2
	EVS-212(Minor)	Environmental Science Practical-3(based on EVS211)	2
	EVS-220 (GE/OE)	Urban Ecosystems	2
	EVS-230 (VSC)	Environmental monitoring (Field) -I	2
	EVS-240 (SEC)	Solid Waste Management Techniques	2
	EVS-245 (CEP)		2
II	EVS-250 (MAJOR)	Environmental Science Practical-4 based on EVS251	2
	EVS-251 (MAJOR)	Fundamentals of ecology	4
	EVS-261 (MINOR)	Water resources management	2
	EVS-262 (MINOR)	Environmental Science Practical-4 based on EVS261	2
	EVS- 270 (OE)	Land resources and conservation	2
	EVS - 280 (VSC)	Environmental monitoring (Lab) -II	2
	EVS - 290 (SEC)	Green Credits	2

Teaching and Evaluation (Only for FORMAL education courses)

Course Credits	No. of Hours per Semester Theory/Practical	No. of Hours per Week Theory/Practical	Maximum Marks	CE 40 %	ESE 60%
1	15 / 30	1 / 2	25	10	15
2	30 / 60	2 / 4	50	20	30
3	45 / 90	3 / 6	75	30	45
4	60 / 120	4 / 8	100	40	60

Eligibility: As per the rules and regulations of Savitribai Phule Pune University (SPPU)

S.Y. B.Sc. Semester III

Title of the Course and Course Code	EVS-200 (Major): Environmental Science Practical-III (based on EVS201)	Credits-2
Course Outcomes (COs) On completion of the course, the students will be able to		Bloom's Cognitive level
CO1	Recall environmental concepts for measuring energy content, production of green energy etc.	1
CO2	Explain analytical techniques for estimation of various elements in environmental samples	2
CO3	Apply practical knowledge to treat leachate and produce bio energy	3
CO4	Analyze environmental impact of resource extraction on water, soil etc	4

Contents	
1.	Estimation of calorific value of the given biomass
2.	Estimation of heat of combustion of the given fuels
3.	Estimation of Zinc from given sample
4.	Estimation of Iron from given sample
5.	Estimation of Nickel from given sample
6.	Treatment of leachate artificial/collected from nearby mine/stone quarry (pH, EC, TDS, Turbidity)
7.	Analysis of soil from contaminated site for pH, organic matter
8.	Analysis of soil from contaminated site for nutrient content
9.	Design and development of microbial fuel cell by using various biomasses (Demonstration)
10.	Design and development of biogas plant and measurement of its performance (Demonstration)
11.	Visit to school of energy studies/ nuclear chemistry laboratory of SPPU/other relevant institute
12.	Continuation of Use of social media for e-networking and dissemination of ideas on

S. Y. B. Sc. Semester III

Title of the Course and Course Code	EVS-201 (Major): Natural Resources Management And Sustainability	Credits-4
Course Outcomes (COs) On completion of the course, the students will be able to		Bloom's Cognitive level
CO1	Outline attributes of natural resource use and management	1
CO2	Understand the complexity of natural resource and issues, and sustainability	2
CO3	Apply theories and methods with interdisciplinary approach towards natural resource management	3
CO4	Critically examine the gap in the resource availability, use, and conservation	4

Unit	Contents	Lectures
Unit I (Amir)	<p>Concept and classification of resources and reserves</p> <ul style="list-style-type: none"> • Resource: actual and potential • Identified resources, undiscovered resources; reserves • Renewable resources: air, biomass, soil, water, etc • Non-renewable resources: fossil fuels, minerals, metallic and non-metallic ores etc. <p>Mineral resources</p> <ul style="list-style-type: none"> • Mineral resources <p>Soil Resources</p> <ul style="list-style-type: none"> • Importance of Soil • Soil Conservation Strategies <p>Marine resources</p> <ul style="list-style-type: none"> • Fisheries and other marine resources • Threats to costal and marine resources • Conservation Strategies <p>Human impact on natural resources</p> <ul style="list-style-type: none"> • Natural resource economics • Loss of resources, degradation of quality, overexploitation • Ecological, social and economic dimension of resource management 	15
Unit II (Amir)	<p>Resources extraction:</p> <ul style="list-style-type: none"> • Types of mining: <ul style="list-style-type: none"> • Surface, Subsurface, Open-pit, Dredging, Strip • Ocean mining for mineral resources • Environmental effects of mineral resource extraction processing and utilization 	15

	<ul style="list-style-type: none"> • Mining and its consequences and affects • Extraction and challenges of processing • Chain of processes from ore to manufactured object :Life Cycle Assessment (LCA) • Use to reuse and recycling: • Resource use management :7R's (Recycle, Refuse, Reduce, Reuse, Repair, Recover, Regift) • Sustainable development – <ul style="list-style-type: none"> • What is unsustainable development and what is sustainable development. • Definition and concept, • The Brundtland commission and later developments, • Determinants of sustainable development, • Indicators of sustainable development • Sustainable society, • International cooperation, • Sustainable development goals. • Millennium development goals • The role of ESD (Education for Sustainable Development) 	
<p style="text-align: center;">Unit III RG</p>	<p>Renewable energy resources:</p> <p>Solar energy:</p> <ul style="list-style-type: none"> • Passive and active solar heating system, • Concept of Solar Cells, Advantages and limitations <p>Hydropower:</p> <ul style="list-style-type: none"> • Principle, potential, benefits and limitations <p>Nuclear Power:</p> <ul style="list-style-type: none"> • Nuclear fission and fusion reactions, pros and cons of Nuclear power, problem of storage and disposal of Radioactive waste <p>Ocean as energy resource :</p> <ul style="list-style-type: none"> • Introduction to Tidal Energy; Wave Energy; Ocean Thermal Energy Conversion (OTEC) <p>Geothermal Energy:</p> <ul style="list-style-type: none"> • Concept , benefits and limitations <p>Energy From Biomass:</p> <ul style="list-style-type: none"> • Methods of biomass energy generation and its benefits. <p>Non-renewable energy resources :</p> <p>Types of fossil fuels:</p> <ul style="list-style-type: none"> • Oil , Natural gas ,Coal reserves • Classification, formation, extraction, processing of fossil fuels <p>Environmental impacts :</p> <ul style="list-style-type: none"> • Oil spills, fossil fuels and climate change • Impact of energy consumption on global economy • Future challenges 	<p>15</p>
<p style="text-align: center;">Unit IV</p>	<p>Natural Resources and Conservation</p> <p>Forest Resources:</p> <ul style="list-style-type: none"> • Economic & Ecological Importance, Sustainable Forest Management Strategies, Community Rights, Data and Drone Technology in Conservation <p>Water Resources:</p>	<p>15</p>

