

B.Sc. (Basic/Hons.) Semester III

ENVIRONMENTAL SCIENCE

Sem	Course Type	Course Code	Course Title	Credits	Hrs/Week	Evaluation Details
III	Mandatory	ENVVSC03	Natural Resources and Management	04	04	C1-20 CIA C2-20 SEE C3- 60
	Mandatory	ENVVSC03P	Mineralogy, Petrology, Energy Resources and Medicinal Plants	02	04	C1-13 CIA C2-12 SEE C3- 25

CIA: Continuous Internal Assessment

SEE: Semester End Examination

Programme Specific Objectives

PSO 1	To develop the understanding of role of natural resources in economic and ecological development
PSO 2	To instil a knowledge of quantifying and evaluating contribution of natural resources management in human development
PSO 3	To motivate and inspire to acquire contemporary understanding and skills leading to issue identification and management of natural resources
PSO 4	To inculcate creativity and innovative spirit in the domain of human-development and natural resource utilisation efficiency

Programme Outcomes

PO 1	Demonstrate competence in understanding the significance of natural resources in economic/ecological development
PO 2	Demonstrate the ability to carry out the process of identification of, data procurement and interpretation with reference to natural resources
PO 3	Ability to understand and appreciate the role of quantification of resource use pattern in contemporary/sustainable development paradigms
PO 4	Be able to understand the demands of data analysis and reporting in natural resource management domain

ENVVSC03– NATURAL RESOURCES AND MANAGEMENT

COURSE TITLE	Natural Resources and Management
Couse code	ENVVSC03
Course credits	04
Total contact hours	52
Formative assessment marks	40 (40%)
Summative assessment marks	60 (60%)

CONTENT OF THEORY COURSE- ENVVSC03	52 Hrs.
<p>Unit-I Resource: Definition; Resource and wealth. Functional theory of resource and dynamic theory of resource. Classification of resources - Organic and inorganic resources; exhaustible and inexhaustible resources; International, National and Individual resources; Ubiquitous and localised resources.</p> <p>Factors influencing resource availability, distribution and utilisation patterns - Nature, Culture and Man. Phantom pile concept.</p> <p>Resources scarcity: Definition; types of resources scarcity – Demand induced, supply-induced, and structural.</p> <p>Conservation of resources: Methods of conservation - Refuse, reduce, reuse, recycle and recovery - Methods of waste reduction (Increasing the durability of products, utilising material substitution, recycling and marketability of industrial waste). Case studies on energy and paper conservation.</p> <p>Natural Resources: Definition, Classification of natural resources based on utility potential.</p>	14 Hr
<p>Unit-II Water Resources: Fresh water - Water budget of India - Dams: Impact on environment – alternatives; Droughts and Floods: Causes and Control Strategies – Watershed Management; Rain Water Harvesting and ground water recharge; River linking – pros and cons. Marine water – Ocean as a resource - Fisheries, aquaculture – prawns and oysters - Transportation – Shipping (people, goods and oil) and its impacts - Desalinisation – Importance and impacts - Coastal erosion and reclamation - Coastal Regulation Zone (CRZ)</p> <p>Ground Water: Impacts of extraction: uplifting and seismic activities, land subsidence, vegetation degradation and food security implications.</p> <p>Water and agriculture: Irrigated and rain-fed cultivation; Types of irrigation. Irrigation and drainage. Nutrient delivery through irrigation.</p> <p>Environmental implications of Conventional Agriculture – Soil degradation, surface and ground water pollution, loss of natural biodiversity, water logging and soil salinity. Hydroponics – Soil-water conservation practices in agriculture.</p>	14 Hr

Unit- III

Forest Resources: Importance of Forestry – Types of Forests of India and Karnataka – Pressures on forest areas – encroachments, forest fires, land use change (allocation for agriculture, industry and housing) and over utilisation of forest resources (harvesting of NTFPs, overgrazing, other anthropogenic pressures).

Impacts of Deforestation: Forest Fires and their Control; Forest conservation: Sacred Groves - Chipko and Appiko Movements; Joint Forest Management; Afforestation and Reforestation (Social forestry, Agro forestry, Urban forestry), Major and Minor Forest Products; Forest based industries (Plywood, Pulp and Paper and Cottage industries).

14 Hr

Ecotourism and its impacts.

Captive plantations and Energy plantations

Forest and wildlife conservation - Protected areas – Sanctuaries -

National Parks – Biosphere Reserves.

Unit-IV

Land resources: Land-use patterns in India. Agro-climatic zones of India and Karnataka. Types of agriculture and cropping patterns. Implications of agriculture on soil - Soil erosion – causes, types, impacts, control measures. Desertification: causes, impacts and control measures.

