गोंय विद्यापीठ
ताळगांव पठार,
गोंय - ४०३ २०६
फोन : + ९१ - ८६६९६०९०४८

Goa University
Taleigao Plateau,Goa - 403 206
Tel : +91-8669609048
Email : registrar@unigoa.ac.in
Website : www.unigoa.ac.in

(Accredited by NAAC with Grade A+)

GU/Acad –PG/BoS - GU-ART /2025-26/627 Date: 11.12.2025

CIRCULAR

The syllabus of the Goa University–Admission Ranking Test (GU-ART) for **Master of Science in Environmental Science** Programme, approved by the Academic Council in its meeting held on 7th November 2025 is attached.

The Dean/Vice-Dean (Academic) of the School of Earth, Ocean and Atmospheric Sciences and the Principals of all the affiliated Colleges are requested to take note of the above and bring the contents of this Circular to the notice of all concerned, including students aspiring to pursue the Master's Programmes.

ASHWIN VYAS LAWANDE
Digitally signed by ASHWIN VYAS LAWANDE
Date: 2025.12.11 12:49:00 +05'30'

(Ashwin V. Lawande)
Deputy Registrar – Academic

To,
1. The Dean, School of Earth, Ocean and Atmospheric Sciences, Goa University.
2. The Vice-Dean (Academic), School of Earth, Ocean and Atmospheric Sciences, Goa University.
3. Principals of all the affiliated Colleges.

Copy to:
1. Controller of Examinations, Goa University.
2. Assistant Registrar (Admissions), Goa University.
3. Assistant Registrar Examinations (UG/PG), Goa University.
4. Director, Directorate of Internal Quality Assurance, Goa University for uploading the Syllabus on the University website.

GOA UNIVERSITY

SYLLABUS FOR GOA UNIVERSITY-ADMISSIONS RANKING TEST (GU-ART) FOR MASTER OF SCIENCE IN ENVIRONMENTAL SCIENCE PROGRAMME

Effective from AY: 2026-2027

Eligibility: A Bachelor's degree in Science with specialization in Agriculture, Botany, Biotechnology, Chemistry, Earth Science, Environmental Science, Environmental Engineering, Fisheries, Geography, Geology, Mathematics, Microbiology, Physics and Zoology.

Modules	Content
Module 1:	**Fundamentals of environmental science & ecology**
	Definition, scope, and importance of environmental science; multi-disciplinary nature of environmental science; abiotic and biotic components of the environment; ecosystem: structure, function, and types; energy flow in ecosystems: food chains, food webs, trophic levels; ecological pyramids: number, biomass, energy; biogeochemical cycles: carbon, nitrogen, phosphorus, sulfur; population ecology: growth models, limiting factors; species interactions – competition, predation, mutualism, parasitism; primary and secondary ecological succession; habitat and niche concepts; ecotone and edge effect; keystone and indicator species; ecosystem services; applied ecology and ecosystem management.
Module 2:	**Biodiversity and conservation biology**
	Levels of biodiversity: genetic, species, ecosystem; biodiversity importance in India and globally; biodiversity hotspots in India; threats to biodiversity: habitat loss, fragmentation, invasive species; endangered species and IUCN red list; in situ and ex situ conservation strategies; national parks, wildlife sanctuaries, biosphere reserves; role of NGOs and community participation in conservation; sustainable use of natural resources; ecotourism and conservation.
Module 3:	**Environmental chemistry, pollution science and ecotoxicology**
	Atmospheric composition and chemistry; major air pollutants and sources; greenhouse gases and global warming; ozone depletion: causes and effects; acid rain and chemical interactions; water and soil pollution; industrial effluents and treatment techniques; solid waste management; noise pollution; pesticides, heavy metals, and biomagnification; radioactive pollution and nuclear hazards; indoor air pollution and health impacts; emerging pollutants: microplastics, nanomaterials, pharmaceuticals; concept and principles of ecotoxicology; fate and transport of toxicants in air, water, and soil; bioaccumulation, biomagnification, and biotransformation; bioassays, indicator species, LC_{50} determination; Minamata disease, DDT, eutrophication.
Module 4:	**Environmental policy, governance and law**
	Environmental policy: frameworks and objectives in India; environmental