	<ul style="list-style-type: none"> • Use of Water Resources & Sustainable Development, Freshwater Shortages, National & International Issues, Strategies for Water Conservation <p>Food Resources:</p> <ul style="list-style-type: none"> • Green Revolution, World Food Problem, Techniques to Increase Food Production, Technology & Sustainable Food System <p>Sustainable Resource Management</p> <ul style="list-style-type: none"> • Concept of Sustainability Science and Development • Integrated Resource Management Strategies • AI's role in Boosting Sustainability • Role of United Nations • International Sustainability Organizations <p>Approaches in Resource Management:</p> <ul style="list-style-type: none"> • Framework for Resource Conservation • Natural Resource Management • Green Economy, Circular Economy and Bio-economy • Technology and Natural Resource Management • Case Studies: National and International 	
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References

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2. R. Lamarsh and A. J. Baratta, "Introduction to Nuclear Engineering" Prentice Hall, New Jersey, ISBN: 0-201-82498-1
3. J. K. Shultis and R. E. Faw, "Fundamentals of Nuclear Science and Engineering"
4. Publisher: Marcel Dekker, ISBN: 0824708342
5. Environment Science; Tyler M.G.; Wadsworth Publishing Co.; 1997
6. Perspective in Environmental Studies; Kaushik & Kaushik; New Age International Pvt. Ltd. Publishers.
7. Environmental Science; Santra S.C.; New Central Book Agency (P) Ltd.; 2 Edition.
8. Environmental Chemistry, Dey A. K.; New Age International Publishers; 6 Edition.
9. Conservation of Natural Resources Hardcover – Big Book, 1 February 2012 by Govind Prasad (Author), Publisher : Discovery Publishing Pvt.Ltd
10. Natural Resource and Biodiversity Conservation Hardcover by Renu Katharia
11. Community Tourism and Natural Resource Conservation Hardcover – 1 March 2011, by David Carr (Author), Publisher : Discovery Publishing Pvt.Ltd
12. Conservation of Natural Resources Paperback – Import, 28 January 2013, by California Dept of Public Instruction (Author), Publisher : Hardpress Publishing
13. Conservation of Natural Resources Hardcover – Big Book, 1 February 2012, by Govind Prasad (Author), Publisher : Discovery Publishing Pvt.Ltd
14. Natural Resources, Conservation, Management and Health Care Hardcover – Big Book, 1 May 2011 by M. V. Subba Rao (Author), Publisher : Discovery Publishing Pvt.Ltd
15. Conservation Of Natural Resources For Food And Environmental Security Hardcover – 1 January 2012 by Dubey S K (Author), Publisher : Satish Serial Publishing House
16. Natural Resources Law: Managing Conflicts Between Resource Extraction and Conservation Paperback – Import, 28 March 2023, Publisher : Independently Published
17. Natural Resources Conservation & Management Hardcover – 1 August 2008 by K. K. Singh (Author), Publisher : M D Publications Pvt. Ltd
18. Sustainable Development of Natural Resources and Wildlife Conservation Hardcover – 1

January 2014 by Ashwani Kumar Dubey (Author), Publisher : Daya Publishing House
19. The conservation of natural resources Kindle Edition by Gifford Pinchot (Author),
Publisher : HardPress.

S. Y. B. Sc. Semester III

Title of the Course and Course Code	EVS-211 (Minor): Ecology and Ecosystems	Credits-2
Course Outcomes (COs) On completion of the course, the students will be able to		Bloom's Cognitive level
CO1	Outline levels and applications of Ecology. Differentiate between classical and modern-day theories of Ecology.	1
CO2	Compare community characteristics	2
CO3	Apply skills for identifying keystone species and outline the concept of Ecosystems.	3
CO4	Execute and organize skills to classify different types of ecosystems and biogeochemical cycles	4

Unit	Contents	Lectures
Unit I	<ul style="list-style-type: none"> • Basics of Ecology Basic concepts, Principals, Scope Definitions: Ecology, landscape, habitat, ecozones, biosphere, ecosystems, Ecosystem stability, resistance and resilience Autecology, synecology • Ecology of Individuals Ecological amplitude; Liebig's Law of the Minimum; Shelford's Law of Tolerance; phenotypic plasticity ecotypes; ecoclines, acclimation ecological niche; types of niche: Eltonian niche, Hutchinsonian niche, fundamental niche, realized niche; niche breadth; niche partitioning; niche differentiation, Thermoregulation strategies of adaptation in plants and animals. 	15
Unit II	<ul style="list-style-type: none"> • Ecology of populations and communities Characteristics of population: density, dispersion, natality, mortality, life tables, survivorship curves, age structure; population growth: geometric, exponential, logistic. • Community Characteristics, keystone species, ecotone and edge effect; species interactions: mutualism, symbiotic relationships, commensalism, amensalism, proto cooperation, predation, competition, parasitism, mimicry, herbivory • Ecological succession: Primary and secondary successions, models and types of successions, climax community concepts, examples of succession 	15

References

1. Learning resources: 1. Odum, E.P. 1971. Fundamentals of Ecology. W.B. Saunders.
2. Singh, J.S., Singh, S.P. & Gupta, S.R. 2006. Ecology, Environment and Resource Conservation. Anamaya Publications.
3. Wilson, E. O. 1985. The Biological Diversity Crisis. BioScience 35: 700-706

S. Y. B. Sc. Semester III

Title of the Course and Course Code	EVS-212 (Minor): Environmental Science Practical-III (based on EVS211)	Credits-2
Course Outcomes (COs) On completion of the course, the students will be able to		Bloom's Cognitive level
CO1	Recall Vegetation Characteristics	1
CO2	Explain the analytical techniques involved in studying ecological patterns	2
CO3	Apply practical knowledge in estimating root biomass using appropriate techniques	3
CO4	Analyze the diversity ecosystems and interactions between species	4

Contents	
1.	Study of grassland vegetation by List Count Quadrat Method to determine the Frequency, Density & Abundance
2.	Study of phenogram of the species from the surrounding area.
3.	Estimation of Root Biomass
4.	Study of association between species
5.	Study of species interactions from forest area
6.	Estimation of IVI from collected vegetation data
7.	Study of wetland (source region visit) and its vegetation and seasonal bird diversity
8.	Visit to a sacred grove/Forest / Grassland / Marine ecosystem to assess its biodiversity
9.	Determination of lime or gypsum requirement for acidic soil
10.	Visit to agricultural college/ soil survey department