Mineral resources: Mining and Quarrying and their impacts; Ecological conflicts of mineral extraction; Deep sea mining and off shore oil exploration. Case studies on Coal and stone quarries.

14 Hr

Energy Resources: Definition. Conventional, non-conventional and alternative energy resources. Energy sources and their impacts: Biomass burning (Fuelwood, Agriculture residue, Cow dung), Fossil fuels, Hydel.

Geothermal, Nuclear energy; Solar (Thermal and Photovoltaic), Wind, Tidal, Microhydel. Briquettes, Wood gas, Energy from waste (Pyrolysis and Biogas), Agri-based fuels (Biodiesel, Gasohal), Hydrogen fuels, Cogeneration.

References

1. Arnab Banerjee, Manoj Kumar Jhariya, Ram Swaroop Meena, Surya Nandan Meena. (2021). Natural Resources Conservation and Advances for Sustainability. Elsevier Science
2. Bettinger, P., Boston, K., Siry, J., & Grebner, D. L. (2016). Forest management and planning. Academic press. Davie, T., & Quinn, N. W. (2019). Fundamentals of hydrology. Routledge.
3. Evans, J. (Ed.). (2008). The Forests Handbook, Volume 1: An Overview of Forest Science.
4. Goel, P. K. (2006). Water pollution: causes, effects and control. New Age International.
5. Grebner, D. L., Bettinger, P., Siry, J., & Boston, K. (2021). Introduction to forestry and natural resources. Academic press.
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7. Jermar, M. K. (1987). Water resources and water management. Elsevier.
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11. Pandey, B. W. (Ed.). (2005). Natural resource management. Mittal Publications.
12. Pennington, K. L., & Cech, T. V. (2021). Introduction to water resources and environmental issues. Cambridge University Press.
13. Peshin, R., & Dhawan, A. K. (Eds.). (2019). Natural Resource Management: Ecological Perspectives. Springer International Publishing.
14. Shit, P. K., Pourghasemi, H. R., Adhikary, P. P., Bhunia, G. S., & Sati, V. P. (Eds.). (2021). Forest resources resilience and conflicts. Elsevier.
15. Viswanathan, B. (2016). Energy sources: fundamentals of chemical conversion processes and applications. Newnes.
16. Walther, J. V. (2014). Earth's natural resources. Jones & Bartlett Publishers.
17. World Bank. (2008). Sustainable land management sourcebook. The World Bank.
18. Young, A. (2000). Land resources: now and for the future. Cambridge University Press.

ENVVSC03P – MINERALOGY, PETROLOGY, ENERGY RESOURCES AND MEDICINAL PLANTS

COURSE TITLE	Mineralogy, Petrology, Energy Resources and Medicinal Plants
Course code	ENVVSC03P
Course credits	02
Total contact hours	52
Formative assessment marks	40 (40%)
Summative assessment marks	60 (60%)

List of Experiments to be conducted in the ENVVSC03P

1. Mineralogy: Identification properties of Minerals
2. Description of Minerals
3. Petrology: Identification properties of Rocks
4. Description of Rocks -- Igneous, Sedimentary and Metamorphic
5. Introduction to Mapping - Direction, scale and conventional signs and symbols
6. Properties of Maps – Latitude & Longitude; Grid references
7. Representation of Relief
8. Study of drainage pattern and settlement pattern
9. Geolocation of resources - Mineral, ore, petroleum and energy resources
10. Characteristics and delineation of watershed using topo sheets
11. Identification of medicinal plants of Karnataka
12. Identification of locally available NTFP's
13. Introduction to agro climatic zones of Karnataka and mapping of local agricultural diversity (District level)

References

1. Ahuja, J. S., Virk, M. J. S., 1993. Map Education. Survey of India.
2. Ramakrishna, T. L. 1998. Mineral Rock Guide of Karnataka. Bharat Geo Guides Publ. Bangalore.
3. Ramakrishna, T. L. 1998. Manual of Rocks, Minerals and Ores of Karnataka. Bharat Geo Guides Publ. Bangalore.
4. Sathyanarayanswami, B. S. 1985. Engineering Geology – Laboratory Manual. Eurasia Publishing House Pvt. Ltd.