Approved by: Academic Council on 7th November 2025

	legislation: Water Act, Air Act, Wildlife Protection Act, Forest Act; Environmental Impact Assessment (EIA).
Module 5:	**Climate change, sustainability & renewable energy**
	Climate change: causes, impacts, mitigation; global warming and sea level rise; carbon footprint and greenhouse effect; climate adaptation strategies; renewable and non-renewable energy sources; energy conservation and efficiency; green technologies and circular economy; sustainable agriculture and urban planning; smart cities and sustainable development.
Module 6:	**Water and mineral resources and their management**
	Hydrological cycle and water balance; surface and groundwater resources; rainwater harvesting; water quality parameters and standards; water pollution treatment techniques; watershed management; irrigation practices and water use efficiency; integrated water resources management (IWRM); Types of mineral resources and their distribution; mining methods and associated environmental impacts; resource depletion and sustainable mining practices; environmental issues of fossil fuel extraction and use; renewable vs. non-renewable resources.
Module 7:	**Soil science & land management**
	Soil formation, types, and classification; soil physical, chemical, and biological properties; soil fertility and nutrient management; soil erosion and conservation techniques; land degradation, desertification, and remediation; sustainable land use planning.
Module 8:	**Environmental microbiology, bioremediation and biotechnology**
	Microorganisms in air, water, soil; role in nutrient cycling and organic matter decomposition; bioremediation principles and applications; wastewater treatment using microbial action; biofertilizers, biocomposting, and vermiculture; microbial degradation of pollutants; environmental biotechnology in pollution mitigation; microbial ecology of soil and water systems; biotechnology in conservation efforts such as tissue culture, cryopreservation.
Module 9:	**Mathematics and statistics**
	Sets, functions; matrices, determinants, linear equations; basic calculus; types of data: qualitative and quantitative; sampling methods and data collection; measures of central tendency (mean, median, mode); measures of dispersion (range, variance, standard deviation); probability distributions (normal, binomial, Poisson); correlation and regression analysis hypothesis testing: t-test, chi-square, ANOVA; applications of statistics.
References/ Readings:	1. Odum, E. P., & Barrett, G. W. (2005). *Fundamentals of ecology* (5th ed.). Brooks/Cole, Boston, MA. 2. Singh, J. S., Singh, S. P., & Gupta, S. R. (2014). *Ecology, environmental science and conservation* (3rd ed.). S. Chand Publishing, New Delhi, India. 3. Rastogi, R. P., & Shukla, A. (2019). *Environmental chemistry* (6th ed.). Goel Publishing House, Meerut, India. 4. Glick, B. R., Patten, C. L., & Holguin, G. (2010). *Environmental biotechnology: Principles and applications*. Springer, New York, NY. 5. Cunningham, W. P., Cunningham, M. A., & Saigo, B. W. (2018). *Environmental science: A global concern* (15th ed.). McGraw-Hill Education, New York, NY.

6. Masters, G. M., & Ela, W. P. (2013). *Introduction to environmental engineering and science* (3rd ed.). Pearson, Upper Saddle River, NJ.
7. Trivedi, R. K., & Goel, P. K. (2010). *Introduction to air pollution* (2nd ed.). Techno-Science Publications, Jaipur, India.
8. Brady, N. C., & Weil, R. R. (2016). *The nature and properties of soils* (15th ed.). Pearson, New Delhi, India.
9. Krebs, C. J. (2014). *Ecology: The experimental analysis of distribution and abundance* (7th ed.). Pearson, San Francisco, CA.
10. Kumar, A., Kumaresan, S., & Sarma, B. K. (2018). *A Foundational Course in Mathematics.* Narosa Publishers, New Delhi.
11. Zar, J. H., & Biostatistics Working Group. (2010). *Biostatistical analysis* (5th ed.). Pearson, New Delhi, India.