

Year-2023-2024

Syllabus of B.Sc. Programme: [Subject Name: Environmental Science]

In accordance with NEP-2020

Year	Semester	Course Code	Title of course	Theory/ Practical	Credits Marks		
1	I	UGEVS-101N	Fundamentals of Environmental Sciences	Theory	2	100	
		UGEVS-101N(P)	Practical work	Practical	2	100	
		<b>Skill Enhancement Course</b>					
		SBSEVS-01(N)	Energy Resources and Green Technology	Theory	4	100	
1	II	UGEVS-102(N)	Ecology and Biodiversity Conservation	Theory	2	100	
		UGEVS-102N(P)	Practical work	Practical	2	100	
		<b>Skill Enhancement Course</b>					
		SBSEVS-02(N)	Environmental Impact Assessment and Legislation	Theory	4	100	
2	III	UGEVS-103(N)	Environmental Microbiology and Biotechnology	Theory	2	100	
		UGEVS-103N(P)	Practical work	Practical	2	100	
2	IV	UGEVS-104N	Plant Physiology and Biochemistry	Theory	2	100	
		UGEVS-104N(P)	Practical Work		2	100	
<b>Discipline Centric Elective Course</b>							
		DCEVS-105N	Environmental Pollution	Theory	2	100	
		DCEVS-106N	Remote Sensing, GIS and Hydrology	Theory	2	100	
		DCEVS-107N(P)	Practical work based on 105 &106	Practical	2	100	
<b>Discipline Centric Elective Course</b>							
		DCEVS-108N	Statistics and Environmental Quality Assessment	Theory	2	100	
		DCEVS-109N	Environmental Geology	Theory	2	100	
		DCEVS-110N(P)	Practical Work based on 108 &109	Practical	2	100	
<b>Total Credit /Marks</b>					<b>36</b>	<b>1600</b>	

Programme: <b>B.Sc.</b>	Year: <b>1</b>	Semester: <b>I</b>
Subject: <b>Environmental Sciences</b>		
Course Code: <b>UGEVS-101N</b>	Course Title: <b>Fundamentals of Environmental Sciences</b>	
<b>Course Objectives:</b> <ul style="list-style-type: none"> <li>➤ To understand basics of outline of environment.</li> <li>➤ To learn about nature and its behavior for living beings.</li> <li>➤ To understand modern concept of environment.</li> <li>➤ To understand basic concept of sustainable development.</li> </ul>		
<b>Course Outcomes:</b> <b>CO 1:</b> Gain knowledge of Bhartiya Gyan Parampara about nature <b>CO 2:</b> Learn about the concept of environment and its components <b>CO3:</b> Able to analyze ambient environment and their future prospects. <b>CO4:</b> Learn about origin of life and theory of evaluation and natural selection. <b>CO5:</b> Also learn about environmental education and their implementation for sustainable development		
<b>Credits: 2</b>	<b>Type of Course: Core</b>	
Max. Marks: <b>100</b>	Min. Passing Marks: <b>36</b>	
<b>Block 1</b>	<b>Environmental History and Evaluation</b>	
Unit I	<b>Vedic Concept of Environment:</b> Bhartiya gyan parampara aur bhartiya vaigyanik; moral and aesthetic nature of environmental science; objectives and historic roots of the subject.	
Unit II	<b>Modern Concept of Environment:</b> Definition, principles and scope of environmental science, environmental studies and environmental technology, concept of environmental chemistry, biotechnology and microbiology need for public awareness.	
Unit III	<b>Evolution:</b> Origin of life and speciation, Darwinism and modern synthetic theory of evolution, natural selection; biochemical basis of origin of life; Hardy -Weinberg equilibrium; genetic drift.	
<b>Block 2</b>	<b>Environmental Education</b>	
Unit IV	<b>Segment of Environment:</b> Atmosphere, hydrosphere, lithosphere, biosphere and anthrosphere; factors affecting environment, natural and artificial environment, biogeochemical cycle.	
Unit V	<b>Environmental Education:</b> Definition and opportunity of environmental education, environmental justice, Environmentalism, environmental education at primary and secondary level.	
Unit VI	<b>Environmental Issues:</b> Integration of environmental concerns, equality and integrity, causes and types of environmental issue, local, regional and global environmental issues and challenges, solution for environmental issues.	
<b>Block 3</b>	<b>Man and Environmental Sustainability</b>	
Unit VII	<b>Man and Environment:</b>	

	Population and density, natality and mortality, biotic potential and growth form of populations, man-environment relationships; impacts of human activity on environment.
Unit VIII	<b>Environment and Human Health:</b> Basic understanding between environment and human health, environmental pollution diseases- allergies, respiratory, cardiovascular, and cancer, personal hygiene- food - balanced diet?
Unit IX	<b>Environmental Sustainability:</b> Concept of sustainability and sustainable development, social, environmental and economic sustainability concepts, carrying capacity, challenges for sustainable development.
<b>Suggested Text Book Readings:</b>	
<ol style="list-style-type: none"> <li>1. S.C. Sandra, "Environmental Science", A new Central Book Agency, 2008</li> <li>2. P.D. Sharma, "Ecology and Environment" Rastogi Publications, 2017</li> <li>3. Neerj Nachiketa, Environment and Ecology: A Dynamic Approach, G.K. Publication Ltd, 2021</li> <li>4. V. K. Ahluwalia, "Environmental Science, Ane Books India, 2013S.</li> <li>5. M.C. Dash, "Concepts of Environmental Management for Sustainable Develop Concepts of Environmental Management for Sustainable Development, I K International Publishing House Pvt. Ltd</li> </ol>	
<b>Suggested online links:</b>	
<ol style="list-style-type: none"> <li>1. Origin of Environmental Science From Vedas: <a href="https://youtu.be/2MJb5JrLNpA">https://youtu.be/2MJb5JrLNpA</a></li> <li>2. Environment: Definition, Scopes and importance: <a href="https://youtu.be/L0uF8121F-0">https://youtu.be/L0uF8121F-0</a></li> <li>3. Environmental Education: <a href="#">(316) Environmental Education   World and Indian Perspective   Environmental Geography   Dr. Krishnanand - YouTube</a></li> <li>4. Human Health and the Environment: <a href="#">Untitled Document (oecd.org)</a></li> <li>5. Global and local environmental sustainability, development and growth: <a href="#">FINAL POST-2015 global and local environmental sustainability.pdf (oecd.org)</a></li> </ol>	
This course can be opted as an elective by the students of following subjects: NO	
Suggested equivalent online courses (MOOCs) for credit transfer: NO	
<b>Electronic media and other digital components in the curriculum:</b>	
<b>Choose any one or more than:</b> (Electronic Media: Audio/Video Lectures, Online Counseling/Virtual Classes/E-Contents/e-SLM/OER/supplementary links for reference/Video Conferencing/Radio broadcast/Web Conferencing/ Other electronic and digital contents)	
Name of electronic media:	Year of incorporation: 2023-24

