PUNJAB PUBLIC SERVICE COMMISSION
COMBINED COMPETITIVE EXAMINATION (CCE) SYLLABUS

BOTANY

Total Marks: 100

SECTION A: CLASSICAL BOTANY

Topics

1. Cryptogamic Botany:

Algae: Classification (Fritsch, Bold & Wynne), Major algal groups (Cyanophyta, Chlorophyta, Charophyta, Bacillariophyta, Phaeophyta, Rhodophyta), thallus organization, pigments, reserve food, life cycles (Isomorphic, Heteromorphic, Diplontic, Triphasic). Economic importance (agar, alginate, biofertilizers). Algal blooms.

Fungi: Classification (Ainsworth), Major fungal groups (Phycomycetes, Ascomycetes, Basidiomycetes, Deuteromycetes), cell wall, hyphal modifications, reproduction. Lichens; mycorrhizae (Ectomycorrhizae vs Endomycorrhizae). Plant diseases & control.

Bryophytes: Liverworts, Hornworts, Mosses – comparative study. Alternation of generations, apogamy, apospory.

2. Pteridophytes & Gymnosperms:

Pteridophytes: Psilopsida, Lycopsida, Sphenopsida, Pteropsida. Heterospory & seed habit.

Gymnosperms: Cycadales, Ginkgoales, Coniferales, and Gnetales– their structure, life history, affinities. Seed structure & ontogeny. Economic importance.

3. Plant Anatomy & Embryology:

Anatomy: Meristems (apical meristems and the tunica-corpus theory). Tissue systems. Vascular cambium & secondary growth (dicot stem/root). Anomalous secondary growth. Leaf, stem, root anatomy.

Embryology: Microsporogenesis, Megasporogenesis. Anther & ovule types. Pollination, fertilization, double fertilization. Embryo & endosperm development. Polyembryony, apomixis.

4. Taxonomy of Angiosperms:

Systematics: Bentham & Hooker, Engler & Prantl, Takhtajan, Cronquist, APG. ICBN/ICN rules. Taxonomic hierarchy. Herbarium & botanical gardens.

Modern Trends: Biosystematics, Chemotaxonomy, Numerical Taxonomy, Molecular Taxonomy.

Families: Fabaceae, Solanaceae, Poaceae, Asteraceae, Liliaceae–their diagnostic characters and economic importance.

5. **Plant Physiology & Biochemistry:**

Water relations: Water potential ($\Psi w = \Psi s + \Psi p + \Psi g$) and its components; water absorption; transpiration; and stomatal regulation. Phloem transport (Pressure-Flow Hypothesis).

Mineral Nutrition: Macro/micronutrients, deficiency symptoms, active/passive transport.

Photosynthesis and respiration: Light-dependent reactions (Z-scheme), Calvin cycle, C3/C4/CAM/pathways, photorespiration, and celluar respiration including glycolysis, the Krebs cycle, the electron transport chain (ETC), and oxidative phosphorylation.

Plant hormones: Auxins, gibberellins acids (GAs), cytokinins, abscisic acid (ABA), and ethylene. Photoperiodism, Vernalization, Dormancy, Germination.

SECTION B: APPLIED, MOLECULAR & ENVIRONMENTAL BOTANY

Topics

6. **Ecology & Environmental Biology:**

Factors: Climatic (Light, Temperature, Wind), Edaphic (Soil), Biotic. **Population & Community Ecology:** Sampling (Quadrat, Line intercept), Ecological characteristics, Succession.

Ecosystem ecology: Components, food chains, food webs, ecological pyramids, and biogeochemical cycles including the hydrological (water) and the nitrogen cycle.

Applied Ecology: Soil salinity & water logging in Pakistan – causes & reclamation. Deforestation, Biodiversity conservation, Pollution.

7. **Cytology & Genetics:**

Cytology: Cell cycle, Mitosis, Meiosis. Ultra-structure of organelles (Mitochondria, Golgi, ER, Plastids, Ribosomes, Nucleus). Chromosomal aberrations; aneuploidy, euploidy, inversions, and translocations.