B.Sc. (Basic/Hons.) Semester IV

ENVIRONMENTAL SCIENCE

Sem	Course Type	Course Code	Course Title	Credits	Hrs/Week	Evaluation Details
IV	Mandatory	ENVVSC04	Biodiversity, Wildlife and Conservation	04	04	C1-20 CIA C2-20 SEE C3- 60
	Mandatory	ENVVSC04P	Biodiversity Assessment and Ecosystem Services	02	04	C1-20 CIA C2-20 SEE C3- 25

CIA: Continuous Internal Assessment

SEE: Semester End Examination

Programme Specific Objectives	
PSO 1	To develop competency in understanding biodiversity and wildlife.
PSO 2	To instill a knowledge about human interactions with uncultivated varieties and develop necessary analytical skills to appreciate these interactions
PSO 3	To motivate and inspire to acquire contemporary understanding and skills leading to issue identification and conservation
PSO 4	To inculcate creativity and innovative spirit in identifying appropriate conservation tools and their timely implementation

Programme Outcomes	
PO 1	Demonstrate competence in understanding the ecological, social and legal dimensions of biodiversity and wildlife
PO 2	Demonstrate the ability to carry out data collection procedures and analysis in field conditions/laboratories and make appropriate interpretations
PO 3	Ability to understand and appreciate the role of biodiversity in specific natural habitats and agroecosystems
PO 4	Be able to develop competence and academic skills in contributing towards biodiversity and wildlife conservation

ENVVSC04-BIODIVERSITY, WILDLIFE AND CONSERVATION

COURSE TITLE	Biodiversity, Wildlife and Conservation
Course code	ENVVSC04
Course credits	04
Total contact hours	52
Formative assessment marks	40 (40%)
Summative assessment marks	60 (60%)

CONTENT OF THEORY COURSE- ENVVSC04	52 HR
<p>Unit-I</p> <p>Biodiversity: Definition: Levels of Biodiversity - genetic diversity, species diversity and ecosystem diversity.</p> <p>Values of Biodiversity: Direct uses - consumptive use value, productive use value; Non-consumptive values -social value, ethical value, aesthetic value, option values and ecosystem service value.</p> <p>Biodiversity Hotspots: Global and Indian centers. Biogeography of India.</p> <p>Biodiversity profile of India: Forests and Grasslands; Wetlands and Riverine ecosystems; Marine and coastal diversity; Agrobiodiversity;</p> <p>Urban Biodiversity; Invasive Alien species.</p> <p>Threats to biodiversity: Over exploitation, Habitat destruction, fragmentation, urbanisation, agriculture extension, river valley projects, industrialisation, deforestation, invasive species, pollution, acidification of soil and water, mining activities, desertification and climate change.</p> <p>Traditional Knowledge and ethics in conservation of biodiversity.</p> <p>A locally relevant case study on biodiversity related aspects. People's Biodiversity Register.</p> <p>Bio-piracy. The Biological Diversity Bill, 2000 and The Biological Diversity (Amendment) Bill, 2021. Convention on Biological Diversity and Agenda 21. National Biodiversity Action Plan (NBAP).</p>	14 hr
<p>Unit-II</p> <p>Wildlife: Definition. Wildlife of India. Values of wildlife.</p> <p>Values of wildlife:</p> <ul style="list-style-type: none"> - Physical utility, economic/monetary value, recreational value, scientific value, ecological value, existence value. - Wildlife damage, human animal conflict, loss of economic productivity, wildlife diseases to man and competition effect. <p>Importance of wildlife: Ecological, economic, socio-cultural, investigatory, medicinal, conservation of biological diversities, importance in agriculture.</p> <p>Threats to wildlife: Over exploitation, habitat loss, encroachment and fragmentation, disease, pollution, invasive and exotic species, Illegal trapping and poaching, agricultural/unrestricted/ over grazing, urbanisation and climate change.</p> <p>Endangered species -- Definition, characteristics and reasons for engendering. Species with a narrow (or single) geographic range, Species with only one or few populations, Species with a small population size, Species with a declining population size, Species hunted or harvested by people, Species with low reproductive ability and/or germplasm-dispersal-ability, Species that require specialised habitat and niche conditions. Endangered species of India.</p>	14 Hr

