FYUGP FRAMEWORK WITH ENVIRONMENTAL SCIENCE AS A MAJOR

SEMESTER	COURSE CODE	COURSE TYPE	COURSE TITLE	CREDITS	
				THEORY	PRACTICAL
I	EVS124J	CT-1	**ENVIRONMENTAL SCIENCE:** ENVIRONMENT AND ECOLOGY	4	2
II	EVS224J	CT-1	**ENVIRONMENTAL SCIENCE:** NATURAL RESOURCES AND BIODIVERSITY	4	2
III	EVS324J	CT-1	**ENVIRONMENTAL SCIENCE:** ENVIRONMENTAL CHEMISTRY	4	2
IV	EVS422J1	CT-1	**ENVIRONMENTAL SCIENCE:** HUMAN AND ENVIRONMENT	3	1
	EVS422J2	CT-2	**ENVIRONMENTAL SCIENCE:** ENVIRONMENTAL POLLUTION	4	2
	EVS422J3	CT-3	**ENVIRONMENTAL SCIENCE:** ENVIRONMENTAL GEOSCIENCE AND DISASTER MANAGEMENT	4	2
V	EVS522J1	CT-1	**ENVIRONMENTAL SCIENCE:** ENVIRONMENTAL LAWS AND POLICIES	3	1
	EVS522J2	CT-2	**ENVIRONMENTAL SCIENCE:** ENVIRONMENTAL POLLUTION CONTROL AND MANAGEMENT	4	2
	EVS522J3	CT-3	**ENVIRONMENTAL SCIENCE:** AQUATIC ECOLOGY	4	2
VI	EVS622J1	CT-1	**ENVIRONMENTAL SCIENCE:** ENVIRONMENTAL ECONOMICS AND SUSTAINABLE DEVELOPMENT	3	1
	EVS622J2	CT-2	**ENVIRONMENTAL SCIENCE:** ATMOSPHERIC SCIENCE	4	2
	EVS622J3	CT-3	**ENVIRONMENTAL SCIENCE:** TERRESTRIAL ECOLOGY	4	2
FYUGP WITH HONOURS					
VII	EVS722J1	CT-1	**ENVIRONMENTAL SCIENCE:** ENVIRONMENTAL IMPACT ASSESSMENT AND AUDITING	3	1
	EVS722J2	CT-2	**ENVIRONMENTAL SCIENCE:** ENVIRONMENTAL ENGINEERING	4	2
	EVS722J3	CT-3	**ENVIRONMENTAL SCIENCE:** ENVIRONMENTAL PLANNING, REMOTE SENSING AND GIS	4	2
VIII	EVS822J1	CT-1	**ENVIRONMENTAL SCIENCE:** CLIMATE CHANGE	3	1
	EVS822J2	CT-2	**ENVIRONMENTAL SCIENCE:** ENVIRONMENTAL TOXICOLOGY	4	2
	EVS822J3	CT-3	**ENVIRONMENTAL SCIENCE:** ENVIRONMENTAL MICROBIOLOGY AND BIOTECHNOLOGY	4	2
FYUGP HONOURS WITH RESEARCH					
VII	EVS722J1	CT-1	**ENVIRONMENTAL SCIENCE:** ENVIRONMENTAL IMPACT ASSESSMENT AND AUDITING	3	1
	EVS722J2	CT-2	**ENVIRONMENTAL SCIENCE:** ENVIRONMENTAL ENGINEERING	4	2
	EVS722J3	CT-3	**ENVIRONMENTAL SCIENCE:** ENVIRONMENTAL PLANNING, REMOTE SENSING AND GIS	4	2
VIII	EVS822RJ1	CT-1	**ENVIRONMENTAL SCIENCE:** RESEARCH METHODOLOGY AND ETH	3	1
	EVS822RP	PROJECT	**ENVIRONMENTAL SCIENCE:** RESEARCH PROJECT	12	

HoD / CONVENOR BOUGS

BACHELORS WITH ENVIRONMENTAL SCIENCE AS MAJOR (CT-1)
1st SEMESTER

EVS124J ENVIRONMENTAL SCIENCE_ENVIRONMENT AND ECOLOGY

CREDITS: THEORY-4, PRACTICAL -2

COURSE LEARNING OUTCOME: *This paper is designed to introduce the basic concepts of Environment and Ecology leading to better understanding of inter-connections of Environmental Science as a discipline. The course will introduce the students to different components of the environment, biotic and abiotic interactions, ecosystem structure and functions and role of humans in shaping the present-day ecology and environment.*

THEORY (4 CREDITS, 60 HOURS)

UNIT I. BASICS OF ENVIRONMENT

Environmental science: Scope and importance, Components of environment: atmosphere, lithosphere, hydrosphere, biosphere (structure and function), Brief account of cryosphere and anthroposphere (built environment).

