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(Accredited by NAAC with Grade A+)

GU/Acad –PG/BoS - GU-ART /2025-26/689 Date: 09.01.2026

CIRCULAR

The syllabus of the Goa University–Admission Ranking Test (GU-ART) for **Master of Science in Botany** and **B.Ed. in Botany** Programmes, approved by the Standing Committee of the Academic Council in its meeting held on 24th & 25th November 2025 is attached.

The Dean/Vice-Dean (Academic) of the School of Biological Sciences and Biotechnology 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 V LAWANDE
Digitally signed by ASHWIN V LAWANDE
Date: 2026.01.09 15:20:37 +05'30'

(Ashwin V. Lawande)
Deputy Registrar – Academic

To,
1. The Dean, School of Biological Sciences and Biotechnology, Goa University.
2. The Vice-Dean (Academic), School of Biological Sciences and Biotechnology, 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'S & B.Ed. IN BOTANY PROGRAMMES

Effective from AY: 2026-2027

Modules	Content
Module 1	**Fundamentals of Botany**
	Brief description of various branches in Botany - Taxonomy, Cytology, Cytogenetics, Ethnobotany, Biotechnology, Molecular Biology, Biochemistry, Paleobotany, Types of fossils – Impression, Compression, Petrification and coal balls. Classification of Plant kingdom up to divisions (G.M. Smith's classification). Plant Morphology - Structure of tap and fibrous root, aerial and underground stem, parts of the leaf, phyllotaxy and venation, cymose and racemose inflorescence, flower parts, aestivation types, fruit types. Tropic movements in plants.
Module 2	**Diversity of Microbes and Non-flowering plants**
	Viruses - Structure, characteristics, viroids, virusoids and prions; **Bacteria** - Features of eubacteria and archaebacteria, shapes and arrangements; **Fungi** - Characteristics, Ainsworth's classification, morphology of *Mucor, Aspergillus, Agaricus, Saccharomyces,* economic importance; **Lichens** - Characteristics, types, mycorrhiza; **Algae** - Characteristics, thallus variation, morphology of *Nostoc, Spirogyra, Sargassum, Polysiphonia*, importance; **Bryophytes –** Characteristics, morphology of *Riccia, Anthoceros, Funaria*, significance; **Pteridophytes –** Features, morphology and reproduction of *Psilotum, Selaginella, Equisetum, Pteris*; **Gymnosperms –** Characteristics, morphology of *Cycas, Pinus, Gnetum*, importance.
Module 3	**Plant Anatomy, Reproductive Biology and Palynology**
	Meristems, simple and complex tissues; primary and secondary growth, stem, root and leaf anatomy, Structure of anther, microsporogenesis and megasporogenesis, development of male and female gametophytes, pollination types, ovule types, double fertilization, embryo and seed structure of dicot and monocot, anatomical adaptations to environment. Definition of palynology and pollen morphology - polarity, symmetry, shape, size, aperture (position and shape), sporoderm stratification and exine ornamentation, applications of palynology

