GOA UNIVERSITY
Taleigao Plateau

SYLLABUS FOR GOA UNIVERSITY ADMISSIONS RANKING TEST (GU-ART) IN BOTANY

I. BIODIVERSITY I (MICROBES, ALGAE, FUNGI AND BRYOPHYTES)

Microbes: Viruses – Discovery, general structure, replication (general account), DNA virus (T-phage); Lytic and lysogenic cycle, RNA virus (TMV); Economic importance; **Bacteria** – Discovery, General characteristics and cell structure; Types - archaebacteria, eubacteria and mycoplasma. Reproduction – vegetative, asexual and recombination (conjugation, transformation and transduction); Economic importance.

Algae: General characteristics; Ecology and distribution; Range of thallus organization and reproduction; Classification of algae; Morphology and life-cycles of the following: *Nostoc, Spirogyra*, *Sargassum*, *Polysiphonia*. Economic importance of algae with special reference to food, biofertilizers and medicine.

Fungi: Introduction- General characteristics, ecology and significance, range of thallus organization, cell wall composition, nutrition, reproduction and classification; True Fungi – General characteristics, ecology and significance with special reference to medicine., life cycle of *Rhizopus (*Zygomycota) *Penicillium*, (Ascomycota), *Agaricus* (Basidiomycota); SymbioticAssociations -**Lichens**: General account, reproduction and significance; **Mycorrhiza**: ectomycorrhiza and endomycorrhiza and their significance.

Bryophytes: General characteristics, Classification, Range of thallus organization. Classification (up to family), morphology, anatomy and reproduction of *Riccia*, *Anthoceros* and *Funaria*. (Developmental details not to be included). Ecology and economic importance of bryophytes with special mention of *Sphagnum.*

II. BIODIVERSITY II (VASCULAR PLANTS)

Pteridophytes: General characteristics, classification, Early land plants (*Cooksonia* and *Rhynia*). Classification (up to family), morphology, anatomy and reproduction of *Psilotum*, *Selaginella*, *Equisetum* and *Pteris*. (Developmental details not to be included). Heterospory and seed habit, stellar evolution. Ecological and economical importance of Pteridophytes.

Gymnosperms: General characteristics, Classification (Coulter & Chamberlain), morphology, anatomy and reproduction of *Cycas*, *Pinus* and *Gnetum*. (Developmental details not to be included). Ecological and economical importance.

Introduction to plant taxonomy: Identification: Functions of Herbarium, important herbaria and botanical gardens of the world and India; **Documentation:** Flora, Keys: single access and

multi-access. Taxonomic evidences from palynology, cytology, photochemistry and molecular data. Taxonomic hierarchy: Ranks, categories and taxonomic groups. **Botanical nomenclature:** Principles and rules (ICN); ranks and names; binominal system, typification, author citation, valid publication, rejection of names, principle of priority and its limitations.

Classification : Types of classification-artificial, natural and phylogenetic. Bentham and Hooker (upto series), Engler and Prantl (upto series); study of families: Asteraceae, Solanaceae, Lamiaceae, Liliaceae and Poaceae. **Biometrics, numerical taxonomy and cladistics:** Characters; variations; OTUs, character weighting and coding; cluster analysis; phenograms, cladograms (definitions and differences).

III. PLANT ANATOMY AND EMBRYOLOGY

Meristematic and permanent tissues: Root and shoot apical meristems; simple and complex tissues.

Primary Structure of organs: Structure of dicot and monocot root, stem and leaf.

Secondary Growth: Activity of Vascular cambium, Anomalous secondary growth in stems of *Boerhaavia, Bignonia & Dracaena* , Wood Anatomy- Wood Elements, heartwood and sapwood , Tension Wood ,Economic importance of wood & wood elements. Periderm & Rhytidome: Structure & Functions

Adaptive & Protective systems: Epidermis, cutin, cuticle & other types of coverings, epidermal appendages, stomatal types, adaptations in Hydrophytes, Xerophytes, Halophytes

Structural organization of flower: Flower as modified reproductive shoot;Structure of anther and pollen; development of male gametophyte, structure and types of ovules; development of female gametophye; ultrastructure of mature embryo sac; types of embryo sacs: monosporic- *Polygonum* type, bisporic- *Allium* type, tetrasporic- *Peperomia* type

Pollination and fertilization: Pollination mechanisms and adaptations; insect pollination as an evolved mechanism, Double fertilization.