UNIT II. POPULATION AND COMMUNITY

Concept of population, Population growth (Density dependent and density independent factors), Survivorship curves and age structure, Biotic potential and carrying capacity (r and k strategists), Population interactions: Mutualism, Protocooperation, Commensalism, Competition, Herbivory, Predation, Parasitism, Community: Concept and characteristics, Ecological succession.

UNIT III. ECOSYSTEMS

Ecosystem: Concept, Organization and significance, Types of ecosystems, Food chains, Food webs and trophic levels, Ecological pyramids, Energy flow in ecosystems, Ecosystem productivity, Decomposition, Biogeochemical cycles: carbon, nitrogen, phosphorus and sulphur.

UNIT IV. HUMAN ECOLOGY

Global and regional human population growth, Theories of human population growth (Malthusian and neo-malthusian), Drivers of human population change, Growth curves and population projections, Earth's carrying capacity and ecological footprint, Brief account of anthropocene.

PRACTICAL (2 CREDITS) 60 HOURS

1. Determination of latitude/ longitude/ altitude using GPS
2. Identification of major rock types
3. Estimation of moisture and field capacity in soils of different ecosystems
4. Estimation of pH and conductivity in soils of different ecosystems
5. Estimation of pH and conductivity in water samples of different ecosystems
6. Analysis of population age structure using demographic data
7. Schematic collection of data for depicting ecological pyramid in the college campus
8. Field /Environmental visit to understand various environmental components

SUGGESTED READINGS:

1. Ecology and Environment, P.D. Sharma (13th Ed.). 2023. Rastogi Publication.
2. Environmental Science, S.C. Santra. 2020. New Central Book Agency, Kolkotta
3. Population and Community Ecology, Sanjay Sheoran.2023. Academic Publication.
4. Environmental Biolog, K.C. Agarwal. 2008. Nidhi Publication.
5. Fundamentals of Ecology, E. Odum. (17th Ed.). Cengage India Pvt. Ltd.
6. Environment and Ecology, Dr. Sandeep Kumar Verma. 2024. Orange Books Publication.
7. Environmental Studies, Anubha Kaushik. 2018. New Age International Pvt. Ltd Publisher.

BACHELORS WITH ENVIRONMENTAL SCIENCE AS MAJOR (CT-1)
2nd SEMESTER

EVS224J ENVIRONMENTAL SCIENCE_ NATURAL RESOURCES AND BIODIVERSITY

CREDITS: THEORY-4, PRACTICAL -2

COURSE LEANING OUTCOME: *This paper is expected to have a broad understanding of various natural resources including biodiversity in terms of availability, utilization and management. The course is expected to give basic understanding regarding different types of natural resources, their importance and global distribution. The students will also have basic knowledge about the diverse life forms present in the world, their status, distribution and need for their conservation and preservation.*

THEORY (4 CREDITS: 60 HOURS)

UNIT I: NATURAL RESOURCES

Natural resources: concept and classification; forest resources; water resources; mineral resources; Energy resources

UNIT II: BIODIVERSITY

Biodiversity: Status and importance; Levels of biodiversity; Values of biodiversity; Endemism, Hot spots and cold spots; India as a mega-diversity nation; Threats to biodiversity, IUCN's Red list (Scheme and Status)

UNIT III: BIOGEOGRAPHY

Geographical classification and zones; Major biomes of the world; Zoogeographic realms of the world: Dispersal: Means, modes and barriers; Migrations

UNIT IV: MANAGEMENT OF NATURAL RESOURCES

Monitoring and management of bio-diversity; Biodiversity conservation; Management of natural resources (forest, minerals, water); Conservation of energy resources

PRACTICAL (02 CREDITS) (60 HOURS)

1. Study of vegetation in a particular ecosystem (lake, forest, agricultural, grassland etc)
2. Study of fauna in a particular ecosystem (lake, forest, agricultural, grassland etc)
3. To determine the minimum size of the quadrat by Species Area Curve Method.
4. To study communities by quadrat method and to determine % Frequency, Density and Abundance.
5. To determine similarity and dissimilarity index of ground vegetation.
6. Calculation of species biodiversity (alpha, beta and gamma)
7. Time-series analysis of natural resource consumption of a given country using publicly available data
8. Visit to a natural ecosystem (Forest, National Park, Sanctuary, Lake)