S. Y. B. Sc. Semester III

Title of the Course and Course Code	EVS-220 (GE/OE): Urban Ecosystems	Credits- 2
Course Outcomes (COs) On completion of the course, the students will be able to		Bloom's Cognitive level
CO1	State existing environmental issues, Conflicts and their potential role in urban development.	1
CO2	Understand the importance as interaction between urban society and its environment transpires in governance and policy decisions.	2
CO3	Identify key challenges posed by increasing development to far-reaching goal of sustainability in urban areas.	3
CO4	Examine sensitivity towards various urban issues and find out innovative solutions for the same	4

Unit	Contents	Lectures
Unit I	<p>Introduction</p> <ul style="list-style-type: none"> • What is Urban ecosystem, Meaning and concept Introduction to urbanization; urban sprawl and associated environmental issues Man as the driver of urban ecosystem increasing challenges posed by modernity for the environment • Environment in an urban setting, Green cities, Commodification of nature; metros, cities and towns as sources and sinks of resources Resource consumption and its social, cultural, economic and ecological perspectives; Urban transformation; Urban pollution (air, water, soil) 	15
Unit II	<p>Urban dwelling</p> <ul style="list-style-type: none"> • Housing scenario across a range of large-medium-small scale cities • Issues of urban dwelling; Energy consumption and waste disposal as well as accumulation • Environmental costs of urban infrastructure • Ecological footprint <p>Urban interface with the environment</p> <ul style="list-style-type: none"> • Eco-housing • Urban sustainability; Challenges associated with sustainability • Natural spaces in a city : Importance and threats • Planning and environmental management perspectives • Benefits of environmental management • Management of urban environment and alternative resources 	15

References

1. McIntyre, N.E. 2000. Urban ecology as an interdisciplinary field: differences in the use of urban between the social and natural sciences. *Urban Ecosystems* 4: 5-24.
2. Grimm, N. B., Faeth, S. H., et al. 2008. Global Change and the Ecology of Cities. *Science* 319: 756-760.
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S. Y. B. Sc. Semester III

Title of the Course and Course Code	EVS-230 (VSC): Environmental monitoring (Field) –I	Credits-2
Course Outcomes (COs) On completion of the course, the students will be able to		Bloom's Cognitive level
CO1	Recall Principles of Environmental Monitoring	1
CO2	Outline Vegetation Morphology and Monitoring Techniques	2
CO3	Apply Vertebrate and Invertebrate Monitoring Skills	3
CO4	Analyze Geospatial Data for Environmental Documentation	4

Unit	Contents	Lectures
Unit I	<p>Introduction to Indicators Planning and designing monitoring - Plant communities, Lake / Wetland, Wildlife, Geospatial data collection, etc Planning of a surveying aquatic Ecosystem</p> <p>Morphology of plants : - Monitoring of identification characters Vegetative characters like Leaf type, arrangement, shapes, etc Reproductive characters like Floral morphology, study of phenogram, study of fruits, etc ,Methods of sampling Grassland vegetation, Vegetation Mapping,</p> <p>Vegetation Monitoring :Association, Correlation and Diversity among the species in the forest, Measurement of height, girth and biomass, Transect method: Line and belt transect, Measurement of frequency, density, abundance and diversity, Shannon index, Simpson Index, IVI,,Forest floor Determination, Litter production</p>	15
Unit II	<p>Vertebrate Monitoring Point count, pug mark, pellet / dung count, call count, scat / pellet analysis and camera trapping etc.</p> <p>Invertebrate Monitoring Net swipe, light trap, pit traps.</p> <p>Study of key taxa: Butterfly, Birds, Amphibians, Reptiles, Mammalian diversity Use of Taxonomic literature and study of key characters for identification of the specimen , Visit to local vegetable / fish market,</p>	15

	Geospatial Data Archiving : Data collection, tools for scientific data collection and mapping, Photo documentation/ use of Google lens for primary identification	
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References

1. Elzinga, C. L., Salzer, D. W., Willoughby, J. W., & Gibbs, J. P. (2001). *Monitoring plant and animal populations: a handbook for field biologists*. John Wiley & Sons.
2. Ansari, A. A., Gill, S. S., Abbas, Z. K., & Naeem, M. (Eds.). (2016). *Plant biodiversity: monitoring, assessment and conservation*. CABI.
3. Sutherland, W. J., Newton, I., & Green, R. (2004). *Bird ecology and conservation: a handbook of techniques* (Vol. 1). OUP Oxford.
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8. Nan, Z. B. (2001). *Remote sensing application to grassland monitoring*.
9. McDiarmid, R. W. (Ed.). (2012). *Reptile biodiversity: standard methods for inventory and monitoring*. Univ of California Press.
10. Wright, L. (1982). *The IUCN Amphibia-Reptilia red data book* (Vol. 1). IUCN.

S. Y. B. Sc. Semester III

Teaching and Evaluation

Sem.	Subject Code	Title	No. of Hrs. per Week (Total-30 Hrs.)	Max. Marks	CE 40 %	ESE 60%	Credits
I	EVS-240	Solid Waste Management Techniques	2	50	20	30	2

Evaluation Process

1. Student must attend weekly Skill Enhancement Course conducted by the college.
2. Internal marks (20 Marks) and External marks (30 Marks) will be based on skills imparted.
3. External examiner will do end Semester Evaluation.
4. No formal written examination will be conducted.
5. Evaluation methods will vary as per the requirements of the course.
6. Student is responsible to complete the required number of credits.

S. Y. B. Sc. Semester III

Skill Sets:

EVS-240	Solid Waste Management Techniques	Credits: 2 Hours: 30
Students will acquire the following skills on completion of the course:		
Students will get required skills related with communication, analytical skills, capacity to grasp and apply legislation, organizational skills, decision-making skills, ability to oversee and manage processes in solid waste management. Some of them are mentioned as follows.		
1.	Students will get an idea of techniques used in understanding market growth and waste generation.	
2.	Students will able to measure credits approaches followed by various agencies under corporate social responsibility towards waste.	
3.	Students will able to estimate waste analysis and its characterization	
4.	They will able to conduct waste audit of the industrial or residential area	
5.	Students will be get exposure to field conditions	
6.	Hands-on exposure about handling of machineries used in waste management.	
7.	Knowledge on waste to energy conversion processes	
8.	Techniques of resource recovery and hidden benefits of economic perspectives	

9.	Exposure about use of online apps and software
10.	Gain the Knowledge on use of GIS and RS in waste management
11.	They will get knowledge on requirements for smart cities and waste management
12.	They will get insights for entrepreneurship development in waste Management
13.	They will get social involvement for the tasks assigned to them.

