



GULBARGA UNIVERSITY

KALABURAGI

NATIONAL EDUCATION POLICY (NEP-2020)

Proposed Curriculum Framework of

**ENVIRONMENTAL SCIENCE
(III and IV SEMESTER)**

for

UNDERGRADUATE PROGRAMME

College affiliated

To

GULBARGA UNIVERSITY

By

CHAIRMAN

DEPARTMENT OF STUDIES AND RESEARCH IN ENVIRONMENTAL SCIENCE

2022-23 Onwards

CURRICULUM STRUCTURE

**Programme: B.Sc. (Honors)
Science**

Subject: Environmental

1. Environmental Science as one of the DSCC –A with another subject as DSCC- B

Sem	Discipline Specific core Courses	Hours of Teaching/week		Discipline Specific Elective Courses (DSE)/Vocational courses (VC)/OE	Hours of Teaching/Week	
		Credit	Hours		Credit	Hours
I	ES 1T1: Divisions of Environment	4	4	ES1OE1: Environmental Conservation Movements OR ES1 OE2: Environmental Pollution	3	4
	ES 1P1: Water quality analysis	2	4			
II	ES 2T1: Ecology – Theory and Practice	4	4	ES2 OE1: Climate Change and Its Implications ES2 OE2: Environment and Public Health in Contemporary Society	3	4
	ES 2P1: Ecological analysis	2	4			
III	ES 3T1: Natural Resources and Management	4	4	ES3 OE1: Women and Environment ES3 OE2: Environmental Disasters and Management	3	4
	ES 3P1: Mineralogy, Petrology, Energy Resources and Medicinal Plants	2	4			
IV	ES 4T1: Biodiversity, Wildlife and Conservation	4	4	ES4 OE1: Environment and Sustainable Agriculture ES4 OE2: Initiative for Environmental Management	3	4
	ES 4P1: Biodiversity Assessment, Ecosystem Services.	2	4			
V	ES 5T1: Environmental Microbiology, Environmental Biotechnology, Environmental Statistics	3	3	ES 5V1: Environmental Chemistry and Instrumentation OR ES 5V2: Urban Waste and Hazardous Waste Management	3	4
	ES 5P1: Environmental Microbiology, Environmental Biotechnology, Environmental Statistics	2	4		OR	OR
	ES 5T2: Air Pollution, Water Pollution and Environmental Engineering	3	3	3	4	
	ES 5P2: Air and Wastewater Analysis	2	4			
VI	ES 6T1: Noise, Land, Radiation Pollution and Solid Waste Management	3	4	ES 6V1: Industrial Wastewater Treatment	3	4
				OR ES 6V2: Disaster Management	3	4

	ES 6P1: Soil analysis, Noise measurement and Solid waste	2	4			
	ES 6T2: Environmental Impact Assessment and Environmental Risk Assessment	3	4			
	ES 6P2: Methods of Environmental Impact and Risk Assessment	2	4			
VII	ES 7T1: Environmental Toxicology	3	4	ES 7E1: Landscape Ecology and Urban Planning	3	4
	ES 7P1: Bioassay, Acute and Sub-acute toxicity tests	2	4	ES 7E2: Environmental Contamination and Remediation technology	3	4
	ES 7T2: Applications of Remote Sensing and Geographical Information Systems	3	4	ES 7R1: Research Methodology	3	4
	ES 7P2: Cartography and Geographical Information Systems	2	4			
	ES 7T3: Occupational, Health and Safety	3	4			
VIII	ES 8T1: Climate Change and Mitigation	3	4	ES 8E3: Quality Assurance and Quality Control in Environmental Analysis	3	4
	ES 8T2: Climate Change Analysis	2	4			
	ES 8T3: Environmental Policy Law and Environmental Management Systems	3	4	ES 8R1: Research Project	6	6

Environmental Economics, Sustainable Development and Business

- AECC 1 : Language 1
 AECC 2 : Language 2
 AECC 3 : Environmental Studies
 AECC 4 : Constitution of India
 SEC1 : Digital fluency
 SEC2 : Artificial Intelligence
 SEC3 : Cyber Security
 SEC4 : Professional Communication