SUGGESTED READINGS:

1. Essential Environmental Science, S.P Mishra. 2023. Ane books Pvt. Ltd.
2. Biodiversity for Sustainable Development, K. laladhas. 2018. Springer International Publishing.
3. Natural Resources, Management for Sustainable Resources, Brantley Kelley. 2019. Larsen and Keller Education.
4. Physical Geography, Savindra Singh. 2009. Prayag Pustak Bahwan.
5. Natural Resourse and Biodiversity, Abhijit Mitra. 2021. HSRA Publication.
6. Ecology, Environment and Resource Conservation, J.S Singh. 2006. Anamaya Publisher.
7. An Advance Textbook on Biodiversity, K V Krishnamurthy. 2003. Oxford and IBH Publication.
8. Conservation of Biodiversity and Natural Resources, M. P Singh. 2004. Daya Publishing House.

Bachelors with Environmental Science as Major
3rd Semester

EVS322J: Environmental Science: Environmental Chemistry

CREDITS: (Theory-4, Practical -2)

Maximum Marks:100 **Minimum Marks: 36**

Course learningoutcome: This course introduces the students to basic analytical chemistry relevant to the course and is designed to and is designed to equip the students to handle the analytical instruments. Emphasis is laid to have an understanding of the chemistry of atmosphere, water and soil. The students will also learn basic principles of various chemical processes occurring in the different components of the environment.

THEORY (4 credits: 60 hours)

Unit I: Analytical Chemistry **(15 hours)**

1.1. Stoichiometry
1.2. Titrimetry and Gravimetry
1.3. Spectrophotometry: UV-Visible
1.4. Flame photometry and AAS
1.5. Chromatography: Paper and TLC

Unit II: Atmospheric Chemistry **(15 hours)**

1.1. Evolution of Earth's atmosphere
1.2. Ions and radicals in the atmosphere
1.3. Inorganic and organic particulate matter
1.4. Photochemical reactions in the atmosphere
1.5. Thermochemical reactions in the atmosphere

Unit III: Water Chemistry **(15 hours)**

1.1. Physico-chemical properties of water
1.2. Solubility of gases in water
1.3. Biochemical oxygen demand and chemical oxygen demand
1.4. Carbonate-bicarbonate system
1.5. Nutrients in water: Phosphorus and nitrogen

Unit IV: Soil chemistry **(15 hours)**

1.1. Pedogenesis
1.2. Soil profile
1.3. Inorganic and organic components of soil
1.4. Physical, chemical and biological properties of soils
1.5. Soil classification and types

PRACTICALS: (2 credits) **(30 hours)**

1. Standardization of reagents – titrants (acids, bases)
2. Experimental verification of Beer-Lambert's law
3. Measurement of ozone gas concentration by ozone sensor
4. Estimation of dry deposition from the atmosphere
5. Determine pH and conductivity of water samples
6. Determination of dissolved oxygen content in water samples
7. Determination of soil texture
8. Determination of pH and conductivity of soil samples

BACHELORS WITH ENVIRONMENTAL SCIENCE AS MAJOR (CT-1)
4th SEMESTER
EVS422J1 ENVIRONMENTAL SCIENCE _ HUMAN AND ENVIRONMENT
CREDITS: (THEORY-3, PRACTICAL -1)

Course outcome: *This course is designed to introduce students with a comprehensive conceptual, theoretical and empirical background between social systems and environment. The course explores important perspectives like environmental education, human cognition and behaviour, psychology, urban stress, Eco-philosophies, ethics and politics and policy. The students will be able to understand the social roots of ecological problems, and to unveil the social responses to the environmental crisis. The course also discusses the environmental history and the rise of environmentalism and environmental organizations.*

THEORY (3 CREDITS: 45 HOURS)

UNIT I: ENVIRONMENTAL EDUCATION

Environmental education: aims, objectives and principles, Environmental protection and religious teachings, Environmental literacy and activism, Environmental ethics, Environmental policy and public attitude

UNIT II: ENVIRONMENTAL PSYCHOLOGY AND SOCIOLOGY

Environment psychology: concept and theory, Influence of environment on human cognition and behaviour, Urban environmental stress, Eco-philosophies: deep, social and feminist, Science, policy and society interface

UNIT III: ENVIRONMENTALISM

Environmentalism: concept and history, Environmental organizations (WWF, UNEP, IUCN, WHO), Environmental justice, The monetization frontier, Environmental politics

PRACTICALS: (1 CREDIT; 30 HOURS)