Programme: <b>B.Sc.</b>	Year: <b>2023-24</b>	Semester: <b>I</b>
Subject: <b>Environmental Sciences</b>		
<b>Course Code: SBSEVS-01N</b>	<b>Course Title: Energy Resources and Green Technology</b>	
<b>Course Objectives:</b>		
<ul style="list-style-type: none"> <li>➤ To understand the concept of energy and its sources</li> <li>➤ To understand fossil fuel energy</li> <li>➤ To learn about biomass energy production</li> <li>➤ To know about green technology</li> </ul>		
<b>Course Outcomes:</b>		
CO1: Able to know about structure and composition of sun.		
CO2: Learn about solar energy		
CO3: Gain the knowledge of fuel energy resource		
CO4: Learn about energy production by water and wind		
CO5: Able to know the concept of green technology and green building		
<b>Credits: 4</b>	<b>Type of Course: Skill Enhancement Course</b>	
<b>Max. Marks: 100</b>	<b>Min. Passing Marks: 36</b>	
<b>Block 1</b>	<b>Solar and Fossil Fuel</b>	
Unit I	<b>Sun as Source of Energy:</b> Concept of energy, energy use from a historical perspective, solar energy, solar radiation, Solar shell, status of solar energy in India.	
Unit II	<b>Fossil Fuel:</b> Classification and composition of fossil fuel, physico-chemical properties of fuel, origin, composition and types of coal, origin, composition and types of liquid fuel (crude oil), classification of gaseous fossil fuels, gross calorific value and net calorific value of different fuels, oil and gas reservoirs and reserves.	
Unit III	<b>Renewable Energy Resources:</b> Solar energy, hydro energy or water power, wind energy, ocean energy (ocean tidal and wave energy and ocean thermal energy conversion (OTEC)), geothermal energy, Indian scenario of renewable energy consumption.	
<b>Block 2</b>	<b>Biomass Energy and Energy Polices</b>	
Unit IV	<b>Biomass as energy source:</b> Biomass resources, dedicated bioenergy crops, characteristics of bioenergy crops, bioenergy routes from biomass, conversion of biomass into fuels challenges in bioenergy utilization, biomass states energy in India.	
Unit V	<b>Other Source of Energy:</b> Conventional and nonconventional energy sources, nuclear fusion for energy, Ethanol and methanol production, pyrolysis and sources gasification, composition of biogas, Urban waste to resource recovery and recycling for energy.	
Unit VI	<b>Energy Policies:</b> Indian emission norms in transportation sector, national programmes to promote biomass energy production in India, solar photovoltaic programmes in India,	

	energy resources available in India, urban and rural energy consumption, national green tribunal (NGT) act, NGT activities.
<b>Block 3</b>	<b>Energy Conservation and Green Energy</b>
Unit VII	<b>Energy Conservation and Green Building:</b> Definition of energy conservation, need for energy conservation in India, benefits of energy conservation, principles of energy conservation, government initiatives for energy conservation; concepts, scope and components of green building, green buildings in India, certification of green building.
Unit VIII	<b>Green Energy:</b> Aim and scope of green technology, concept of green energy and green technology, biomass energy production, solar and green battery technology; Fuel cell technologies and application to waste-to-energy conversion.
Unit IX	<b>Green Nanotechnology:</b> Understanding green tech, sectors using green tech, green nanotechnology necessity of green technology, categories of green technology; environmental profits of green building, economic benefits of green building, goals of green technology, limitations of green processes and technology.
<b>Suggested Text Book Readings:</b> <ol style="list-style-type: none"> <li>1. S.C. Bhatia and R. K. Gupta, "Textbook of Renewable Energy", WPI Publishing-2019</li> <li>2. Renu, Dhupper, "Textbook on Energy Resources and Management" CBS Publishers &amp; Distributors-2015</li> <li>3. Mahmood Zohoori, Advantages and Disadvantages of Green Technology; Goals, Challenges and Strengths, International Journal of Science and Engineering Applications, ISSN-2319-7560</li> <li>4. G.D. Rai, Non conventional energy sources, Khanna publication.</li> <li>5. Sameer Sarkar, Fuel Technology, New Delhi, orient longman.</li> </ol>	
<b>Suggested online links:</b> <ol style="list-style-type: none"> <li>1. Energy from the Sun: <a href="#">EnergyfromtheSunStudentGuide.pdf (need.org)</a></li> <li>2. Energy Conservation, Renewable Energy: <a href="#">Introduction: (ernet.in)</a></li> <li>3. Renewable Energy and Green Growth in India: <a href="#">Project ReportTemplate (teriin.org)</a></li> <li>4. What is Biomass: <a href="https://youtu.be/DueF2df52IE">https://youtu.be/DueF2df52IE</a></li> </ol>	
<b>Energy sources and Conversion Process - YouTube</b>	
This course can be opted as an elective by the students of following subjects: NO	
Suggested equivalent online courses (MOOCs) for credit transfer;	
1. <a href="#">Energy Resources and conversion processes - Course (swayam2.ac.in)</a>	
<b>Electronic media and other digital components in the curriculum:</b> <b>Electronic media and other digital components in the curriculum: Choose any one or more than:</b> (Electronic Media: Audio/Video Lectures, Online Counseling/Virtual Classes/E-Contents/e-SLM/OER/supplementary links for reference/Video Conferencing/Radio broadcast/Web Conferencing/ Other electronic and digital contents)	
Name of electronic media:	Year of incorporation: 2023-24