<p>Endemic species – Concept, types, characteristics, theories of endemism. Endemic Wildlife Species of India. Wildlife (Protection) Act, 1972.</p>	
<p>Unit-III Ecosystem Services: Concept and Definition. Regulating services: Purification of water and air; Carbon sequestration and climate regulation; Waste decomposition and detoxification; Regulation of prey populations; Pollination; Biological pest and disease control; Disturbance regulation (Flood protection). Provisioning services: Food (crops, wild foods and spices); Raw materials (Timber, fuelwood, organic matter, fodder, and fertiliser); Genetic resources (crop improvement genes, and health care); Biogenic minerals; Medicinal resources (Pharmaceuticals, chemical models, and bioassay organisms); Energy (Hydropower, biomass fuels); Ornamental resources (Fashion, handicrafts, jewelry, pets, worship, decoration, and souvenirs). Cultural services: Cultural (Nature motifs in books, film, painting, folklore, national symbols, advertising); Aesthetics, spiritual and historical (Art, religious and heritage value); Recreational experiences (Ecotourism, outdoor sports and recreation); Science and education (Academic excursions and scientific discovery); Therapeutic (Ecotherapy, social forestry and animal assisted therapy). Supporting services: Nutrient cycling, Soil formation, Primary production and Habitat provision.</p>	14 Hr
<p>Unit-IV Conservation (Biodiversity and Wildlife): Definition, need and significance. Conservation vs. Preservation. Conservation goals - Habitat conservation. Prevention of deforestation, Preventing species from extinction, Sustainable harvest of biological resources and climate change mitigation. Terminologies of conservation significance: Keystone species, Foundation species, Umbrella Species and Flagship species, Edge species, Critical link species, Indicator species, Priority species and Rare species. IUCN Red Listed species - Data Deficient, Least Concern, Near Threatened, Vulnerable, Endangered, Critically Endangered, Extinct in the Wild and Extinct. In-situ conservation: Protected areas – Sanctuaries - National Parks – Biosphere Reserves - Project Tiger and Project Elephant; Ramadevara betta Vulture Sanctuary. Community Conserved Areas – case studies on Black Buck, Snow leopard, Amur falcon and Sarus Crane. Ex-situ conservation: Captive breeding (Botanical gardens, zoological parks, seed banks). Case study of <i>Ailuropoda melanoleuca</i> (Giant panda), <i>Ramosmania heterophylla</i> and <i>Madhuca insignis</i>. Cryopreservation, pollen storage, tissue culture, genetic engineering, field gene banks. Case study of Indian rhinoceros and black rhinoceros. International conservation efforts - Ramsar Convention, Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), Convention on the Conservation of Migratory Species of Wild Animals (CMS), Trade Records Analysis of Flora and Fauna in Commerce (TRAFFIC). Reducing Emissions from Deforestation and Forest Degradation (REDD) and REDD+.</p>	14 Hr

References

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2. Boenigk, J., Wodniok, S., & Glücksman, E. (2015). Biodiversity and earth history. Springer.

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4. Grunewald, K., & Bastian, O. (Eds.). (2015). Ecosystem services—concept, methods and case studies. Springer.
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13. Tandon, U., Parasaran, M., & Luthra, S. (Eds.). (2017). Biodiversity: Law, Policy and Governance. Taylor & Francis.
14. Weathers, K. C., Strayer, D. L., & Likens, G. E. (Eds.). (2021). Fundamentals of ecosystem science. Academic Press.

ENVVSC04P – BIODIVERSITY ASSESSMENT AND ECOSYSTEM SERVICES

COURSE TITLE	Biodiversity Assessment and Ecosystem Services
Couse code	ENVVSC04P
Course credits	02
Total contact hours	52
Formative assessment marks	40 (40%)
Summative assessment marks	60 (60%)

List of Experiments to be conducted in the ENVVSC03P

1. Documentation and assessment of tree diversity – Census method/Point centered quarter method
2. Documentation and assessment of avian faunal diversity – Line transect method
3. Documentation and assessment of winged insect fauna – Light trap/Sticky trap method
4. Documentation and assessment of Butterflies – Visual encounter /Photographic survey
5. Documentation and assessment of soil fauna – Pitfall trap method
6. Documentation and assessment of crop diversity – Sampling method
7. Identification and documentation of aquatic macroflora – Visual encounter survey
8. Estimation of animal population size – Mark, Release and Recapture method
9. Assessment of regulatory services of terrestrial ecosystems (Green spaces) – Comparison method (air temperature, relative humidity and solar influx).
10. Assessment of provisional services of wetland ecosystems – Questionnaire survey method.
11. Introduction to global biodiversity databases – Global Biodiversity Information Facility (GBIF), Integrated Biodiversity Assessment Tool (IBAT-alliance)
12. Hands-on experience with biodiversity assessment software - Paleontological Statistics Software Package for Education and Data Analysis (PAST). Note: Data from experiment No 1 to 8 can be used for analysis.
13. Mapping of International, National and State-wise biodiversity and wildlife conservation sites – Hotspots, Ramsar convention sites, Biosphere reserves, National parks, Sanctuaries, Protected areas and Ecologically significant zones.

References

1. Henderson, P. A., & Southwood, T. R. E. (2016). Ecological methods. John Wiley & Sons.
2. Michael, P. (1986). Ecological Methods for Field and Laboratory Investigations. Tata Mc Graw-Hill Publishing Co. Ltd.
3. Ravindranath, S., & Premnath, S. (1997). Biomass studies: field methods for monitoring biomass. Mohan Pramlani.
4. Rolan, R. G. (1973). Laboratory and Field Investigations in General Ecology. Macmillan Co.
5. Sutherland, W. J. (Ed.). (2006). Ecological census techniques: a handbook. Cambridge University press.