1. Formulation of questionnaire for the assessment of environmental education among the people.
2. Assessing the impacts of economic development on human lives.
3. Visit to marginalized localities for environmental education and environmental awareness.
4. Preparing a list of projects taken by WWF in India

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BACHELORS WITH ENVIRONMENTAL SCIENCE AS MAJOR (CT-2)
4th SEMESTER
EVS422J2 ENVIRONMENTAL SCIENCE _ ENVIRONMENTAL POLLUTION
CREDITS: (THEORY-4, PRACTICAL -2)

Course outcome: *The students in this course will be provided a comprehensive picture of pollution scenario especially air and radiation pollution and its likely impact of pollutants on the environment. Students will be able to achieve competence in the area of prevention and control measures of various types of pollution like air, noise, and electromagnetic.*

THEORY (4 CREDITS: 60 HOURS)

UNIT I: AIR AND NOISE POLLUTION

Air pollution: Sources and classification, Indoor air pollution, Air quality standards and monitoring: SO2, NO2, CO, PM and ozone, Noise pollution: sources and measurement, Noise standards; Impact of air and noise pollution on human health and environment

UNIT II: WATER POLLUTION

Water Pollution: sources and types, Inland water and marine pollution, Biocides and heavy metals, Water quality standards and monitoring, Impacts of water pollution on human health and environment

UNIT III: SOIL POLLUTION

Soil pollution: causes and types, Land degradation and desertification, Soil erosion: causes and impacts, Fate of pesticides and fertilizers in soil; Soil quality standards and monitoring

UNIT IV: WASTE AND RADIATION POLLUTION

Solid waste pollution, Electronic waste pollution, Plastic waste pollution, Radiation exposure and human health, Light pollution

PRACTICALS: (02 CREDIT; 60 HOURS)

1. Study of ambient noise levels in different zones
2. Determination of particulate matter (PM) in ambient air
3. Determination of dissolved oxygen content in water samples
4. Determination of nitrate in a water sample.
5. Determination of phosphorus in a water sample.
6. Estimation of organic carbon in different soils samples
7. Estimation of nitrogen in different soils samples
8. Qualitative and quantitative assessment of municipal solid waste

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BACHELORS WITH ENVIRONMENTAL SCIENCE AS MAJOR (CT-3)
4th SEMESTER
EVS422J3 ENVIRONMENTAL SCIENCE _ ENVIRONMENTAL GEOSCIENCE AND DISASTER MANAGEMENT

CREDITS: (THEORY-4, PRACTICAL -2)

CREDITS: THEORY-4, PRACTICAL -2

Course learning outcome: *This course provides an in-depth understanding of environmental geoscience and disaster management, exploring the relationship between natural processes, environmental factors, and their impact on human societies. Students will learn about the causes and consequences of various natural disasters, mitigation strategies, and disaster preparedness.*

THEORY (4 CREDITS: 60 HOURS)

UNIT I: INTRODUCTION TO ENVIRONMENTAL GEOSCIENCE

Origin and evolution of earth, Geological time scale, Earth's structure and plate tectonics, Geomagnetism: Magnetic and gravitational fields of the earth, Continental drift: Plate tectonics and Neotectonics

UNIT II: GEOCHEMISTRY

Geochemical classification and distribution of elements in earth, Mobility of trace elements, Concept of rare earth elements, Radioactive tracers, Geochemical cycles - C, N, P, S

UNIT III: NATURAL HAZARDS AND DISASTERS

Concept and classification of natural hazards and disasters, Concept of hazard risk and vulnerability, Types of natural hazards and disasters (earthquakes, volcanic eruptions, tsunamis, hurricanes, floods, landslides, avalanches, global climate extremes), Causes and triggers of natural disasters, Case studies of significant historical events

UNIT IV: DISASTER, MITIGATION AND MANAGEMENT

Basic principles of disaster management, Disaster management cycle, Disaster management policy (National and State Bodies for Disaster Management), Early warning systems, Disaster management: success and failure studies

PRACTICALS: (02 CREDITS; 60 HOURS)

1. Estimation of calcium and magnesium in soil samples
2. Estimation of sodium and potassium in soil samples
3. Estimation of total hardness in water samples
4. Estimation of calcium and magnesium in water samples
5. Estimation of sodium and potassium in water samples
6. Estimation of sulfur in soil and water samples
7. Preparation of maps showing distribution of important metallic and non-metallic deposits
8. Identifying potential natural hazards, such as flood-prone zones, earthquake risk areas, and landslide susceptibility, and create hazard maps