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Module 4	**Plant Physiology:** Water relations, water potential components, transpiration, ascent of sap, mineral nutrition, macronutrient and micronutrient roles, deficiency symptoms, phytohormones and physiological responses, biological nitrogen fixation and nitrate and ammonia assimilation, vernalization, abiotic stress responses including drought and salinity, photosynthetic pigments, light and dark reaction, metabolic pathways including glycolysis, TCA cycle, oxidative phosphorylation.
Module 5	**Cell Biology and Plant Biochemistry** Structure and differences between Prokaryotic (Bacterial Cell) and Eukaryotic cells (plant cell), cell wall, membranes, plastids, mitochondria and cytoskeleton; cell cycle and its regulation; biomolecules - carbohydrates, lipids, proteins and nucleic acids, enzyme structure, mechanism and regulation, Classification of secondary metabolites and their functions; definition, classification, properties, occurrence, functions and deficiency diseases of vitamins A, B complex, C, D, E and K.
Module 6	**Ecology, Interactions, Ecosystems and Biofertilizers** Plant–plant and plant–animal interactions, pollen dispersal strategies, ecological succession, population and community structure, ecosystem types, energy flow and nutrient cycles, biodiversity levels and conservation strategies, effects of pollution and climate change, ecological adaptations, sustainable environmental practices, field-based vegetation analysis and ecological data interpretation. Microbial diversity as Bio-fertilizers, cyanobacteria, *Rhizobium* and mycorrhiza, biofertilizer production and application, nitrogen-fixing organisms.
Module 7	**Soil and Water Analysis** Importance and scope of soil and water analysis, relationship between soil and water quality, significance in agriculture and ecosystems, environmental impact assessment, effects of soil and water quality on plant systems, mitigation for sustainable growth, soil sampling methods, importance of representative samples, sample preparation, soil sampling tools, soil fertility, role of microorganisms, indicators of soil health, water sampling methods, sample handling, water sampling tools, basic physico-chemical water analysis, turbidity, colour, odour, pH, EC, BOD, detection of pathogens in water.
Module 8	**Economic and Entrepreneurial Botany** Economic uses of plants - Cereals, pulses, oilseeds, fibres, medicinal plants, beverages, spices, timber, gums, resins, dyes, industrial products. Introduction to floriculture, scope of floral designing, basic tools and materials, flower holders, containers, floral foam, chicken wire, wreath rings, adhesives, cutting tools, picks, accessories, decorative materials; Flowers and foliage - line, mass, filler and form flowers; Fresh flower arrangements - line,

	mass, line-mass styles, circular, triangular, crescent and S-curve arrangements.
References/ Readings:	1. **Gangulee, SC, Das, KS, Dutta, CD. and Kar, AK** (1968). College Botany Vol. I, II and III. Central Education Enterprises 2. **Kochhar, SL** (2012). Economic Botany in the Tropics. MacMillan India Ltd., New Delhi. 3. **Shailesh, R** (2019). Everyday Ayurveda: The complete book of Ayurvedic home remedies. Notion Press, India. 4. **Pandey, BP** (2017). Botany for Degree students: Biodiversity. S. Chand and Company Ltd., New Delhi. 5. **Sharma, OP** (2011). Series on Diversity of Microbes and Cryptogams: Algae. Mc Graw Hill Education India Pvt. Ltd., Chennai. 6. **Singh, V, Pande, PC and Jain, DK** (2019). A textbook of Botany Archegoniate (Bryophyta, Pteridophyta, Gymnosperms and Palaeobotany). Rastogi Publications, Meerut. 7. **Jain, VK** (2022). Fundamentals of Plant Physiology. S. Chand and Company, Delhi. 8. **Abrahamson, WG** (1989). Plant-animal interactions. McGraw-Hill Book Company, NY. 9. **Gupta, PK** (2001). Methods in Environmental Analysis: Water Soil and Air. Agrobios, India 10. **Bhojwani, SS, Bhatnagar, SP and Dantu, PK** (2015). Embryology of Angiosperms. 6th edition. Vikas Publishing House Pvt. Ltd., Noida. 11. **Pandey, BP** (2014). Plant Anatomy. S. Chand & Company Pvt. Ltd., New Delhi. 12. **Campbell**, **MK** (2012). Biochemistry. 7th edition. Cengage Learning, Boston 13. **Jain**, **JL**, **Jain**, **S** and **Jain**, **N** (2007). Elementary Biochemistry. 3rd edition. S. Chand and Company Ltd., New Delhi. 14. **Rakshit, A, Singh, HB, Parihar, M, Singh, AK, and Meena V (2021)**. Biofertilizers: Volume 1: Advances in Bio-inoculants. Woodhead Publishing, Elsevier. 15. **Erdtman, G** (1969). Handbook of palynology: morphology, taxonomy, ecology; an introduction to the study of pollen grains and spores. Hafner Pub. Co., New York. 16. **Prasad, S & Kumar, U** (2003). Commercial Floriculture. Agrobios, Rajasthan