Title of the Course and Course Code	EVS-240 (SEC): Solid Waste Management Techniques	Credits-2
Course Outcomes (COs) On completion of the course, the students will be able to		Bloom's Cognitive level
CO1	Describe the extent of solid waste problem at local, regional and national level	1
CO2	Outline the opportunities available in solid waste management and skilled associated with it	2
CO3	Demonstrate various requirements for auditing of the wastes	3
CO4	Compare various technologies available for waste management	4

Unit	Contents	Lectures
Unit I	<p>Basics in Waste Management</p> <ul style="list-style-type: none"> • Waste Management Hierarchy • Principles of Waste Management • Types of waste • Characterization & Classification of waste • Zero-Waste, Zero-Pollution, Zero-Landfill • Market Linkages and Waste Management • Credits Perspective - Circular Economy <p>Waste Analysis and Waste Audit</p> <ul style="list-style-type: none"> • Proximate Analysis of Solid Waste • Waste Audit, Checklist for Performance, Audit in Waste Collection, Segregation, Transport, Treatment <p>Waste to Wealth Approach</p> <ul style="list-style-type: none"> • Power Generation from Wastes • Refuse derived fuel (RDF), Combustion, Incineration, Pyrolysis, Gasification, Landfill gas (LFG) recovery, Anaerobic digestion • Plastic Waste Management • Techniques of Resource Recovery: Composting, Bio enzymes • Entrepreneurships in waste management. 	15

Unit II	<p>Smart Management Technologies</p> <ul style="list-style-type: none"> • Recycling Robots, Automated Waste Collection, Pneumatic Waste Pipes, Solar-Powered Trash Compactors, E-Waste Kiosks, Recycling Apps • IoT and AI Applications in Waste Management • Applications of GIS and RS in Waste Management • Software in Waste Management • Green Technologies for Companies • Smart Cities and Waste Management <p>Entrepreneurship in Waste Management</p> <ul style="list-style-type: none"> • Innovation & Entrepreneurship • Formal and Non-formal Sector • Machinery Used for Waste Management • Granulators, Centrifuge Separator, Baling Press, Separators etc. • Public-Private Partnerships and Community Driven Waste Management • Case Studies & Success Stories of Waste Utilization In Industrial Sectors 	15
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References

1. Waste Management by Victor Bonn, Publisher: Clanrye International
2. Waste Management: Status and Challenges, by L JENNINGS, Publisher: Educo Publisher
3. A Comprehensive Book on Solid Waste Management with Application, Publisher: Misha Books
4. Handbook of Solid Waste Management, by George Tchobanoglous and Frank Kreith, Publisher: McGraw-Hill Education
5. Strategies of Industrial and Hazardous Waste Management (Environmental Engineering Series) by Nelson L. Nemerow (Author), Franklin J. Agardy, Publisher : John Wiley & Sons
6. Waste Water Management Hardcover, by J. Premalatha, Bhaarathi Dhurai, N. Saraswathy, K. Thangamani, P. Ramalingam. Publisher : Narosa Publishing House
7. Waste Management and the Green Economy: Law and Policy, by Andreas R. Ziegler, Jorun Baumgartner, Katharina Kummer Peiry, Publisher : Edward Elgar Publishing Ltd
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14. White, P.R., Franke, M. & Hindle P. 1995. Integrated Solid Waste Management: A Lifecycle Inventory. Blackie Academic & Professionals.

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Proposed Evaluation Methods:

1. Visit to solid waste handling/ treatment site
2. Training / Internship related to Solid waste management method
3. Report writing
4. Case study presentation/ Group discussion
5. SWOT analysis of any given area.
6. Case study presentation / Cantastoria
7. Project /Training
8. Report writing

Evaluation methods and marks distribution

CE 20 Marks	External Evaluation 30 Marks			Total 50 Marks
1.MCQs 2.Group Discussion 3.Cantastoria 4.Case Study Analysis	1.Field Visit 2. Online and Offline Surveys	1.Training 2.Internship 3.Project	1.SWOT Analysis 2.Similar methods 3.Report Presentation	

S. Y. B. Sc. Semester III

Title of the Course and Course Code	EVS-245 (CEP):	Credits-2
Course Outcomes (COs) On completion of the course, the students will be able to		Bloom's Cognitive level
CO1	Understands Rural life, Culture and Social realities	1
CO2	Develop a sense of empathy and bonds of mutuality with local community	2

CO3	Appreciate significant contributors of local communities to Indian Society and Economy	3
CO4	Learn to value the local knowledge and wisdom of the community	4

Unit	Contents	Lectures
Unit I	<ul style="list-style-type: none"> • Study of Rural Society: Rural lifestyle, Rural society, caste and Gender relations ,rural values with respect to community, nature and resources, elaboration of “soul of India lies in Villages”(Gandhi)Rural Infrastructure • Understanding Rural Economy and Livelihood: Agriculture farming, land ownership, water management, animal husbandry, non-farm livelihoods and artisans, rural entrepreneurship, Rural markets 	15
Unit II	<ul style="list-style-type: none"> • Rural Institutions :Traditional rural organizations, self-help groups, Panchyati Raj institutions(Gram Sabha, Gram Panchayat, standing committees)local civil society,local institutions, local administrations • Rural Development :History of Rural development in India, Current national programme s:Sarva shiksha Abhiyaan, Beti Bachao Beti Padhao, Ayushmann Bharat ,Swacch Bharat, PMAwaas Yojana, Skill India, Gram Panchayat Decentralized planning, NRLM MNREGA 	15

References

1. .Singh, Katar, Rural Development: Principles, policies and Management, Sage Publications, New Delhi2015

S. Y. B. Sc. Semester IV

Title of the Course and Course Code	EVS-250 (Major): Environmental Science Practical-IV (based on EVS251)	Credits-2
Course Outcomes (COs) On completion of the course, the students will be able to		Bloom's Cognitive level
CO1	Recall and list the parameters studied in grassland vegetation using the List Count Quadrat Method. Identify and state the concepts of Frequency, Density, and Abundance.	1
CO2	Understand the concept of phenograms and interpret species relationships. Explain the patterns observed in phenograms for a better understanding of species associations in the surrounding area.	2
CO3	Apply knowledge in assessing primary productivity within a grassland community. Use appropriate techniques and methods to measure and calculate primary productivity values.	3
CO4	Analyze biodiversity in different ecosystems by studying wetlands, sacred groves, forests, grasslands, and marine ecosystems. Evaluate seasonal bird diversity and biodiversity during visits, demonstrating the ability to analyze and interpret ecological data.	4