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BACHELORS WITH ENVIRONMENTAL SCIENCE AS MAJOR (CT-1)
5th SEMESTER

EVS522J1 ENVIRONMENTAL SCIENCE_ ENVIRONMENTAL LAWS AND POLICY

CREDITS: (THEORY-3, PRACTICAL -1)

COURSE LEARNING OUTCOME: *This course is framed in such a way that students of environmental science should be aware of the legal perspective on various issues and dimensions of environment. They will get a better understanding about the situation whether there is matching response from the legal and policy front of the nation towards the ever-increasing environmental degradation.*

THEORY (3 CREDITS: 45 HOURS)

UNIT I: ENVIRONMENTAL PROTECTION

An overview of evolution of environmental laws and policy in India, Environment protection: Provisions of Indian constitution (48A, 51A, and 253); Wildlife protection Act (amended) (1972), Water prevention and control of pollution Act, Air prevention and control of pollution Act

UNIT II: NATIONAL LAWS

Forest Conservation Act (1980), Environmental Protect Act, 1986, National green tribunal Act (2010), Solid wastes (management and handling) rules (2016), Hazardous and other waste rules, 2016

UNIT III: NATIONAL POLICIES AND MISSIONS

National Environmental Policy, 2006; National Water Policy, 2012; National Energy Policy, 2017; National Forest Policy, 2018; National Missions

PRACTICALS: (1 CREDITS) (30 HOURS)

1. Case studies under article 14, 19, and 21
2. Study of any success story regarding the with implementation of Environmental Laws and Policies
3. Identification of biomedical and hazardous waste in households
4. Case study under Forest Conservation Act, 1980, EPA, 1986, NGT 2010

SUGGESTED READINGS:

1. Environmental protection, Sue, Elworthy & Jane, Holder. 1997. Cambridge University Press
2. Environmental and Pollution Laws in India, T. S. Doabia (4th Ed.). 2022. Lexis Nexis Publishers.
3. Environmental Law and Policy in India, Shyam, Diwan & Armin, Rosencranz (3rd Ed.). 2023. Oxford University Press
4. Environmental Law in India, Gurdip Singh (2nd Ed.). 2016. MacMillan Publisher.

BACHELORS WITH ENVIRONMENTAL SCIENCE AS MAJOR (CT-2)
5th SEMESTER

EVS522J2 ENVIRONMENTAL SCIENCE_ ENVIRONMENTAL POLLUTION CONTROL AND MANAGEMENT

CREDITS: THEORY-4, PRACTICAL -2

COURSE LEARNING OUTCOME: *The students in this course will be able to achieve the competence in the area of prevention and control measures of various types of pollution like air, water, soil, noise and electromagnetic. Students are expected to achieve the technical competence in monitoring the various types of pollutants.*

THEORY (4 CREDITS: 60 HOURS)

UNIT I: AIR POLLUTION CONTROL AND MANAGEMENT

Control of particulate air and gaseous air pollution; Bio-filters for control of air pollution; Indoor air pollution control; Noise control and abatement measures

UNIT II: WATER POLLUTION CONTROL AND MANAGEMENT

Sanitation and sewage treatment (Municipal. Industrial and Agriculture); Control of eutrophication; Restoration of lakes and wetlands; Control of stream and river pollution; Groundwater pollution management; Control of marine pollution

UNIT III: SOIL POLLUTION CONTROL AND MANAGEMENT

Control of soil pollution; Soil conservation and control of soil erosion; Waste lands and their reclamation; Reclamation of soils (acidic. alkaline, sodic); Sustainable agricultural practices; integrated pest management.

UNIT IV: WASTE AND RADIATION MANAGEMENT

Plastic and E-waste management; Radioactive waste management: Reduction in health impacts of cell phones and towers; Solutions for reducing light pollution; Measures to control thermal pollution;

PRACTICALS: (2 CREDITS) 60 HOURS

1. Determination of gaseous pollutants in ambient air
2. Case studies on air quality index of various cities
3. Estimation of BOD in different waters
4. Estimation of COD in different waters
5. Measurement of soil erosion
6. Survey of a local area for identification of common soil pollutants such as pesticides, organic pollutants and fertilizers
7. Preparation of report about solid waste management practices adopted in the campus of the institute.
8. Visit to any landfill site /SWM facility

SUGGESTED READINGS:

1. Environmental protection, Sue, Elworthy & Jane, Holder. 1997. Cambridge University Press
2. Environmental and Pollution Laws in India, T. S. Doabia (4th Ed.). 2022. Lexis Nexis Publishers.
3. Environmental Law and Policy in India,: Shyam, Diwan & Armin, Rosencranz (3rd Ed.). 2023. Oxford University Press
4. Environmental Law in India, Gurdip Singh (2nd Ed.). 2016. MacMillan Publisher.
5. Handbook of Air Pollution Prevention and Control, Nicholas, P. Cheremisinoff. 2002. Butterworth-Heinemann LTD BH.
6. Handbook of Air Pollution Prevention and Control, Shrinivash Rao. 2016. Scitus Academics LLC.
7. Water Quality Control Handbook, E. R. Alley. 2007. The McGraw-Hill Companies INC.
8. Water Pollution and Management, S. Malik, Sunil Kumar and Umesh Bharti. 2011. Biotech Books.
9. Soil Pollution: Origin, Monitoring and Remediation, Ibrahim Mirsal. 2008. Springer-Verlag Berlin and Heidelberg GmbH and Co.K.
10. Soil Pollution: Processes and Dynamics, Bruno Yarson, Raoul Calvet, Rene Prost. 1996. Springer-Verlag Berlin and Heidelberg GmbH and Co. K.
11. Radioactive Waste Management, James Saling (2nd Ed.). 2001. Routledge.
12. Decommissioning and Radioactive Waste Management, A. Rahman. 2008. Whittles Publishing.

BACHELORS WITH ENVIRONMENTAL SCIENCE AS MAJOR (CT-3)
5th SEMESTER

EVS522J3 ENVIRONMENTAL SCIENCE_ AQUATIC ECOLOGY

CREDITS: (THEORY-4, PRACTICAL -2)

COURSE LEARNING OUTCOME: *It offers students a snapshot of the physical, chemical, and biological processes that characterize inland waters such as lakes, streams, rivers, and wetlands and focusses on understanding the relationships between humans and freshwater, and discusses these challenges in Management. Field and laboratory study of the ecology of freshwater systems lead to provide experience by sampling and identifying freshwater organisms, designing and analysing ecological experiments.*

THEORY (4 CREDITS: 60 HOURS)

UNIT I: FRESHWATER BIODIVERSITY

Major taxonomic groups of freshwater biodiversity: Algae, Zooplankton, Macrophytes, Macro-invertebrates and Fish, Measures of diversity; Endemism and Biological invasion in freshwater ecosystems

UNIT II: STREAM AND RIVER ECOLOGY

Fluvial ecosystem diversity, Stream classification, Stream flow and Hydrograph, Environmental Flow, Influence of thermal regime and substrate on aquatic biota, streams and rivers as products of Landscapes

UNIT III: LAKES AND WETLAND ECOLOGY

Lakes: Origin, diversity, distribution and Classification, Wetlands: Origin, diversity, distribution and Classification, Lake stratification, Paleolimnology, Ontogeny of freshwater systems

UNIT IV: THREATS TO FRESHWATER SYSTEMS

Threats to freshwater systems: Habitat and hydrology modification, Channelization, mining, invasion, pollution, overexploitation, acidification, dams, Climate change, Harmful algal blooms

PRACTICALS: (2 CREDITS) (60 HOURS)

1. Collection/Identification of some freshwater phytoplankton specimen
2. Collection/Identification of some freshwater Periphyton specimen
3. Collection/Identification of some freshwater Zooplankton specimen
4. Collection/Identification of some Macro-invertebrates Specimen
5. Calculation of species diversity indices from a given data
6. Calculation of Nygaards Indices and water pollution index
7. Chlorophyll estimation of any freshwater system
8. Case studies on control of water pollution in any lake/river in Jammu and Kashmir

SUGGESTED READINGS:

1. Limnology: Lake and River Ecosystems, Wetzel. R.G.2001. Academic Press.
2. Freshwater Ecology: Concepts and Environmental Applications of Limnology, Walter K. Dodds, Matt R. Whiles. 2019. Academic Press.
3. Introduction to Limnology, Dodson, S. 2005. McGraw-Hill Education.
4. Aquatic ecology and biodiversity, Olando Martin.2017. Caliisto reference.
5. Aquatic Ecology, Vincent Jenning.2018. Syrawood Publishing House
6. Limnology, McGraw-Hill, Goldman, C. R., and A. J. Horne .1994.
7. Stream Ecology: Structure and function of running waters, AG. Allan J.D, Capps K.A., Castillo M.M. 2021. Springer Nature Switzerland.
8. Wetland Ecology: Principles and Conservation, Keddy, P.A. 2010. Cambridge University Press, Cambridge.