2nd Year B.Sc. (Basic/Hons.)

ENVIRONMENTAL SCIENCE- Open Elective Papers

Year	Course Type	Course Code	Course Title	Credits	Hrs/Week	Evaluation Details
II Year	Open Elective	ENVOEC07	Women and Environment	03	03	C1-20 CIA C2-20 SEE C3- 60
		ENVOEC08	Environmental Disasters and Management	03	03	C1-20 CIA C2-20 SEE C3- 60
		ENVOEC09	Environment and Sustainable Agriculture	03	03	C1-20 CIA C2-20 SEE C3- 60
		ENVOEC10	Initiatives for Environmental Management	03	03	C1-20 CIA C2-20 SEE C3- 60

CIA: Continuous Internal Assessment

SEE: Semester End Examination

ENVOEC07: WOMEN AND ENVIRONMENT

COURSE TITLE	Women and Environment
Couse code	ENVOEC07
Course credits	03
Total contact hours	42
Formative assessment marks	40 (40%)
Summative assessment marks	60 (60%)

CONTENT OF OPEN ELECTIVE THEORY COURSE – ENVOEC07	42 Hr
<p>Unit-I</p> <p>Ecology and Environment: Definitions, meaning and significance. Ecosystem: Structure and function. Natural resources – definition, their local availability, harvest and utility. Gender ideology. Gender inequality and gender justice in India. Women studies: Concept, Objectives of women studies. Nature and Feminine principle - basic human needs from rural and urban environment.</p> <p>Interaction of women with the local ecosystems for household water collection, fuelwood, fodder, medicinal plants, livestock management, food security and non-timber forest produce.</p> <p>Rural women: Role in agriculture sector – Soil-water conservation, chemical free food and food storage. Role in social forestry (Achieving the 5F objectives – Food, Fodder, Firewood, Fiber and Fertiliser). Conservation of indigenous species.</p> <p>Urban women: Role in urban climate management, lifestyle choices and resource conservation – water, electricity, food, fuel resources and development of conservation culture among young generation. Sustainable Development Goals: Goal No. 5 - Gender equality.</p>	14 Hr
<p>Unit-II</p> <p>Eco-feminism: Meaning and concept, Emergence and branches of Ecofeminism. Eco-feminism in the global economy, Eco-feminist power, politics and resistance to war and violence.</p> <p>Women and resource scarcity: Impacts of Natural resource depletion, Climate change and environmental degradation on women.</p> <p>Impacts of commonly used chemicals on Women and Environment: Endocrine-disrupting chemicals (EDCs), household chemicals, pesticides, cosmetics, food additives, food preservatives, organic pollutants, Volatile Organic Compounds (VOC's) and indoor air pollution from cooking activities.</p> <p>Climate change and women's health: Vector borne diseases, poor air quality and extreme variance in climatic temperatures (Anemia, malnutrition and food insecurity - reduced cognitive skills, poor attention span, reduced working memory and poor education outcomes. Respiratory distress, cardiovascular disease, negative birth outcomes and reduced mental health in children).</p>	14 Hr

Post-disaster impacts on women: Higher risk of physical, sexual, and domestic violence in the aftermath of disasters. Increased stress due to forced migration, mood disorders and poor economic recovery.

Unit-III

Women response to environmental degradation: Case studies of collective empowerment – The Chippko Movement (Gaura Devi - Mahila Mangal Dal), Silent Valley Conservation Movement (Sugathakumari), Neem Patent Victory (World's First Case Against Biopiracy), Narmada Bachao Andolan (NBA).

Women and Environmental Conservation: Joint Forest Management (JFM), Social Forestry, Agroforestry, Agriculture, Community nurseries and seed banks, Household Solid Waste Management, Home gardens/rooftop gardening, United Nations Clean Development Mechanism (CDM).

14 Hr

Women empowerment through Ecotourism, Cottage industries (NTFP and forest produce processing and value addition), Eco-entrepreneurship (Handicrafts, Case studies of Desi-Charaka and Hasiru Dala).

Prominent women environmentalists: Rachel Carson, Wangari Maathai, Gro Harlem Brundtland, Elinor Ostrom, Amritha Devi Bishnoi, Medha Patkar, Sunita Narain, Tulsi Gowda and Saalumarada Thimmakka.