Programme: <b>B.Sc.</b>	Year: <b>2023-24</b>	Semester: <b>II</b>
Subject: <b>Environmental Sciences</b>		
Course Code: <b>UGEVS-102N</b>	Course Title: <b>Ecology and Biodiversity Conservation</b>	
<b>Course Objectives:</b>		
<ul style="list-style-type: none"> <li>➤ To understand about ecology and this types</li> <li>➤ To learn about ecosystem and its function.</li> <li>➤ To learn about biodiversity and its conservation.</li> </ul>		
<b>Course Outcomes:</b>		
<b>CO1:</b> Able to know the concept of ecology and their role in understanding of environment.		
<b>CO 2:</b> Gain basic understanding of ecosystem and its function in nature for natural balance.		
<b>CO3:</b> Ability to understand the characteristic of autecology and synecology.		
<b>CO4:</b> Learn about natural diversity, its types and role in nature.		
<b>CO5:</b> Also learn assessment of biodiversity.		
<b>Credits: 2</b>	<b>Type of Course: Core</b>	
<b>Max. Marks: 100</b>	<b>Min. Passing Marks: 36</b>	
<b>Block 1</b>	<b>Ecology</b>	
Unit I	<b>Ecology and Environment:</b> Concept and Definition of ecology and environment, types of ecology; Environmental factors (Abiotic and biotic), their importance and role, ecological Hierarchy.	
Unit II	<b>Autecology:</b> Population characteristics- dispersion, density, natality, mortality, age, structure, population growth; human population & growth; ecological niche and habitat	
Unit III	<b>Synecology:</b> Community structure, growth forms, concept of keystone species, ecotone, ecotypes, ecophene, ecological indicators; ecological succession.	
<b>Block 2</b>	<b>Ecosystem</b>	
Unit IV	<b>Components of Ecosystem:</b> Components, structure and function of ecosystem; properties of ecosystem, major ecosystems, types of ecosystem in nature, terrestrial, aquatic ecosystem, and biome.	
Unit V	<b>Trophic Levels:</b> Energy flow in ecosystem, food chain and food web, ecological pyramid, types of ecological pyramid, productivity.	
Unit VI	<b>Energy-its Flow in Ecosystem:</b> Energy-defined in ecosystem, three sources of energy in ecosystem, Y-shaped energy flow model, Two channel energy flow model.	
<b>Block 3</b>	<b>Biodiversity</b>	
Unit VII	<b>Introduction to Biodiversity:</b> Concept of biodiversity, types of biodiversity, biodiversity as a natural resource, loss of biodiversity, factors affecting biodiversity, biodiversity hotspots; hotspots in India.	
Unit VIII	<b>Biodiversity Conservation:</b>	

	Conservation of natural biodiversity-approaches and conventions, In-situ conservation, Ex-situ conservation; Role of local communities and traditional knowledge in conservation.
Unit IX	<b>Biodiversity Assessment:</b> Identification of biodiversity, measuring biodiversity, biodiversity at local, national and global levels, habitat destruction, fragmentation, transformation, degradation and overexploitation, causes, impacts of pesticide and pollution on biodiversity.
<b>Suggested Text Book Readings:</b>	
<ol style="list-style-type: none"> <li>1. S.C. Sandra, "Environmental Science", A New Central Book Agency, 2008.</li> <li>2. P.D. Sharma, "Ecology and Environment" Rastogi Publications, 2017</li> <li>3. Neerj Nachiketa, Environment and Ecology: A Dynamic Approach, G.K. PublicationLtd, 2021</li> <li>4. A text Book of Environment Studies, Asthana, D. K. and Asthana, M. 2006, S. Chand &amp; Co.-2010.</li> <li>5. Dr. Y. K. Singh, "Environmental Science" New Age International Private Limited-2006</li> </ol>	
<b>Suggested online links:</b>	
<ol style="list-style-type: none"> <li>1. Textbook for Environmental Studies, Erach Bharucha <a href="https://www.ugc.ac.in/oldpdf/modelcurriculum/env.pdf">https://www.ugc.ac.in/oldpdf/modelcurriculum/env.pdf</a></li> <li>2. Environmental Science, Tom Theis and Jonathan Tomkin, OpenStax CNX, National Digital Library of India. <a href="http://ndl.iitkgp.ac.in/document/N2tzeE1aWWpUMm04b211VVZEdSsvK09RckFISkE0OWI3b1Flb2ZTNHFxST0">http://ndl.iitkgp.ac.in/document/N2tzeE1aWWpUMm04b211VVZEdSsvK09RckFISkE0OWI3b1Flb2ZTNHFxST0</a></li> <li>3. Environmental Science, CEC EduSat, National Digital Library of India.</li> <li>4. Biodiversity: <a href="#">Chapter4.p65 (ugc.ac.in)</a></li> </ol>	
This course can be opted as an elective by the students of following subjects: Anyone	
Suggested equivalent online courses (MOOCs) for credit transfer;	
1. <a href="#">Biodiversity and Ecological Resources - Course (swayam2.ac.in)</a>	
<b>Electronic media and other digital components in the curriculum:</b>	
<b>Choose any one or more than:</b> (Electronic Media: Audio/Video Lectures, Online Counseling/Virtual Classes/E-Contents/e-SLM/OER/supplementary links for reference/Video Conferencing/Radio broadcast/Web Conferencing/ Other electronic and digital contents)	
Name of electronic media:	Year of incorporation: 2023-24

Programme: <b>B.Sc.</b>	Year: <b>2023-24</b>	Semester: <b>II</b>
Subject: <b>Environmental Sciences</b>		
Course Code: <b>SBSEVS-02N</b>	Course Title: <b>Environmental Impact Assessment and Legislation</b>	
<b>Course Objectives:</b> <ul style="list-style-type: none"> <li>➤ To understand the basic concept of EIA</li> <li>➤ To understand methodology of data collection</li> <li>➤ To learn about environmental impact and social impact</li> <li>➤ To know environmental legislation and policy</li> </ul>		
<b>Course Outcomes:</b> CO1: Learn the concept of EIA and why it is useful in environmental clearance. CO2: Learn the components of EIA and its methodology to use CO3: Able to know the role of EIA in water, soil and air analysis. CO4: Learn about EIA regulation of in India CO5: Also learn about environmental law and its implementation of conservation of nature.		
Credits: <b>4</b>	Type of Course: <b>Skill Enhancement Course</b>	
Max. Marks: <b>100</b>	Min. Passing Marks: <b>36</b>	
<b>Block 1</b>	<b>EIA Components and Data Collections</b>	
Unit I	<b>Basic Concept of EIA:</b> Definition, principle and objectives of EIA, need for EIA, Types of EIA, Hierarchy in EIA, Advantages of EIA, application form of EIA, composition of expert committee for EIA process.	
Unit II	<b>Components of EIA:</b> EIA process, screening, scoping, baseline data, impact prediction, assessment of alternatives, delineation of mitigation measure and EIA report, public hearing, decision making, monitoring, environmental clearance conditions.	
Unit III	<b>Impact Assessment and Data Collections:</b> Environmental impact, social impact, impact identification and prediction, baseline data collection, construction stage impacts, post project impacts.	
<b>Block 2</b>	<b>EIA Policies and Life Cycle Assessment (LCA)</b>	
Unit IV	<b>EIA policies:</b> EIA notifications, Government of India Ministry of Environment and Forest Notification (2000), list of projects requiring, environmental clearance.	
Unit V	<b>EIA Regulations in India:</b> Status of EIA in India; current issues in EIA; case study of hydropower projects/ thermal projects, salient features of 2006 amendments to EIA notification	
Unit VI	<b>Life Cycle Assessment (LCA):</b> Life cycle analysis, methodology, management, flow of materials-cost criteria- case studies, introduction to ISO 14000.	
<b>Block 3</b>	<b>Environmental Management, Act and Polices</b>	
Unit VII	<b>Environmental Management:</b>	