Genetics: Mendelian laws of segregation and independent assortment; backcross and test crosses. Dominance, Incomplete dominance. Sex- linked inheritance. Linkage & Crossing over. Multiple alleles, Epistasis.

8. **Molecular Biology & Biotechnology:**

Molecular biology: DNA as the hereditary material; DNA replication; transcription; the genetic code; and translation. Regulation of gene expression (lac operon).

Biotechnology: Genetic engineering, genetically modified organisms (GMOs), tissue culture, and applications in agriculture and medicine.

9. **Evolution:**
Concepts and history of evolution; convergent, divergent, and parallel evolution; natural selection; origin and the first plant cell; evolution of organized plant structures; and early aquatic and terrestrial ecosystems.

10. **Applied & Economic Botany:**
Economic importance of plants: Cereals, Pulses, Oilseeds, Fibers, Medicinal Plants, Timber, Fruits. Ethnobotany in Pakistan. Conservation strategies.

Suggested readings:

1) Ahmad, S., Iqbal, S.H. & Khalid, A.N. (1997). Fungi of Pakistan. Sultan Ahmad Mycological Society of Pakistan.
2) Alexopoulos, C.J., Mims, C.W. & Blackwell, M. (1996). Introductory Mycology, 4th ed. Wiley.
3) Ali, S.I., Nasir, E. & Qaiser, M. (eds.) (1970–to date). Flora of Pakistan. University of Karachi / Missouri Botanical Garden.
4) Bold, H.C. & Wynne, M.J. (1985). Introduction to the Algae: Structure and Reproduction. Prentice-Hall.
5) Cooper, G.M. & Adams, K. (2022). The Cell: A Molecular Approach, 9th ed. Oxford University Press/Sinauer.
6) Cotton, C.M. (1996). Ethnobotany: Principles and Applications. Wiley.
7) Cunningham, A.B. (2001). Applied Ethnobotany. Earthscan.
8) Cutler, D.F., Botha, T. & Stevenson, D.W. (2008). Plant Anatomy: An Applied Approach.
9) Esau, K. (1965). Plant Anatomy, 2nd ed. John Wiley & Sons, Hoboken.
10) Fahn, A. (1990). Plant Anatomy, 4th ed. Pergamon Press.
11) Goffinet, B. & Shaw, A.J. (eds.) (2009). Bryophyte Biology, 2nd ed. Cambridge University Press.
12) Gurevitch, J., Scheiner, S.M. & Fox, G.A. (2020). The Ecology of Plants, 3rd ed. Oxford University Press.
13) Lee, R.E. (2018). Phycology, 5th ed. Cambridge University Press.
14) Primrose, S.B. & Twyman, R.M. (2006). Principles of Gene Manipulation and Genomics, 7th ed. Blackwell.
15) Salisbury, F.B. & Ross, C.W. (1992). Plant Physiology, 4th ed. Wadsworth.
16) Sharma, O.P. (1986). Textbook of Algae. New Delhi: Tata McGraw-Hill.
17) Singh, G. (2019). Plant Systematics: An Integrated Approach, 4th ed. CRC Press.

18) Slater, A., Scott, N.W. & Fowler, M.R. (2008). Plant Biotechnology: The Genetic Manipulation of Plants, 2nd ed. Oxford University Press.

19) Smith, T.M. & Smith, R.L. (2021). Elements of Ecology, 9th ed. Pearson.

20) Taiz, L., Zeiger, E., Møller, I.M. & Murphy, A. (2015). Plant Physiology and Development, 6th ed. Sinauer.

21) Vanderpoorten, A. & Goffinet, B. (2009). Introduction to Bryophytes. Cambridge University Press.

22) Vashishta, B.R., Sinha, A.K. & Kumar, A. (2010). Botany for Degree Students (Bryophyta / Pteridophyta / Gymnosperms). S. Chand.

23) Watson, J.D. et al. (2013). Molecular Biology of the Gene, 7th ed. Pearson.

24) Webster, J. & Weber, R.W.S. (2007). Introduction to Fungi, 3rd ed. Cambridge University Press.

Note: **The above list is only suggestive and not exhaustive. Candidates may consult other standard books and relevant material covering the prescribed syllabus.**

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