Contents
<ol style="list-style-type: none"> 1. Study of grassland vegetation by List Count Quadrat Method to determine the Frequency, Density & Abundance. 2. Study of Phenograms of the species from surrounding area. 3. Study of primary productivity from grassland community. 4. Estimation of Root Biomass 5. Estimation of IVI from collected vegetation data. 6. Study of wetland (source region visit) and its vegetation and seasonal bird diversity 7. Visit to a sacred grove/Forest / Grassland / Marine ecosystem to assess its biodiversity. 8. Continuation of Use of social media for e-networking and dissemination of ideas on environmental issues pertaining to the course. 9. Study of association between species 10. Estimation of soil bulk density from g given soil sample 11. Estimation of field capacity of given soil sample 12. Determination of lime or gypsum requirement for acidic soil. 13. Estimation of Available nitrogen from given soil sample 14. Estimation of phosphate from given soil sample 15. Estimation of Sodium from given soil sample 16. Visit to agricultural college/ soil survey department 17. Continuation of Use of social media for e-networking and dissemination of ideas on environmental issues pertaining to the course

S. Y. B. Sc. Semester IV

Title of the Course and Course Code	EVS-251 (Major): Fundamentals of ecology	Credits-4
Course Outcomes (COs) On completion of the course, the students will be able to		Bloom's Cognitive level
CO1	Outline levels and applications of Ecology. Differentiate between classical and modern day theories of Ecology.	1
CO2	Compare and correlate ecological dynamics and regulation of vital processes on earth as biogeochemical cycles	2
CO3	Apply skills for identifying keystone species and outline the concept of Ecosystems	3
CO4	Analyse ecosystem services, ecological resilience, ecological economics, and landscape ecology	4

Unit	Contents	Lectures
Unit I	<ul style="list-style-type: none"> • Basics of Ecology Basic concepts, Principals, Scope Definitions: Ecology, landscape, habitat, ecozones, biosphere, ecosystems, Ecosystem stability, resistance and resilience Autecology, synecology Ecological amplitude; Liebig's Law of the Minimum; Shelford's Law of Tolerance;	15
Unit II	<p style="text-align: center;">Ecology of Individuals</p> phenotypic plasticity ecotypes; ecoclines, acclimation ecological niche; types of niche: Eltonian niche, Hutchinsonian niche, fundamental niche, realized niche; niche breadth; niche partitioning; niche differentiation, Thermoregulation strategies of adaptation in plants and animals <p style="text-align: center;">Ecology of populations</p> Characteristics of population: density, dispersion, natality, mortality, life tables, survivorship curves, age structure; population growth: geometric, exponential, logistic.	15

<p>Unit III</p>	<p>Ecology of communities:</p> <p>Community Characteristics, keystone species, ecotone and edge effect; species interactions: mutualism, symbiotic relationships, commensalism, amensalism, proto cooperation, predation, competition, parasitism, mimicry, herbivory; Ecological succession: Primary and secondary successions, models and types of successions, climax community concepts, examples of succession</p>	<p>15</p>
<p>Unit IV</p>	<p>Ecosystem Ecology</p> <p>Concept and Types of ecosystem: forest, grassland, lentic, lotic, estuarine, marine, desert, wetlands</p> <ul style="list-style-type: none"> • Structure and functions of ecosystem • Abiotic and biotic components; ecosystem boundary • Ecological adaptations of the Plant and animal species in the hydrophytes, mesophytes and xerophytes • Ecosystem function; ecosystem metabolism; primary production, secondary production, GPP, NPP and trophic efficiency, ecosystem connections: food chain, food web; models of energy flow, detritus pathway of energy flow and decomposition processes • Ecological efficiencies Ecological pyramids: pyramids of number, biomass, and energy. <p>Biogeochemical cycles</p> <ul style="list-style-type: none"> • Types of biogeochemical cycles • Hydrological Cycle • Carbon cycle; • Nitrogen cycle; • phosphorus cycle; • Sulphur cycle • Human modified ecology –Applied Ecology 	<p>15</p>
<p>References</p> <ol style="list-style-type: none"> 1. Odum, E.P. 1971. Fundamentals of Ecology. W.B. Saunders. 2. Singh, J.S., Singh, S.P. & Gupta, S.R. 2006. Ecology, Environment and Resource Conservation. Anamaya Publications. 3. Wilson, E. O. 1985. The Biological Diversity Crisis. BioScience 35: 700-706. 4. Kormondy, E. J. (1969). Concepts of ecology. 5. Levin, S. A., Carpenter, S. R., Godfray, H. C. J., Kinzig, A. P., Loreau, M., Losos, J. B., ... & Wilcove, D. S. (Eds.). (2009). The Princeton guide to ecology. Princeton University Press. 6. Smith, R. L., Smith, R. L., Hickman, G. C., & Hickman, S. M. (1998). Elements of ecology. 7. Weathers, K. C., Strayer, D. L., & Likens, G. E. (Eds.). (2021). Fundamentals of ecosystem science. Academic Press. 8. Chapin, F. S., Matson, P. A., Mooney, H. A., & Vitousek, P. M. (2002). Principles of terrestrial ecosystem ecology. 		

9. Daily, G. C. (1997). Introduction: what are ecosystem services? Nature's services: Societal dependence on natural ecosystems, 1(1).
10. Jørgensen, S. E. (2002). Integration of Ecosystem Theories: A Pattern: A Pattern. Springer Science & Business Media.

S. Y. B. Sc. Semester IV

Title of the Course and Course Code	EVS-261 (Minor): Water Resource Management	Credits-2
Course Outcomes (COs) On completion of the course, the students will be able to		Bloom's Cognitive level
CO1	Outline the various water sources and use for development of our society	1
CO2	Explain water resources, its utilization and management along with problems associated with it. Discuss traditional and advanced water management practices.	2
CO3	Examine the design parameters of a water resources system using elementary methods	3
CO4	Explain water resource management techniques and their significance with respect to conservation of environment	4

Unit	Contents	Lectures
Unit I (AMIR)	<p>Water Availability around the globe: Forms of water available in earth, Surface, ground and atmospheric water, Salt water and fresh water.</p> <p>Hydrologic Cycle and Processes: Precipitation – types and forms, Infiltration, Evaporation, Interception, Runoff.</p> <p>Global atmospheric and oceanic circulation and their impact on weather and climate.</p> <p>Measurement techniques: Use of Rain-gauges, RADAR and satellites for rainfall measurement</p> <p>Ground Water Hydrology: Aquifers and its types,</p>	15