	Environmental appraisal, environmental impact statement (EIS), environmental management plan (EMP), environmental audit; sustainable development.
Unit VIII	<b>Environmental Act:</b> Environmental laws and protection acts, existing provision of central and state government on environment protection, the Environment (protection) act (1986), the water act (1974), the air act (1981), wild life act (1972).
Unit IX	<b>Guidelines and Policies:</b> Guidelines and policies for control of environmental pollution, Environmental Policy of India, solid and hazardous waste management, handling and management rules.
<b>Suggested Text Book Readings:</b>	
<ol style="list-style-type: none"> <li>1. S.R. Khandeshwar, N.S. Raman and A.R. Gajbhiye , Environmental Impact Assessment, Dreamtech Press-2019.</li> <li>2. Anjaneyulu Yerramilli, Environmental Impact Assessment Methodologies, BS Publications-2020.</li> <li>3. George Alex, Environmental Impact Assessment (EIA), Blue Rose Publishers-2020.</li> <li>4. Teacher_manual_master_EIA.pdf (iitr.ac.in)</li> <li>5. N. Maheshwara Swamy, Text Book on Environmental Law, Asia Law House-2022</li> </ol>	
<b>Suggested online links:</b>	
<ol style="list-style-type: none"> <li>1. <a href="#">(187) Everything About EIA - Environmental Impact Assessment 2006 - Draft 2020 - YouTube</a></li> <li>2. <a href="#">(187) Environmental Impact Assessment   EIA Process   Its Components   Benefits of EIA   Environmental Sci - YouTube</a></li> <li>3. <a href="#">Environmental Science II Environmental Assessment ,Management &amp; Legislation II UGC NET II PAPER-2 - YouTube</a></li> <li>4. <a href="#">(187) Lecture 13: EIA – Law, Policy and Institutional arrangements for EIA system - YouTube</a></li> <li>5. <a href="#">Environmental Management - ISO 14000 - 20 Nov, 6 PM - YouTube</a></li> </ol>	
<a href="#">(187) Environment Law (पर्यावरण विधि) - YouTube</a>	
This course can be opted as an elective by the students of following subjects: Any one	
Suggested equivalent online courses (MOOCs) for credit transfer:	
1. <a href="#">Environmental Impact Assessment - Course (nptel.ac.in)</a>	
<b>Electronic media and other digital components in the curriculum:</b>	
<b>Choose any one or more than:</b> (Electronic Media: Audio/Video Lectures, Online Counseling/Virtual Classes/E-Contents/e-SLM/OER/supplementary links for reference/Video Conferencing/Radio broadcast/Web Conferencing/ Other electronic and digital contents)	
Name of electronic media:	Year of incorporation: 2023-24

Programme: <b>B.Sc.</b>	Year: <b>2023-24</b>	Semester: <b>III</b>
Subject: <b>Environmental Sciences</b>		
Course Code: <b>UGEVS-103N</b>	Course Title: <b>Environmental Microbiology and Biotechnology</b>	
<b>Course Objectives:</b>		
<ul style="list-style-type: none"> <li>➤ To understand the microbial diversity and culture.</li> <li>➤ To learn about role microbial degradation of pollutants.</li> <li>➤ To know about nucleic acid and gene expression.</li> </ul>		
<b>Course Outcomes:</b>		
CO1: Able to know the microbial world and their classification CO2: Able to know the role of microbes in environment CO3: Learn the concept of microbial transformation CO4: Knowledge gain about nature of microbial degradation CO5: Learn about the nucleic acid and protein and also the DNA technology and gene expression.		
Credits:2	Type of Course: <b>Core</b>	
Max. Marks: 100	Min. Passing Marks: 36	
<b>Block 1</b>	<b>Microbial World</b>	
Unit I	<b>Introduction to Microbes:</b> Classification of micro-organisms, and their nomenclature, Whittaker's five kingdom classification system and their utility, culture media, nutritional requirements and growth characteristics of bacteria.	
Unit II	<b>Microbial Transformation:</b> Concept of microbial transformation, accumulation and concentration of metals, metal leaching, extraction; role of microbes in copper and uranium extraction, use of bioreactors for bioremediation.	
Unit III	<b>Microbial Degradation:</b> Microbes in waste decomposition, role of microbes in soil fertility, microbes in agriculture, industry, medicine and wastewater treatment use, degradation of xenobiotics in environment	
<b>Block 2</b>	<b>Microbial Bioremediation:</b>	
Unit IV	<b>Microbes in gaseous production:</b> Bioreactors for bioremediation, composting, bioventing, biogas production; methane, factor effecting methane, biodegradation of hydrocarbon.	
Unit V	<b>Ecological Restoration and Bioremediation:</b> Bioremediation and phytoremediation, specific bioremediation technologies for water and land forming, biosparging, degradative pathways of plasmids, hydrocarbons, pesticides, heavy metals and heavy metal tolerance in microbes.	
Unit VI	<b>Ecologically Safe Products and Processes:</b> Plant growth Promoting Rhizobacteria (PGPR): biofertilizers, microbial insecticides and pesticides, bio-control of plant pathogen, Integrated pest management; development of stress tolerant plants, biofuels; mining and metal biotechnology.	
<b>Block 3</b>	<b>Nucleic Acid and Gene Expression</b>	