Members of BOS;

- | | |
|--|------------------|
| 1. Dr. Prakash Kariyajjanavar, GUK | Chairman |
| 2. Prof. Vijaykumar K, GUK | Member, Internal |
| 3. Prof. Chandrakant R Kelmani, GUK | Member, Internal |
| 4. Prof. K Lingappa, GUK | Member, Internal |
| 5. Prof. Nandini N, Bangalore University | Member, External |
| 6. Prof. J Narayana, Kuvempu University | Member, External |
| 7. Dr. M Lingadevaru, CUK | Member, External |

B.Sc. (Basic/Hons.) Semester 3

Title of the Course: **ES 3T1 – NATURAL RESOURCES AND MANAGEMENT**

Number of Theory Credits	Number of lecture hours/semester	Number of practical Credits	Number of practical hours/semester
4	52	2	52

Programme Specific Objectives	
PSO 1	To develop the understanding of role of natural resources in economic and ecological development.
PSO 2	To instill 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.

Content of Theory Course 3	52Hrs
Unit – 1	14
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 localized resources. Factors influencing resource availability, distribution and utilization patterns - Nature, Culture and Man. Phantom pile concept. Resources scarcity: Definition; types of resources scarcity - Demand-induced, supply-induced, and structural. Conservation of resources: Methods of conservation - Refuse, reduce, reuse, recycle and recovery - Methods of waste reduction (Increasing the durability of products, utilizing material substitution, recycling and marketability of industrial waste). Case studies on energy and paper conservation. Natural Resources: Definition, Classification of natural resources based on utility potential.	

Unit – 2	14
<p>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.</p> <p>Marine water – Ocean as a resource</p> <ul style="list-style-type: none"> - Fisheries, aquaculture – prawns and oysters - Transportation – Shipping (people, goods and oil) and its impacts - Desalinization– Importance and impacts - Coastal erosion and reclamation - Coastal Regulation Zone (CRZ) <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. 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>	
Unit - 3	14
<p>Forest Resources: Importance of Forestry – Types of Forests of India and Karnataka – Pressures on forest areas – <i>encroachments, forest fires, land use change (allocation for agriculture, industry and housing)</i> and over utilization 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). Ecotourism and its impacts. Captive plantations and Energy plantations Forest and wildlife conservation - Protected areas – Sanctuaries - National Parks – Biosphere Reserves.</p>	
Unit - 4	14
<p>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. 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 (<i>Biodiesel, Gasohol</i>), Hydrogen fuels. Cogeneration.</p>	

References

- Arnab Banerjee, Manoj Kumar Jhariya, Ram Swaroop Meena, Surya Nandan Meena. (2021). *Natural Resources Conservation and Advances for Sustainability*. Elsevier Science
- 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.
- Evans, J. (Ed.). (2008). *The Forests Handbook, Volume 1: An Overview of Forest Science*.
- Goel, P. K. (2006). *Water pollution: causes, effects and control*. New Age International.
- Grebner, D. L., Bettinger, P., Siry, J., & Boston, K. (2021). *Introduction to forestry and natural resources*. Academic press.
- Innes, J. L., & Tikina, A. V. (Eds.). (2016). *Sustainable forest management: From concept to practice*. Taylor & Francis.
- Jermar, M. K. (1987). *Water resources and water management*. Elsevier.
- Misra, H. N. (Ed.). (2014). *Managing Natural Resources: Focus on land and water*. PHI Learning Pvt. Ltd..
- Murty, J. V. S. (1998). *Watershed management*. New Age International.
- Nandini, N., Sunitha N., & Sucharita Tandon (2019). *A text book on Environmental Studies (AECC)*. Sapna Book House, Bengaluru.
- Pandey, B. W. (Ed.). (2005). *Natural resource management*. Mittal Publications.
- Pennington, K. L., & Cech, T. V. (2021). *Introduction to water resources and environmental issues*. Cambridge University Press.
- Peshin, R., & Dhawan, A. K. (Eds.). (2019). *Natural Resource Management: Ecological Perspectives*. Springer International Publishing.
- Shit, P. K., Pourghasemi, H. R., Adhikary, P. P., Bhunia, G. S., & Sati, V. P. (Eds.). (2021). *Forest resources resilience and conflicts*. Elsevier.
- Viswanathan, B. (2016). *Energy sources: fundamentals of chemical conversion processes and applications*. Newnes.
- Walther, J. V. (2014). *Earth's natural resources*. Jones & Bartlett Publishers.
- World Bank. (2008). *Sustainable land management sourcebook*. The World Bank.
- Young, A. (2000). *Land resources: now and for the future*. Cambridge University Press.