	Flow of groundwater in aquifers, Surface and Groundwater interaction.	
Unit II	<p>Humans and Water: Economics of Water Resources, Water Footprint, Water Quality Standards, Role of State in Water Resource Management, Traditional Water Harvesting Systems, Environmental Status Report of Rivers</p> <p>Water Resources and Related Issues: Water Resources of India, National Water Policy of India and Governance, Interlinking of Rivers, Water Crisis & Ecological Losses, Conflicts over Water: Local, National & International, Case Studies</p> <p>Water Resources Engineering: Types of Water Resources Projects, Objectives and Principles, Power Generation, Types of Dams, Multipurpose Projects, Advantage & Disadvantages.</p> <p>Integrated Water Resources Management Demand Management Strategies Role of Corporate Sector: Case Studies</p>	15
<p>a. References:</p> <ol style="list-style-type: none"> 2. Modi P. N., "Irrigation Water Resources and Water Power Engineering", Standard Book House 3. Subramanya, K., "Engineering Hydrology", McGraw Hill Education 4. Chow V. T., Maidment D. R., Mays L. W., "Applied hydrology", McGraw Hill Education 5. Garg S. K., "Hydrology and Water Resources Engineering", Khanna Publishers 6. Bansil, P.C. 2004. Water Management in India. Concept Publishing Company, India. 7. Brebbia, C.A. 2013. Water Resources Management VII. WIT Press. 8. CEA. 2011. Water Resources and Power Maps of India. Central Board of Irrigation & Power. 9. Grumbine, R.E. & Pandit, M.K. 2013. Threats from India's Himalaya dams. Science 339: 10. Loucks, D.P., Stedinger, J.R. & Haith, D. A. 1981. Water Resource Systems Planning and a. Analysis. Englewood Cliffs, NJ, Prentice Hall. 11. Mays, L.W. 2006. Water Resources Sustainability. The McGraw-Hill Publications. 12. Schward& Zhang, 2003. Fundamentals of Groundwater. John Willey and Sons. 13. Souvorov, A.V. 1999. Marine Ecologonomics: The Ecology and Economics of Marine a. Natural Resource Management. Elsevier Publications. 14. Vickers, A. 2001. Handbook of Water Use and Conservation. Water Plow Press. 15. The Human-Water Relationship Paperback – Import, 22 June 2011 by Bruce Simmons (Author), Publisher : VDM Verlag 16. The Human Right to Water Paperback – 15 February 2017 by Inga Winkler (Author), Publisher : Hart Publishing India 17. Right to Water: No. 3 (Health & Human Rights Publication S.) Paperback – Import, 12 August 2003 by World Health Organization (Creator), Publisher : World Health Organization 		

18. Water, Agriculture, and Sustainable Well-Being (Ecological Economics & Human Well-Being) Hardcover – 23 September 2009, by Unai Pascual (Editor), Amita Shah (Editor), Jayanta Bandyopadhyay (Editor), Publisher : OUP India
19. Elementary Irrigation and Water resource Engineering Paperback – 1 January 2021
 - a. by SK Garg (Author), Rajeshwari Garg (Author), Publisher : Khanna publishers
20. Groundwater Resources and Salt Water Intrusion in a Changing Environment Paperback – 6 November 2019 by Maurizio Polemio (Editor), Kristine Walraevens (Editor), Publisher : Mdpi AG
21. Water Resources Engineering Paperback – 23 January 2013, by Linsley (Author), Publisher : McGraw Hill Education India Pvt Ltd
22. Water Resources: Mapping, Monitoring and Management Hardcover – Import, 1 April 2017 by Pawan Kumar Tyagi (Author), Publisher : Discovery Publishing House Pvt Ltd
23. Geography of Water Resources Hardcover – 20 February 2008 by Ram Kumar Gurjar (Author), B. C. Jat (Author), Publisher : Rawat Pubns

S. Y. B. Sc. Semester IV

Title of the Course and Course Code	EVS-262 (Minor): Environmental Science Practical-III (based on EVS261)	Credits-2
Course Outcomes (COs) On completion of the course, the students will be able to		Bloom's Cognitive level
CO1	Outline the various water parameters and reasons behind pollution	1
CO2	Examine newer approaches for water effective water	2
CO3	Analyze methods for water audit and compare measures for water conservation	3
CO4	Compare various methods to conserve water quality	4

Contents	
<ol style="list-style-type: none"> 1. Laboratory safety rules and introduction to laboratory equipment. 2. Determination of Chlorides from water. 3. Determination of Turbidity in water by Secchi disc (Field practical). 4. Calculation of Water Quality Index 5. Preparation of Rainwater Harvesting Unit 6. Corporate Sector: Case Study Visit to Water Management Units 7. Calculation of Water Capacity from Water Reservoir 8. Estimation of Hydropower Potential form Water Reservoir 9. Estimation of Water Audit from Selected Area 10. Preparation of Simple Hydrological Model for Small Watershed 11. Water Resource Planning and Management Exercise 12. Calculation of Water Footprint 13. Practical's based on Software Or Online Contents about Water Resources 14. Visit to watershed / backwater / dam/ reservoir 15. Visit to ecofriendly village/ Traditional Water Harvesting system/other relevant place 16. Any Other Additional Practicals Based on Syllabi Contents 	

S. Y. B. Sc. Semester IV

Title of the Course and Course Code	EVS-270 (GE/OE): Land Resources and Conservation	Credits-2
Course Outcomes (COs) On completion of the course, the students will be able to		Bloom's Cognitive level
CO1	Recall different concepts and important key terms of soil health. Identify the factors affecting soil and responsible for degradation.	1
CO2	Discuss drivers of Land degradation and management. Compare the land management practices followed in developing and developed world as per social need	2
CO3	Examine the advanced techniques for effective management of land. Apply eco-friendly technologies for management of land.	3
CO4	Differentiate between soil resistance and resilience. Classify and describe soil erosion processes. Identify different causes of soil erosion.	4

Unit	Contents	Lectures
Unit I	<p>Introduction</p> <ul style="list-style-type: none"> • The concept of soil and ecological importance <p>Fundamentals of soil science</p> <ul style="list-style-type: none"> • Process of formation of soil • Soil Profile • Soil constituents , Micro and macro nutrients • Soil Ecology: soil microbes and their importance <p>Soil degradation - causes</p> <ul style="list-style-type: none"> • Soil resistance and resilience • Nature and types of soil erosion • Soil pollution and its causes: agricultural practices , industrial and urban development, mining and mineral extraction toxic organic chemicals, organic contaminants. <p>Environmental Impacts of Land Degradation</p> <ul style="list-style-type: none"> • Cost of land degradation • Loss Ecosystem services • Farming practices and associated problems • Emerging threats of land degradation: Effect on soil fertility, desertification etc. <p>Soil Conservation and its importance:</p> <ul style="list-style-type: none"> • Need for soil conservation and restoration of soil fertility 	15