Unit VII	<b>Structure of Nucleic acid and Proteins:</b> Nucleoside, nucleotide and nucleic acids, structural forms and characteristics of DNA and RNA, physical and chemical properties of nucleic acid.
Unit VIII	<b>Recombinant DNA technology:</b> Recombinant DNA: origin and current status; steps of preparation; restriction enzymes, polymerases, R-DNA technology in environmental management.
Unit IX	<b>Gene Expression:</b> Gene vs. Allele concept, quantitative genetics and multiple factors, inheritance and polygenic inheritance, sex chromosome structure and sex linked inheritance, sex linked diseases.
<b>Suggested Text Book Readings:</b>	
<ol style="list-style-type: none"> <li>1. R.C. Dubey and D.K. Maaheshwari, A Textbook of Microbiology, S. Chand Publication-2013.</li> <li>2. Ian L. Pepper, Charles P. Gerba, Terry J. Gentry, A Microbiology, Academic Press-2015.</li> <li>3. K Vijaya Ramesh , Environmental Microbiology, MJP Publication-2019.</li> <li>4. P.K. Mahapathra, A Textbook of Environmental Microbiology, I K International Publishing House Pvt. Ltd-213.</li> <li>5. Gareth M. Evans Judith C. Furlon, Environmental Biotechnolog, Theory and Application, John Wiley &amp; Sons Ltd, 2003.</li> <li>6. R. K. Sinha, Environmental Biotechnology, Aavishkar Publishers &amp; Distributors-2007</li> </ol>	
<b>Suggested online link:</b>	
<ol style="list-style-type: none"> <li>1. <a href="#">Introduction of Microorganism    B.Sc-1st Year Botany (Paper-I) Microbiology    Prahalad bhaiya - YouTube</a></li> <li>2. <a href="#">Microorganism, Bacteria, Algae, Fungi &amp; Protozoa - Chapter 2 - Microorganisms: Friend and Foe - YouTube</a></li> <li>3. <a href="#">BIODEGRADATION OF PESTICIDES - YouTube</a></li> <li>4. <a href="#">Bioremediation   Microbiology   Environmental Microbiology - YouTube</a></li> <li>5. <a href="#">Biogas (Methane) Production - Process, Applications, Advantages and Disadvantages - YouTube</a></li> <li>6. <a href="#">(185) Recombinant DNA technology ( Genetic engineering) - YouTube</a></li> <li>7. <a href="#">(185) Biomolecule   Proteins &amp; Nucleic Acid   L4   NEET 2022/23   Seep Pahuja - YouTube</a></li> </ol>	
This course can be opted as an elective by the students of following subjects: NO	
Suggested equivalent online courses (MOOCs) for credit transfer: NO	
<b>Electronic media and other digital components in the curriculum:</b>	
<b>Choose any one or more than:</b> (Electronic Media: Audio/Video Lectures, Online Counseling/Virtual Classes/E-Contents/e-SLM/OER/supplementary links for reference/Video Conferencing/Radio broadcast/Web Conferencing/ Other electronic and digital contents)	
Name of electronic media:	Year of incorporation: 2023-24

Programme: <b>B.Sc.</b>	Year: <b>2023-24</b>	Semester: <b>IV</b>
Subject: <b>Environmental Sciences</b>		
Course Code: <b>UGEVS-104N</b>	Course Title: <b>Plant Physiology and Biochemistry</b>	
<b>Course Objectives:</b>		
<ul style="list-style-type: none"> <li>➤ To understand the plant stress and their its control</li> <li>➤ To know about mineral and nitrogen fixation.</li> <li>➤ To know about mechanism of photosynthesis and respiration in plant.</li> </ul>		
Course Outcomes: <b>CO 1:</b> Able to understand about plant cell absorption mechanism. <b>CO 2:</b> Learn the role of plant growth regulator. <b>CO 3:</b> Gain the concept of nitrogen fixation. <b>CO 4:</b> Learn about plant minerals and its transportation <b>CO 5:</b> Also learn about photosynthesis and respirator regulation.		
Credits: 2	Type of Course: <b>Core</b>	
Max. Marks: 100	Min. Passing Marks: 36	
<b>Block 1</b>	<b>Plant Cell, Stress and Growth Regulator</b>	
Unit I	<b>Plant Cell and Transportation:</b> Plant cell, absorption, transportation of water, properties of solution, permeability, imbibitions, osmosis, ascent of sap.	
Unit II	<b>Plants Stress:</b> Abiotic and biotic stress; salinity, water stress, chilling, heat, pathogenesis, heavy metals and their impact on plant growth and metabolism.	
Unit III	<b>Plant Growth Regulator:</b> Phytohormones and its effect on plant growth and development, regulation of plant morphogenetic processes by light, role plant growth hormone in agriculture.	
<b>Block 2</b>	<b>Minerals and Nitrogen Fixation</b>	
Unit IV	<b>Plant Minerals:</b> Mineral elements in plants, types of plant nutrients, classification of minerals nutrients, availability of micro and macronutrients, essential and non-essential nutrients, common mineral diseases in plants.	
Unit V	<b>Nitrogen Fixation and Assimilation:</b> Nitrogen cycle, Biological nitrogen fixation by free living and in symbiotic association, structure and function of enzyme nitrogenase.	
Unit VI	<b>Nitrogen Metabolism:</b> Assimilation of nitrate, enzyme of nitrate reduction and their regulation and assimilation of ammonia into organic compounds.	
<b>Block 3</b>	<b>Photosynthesis and Respiration:</b>	
Unit VII	<b>Photosynthesis:</b> Chloroplast structure, photosynthetic apparatus, photosynthetic apparatus, photosynthetic membranes and organelles, z scheme, light dependent reactions, Hill	

	reaction, generation of NADPH and ATP, Cyclic and non cyclic Photophosphorylation,
Unit VIII	<b>Carbon Assimilation:</b> Calvin cycle, and photorespiration, C4 cycle and CAM cycle, carbon cycle.
Unit IX	<b>Respiration:</b> Structure of mitochondria, Types of respiration, glycolysis, regulation of plant glycolysis, translocation of metabolites across mitochondrial membrane, TCA cycle.
<b>Suggested Text Book Readings:</b>	
<ol style="list-style-type: none"> <li>1. A Textbook of Plant Physiology, Biochemistry And Biotechnology, S K Verma, Mohit Verma, S Chand Publication, 1995.</li> <li>2. Fundamentals of Plant Physiology, by V. K. Jain , S Chand Publication, 2017.</li> <li>3. Introduction to Plant Physiology, Norman P. A. Hüner ,William G. Hopkins, Wiley publication, 2008.</li> <li>4. Outline Of Plant Physiology, Robert M. Devlin, Medtech Publication, 2017.</li> <li>5. Physiochemical and Environmental Plant Physiology, Nobel, P. S. Academic Press; 4 edition, 2009.</li> </ol>	
<b>Suggested online link:</b>	
<ol style="list-style-type: none"> <li>1. <a href="#">Temperature stress in plants   Stress Physiology in Plants - YouTube</a></li> <li>2. <a href="#">Mineral Nutrition in Plants - Biological Nitrogen Fixation - Nitrate Assimilation - YouTube</a></li> <li>3. <a href="#">Photosynthesis - Non cyclic Photophosphorylation - YouTube</a></li> <li>4. <a href="#">Photosynthesis - Pigments - YouTube</a>.</li> <li>5. <a href="#">Plant Respiration   Biology   NEET 2020   Ritu Rattewal - YouTube</a></li> </ol>	
This course can be opted as an elective by the students of following subjects: Any one	
Suggested equivalent online courses (MOOCs) for credit transfer: NO	
<b>Electronic media and other digital components in the curriculum:</b>	
<b>Choose any one or more than:</b> (Electronic Media: Audio/Video Lectures, Online Counseling/Virtual Classes/E-Contents/e-SLM/OER/supplementary links for reference/Video Conferencing/Radio broadcast/Web Conferencing/ Other electronic and digital contents)	
Name of electronic media:	Year of incorporation: 2023-24