Formative Assessment – Continuous Internal Assessment = 40% (40 Marks)	
Assessment Occasion/ type	Weightage in Marks
End Semester Examination	60% (60 Marks)
Total	100% (100 Marks)

Content of Practical Course 3: List of Experiments to be conducted

ES 3P1 – MINERALOGY, PETROLOGY, ENERGY RESOURCES AND MEDICINAL PLANTS

(Total Teaching Hours = 52; Total Credits = 2)

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

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

Formative Assessment – Practical Internal Assessment = 50% (25 Marks)	
Assessment Occasion/ type	Weightage in Marks
End Semester Examination	50% (25 Marks)
Total	100% (50 Marks)

ES 3OE3: WOMEN AND ENVIRONMENT

Number of Theory Credits	Number of lecture hours/semester
3	42

Content of OPEN ELECTIVE Theory Course 3	42Hrs
Unit – 1	14
<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. Interaction of women with the local ecosystems for household water collection, fuel wood, fodder, medicinal plants, livestock management, food security and non-timber forest produce. 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 Fertilizer). Conservation of indigenous species. 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>	
Unit – 2	14
<p>Eco-feminism: Meaning and concept, Emergence and branches of Eco-feminism, Eco-feminism in the global economy, Eco-feminist power, politics and resistance to war and violence. Women and resource scarcity: Impacts of Natural resource depletion, Climate change and environmental degradation on women. 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. Climate change and women's health: Vector borne diseases, poor air quality and extreme variance in climatic temperatures (<i>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</i>). 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.</p>	
Unit – 3	14
<p>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</p>	

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). 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 Brundt and, Elinor Ostrom, Amritha Devi Bishnoi, Medha Patkar, Sunita Narain, Tulsi Gowda and Saalumarada Thimmakka.

References

- Altman, I., & Churchman, A. (Eds.). (2013). *Women and the Environment* (Vol. 13). Springer Science & Business Media.
- Arjun Gope, Abhijit Sarkar, Prasamita Sarkar, Santanu Majumder, Kuldip Gosai. (2019). *Environmental Issues & Sustainable Development*. Notion Press.
- Barbier, E. B. (2013). *Economics, natural-resource scarcity and development (Routledge revivals): Conventional and alternative views*. Routledge.
- Breton, M. J. (2016). *Women pioneers for the environment*. Northeastern University Press.
- Brosius, P. J., Tsing, A. L., & Zerner, C. (Eds.). (2005). *Communities and conservation: histories and politics of community-based natural resource management*. Rowman Altamira.
- Dankelman, I., & Davidson, J. (2013). *Women and the Environment in the Third World: Alliance for the Future*. Routledge.
- d'Eaubonne, F. (2022). *Feminism or Death: How the Women's Movement Can Save the Planet*. Verso Books.
- Guha, R. (2014). *Environmentalism: A global history*. Penguin UK.
- Ivanova, M. (2020). *The Future We Choose: Surviving the Climate Crisis*.
- Larsson, J., & Päiviö Sjaunja, E. L. (2022). *Self-Governance and Sami Communities: Transitions in Early Modern Natural Resource Management* (p. 247). Springer Nature.
- Rodda, A. (1991). *Women and the Environment* (No. P01 R686). Zed Books.
- Sachs, C. E. (2014). *Women working in the environment: Resourceful natures*. Routledge.
- Sonneborn, L. (2007). *The environmental movement: protecting our natural resources*. Infobase Publishing.