	<ul style="list-style-type: none"> • Restoration of degraded land and its benefits • Food security: Components and challenges • Nutrient cycles : Biogeochemical cycles and its role in nutrient cycling • Ecosystem services • Methods useful for soil conservation • Sustainable agriculture 	
<p style="text-align: center;">Unit II</p>	<p>Land Use and Land Degradation</p> <ul style="list-style-type: none"> • Land as a resource • Economic importance of land • Biological and Physical Phenomena in Land Degradation • Drivers of Land Degradation: Deforestation, Desertification, Rangeland Degradation, Urban Encroachment • Monoculture, Industrial Expansion • Social Aspects of Land Degradation: Human Population Pressure, Poverty, Socio-Economic and Institutional Factors • Drivers of LULC in Major Geographic Zones and Biodiverse Regions- The Himalaya and The Western Ghats • Assessment of Land Degradation Using Machine-Learning Approach <p>Controlling Land Degradation</p> <ul style="list-style-type: none"> • Sustainable Land Management Practices • Ecofarming & Sustainable Regenerative Farming • Watershed Management Techniques • Management of Grazing Lands • Irrigation Water Management • Management of Mining and Quarrying • Land Degradation Neutrality • Land Use Planning and Management • Biotechnological Approaches for Restoration • Soil Solarization • RS and GIS as Tool • Applications of Artificial Intelligence and IoT 	<p>15</p>
<p>References</p> <ol style="list-style-type: none"> 1) A Textbook of Soil Science – J.A. Daji – Media Promoters and Publ. Pvt. Ltd. Mumbai 2) Environmental Chemistry: B.K. Sharma 3) Environmental Science; Santra S.C.; New Central Book Agency (P) Ltd.; 2 Ed. 4) Handbook of Methods in Environmental Studies Vol-I &II; Mailti S.K.; ABD Publishers; Jaipur 5) Environmental Chemistry, Dey A. K.; New Age International Publishers; 6 Edt.. 6) Managing Land Degradation for Enhancing Farm Productivity Hardcover – 1 January 2021 by Omprakash Meena P.R. Bhatnagar, D. Dinesh, Vijaysingh Kakade, V.C. Pande (Author), Publisher : Satish Serial Publishing House 7) Land Degradation and Desertification Hardcover – 1 January 2003, by V. C. Jha (Editor) Publisher : Rawat Pubns) 1January 2003(;Rawat Pubns 		

- 8) Land Acquisition and Resource Development in Contemporary India, by Shashi Ratnaker Singh (Author), Hardcover – 1 April 2021, Publisher : Cambridge University Press
- 9) Land and Water Resource Management System in Ancient India Hardcover – 1 January 2016 by Dr. Mohan Lal Chadhar (Author), Publisher : Radha Publication
- 10) Geoinformatics Application for Evaluation of Land and Water Resources Paperback – 24 April 2020 by Alaguraja Palanichamy (Author), Thangamani Vellayan (Author), Publisher : Walnut Publication
- 11) Our Land and Water Resources: Current and Prospective Supplies and Uses (Classic Reprint) Paperback – 18 May 2018, by U. S. Economic Research Service (Author), Publisher : Forgotten Books
- 12) Land and Water Management Engineering Paperback – 1 January 2013, by Madan K. Jha V.V.N. Murty (Author), Publisher : Kalyani Publishers
- 13) Sustainable Land Management in Asia: Introducing the Landscape Approach Kindle Edition by William Critchley (Author), Frank Radstake (Author), Publisher : Asian Development Bank
- 14) Sustainable Land Management: Challenges, Opportunities, and Trade-offs (Agriculture and Rural Development Series) Kindle Edition, by World Bank (Author), Publisher : world bank publications
- 15) Ravine Land Management: Principles Practices And Strategies (Pb) Unknown Binding – 30 November 2021 By R. K. Singh (Author), R. S. Kurothe (Author), Ashok Kumar (Author), Shakir Ali (Author), A. K. Singh And P. K. Mishra (Author), Publisher : Indian Council Of Agricultural Research.
- 16) Land Acquisition and Resource Development in Contemporary India Hardcover – 1 April 2021 by Shashi Ratnaker Singh (Author), Publisher : Cambridge University Press

S. Y. B. Sc. Semester IV

Title of the Course and Course Code	EVS-280 (VSC): Environmental monitoring (Lab) –II	Credits-2
Course Outcomes (COs) On completion of the course, the students will be able to		Bloom's Cognitive level
CO1	Recall basic concepts and principles behind various environmental monitoring processes e.g. water, air, soil, noise etc.	1
CO2	Summarize definitions of sample, its types etc. Explain various steps and precautions required before sampling of soil, water, air etc.	2
CO3	Apply practical skills for analysis of Air, Soil, Noise, and water quality.	3
CO4	Identify unknown pollutants from given water, soil, air samples.	4

Unit	Contents	Lectures
Unit I	Instruments in Environmental Monitoring : pH meter, Conductivity meter, Colorimeter, UV Spectrophotometer, Atomic absorption spectrophotometer Flame photometer, Hot air oven, autoclave, laminar flow, RDS, RSPM 2.5, Handy sampler, Gas	15

	<p>chromatography, Mass spectroscopy, Scanning electron microscopy</p> <p>Weather and Air Monitoring:</p> <p>Introduction to weather system and parameters, Light, Rainfall, Wind direction, Wind velocity, (Movement of pollutants), Temperature, Pressure, Humidity, Weather Monitoring tools / instruments and their working principle</p> <p>Noise and Radiation Monitoring:</p> <p>Introduction of noise & vibration, National standard for noise Sound Exposure Level (SEL), Equivalent Sound Level [Leq(h)] Noise Index,</p> <p>Radiation types and measurement, G. M counter, scintillation counter, personal dosimetry, Units of measurements, Half-life period, and radiation dose measurement.</p>	
<p>Unit II</p>	<p>Air Monitoring:</p> <ul style="list-style-type: none"> • Sampling types, techniques, • Site and parameter selection, • National standards for ambient air quality, • Monitoring of particulate matter, SO_x and NO_x, Ambient and stack air monitoring techniques, • Air Monitoring tools/instruments used for air its work principle <p>Water Monitoring / Sampling, and its Analysis:</p> <ul style="list-style-type: none"> • Objectives of water monitoring • Types of samples and collection of samples • Sample preservation • Physical, chemical, biological parameters of water & its monitoring • General effluent standards • Stream standards Drinking water standard (IS10500 and WHO Standards) <p>Soil monitoring / testing:</p> <ul style="list-style-type: none"> • Types of soil sampling and sample units, Site selection, Important soil quality indicators • Instruments / equipment's used in soil monitoring 	<p>15</p>
<p>References</p> <ol style="list-style-type: none"> 1. Handbook of Methods in Environmental Studies: Vol.1 By Maiti, Subodh. (2003). 2. Handbook of Methods in Environmental Studies: Vol 2 (Air, noise, soil and overburden analysis). By Maiti, Subodh. (2003). 3. Waste Water Engineering, Metcalf and Eddy, INC, Tata McGraw Hills 4. Indian Standard for Drinking Water, BSI, New Delhi. Environmental Pollution 5. Control, C. S. Rao, Wiley Eastern Ltd.,1993 		