Programme: <b>B.Sc.</b>	Year: <b>2023-24</b>	Semester: <b>V</b>
Subject: <b>Environmental Sciences</b>		
Course Code: <b>DCEVS-105N</b>	Course Title: <b>Environmental Pollutions</b>	
<b>Course Objectives:</b>		
<ul style="list-style-type: none"> <li>➤ To understand about environmental pollution</li> <li>➤ To learn water, air, soil and radioactive pollution</li> <li>➤ To learn how to control environmental pollution.</li> </ul>		
<b>Course Outcomes:</b>		
CO1: Gain the knowledge of environmental pollution its source and sink		
CO 2: Learn the physiochemical characteristic water and its effects on living beings.		
CO3: Learn how to detect and control the soil and air pollution.		
CO4: Learn about techniques used in assessment of environmental pollution		
CO5: Learn how to ecological balance is necessary to control environmental pollution.		
Credits: <b>2</b>	Type of Course: <b>Discipline Centric Elective Course</b>	
Max. Marks: <b>100</b>	Min. Passing Marks: <b>36</b>	
<b>Block 1</b>	<b>Water and Air Pollution</b>	
Unit I	<b>Introduction of Pollutant:</b> Definition of pollution and pollutants, source and sink of pollutants, classification of pollutants, difference between pollutants and contaminants.	
Unit II	<b>Water Pollution:</b> Definition and sources of water pollution, types of water pollutants, effects of water pollutants on river water and potable water in India, measure of water pollution.	
Unit III	<b>Air Pollution:</b> Definition and sources of air pollution, atmospheric composition, types of air pollutants, acid rain, particulate matter, factors effecting air pollution, control measure of air pollution.	
<b>Block 2</b>	<b>Soil, Noise and Radioactive Pollution</b>	
Unit IV	<b>Soil pollution:</b> Definition and sources of soil pollution, nature of soil pollutants, physiochemical and biological properties of soil, factor effecting soil pollution, measure of soil pollution.	
Unit V	<b>Noise Pollution:</b> Definition of noise pollution, noise exposure level, effects of noise pollution, measure and control of noise pollution.	
Unit VI	<b>Radioactive Pollution:</b> Definition and sources of radioactive pollution, sources of radiations, nuclear pollution, biological effects of radiations, control measures, radioactive pollution.	
<b>Block 3</b>	<b>Effects and Control of Pollution</b>	

Unit VII	<b>Thermal Pollution:</b> Definition and sources of thermal pollution, causes of thermal pollution, control and measure of thermal pollution.
Unit VIII	<b>Effects of Environmental Pollution:</b> Effects of heavy metal pollution on natural water and soil, metal toxicity and its effects on human beings, effects of environmental pollution on agriculture.
Unit IX	<b>Pollution Control:</b> Techniques used in water treatment, oxidation ponds, fluidized bed reactors, air samplers, sequencing batch reactor, bioscrubbers, biotrickling filters, Afforestation.

**Suggested Text Book Readings:**

1. S.C. Sandra, "Environmental Science", A new Central Book Agency, 2008.
2. A.K. De, "Environmental Chemistry" Publisher: New Age Publisher International Pvt Ltd-2016.
3. Balram Pani, "Textbook of Environmental Chemistry" I K International Publishing House Pvt. Ltd-2103.
4. A text Book of Environment Studies, Asthana, D. K. and Asthana, M. 2006, S. Chand & Co.-2010.
5. Dr. Y. K. Singh, "Environmental Science" New Age International Private Limited-2006.

**Suggested on line link:**

1. Textbook for Environmental Studies, Erach Bharucha  
<https://www.ugc.ac.in/oldpdf/modelcurriculum/env.pdf>
2. Environmental Science, Tom Theis and Jonathan Tomkin, OpenStax CNX, National Digital Library of India.  
<http://ndl.iitkgp.ac.in/document/N2tzeE1aWWpUMm04b211VVZEdSsvK09RckFISkeE0OWI3b1Flb2ZTNHFxST0>
3. Environmental Science, CEC EduSat, National Digital Library of India.
4. POLLUTION <https://youtu.be/kOGqRMwAC6U>
5. Pollution and its Control: [\(316\) Pollution and its Control - Environmental and Ecology | Crack UPSC CSE/IAS - YouTube](#)

This course can be opted as an elective by the students of following subjects: NO

1. Environmental Pollution and Global issues - Course ([swayam2.ac.in](http://swayam2.ac.in))  
[https://onlinecourses.swayam2.ac.in/cec19\\_cs06/preview](https://onlinecourses.swayam2.ac.in/cec19_cs06/preview)

**Electronic media and other digital components in the curriculum:**

**Choose any one or more than:**(Electronic Media: Audio/Video Lectures, Online Counseling/Virtual Classes/E-Contents/e-SLM/OER/supplementary links for reference/Video Conferencing/Radio broadcast/Web Conferencing/ Other electronic and digital contents)

Name of electronic media:	Year of incorporation: 2023-24
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Programme: <b>B.Sc.</b>	Year: <b>2023-24</b>	Semester: <b>V</b>
Subject: <b>Environmental Sciences</b>		
Course Code: <b>DCEVS-106N</b>	Course Title: <b>Remote Sensing, GIS and Hydrology</b>	
<b>Course Objectives:</b> <ul style="list-style-type: none"> <li>➤ To understand to Remote sending and GIS in environmental management.</li> <li>➤ To understand the water hydrology and it role in environmental balance.</li> <li>➤ To learn how to about hydrological process.</li> </ul>		
<b>Course Outcomes:</b> <b>CO1:</b> Able to know the principle of remote sensing and tools used in remote sensing. <b>CO2:</b> Learn about the role GIS in determination of real time data sampling. <b>CO3:</b> Known the concept of hydrological maintenance of environment. <b>CO4:</b> Learn about hydrograph, and hydrograph Analysis for water resources <b>CO5:</b> Also learn about water harvesting and food management system.		
Credits: <b>2</b>	<b>Type of Course: Discipline Centric Elective Course</b>	
Max. Marks: <b>100</b>	Min. Passing Marks: <b>36</b>	
<b>Block 1</b>	<b>Concept and Application of Remote Sensing</b>	
Unit I	<b>Concept of Remote Sensing:</b> Electromagnetic radiation and atmospheric window, principle of remote sensing, types of remote sensing, data acquisition and it applications	
Unit II	<b>Geographical Information System (GPS):</b> Concept of GIS, Principles, Elements and its applications, GPS principle and applications.	
Unit III	<b>Application of Remote Sensing:</b> Application of remote sensing in atmospheric and ocean studies, climate change, forestry, and environment.	
<b>Block 2</b>	<b>Concept and Hydrological Process</b>	
Unit IV	<b>Concept of Hydrology:</b> Hydrologic cycle, water availability, water balance, precipitation, evapotranspiration study by remote sensing.	
Unit V	<b>Hydrological Process:</b> Water table, aquifer, evaporation and transpiration, Interflow, Gravity Drainage, Surface Runoff, Return flow, Recharge.	
<b>Unit VI</b>	<b>Hydrograph Analysis:</b> Hyetograph, Runoff, drainage basin characteristics; Hydrograph concepts, assumptions and limitations, Unit of hydrograph.	
<b>Block 3</b>	<b>Flood Management and Water Harvesting</b>	
Unit VII	<b>Reservoir:</b> Types, site selection, zones of storage, safe yield, reservoir capacity, reservoir sedimentation and control study.	
Unit VIII	<b>Flood Management:</b>	