References

1. Altman, I., & Churchman, A. (Eds.). (2013). Women and the Environment (Vol. 13). Springer Science & Business Media.
2. Arjun Gope, Abhijit Sarkar, Prasamita Sarkar, Santanu Majumder, Kuldip Gosai. (2019). Environmental Issues & Sustainable Development. Notion Press.
3. Barbier, E. B. (2013). Economics, natural-resource scarcity and development (Routledge revivals): Conventional and alternative views. Routledge.
4. Breton, M. J. (2016). Women pioneers for the environment. Northeastern University Press.
5. Brosius, P. J., Tsing, A. L., & Zerner, C. (Eds.). (2005). Communities and conservation: histories and politics of community-based natural resource management. Rowman Altamira.
6. Dankelman, I., & Davidson, J. (2013). Women and the Environment in the Third World: Alliance for the Future. Routledge.
7. d'Eaubonne, F. (2022). Feminism or Death: How the Women's Movement Can Save the Planet. Verso Books.
8. Guha, R. (2014). Environmentalism: A global history. Penguin UK.
9. Ivanova, M. (2020). The Future We Choose: Surviving the Climate Crisis.
10. Larsson, J., & Päiviö Sjaunja, E. L. (2022). Self-Governance and Sami Communities: Transitions in Early Modern Natural Resource Management (p. 247). Springer Nature.
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12. Sachs, C. E. (2014). Women working in the environment: Resourceful natures. Routledge.
13. Sonneborn, L. (2007). The environmental movement: protecting our natural resources. Infobase Publishing.

ENVOEC08: ENVIRONMENTAL DISASTERS AND MANAGEMENT

COURSE TITLE	Environmental Disasters and Management
Course code	ENVOEC08
Course credits	03
Total contact hours	42
Formative assessment marks	40 (40%)
Summative assessment marks	60 (60%)

CONTENT OF OPEN ELECTIVE THEORY COURSE- ENVOEC08	42 HR
<p>Unit-I</p> <p>Disasters: Definition, History of disasters; Components of disasters.</p> <p>Weather parameters: Concept, Definition, Units and measurements of Temperature, Pressure, Precipitation (Rain, snow, hail), Wind (Speed and direction) and Relative humidity.</p> <p>Types of disasters: Natural disasters and Man-made disasters.</p> <p>Natural disasters: Definitions and introduction to Earthquakes, Tropical cyclones, Cloud bursts, Floods, Drought, Land subsidence, Landslides, Mudslides, Volcanoes, Tsunami, Avalanches, Heat waves, Cold waves, Dust storms, and Locust attacks.</p> <p>Man-made disasters: Definitions and introduction to Gas leaks, Toxic and Hazardous wastes, Nuclear and radiation accidents, Oil spills, Forest fires, Pandemics, Weather Extremes & Climate Change and Wars.</p> <p>Definitions of Risk, Hazard, Exposure, Vulnerability, Response, Mitigation, Preparedness and Prevention.</p> <p>Mitigation and Management techniques of Disaster: Basic principles of disaster management, Disaster Management cycle, Disaster management policy. Disaster Management Authority at National, State and District levels; Roles and responsibilities of Govt. Authorities including Local Self Govt. at various levels.</p>	14 Hr
<p>Unit-II</p> <p>Natural Disasters</p> <p>Earthquakes - types and causes, magnitude and intensity, seismic zones of India and Karnataka. Earthquake measurements (Richter Scale) and predications. Earthquake preparedness and management.</p> <p>Tropical Cyclones - Types and causes. Cyclone naming. Cyclone prediction, warning, Preparedness and Management.</p> <p>Floods - Types and causes, Flash floods. Cloud bursts, Floods warning, Preparedness and Management.</p> <p>Land subsidence - Types and causes, Landslides and Mudslides and Avalanches. Land subsidence preparedness and management.</p>	14 Hr

<p>Tsunami- types and causes. Tsunami prediction, warning, preparedness and management.</p> <p>Heat waves and Cold waves- Causes and effects, Warning, preparedness and management.</p> <p>Locust attacks, - Causes and effects Preparedness and management.</p> <p>Tsunami - types and causes. Tsunami prediction, warning, preparedness and management.</p> <p>Heat waves and Cold waves- Causes and effects, Warning, preparedness and management.</p> <p>Locust attacks- Causes and effects Preparedness and management.</p>	
<p>Unit III</p> <p>Man-made disasters</p> <p>Nuclear disaster: Chernobyl and Fukushima - Episode and effects.</p> <p>Exxon Valdez oil spill - Episode, effects and management.</p> <p>Indonesia's land and forest fires – Episode, effects and management.</p> <p>Bhopal Gas Tragedy - Episode, causative agent, effects and recovery. Damage and compensation.</p> <p>Visakhapatnam gas leak - Episode, causative agent and effects. Damage and compensation.</p> <p>Endosulfan disaster in Karnataka and Kerala - Episode and effects. Damage and compensation.</p> <p>Ennore oil spill - Episode and effects.</p> <p>Uttarakhand and Kerala floods - Episode, effects and management. Kodagu Landslides/Recent/Local episodes, effects and management.</p> <p>Bandipura Forest fires/Recent/Local episodes, effects and management.</p> <p>Bengaluru Urban floods/Recent/Local episodes, causes, effects, and management.</p> <p>Epidemics, Pandemics and Zoonoses.</p>	<p>14 Hr</p>