6. Air Pollution Control and Engineering, De Nevers, McGraw Hills, 1993
7. Fundamentals of Air Pollution, Samuel, J. W., 1971, Addison Wesley Publishing
8. Fundamentals of Environmental Pollution, Krishnan Khannan, S. Chand and Company Ltd., 1994.
9. Noise Pollution, Vandana Pandey, Meerut Publishers, 1995.
10. Environmental Pollution Control, C. S. Rao, Wiley Eastern Ltd., 1993.
11. Air Pollution Control and Engineering, De Nevers, McGraw Hills, 1993.
12. Fundamentals of Environmental Pollution, Krishnan Khannan, S. Chand and
13. Company Ltd., 1994.
14. Environmental Chemistry, A. K. De., New Age Intl. Pub Co, New Delhi, 1990
15. Environmental Pollution Analysis - S. M. Khopka

S. Y. B. Sc. Semester IV

Teaching and Evaluation

Sem.	Subject Code	Title	No. of Hrs. per Week (Total-30 Hrs.)	Max. Marks	CE 40 %	ESE 60%	Credits
I	EVS-290	Green Credits	2	50	20	30	2

Evaluation Process

7. Student must attend weekly Skill Enhancement Course conducted by the college.
8. Internal marks (20 Marks) and External marks (30 Marks) will be based on skills imparted.
9. External examiner will do end Semester Evaluation.
10. No formal written examination will be conducted.
11. Evaluation methods will vary as per the requirements of the course.
12. Student is responsible to complete the required number of credits.

Skill Sets:

Components and Tools	Credits: 2 Hours: 30
1. Conceptual Understanding:	
- Ability to define and comprehend the concepts of Green Credits and Carbon Credits.	
- Understanding the historical background and evolution of these credit systems.	
- Appreciation of the importance and purpose of these credits in addressing environmental challenges.	
2. Environmental Knowledge:	
- Awareness of climate change and global warming issues.	
- Understanding the sources and impact of greenhouse gas emissions on the environment and ecosystems.	
3. Green Credits Skills:	
- Knowledge of the definition and characteristics of Green Credits.	
- Familiarity with various types of Green Credits, including Renewable Energy Certificates, Energy Efficiency Credits, Sustainable Agriculture Credits, and Forestry Credits.	
- Understanding the mechanisms for issuance and trading of Green Credits.	
- Ability to analyse the benefits and challenges associated with Green Credits.	

4. Carbon Credits Skills:
- Knowledge of the definition and characteristics of Carbon Credits.
- Familiarity with various types of Carbon Credits, such as Certified Emission Reductions (CERs) and Verified Emission Reductions (VERs).
- Understanding of carbon offsetting projects and carbon pricing mechanisms.
5. Implementation and Case Study Skills:
- Practical knowledge of implementing Green Credits and Carbon Credits.
- Understanding corporate initiatives and sustainability programs related to these credits.
- Familiarity with government policies and incentives supporting these credit systems.
- Knowledge of international agreements and protocols related to Green Credits and Carbon Credits.
6. Critical Thinking and Problem Solving:
- Ability to critically analyze the challenges associated with Green Credits and Carbon Credits.
- Problem-solving skills to address issues related to the implementation and effectiveness of these credit systems.

S. Y. B. Sc. Semester IV

Title of the Course and Course Code	EVS-290 (SEC): Green Credits	Credits-2
Course Outcomes (COs) On completion of the course, the students will be able to		Bloom's Cognitive level
CO1	Define and explain the concepts of carbon credits and green credits.	1
CO2	Differentiate between various types of carbon credits and green credits.	2
CO3	Analyze and calculate carbon footprints for different activities or entities.	3
CO4	Critically evaluate carbon credit projects in terms of their environmental and social impact.	4

Unit	Contents	Lectures
Unit I	1. Introduction to Green Credits and Carbon Credits	15
	<ul style="list-style-type: none"> • Definition and Conceptual Understanding • Historical Background and Evolution • Importance and Purpose 	
	2. Environmental Context	
	<ul style="list-style-type: none"> • Climate Change and Global Warming 	

	<ul style="list-style-type: none"> • Greenhouse Gas Emissions • Impact on Environment and Ecosystems <p>3. Green Credits</p> <ul style="list-style-type: none"> • Definition and Characteristics • Types of Green Credits <ol style="list-style-type: none"> 1. Renewable Energy Certificates (RECs) 2. Energy Efficiency Credits 3. Sustainable Agriculture Credits 4. Forestry Credits <ul style="list-style-type: none"> • C. Mechanism for Issuance and Trading • D. Benefits and Challenges 	
Unit II	<p>4. Carbon Credits</p> <ul style="list-style-type: none"> • Definition and Characteristics • Types of Carbon Credits <ol style="list-style-type: none"> 1. Certified Emission Reductions (CERs) 2. Verified Emission Reductions (VERs) <ul style="list-style-type: none"> • Carbon Offsetting Projects • Carbon Pricing Mechanisms <p>5. Comparison between Green Credits and Carbon Credits</p> <ul style="list-style-type: none"> ▪ Objectives and Targets ▪ Scope and Coverage ▪ Market Dynamics and Participants ▪ Policy and Regulatory Frameworks <p>6. Implementation and Case Studies</p> <ul style="list-style-type: none"> ▪ Corporate Initiatives and Sustainability Programs ▪ Government Policies and Incentives ▪ International Agreements and Protocols ▪ Success Stories and Lessons Learned 	15
<p>References</p> <ol style="list-style-type: none"> 1. Green Credits Policy and practice reviews article 2. What is Green Credit Initiative, launched by PM Modi at COP28 3. Green credit guideline and enterprise export green-sophistication 4. India Introduces ‘Green Credit’ Scheme to Drive Clean Development 		