BACHELORS WITH ENVIRONMENTAL SCIENCE AS MAJOR (CT-1)
6th SEMESTER

EVS622J1 ENVIRONMENTAL SCIENCE_ ENVIRONMENTAL ECONOMICS AND SUSTAINABLE DEVELOPMENT

CREDITS: (THEORY-3, PRACTICAL -1)

COURSE LEARNING OUTCOME: *This course focuses on the ecosystem services and provides students an understanding of various types of services provided freely by the nature. In particular, the course aims to make students learn about how good environment is key to a strong economy, and how the two are interrelated. The students will examine issues in the contemporary environmental discourse from an economists' point of view as well as discuss the argument that how environment sets the limits to economic growth thereby setting the context for the emergence of the idea of sustainable development.*

THEORY (3 CREDITS: 45 HOURS)

UNIT 1: ECONOMY AND THE NATURAL ENVIRONMENT

Environmental economics: definition and scope; Natural capital and flow; Concept of intangibles and externalities; Carbon credits and carbon market

UNIT II: ECOSYSTEM SERVICES AND THEIR VALUATION

Typologies of ecosystem services; Valuation and accounting of ecosystem services; Methods of environmental valuation, (empirical approaches, revealed preference methods and direct methods); Incentives for ecosystem services (IES) in the Himalayas

UNIT III: SUSTAINABLE DEVELOPMENT

Concept of sustainable development; Sustainable development goals; Circular economy; Green infrastructure; Sustainable cities and globalization

PRACTICALS: (1 CREDITS) 30 HOURS

1. Economic valuation of ecosystem services: a case study of natural forests
2. A cost benefit analysis of urban/rural solid waste management project.
3. Calculation of carbon footprint
4. Assessing the level of knowledge, attitude and practices of different sections of society towards sustainability.

SUGGESTED READINGS:

1. Economics of Natural Resources and the Environment, David W. Pearce et al. 1990. John Hopkins University press, Baltimore.
2. Environmental Economics- based on choice-based credit system (CBCS) for undergraduate and postgraduate course and NTA, UGC, NET, Mani., N. 2020. New Century Publications.
3. Ecology, Environmental Science and Conservation, J.S Singh et al. 2014. S. Chand Publication New Delhi.
4. Sustainable Cities, Graham Haughton, et al. 2023. Routledge, Taylor and Francis Group.
5. Environmental Economics in Theory and Practice, Nick Hanley et al. 2023. Springer.
6. Valuing Environmental and Natural Resources, Timothy C et al. 2002. Edward Elgar Publishing Inc.
7. Economic Valuation of the Environment: Methods and Case Studies 200, Guy Gurrot et al Edward Elgar Publishing Inc.
8. Understanding Carbon Credits, Gurmit Singh. 2009. Aditya Books Pvt. Ltd.

BACHELORS WITH ENVIRONMENTAL SCIENCE AS MAJOR (CT-2)
6th SEMESTER

EVS622J2 ENVIRONMENTAL SCIENCE_ ATMOSPHERIC SCIENCE

CREDITS: (THEORY-4, PRACTICAL -2)

COURSE LEARNING OUTCOMES: *Atmospheric Science is the study of the Earth's atmosphere, its composition, structure, and dynamics. This course provides an introduction to the fundamental concepts and principles in atmospheric science, including meteorology and climatology.*

THEORY (4 CREDITS: 60 HOURS)

UNIT I: METEOROLOGY

Meteorological parameters: Atmospheric pressure, temperature, precipitation, humidity; Wind, atmospheric stability; Radiation and heat budget:

UNIT II: CLIMATOLOGY

Fundamentals of climatology; Classification of climate: Koppen's; Monsoon and climatic zones of India

Western disturbances and climate of J&K; Paleo-climatology and climate change

UNIT III: ATMOSPHERE COMPOSITION AND CIRCULATION

Composition and structure of atmosphere; Atmospheric aerosols: Types, sources and atmospheric effects; Atmospheric-sea interactions; Atmospheric general circulation; Climate variability and forcing: Madden Julian oscillations (MJO), El-nino and southern oscillations (ENSO), Indian Ocean dipole (IOD)

UNIT IV: ATMOSPHERIC DATA ANALYSIS

Weather analysis and forecasting techniques; Dry and wet atmospheric deposition; LIDARS, SODARS, weather RADARS; Remote-sensing techniques (WP-RASS); Self-recording instruments, radiosondes, radiometer sondes, ozone sonde; Satellite meteorology: visible and infrared radiometer and multi scanner radiometer

PRACTICALS: (2 CREDITS) (60 HOURS)