	Types of floods, Causes of flooding, Alleviation, Levees and floodwalls, Floodways, Channel improvement, Flood damage analysis by remote sensing.
Unit IX	<b>Water Harvesting:</b> Rainwater collection, runoff collection, ponds, tanks, natural and artificial ground water recharge methods, agriculture rain water harvesting.
<b>Suggested Text Book Readings:</b> <ol style="list-style-type: none"> <li>1. M. Anji Reddy, Text Book of Remote Sensing and Geographical Information Systems, Publications/BSP Books-2012.</li> <li>2. Kali Charan Sahu, Textbook of Remote Sensing and Geographical Information Systems, Atlantic Publishers and Distributors (P) Ltd-2022.</li> <li>3. K. Subramanya, Engineering Hydrology, McGraw Hill Education, 2017.</li> <li>4. Savindra Singh, Fundamentals of Hydrology, Pravalika,</li> <li>5. R. N. Saxena, Elements of Hydrology and Groundwater, PHI Learning-2017.</li> </ol>	
<b>Suggested online link:</b> <ol style="list-style-type: none"> <li>1. <a href="#">(185) Remote sensing in hindi   remote sensing and gis   lecture 1 - YouTube</a></li> <li>2. <a href="#">(185) GIS (geographic information systems )   introduction to gis   lecture 1 - YouTube</a></li> <li>3. <a href="#">(185) Application of remote sensing   remote sensing and gis   lecture 6 - YouTube</a></li> <li>4. <a href="#">(185) Hydrologic Processes - YouTube</a></li> <li>5. <a href="#">(185) Basics of Hydrograph Analysis and Uses - Hydrograph Analysis - GATE Hydrology - YouTube</a> <a href="#">(185) Hydrograph and Runoff - Hydrology - YouTube</a></li> </ol>	
This course can be opted as an elective by the students of following subjects: NO	
Suggested equivalent online courses (MOOCs) for credit transfer: <ol style="list-style-type: none"> <li>1. <a href="#">Basics of Remote sensing, GIS &amp; GNSS technology and their applications - Course (swayam2.ac.in)</a></li> <li>&amp;</li> <li>2. <a href="#">Surface Water Hydrology - Course (nptel.ac.in)</a></li> </ol>	
<b>Electronic media and other digital components in the curriculum:</b> <b>Choose any one or more than:</b> (Electronic Media: Audio/Video Lectures, Online Counseling/Virtual Classes/E-Contents/e-SLM/OER/supplementary links for reference/Video Conferencing/Radio broadcast/Web Conferencing/ Other electronic and digital contents)	
Name of electronic media:	Year of incorporation: 2023-24

Programme: <b>B.Sc.</b>	Year: <b>2023-24</b>	Semester: <b>VI</b>
Subject: <b>Environmental Sciences</b>		
<b>Course Code: DCEVS-108N</b>	<b>Course Title: Statistics and Environmental Quality Assessment</b>	
<b>Course Objectives:</b>		
<ul style="list-style-type: none"> <li>➤ To learn graphical representation of environmental data</li> <li>➤ To learn about data analysis techniques</li> <li>➤ To know about water and soil quality analysis</li> </ul>		
<b>Course Outcomes:</b>		
<b>CO1:</b> Useful to known about environmental statistics and data management.		
<b>CO2:</b> Learn about the diagram and graphs plot		
<b>CO3:</b> Able to understand the probability, variable and standard deviation		
<b>CO4:</b> Able to understand the analysis of variance.		
<b>CO5:</b> Able to Learn about air water and soil quality assessment.		
Credits: <b>2</b>	<b>Type of Course: Discipline Centric Elective Course</b>	
Max. Marks: <b>100</b>	Min. Passing Marks: <b>36</b>	
<b>Block 1</b>	<b>Graphical representation of Environmental data</b>	
Unit I	<b>Environmental Statistics:</b> Concept and scope of environmental statistics, role of statistics in environmental data interpretation, environmental data accuracy and environmental quality measurement, statistical tools	
Unit II	<b>Data and Frequency:</b> Concept of data, types of data, grouped data, tools of data management, frequency, frequency distribution, types of frequency distribution, frequency distribution table and graphs.	
Unit III	<b>Diagram and Graphs:</b> Graphical interpretation, simple diagram, multiple diagram, component bar diagram, percentage bar diagram, Pie-diagram, histogram, frequency curve, frequency polygon and line graph.	
<b>Block 2</b>	<b>Data Analysis Techniques</b>	
Unit IV	<b>Data Analysis Tools:</b> Concepts of mean, mode, median and geometric mean percentile and quartiles.	
Unit V	<b>Probability and Standard Distribution:</b> Probability distribution, normal distribution, sampling distribution, standard deviation and standard error, testing of hypothesis	
Unit VI	<b>Analysis of Variance:</b> Concept of statistical variance, basic principles of one way and two way analysis	
<b>Block 3</b>	<b>Air Water and Soil Quality Assessment</b>	
Unit VII	<b>Air Quality Monitoring:</b> Composition of air, air quality standard, air sampling, Particulate matter, qualitative analysis of SO <sub>2</sub> , and NO <sub>2</sub> .	
Unit VIII	<b>Water Quality Monitoring:</b>	