Embryo and endosperm, Seed Structure: Structure of Dicot and monocot embryo;

Endosperm types and functions, structure of mature seed, Endospermous seeds. Fruit & Seed dispersal mechanisms &adaptations)

Apomixis and Polyembryony: Concepts, types and practical applications**.**

IV. PLANT PHYSIOLOGY

Plant-water relations: Importance of water, water potential and its components; Transpiration and its significance; Factors affecting transpiration; Root pressure and guttation.

Mineral nutrition: Essential elements, macro and micronutrients; Criteria of essentiality of elements; Role of essential elements; Transport of ions across cell membrane, active and passive transport carriers, channels and pumps

Translocation in phloem Composition of phloem sap, girdling experiment; Pressure flow model; Phloem loading and unloading

Enzymes: Structure and properties; Mechanism of enzyme catalysis and enzyme inhibition.

Photosynthesis: Photosynthetic Pigments (Chl a, b, Xanthophylls, Carotene); Photosystem I and II, reaction center, antenna molecules; Electron transport and mechanism of ATP synthesis; C3, C4 and CAM pathways of carbon fixation; Photorespiration.

Respiration: Glycolysis, anaerobic respiration, TCA cycle; Oxidative phosphorylation, Glyoxylate, Oxidative Pentose Phosphate Pathway.

Nitrogen metabolism: Biological nitrogen fixation; Nitrate and ammonia assimilation.

Plant growth regulators: Discovery and physiological roles of auxins, gibberellins, cytokinins, ABA, ethylene.

Plant response to light and temperature: Photoperiodism (SDP, LDP, Day neutral plants); Phytochrome (discovery and structure), redand far red-light responses on photomorphogenesis; Vernalization.

Suggested Readings:

Biodiversity I& II

1. Bold, H. C., Alexopoulos, C. J. and Delevoryas, T. 1980. Morphology of Plant and Fungi. Harper and Foul Co., New York.
2. Bold H. C. and Wynne M. J. 1978. Algae-Structure and Reproduction. Prentice hall Englewood cliffs, New Jersey.
3. Clifton, A. 1985. Introduction to the Bacteria. McGraw Hill Co., New York.
4. Chamberlain C. J. 1986.Gymnosperms structure and evolution. C.B.S. Publishers.
5. Dube, H. C. 1990. An Introduction to Fungi. Vikas Publishing House Ltd., Delhi.
6. Gifford, E. M. and Foster, A. S. 1989. Morphology and Evolution of Vascular Plants.
7. Kumar, H. D. 1988. Introductory Phycology. Affiliated East-West Press Ltd., NY.
8. Mandahar, C. L. 1978. Introduction to Plant Viruses. Chand and Co. Ltd., New Delhi.
9. Puri, P. 1985. Bryophytes. Atmaram and Sons, Delhi, Lucknow.
10. Rashid A. 1986. An introduction to Pteridophytes. Vani Educational Book, N. D.C.
11. Sporne, K. R. 1991. The Morphology of Gymnosperms. B.I. Publications Pvt., Bombay.

Plant Anatomy and Embryology

1. Esau K. 2006. Anatomy of Seed Plants. 2nd edition.Wiley Eastern Private Ltd.,N.Delhi.
2. Arthur J. E.&MacDanielsL.H. 1977.*An Introduction to Plant Anatomy*. 2nd Edition. Tata McGraw-Hill Publishing Company Ltd.; Bombay-N.Delhi.
3. Bhojwani, S.S. & Bhatnagar, S.P. 2011. *Embryology of Angiosperms*. 5th edition. Vikas Publication House Pvt. Ltd. New Delhi.
4. A. Fahn. 1990.*Plant Anatomy*.4th edition. Pergamon Press

Plant Physiology

1. Taiz, L.; Zeiger, E.2010. *Plant Physiology*. Sinauer Associates Inc., U.S.A. 5th Edition.
2. Hopkins, W.G., Huner, N.P.2009. *Introduction to Plant Physiology*. John Wiley &Sons, U.S.A. 4th Edition.
3. Bajracharya, D.1999. *Experiments in Plant Physiology- A Laboratory Manual*.Narosa Publishing House, New Delhi.