1. Visit local weather stations for demonstration of meteorological parameters
2. Measure temperature, humidity, and pressure at different altitudes.
3. Understand cloud formation and classification by using cloud charts
4. Set up rain gauges to measure precipitation.
5. Survey of local area for collection of activity data for air pollution studies
6. Survey of local area for emission inventory for air pollution studies
7. Study of weather maps/satellite imagery for identification of different atmospheric features
8. Measurements of wet and dry depositions

SUGGESTED READINGS:

1. The Asian Summer Monsoon: Characteristics, Variability, Teleconnections and Projection, Yunyun Liu, Ping Liang, Ying Sun .2019. Elsevier.
2. Mid latitude synoptic Meteorology: Dynamics, Analysis and forecasting. American Meteorology Society, Lackmann Gary .2011.
3. Tropical Meteorology: An Introduction, T. N. Krishnamurti, Lydia Stefanova, and Vasubandhu Misra .2013. Springer Science & Business Media.
4. Basic Physical Chemistry for the Atmospheric Sciences, Peter V. Hobbs .2000. Cambridge University Press.
5. Measurement Methods in Atmospheric Sciences: In Situ and Remote, S. Emeis .2010. Gebr. Borntraeger Science Publishers.
6. Monsoon Meteorology, C.P. Chang T.N Krishnamurti .1987. Oxford University Press Inc.
7. Atmospheric Science,An Introductory Survey, John M. Wallace, Peter V. Hobbs .2006. Second Edition. Elsevier/Academic Press.
8. Satellite Meteorology: An Introduction, Stanley Q. Kidder and Thomas H. Vonder Haar .1995. Elsevier.

BACHELORS WITH ENVIRONMENTAL SCIENCE AS MAJOR (CT-3)
6th SEMESTER

EVS622J3 ENVIRONMENTAL SCIENCE_ TERRESTRIAL ECOLOGY

CREDITS: (THEORY-4, PRACTICAL -2)

COURSE LEARNING OUTCOME: *To give a broad outline and deep understanding of different terrestrial systems, components and interactions. This course shall help students in understanding that the structure and function of terrestrial ecosystems is fundamental to their conservation. This course provides a conceptual framework for understanding the range of the world's terrestrial ecosystems and provides practical field experience with major terrestrial ecosystems.*

THEORY (4 CREDITS: 60 HOURS)

UNIT I: TERRESTRIAL ECOSYSTEMS

Distribution of terrestrial ecosystems; Community structure and functioning; Patterns of terrestrial primary production; Terrestrial decomposition; Carbon sequestration storage and utilization

UNIT II: FOREST ECOLOGY

Major forest types of the world; Major Forest types in India; Forest community structure and function; Forest biota; Deforestation and global climate change

UNIT III: DESERT ECOLOGY

Introduction to world deserts; Classification of desert; Ecological complexity of desert ecosystems; Ecological adaptation of desert flora and fauna

UNIT IV: GRASSLANDS AND AGROECOSYSTEMS

Major grassland types of the world; Grassland types in India; Management of grassland ecosystems
Concept of agroecosystems; Role of biodiversity in agroecosystems

PRACTICALS: (2 CREDITS) 60 HOURS

1. Estimation of primary productivity in terrestrial ecosystems
2. Estimation of light intensity in different ecosystems
3. Determination of DBH of tree species in a forest and calculation of the basal area
4. Determine carbon sequestration potential of any terrestrial ecosystem in your area
5. Explore insect biodiversity and population dynamics by using sweep nets, pitfall traps, or insect traps in different habitats.
6. Study bird populations and their distribution in different terrestrial ecosystems
7. Study the impact of grazing on plant community
8. Field visit to the local agricultural area for evaluation of IPM strategies

SUGGESTED READINGS:

1. Ecology, Environmental Science and Conservation J.S Singh et al. 2014. S. Chand Publication, New Delhi.
2. Principles Of Terrestrial Ecosystem Ecology, F. Stuart Chaplin et al. 2011. Springer.
3. Forest Ecology, Burton V. Barnes. 1998. Wiley.
4. Forest Ecology, J.B Lal. 2011. Natraj Publisher.
5. The Biology of Agroecosystems, Nicola P. Randall et al. 2019. Oxford university press.
6. Grasses And Grassland Ecology, David J Gibson. 2009. Oxford university press.
7. The Biology of Grasslands, Brian J Wiley. 2018. Oxford university press.
8. Dispersal Biology of Desert Plants (Adaptations of Desert Organisms), Karen van Rheede van Oudtshoorn et al.2010. Springer-Verlag Berlin and Heidelberg GmbH & Co. K.