Formative Assessment – Continuous Internal Assessment = 40% (40 Marks)	
Assessment Occasion/ type	Weightage in Marks
End Semester Examination	60% (60 Marks)
Total	100% (100 Marks)

ES 3OE3: ENVIRONMENTAL DISASTERS AND MANAGEMENT

Number of Theory Credits	Number of lecture hours/semester
3	42

Content of OPEN ELECTIVE Theory Course 3	42Hrs
Unit - 1	14
<p>Disasters: Definition, History of disasters; Components of disasters. Weather parameters: Concept, Definition, Units and measurements of Temperature, Pressure, Precipitation (Rain, snow, hail), Wind (Speed and direction) and Relative humidity. Types of disasters: Natural disasters and Man-made disasters. 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. 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. Definitions of Risk, Hazard, Exposure, Vulnerability, Response, Mitigation, Preparedness and Prevention. 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>	
Unit - 2	14
<p>Natural Disasters Earthquakes-types and causes, magnitude and intensity, seismic zones of India and Karnataka. Earthquake measurements (Richter Scale) and predications. Earthquake preparedness and management. Tropical Cyclones - Types and causes. Cyclone naming. Cyclone prediction, warning, Preparedness and Management. Floods - Types and causes, Flash floods. Cloud bursts, Floods warning, Preparedness and Management. Land subsidence - Types and causes, Landslides and Mudslides and Avalanches. Land subsidence preparedness and management. Tsunami -types and causes. Tsunami prediction, warning, preparedness and management. Heat waves and Cold waves –Causes and effects, Warning, preparedness and management. Locust attacks–Causes and effects Preparedness and management.</p>	
Unit - 3	14
<p>Man-made disasters Nuclear disaster: Chernobyl and Fukushima- Episode and effects. Exxon Valdez oil spill - Episode, effects and management. Indonesia's land and forest fires – Episode, effects and management. Bhopal Gas Tragedy - Episode, causative agent, effects and recovery. Damage and compensation. Visakhapatnam gas leak - Episode, causative agent and effects. Damage and compensation. Endosulfan disaster in</p>	

Karnataka and Kerala - Episode and effects. Damage and compensation. Ennore oil spill - Episode and effects. Uttarakhand and Kerala floods - Episode, effects and management. Kodagu Landslides/Recent/Local episodes, effects and management. Bandipur Forest fires/Recent/Local episodes, effects and management. Bengaluru Urban floods/Recent/Local episodes, causes, effects, and management. Epidemics, Pandemics and Zoonoses.

References

- Bhattacharya, T. (2012). *Disaster Science and Management*. Tata McGraw-Hill Education.
- Collins, L. R. (2000). *Disaster management and preparedness*. CRC Press.
- Kapur, A. (2010). *Vulnerable India: a geographical study of disasters*. SAGE Publications India.
- Murthy, D. B. N. (2007). *Disaster Management: Text and case studies*. Deep and Deep Publications.
- Rajendra Kumar Pandey. (2020). *Disaster Management in India*. SAGE Publications, Incorporated.
- Roy, T. (2012). *Natural Disasters and Indian History: Oxford India Short Introductions*. OUP Catalogue.
- Sahni, P., Dhameja, A., and Medury, U. (2001). *Disaster mitigation: experiences and reflections*. PHI Learning Pvt. Ltd..
- Sharma, S. C. 2008. *Disaster Management*. Khanna Publishing House.
- Shrivastava, A.K. (2015). *Text book of Disaster Management*. Scientific Publishers.
- Sulphey, M. M. (2016). *Disaster management*. PHI Learning Pvt. Ltd..

Formative Assessment – Continuous Internal Assessment = 40% (40 Marks)	
Assessment Occasion/ type	Weightage in Marks
End Semester Examination	60% (60 Marks)
Total	100% (100 Marks)