References

1. Bhattacharya, T. (2012). Disaster Science and Management. Tata McGraw-Hill Education.
2. Collins, L. R. (2000). Disaster management and preparedness. CRC Press.
3. Kapur, A. (2010). Vulnerable India: a geographical study of disasters. SAGE Publications India.
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6. Roy, T. (2012). Natural Disasters and Indian History: Oxford India Short Introductions. OUP Catalogue.
7. Sahni, P., Dhameja, A., and Medury, U. (2001). Disaster mitigation: experiences and reflections. PHI Learning Pvt. Ltd..
8. Sharma, S. C. 2008. Disaster Management. Khanna Publishing House.
9. Shrivastava, A. K. (2015). Text book of Disaster Management. Scientific Publishers.
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ENVOEC09: ENVIRONMENT AND SUSTAINABLE AGRICULTURE

COURSE TITLE	Environment and Sustainable Agriculture
Course code	ENVOEC09
Course credits	03
Total contact hours	42
Formative assessment marks	40 (40%)
Summative assessment marks	60 (60%)

CONTENT OF OPEN ELECTIVE THEORY COURSE- ENVOEC09	42 Hrs
<p>Unit-I Environment – Definition, scope and significance. Agriculture – Definition, scope and significance. Environmental basis for agriculture and food. Agricultural patterns in India. Socio-economic pressures on agriculture. Food security and food scarcity. Types of agriculture – rain-fed cultivation and irrigation – water intensive agriculture -- Reservoirs and ground water exploitation. Conventional and mechanised agriculture. Natural and chemical agriculture. Subsistence and commercial agriculture. Environmental effects of land use and landscape changes.</p>	14 Hr
<p>Unit-II Environmental determinants of agriculture – role of rainfall, humidity, wind, topography and edaphic factors in crop selection. Animal husbandry – Dairy and poultry – role of transboundary species of cattle in Indian scenario. Pisciculture – Environmental effects of intensive pisciculture. Agricultural biodiversity: Crop diversity – Definition and significance. Poly culture and mono culture. Influences of green revolution on modern agricultural practices of India – Loss of agrobiodiversity – Influence of transboundary crops. Agricultural biotechnology – Genetically Modified Crops – Influence on environment. Pollination crisis. Integrated pest management.</p>	14 Hr
<p>Unit-III Environmental impacts of agriculture – Loss of biodiversity – soil salinity – fertiliser and pesticide pollution, Climate change and global warming. Erosion and problems of deposition in irrigation systems. Desertification. Biomagnification Case studies. Contemporary issues and management – Farmer distress – market mechanisms – natural farming methods/organic farming. Urban agriculture and hydroponics. Ecological principles of farming – Sustainable agriculture – Significance of indigenous crops and cattle varieties. Watershed management. Agricultural policies of India.</p>	14 hr

References

1. Altieri, M. A. (2018). Agroecology: the science of sustainable agriculture. CRC Press.
2. Campanhola, C., & Pandey, S. (Eds.). (2018). Sustainable food and agriculture: An integrated approach. Academic Press.
3. de Zeeuw, H., & Drechsel, P. (Eds.). (2015). Cities and agriculture: Developing resilient urban food systems. Routledge.
4. Eric Lichtfouse, Mireille Navarrete, Philippe Debaeke, Souchere Veronique, Caroline Alberola. (2009). Sustainable Agriculture. Springer Science & Business Media.

5. Kazim B. Rahim Debash Sarkar Bidhan Chand. (2012). Sustainable Agriculture and Environment. New Delhi Publishers.
6. Satyanarayana. T., Johri, B. N., & Prakash. A. (Eds.). (2012). Microorganisms in sustainable agriculture and biotechnology. Springer Science & Business Media.
7. Songstad, D. D., Hatfield, J. L., & Tomes, D. T. (Eds.). (2014). Convergence of food security, energy security and sustainable agriculture (Vol. 67). New York: Springer.