	Water quality analysis, water quality parameters study as BOD, COD, pH, turbidity and nitrate, salinity, test of <i>coli</i> forms, water quality standard in India.
Unit IX	<b>Soil Quality Monitoring:</b> Soil quality, organic matter determination, exchangeable calcium and magnesium, soil quality standard in India.
<b>Suggested Text Book Readings:</b>	
<ol style="list-style-type: none"> <li>1. S.C. Sandra, "Environmental Science", A new Central Book Agency, 2008.</li> <li>2. A.K. De, "Environmental Chemistry" Publisher: New Age Publisher International Pvt Ltd-2016.</li> <li>3. Balram Pani, "Textbook of Environmental Chemistry" I K International Publishing House Pvt. Ltd-2103.</li> <li>4. Practical Statistics for Environmental &amp; Biological Scientists, John Townened, John Wiley &amp; Sons Inc publication.</li> </ol>	
<b>Suggested online link:</b>	
<ol style="list-style-type: none"> <li>1. Environment Statistics: <a href="#">Microsoft Word - Brochure Environment 2015 (un.org)</a></li> <li>2. Fundamentals of environment statistics: <a href="#">Microsoft PowerPoint - Session 2-1 Basic concepts of environment statistics (UNSD).ppt</a></li> <li>3. Mean, Median and Mode: <a href="#">meanmedianmode (statstutor.ac.uk)</a></li> <li>4. Soil Quality and Methods for its Assessment: <a href="#">Bramoh FM.indd (core.ac.uk)</a></li> <li>5. Water Quality Assessment Of Water Bodie: <a href="#">Slide 1 (cpcb.nic.in)</a></li> <li>6. Air Quality Assessment: <a href="#">Microsoft Word - air quality technical report (nj.gov)</a></li> </ol>	
This course can be opted as an elective by the students of following subjects: Anyone	
Suggested equivalent online courses (MOOCs) for credit transfer: NO	
<b>Electronic media and other digital components in the curriculum:</b>	
<b>Choose any one or more than:</b> (Electronic Media: Audio/Video Lectures, Online Counseling/Virtual Classes/E-Contents/e-SLM/OER/supplementary links for reference/Video Conferencing/Radio broadcast/Web Conferencing/ Other electronic and digital contents)	
Name of electronic media:	Year of incorporation: 2023-24

Programme: <b>B.Sc.</b>	Year: <b>2023-24</b>	Semester: <b>VI</b>
Subject: <b>Environmental Sciences</b>		
<b>Course Code: DCEVS-109N</b>	<b>Course Title: Environmental Geology</b>	
<b>Course Objectives:</b>		
<ul style="list-style-type: none"> <li>➤ To understand the history of earth origin and their surface process.</li> <li>➤ To understand atmosphere and its composition and heat balance in nature.</li> <li>➤ To learn how rocks and minerals are formed by natural process</li> <li>➤ To know how the mountain and river are originate.</li> </ul>		
<b>Course Outcomes:</b>		
CO1: Useful to know about earth formation, earth composition, atmosphere and hydrosphere.		
CO2: Understanding the surface process of earth system that how the rocks, mineral are available for living being and how the geographical formation are occurs like mountain and river.		
CO3: Understand the formation of rocks and mineral, its composition, and weathering process and rock cycling.		
CO4: Learn about Plate tectonic in mountain formation and its role in earthquake generation.		
CO5: Able to understand about geological hazardous like earthquakes and volcano		
Credits: <b>2</b>	Type of Course: <b>Discipline Centric Elective Course</b>	
Max. Marks: <b>100</b>	Min. Passing Marks: <b>36</b>	
<b>Block 1</b>	<b>Earth and Atmosphere</b>	
Unit I	<b>History of Earth:</b> Concept of the earth formation, formation and composition of core, mantle, crust, atmosphere and hydrosphere; chemical composition of the earth.	
Unit II	<b>Origin of Earth:</b> Geological time scale and major changes on the Earth's surface, Holocene and the emergence of humans, Concept of plate tectonics and continental drift theory, gravitational and magnetic fields of the earth.	
Unit III	<b>Earth Atmosphere:</b> Atmosphere, evolution of earth's atmosphere, composition of atmosphere, physical and optical properties, earth's energy balance; energy transfers in atmosphere; earth's radiation budget.	
<b>Block 2</b>	<b>Earth Surface Process and Rocks Formation</b>	
Unit IV	<b>Earth Surface Processes:</b> Circulation, interfaces, atmosphere-ocean interface, atmosphere-land interface, ocean-land interface; land surface processes, fluvial and glacial processes, rivers and geomorphology.	
Unit V	<b>Minerals and Rocks Formation:</b> Composition of rocks and minerals, rock cycle: lithification and metamorphism; Three rock laws; rock structure, igneous, sedimentary and metamorphic rocks.	
Unit VI	<b>Weathering of Minerals and Rocks:</b>	

	Physical, biogeochemical processes of weathering; physical processes of erosion, factors affecting erosion and agents of erosion; aeolian transportation and deposition of sediments by running water.
<b>Block 3</b>	<b>Mountain and River Origin and Natural Hazardous</b>
Unit VII	<b>Mountain Origin:</b> Plate tectonic in mountain formation, continental collision and formation of the Himalaya; ocean floor spreading, formation of peninsular Indian mountain systems - western and eastern ghats, Vindhyas and Aravallis.
Unit VIII	<b>River Origin:</b> Perennial river systems and evolution of monsoon in Indian subcontinent; formation of Indo-Gangetic Plains, progression of agriculture in the Indian subcontinent in Holocene.
Unit IX	<b>Natural Hazards:</b> Geological hazards, earthquakes and volcano, characteristics of earthquakes, Types of waves, magnitude scales, Richter scale, volcanic feature, types of volcanic eruptions, active and inactive volcanoes.
<b>Suggested Text Book Readings:</b> <ol style="list-style-type: none"> <li>1. Savindra Singh, "Fundament of physical geography, Pravalika Publcatons-2022</li> <li>2. Savindra Singh, "Environmental Geography" Pravalika Publications-2019</li> <li>3. Thompson and Turk, "Environmental Geoscience: Thomson Learning-1995</li> <li>4. Jeff Keller, "Environmental Geology" Pearson-1999.</li> <li>5. Savindra Singh, "Fundamentals of Hydrology, Pravalika - 2018</li> <li>6. Dorothy Merits, "Environmental Geology: An Earth Systems Approach, W.H. Freeman-2014</li> </ol>	
<b>Suggested online link:</b> <ol style="list-style-type: none"> <li>1. Theories of Origin of Earth - Part 1 (Examrace - Dr. Manishika) - YouTube</li> <li>2. History of the Earth: <a href="#">History Of The Earth (Eolss.Net)</a></li> <li>3. History of Earth: <a href="#">History Of Earth - Wiki.Pdf (Content-Calpoly-Edu.S3.Amazonaws.Com)</a></li> <li>4. Weathering &amp; Mass-Wasting Processes: <a href="#">Weathering, Erosion, and Mass-Wasting Processes (cuny.edu)</a></li> <li>5. The Evolution of Mountain: <a href="#">D:WPYSGSG3ERTHHIST.99.wpd (jmu.edu)</a></li> </ol>	
This course can be opted as an elective by the students of following subjects: NO	
Suggested equivalent online courses (MOOCs) for credit transfer: NO	
<b>Electronic media and other digital components in the curriculum: Choose any one or more than:</b> (Electronic Media: Audio/Video Lectures, Online Counseling/Virtual Classes/E-Contents/e-SLM/OER/supplementary links for reference/Video Conferencing/Radio broadcast/Web Conferencing/ Other electronic and digital contents)	
Name of electronic media:	Year of incorporation: 2023-24