ENVOEC10: INITIATIVES FOR ENVIRONMENTAL MANAGEMENT

COURSE TITLE	Initiatives for Environmental Management
Course code	ENVOEC10
Course credits	03
Total contact hours	42
Formative assessment marks	40 (40%)
Summative assessment marks	60 (60%)

CONTENT OF OPEN ELECTIVE THEORY COURSE- ENVOEC10	42 Hrs
<p>Unit-I</p> <p>Environment: Definition and components of the environment – Atmosphere, hydrosphere, lithosphere and biosphere – Definitions and influences on human beings.</p> <p>Environmental issues: Natural resource overuse and depletion, pollution, loss of biodiversity, Degradation of air, water and land. Water and wastewater management: Household water demand and uses. Availability of water for household uses. Centralised supply system –Rivers. Water treatment for portable purposes. Decentralised sources –Bore wells. Sustainable use of water – Reuse and recycling, rooftop rainwater harvesting. Grey water management – Septic tanks.</p> <p>Energy conservation: Sources of energy – Electricity, LPG, Other petroleum fuels and feasible alternative sources (Solar heating and photovoltaic). Measures to conserve energy – LED, energy efficient electrical appliances. Bureau of Energy Efficiency standards and labelling.</p> <p>Domestic solid waste management: Biodegradable – Kitchen waste - Issues and management.</p> <p>Compositing – Composters – Bin composter, three tier composters, pipe composting and mechanical composters. Human excreta - Issues and management. Bio-toilets. Dry/waterless toilets.</p> <p>Non- Biodegradable – Issues and management.</p> <p>Segregation -- Dry, recyclables and sanitary wastes – Incinerators, pyrolysis and sanitary landfills.</p>	14 Hr
<p>Unit-II</p> <p>Agriculture: Implications on soil water management – Fertiliser pollution– Soil salinity, Eutrophication and Bio-magnification.</p> <p>Pesticide pollution- DDT and Endosulphan - Integrated Pest Management (IPM), Biopesticides, Genetic Modified Crops (GMCs). Natural farming methods. Irrigation and drainage systems (Israel Model), Hydroponics and Aeroponics.</p>	14 Hr

<p>Alternative cultivation methods: Negative impacts of food grown by conventional agriculture methods. Minimizing fertiliser use and preventing chemical pesticide usage. Role of rooftop gardens and kitchen gardens in regulating microclimate. Biofertilisers- Rhizobium, Azotobactor, Azospirillum, Blue green algae, Azolla, Mycorrhizae. Livestock management: Dung and urine management – Biogas plants, Farm Yard Manure (FYM) and Vermi-composting.</p> <p>Human dwellings as micro climatic regimes: Variations in temperature and relative humidity in indoor and outdoor environment. Impacts of increased temperatures. Role of vegetation in micro climate regulation and Carbon capture. Green buildings and micro climate regulations.</p>	
<p>Unit-III</p> <p>Environmental Management: Definition, need, significance and applications. Environmental Technology vs. Technology for Environment. Technological solutions for environmental degradation: Concept, advantages and limitations. Remedial actions - Waste recycling; Preventive actions - pollution prevention and Management actions - Environmental Management System (ISO 14000 series). Factors influencing transfer of Environmental technology - developer to technology user: Information, Research and Marketing.</p> <p>Factors influencing technology development: Localisation, Customisation and Contextualisation.</p> <p>External factors influencing technology transfer: Laws and legislation; Administrative/Management systems; Information management; and Codes and Standards (Eco-labelling and Green ratings). Resource measurements and monitoring, Ecological footprint analysis, Carbon footprint analysis, Water footprint analysis, Micro-</p> <p>Role of individuals in Environmental management: climate monitoring and Participation in eco-friendly and sustainable endeavours.</p>	14 Hr

References

1. Baskar, S., & Baskar, R. (2007). Environmental Studies for Undergraduate Courses. Unicorn Books.
2. Behera, B. K., & Prasad, R. (2020). Environmental technology and sustainability: Physical, chemical and biological technologies for clean environmental management. Elsevier.
3. Broniewicz, E. (Ed.). (2011). Environmental management in practice. BoD-Books on Demand.
4. Kreith, F., & Tchobanoglous, G. (2002). Handbook of solid waste management. McGraw-hill.
5. Mitchell, B. (2013). Resource and environmental management. Routledge.
6. Nandini, N., Sunitha N., & Sucharita Tandon (2019). A text book on Environmental Studies (AECC). Sapna Book House, Bengaluru.
7. National Research Council. (1999). Technologies for Environmental Management, The Department of Energy's Office of Science and Technology.
8. Theodore, M. K., & Theodore, L. (2021). Introduction to environmental management. CRC Press.
9. Waite, R. (2013). Household waste recycling. Routledge.
10. Wong, J. W., Surampalli, R. Y., Zhang, T. C., Tyagi, R. D., & Selvam, A. (Eds.). (2016, January). Sustainable solid waste management. Reston, VA: American Society of Civil Engineers.