

## **Ph.D. PRELIMINARY QUALIFYING EXAMINATION**

### **Syllabus for Paper I Methodology (Botany)**

1. Photography: Principles and methods of digital photography, photomicrography and image analysis.
2. Microscopy and micrometry: Resolving power, numerical aperture, lens aberrations and their corrections, sources of contrast, amplitude change and phase shift, bright field microscopy, dark field microscopy, UV microscopy, fluorescence microscopy, polarized light microscopy, phase contrast microscopy, interference contrast microscopy. Inverted microscopes and stereomicroscopes. Tools and techniques of micrometry.
3. Electron microscopy: Principles and methods of TEM and SEM. Parts of electron microscopes, resolving power, electromagnetic lenses and their aberrations, specimen preparation for TEM. and SEM.
4. Photometry: Colorimetry and spectrophotometry. Electromagnetic spectrum-absorption spectrum- Extinction coefficient. Chromatography- principles and types. Molecular sieving. Electrophoresis: theory and types. Isoelectric focusing.
5. Sedimentation techniques: Theory of velocity sedimentation- instruments-applications.
6. Methods of Molecular Biology: Extraction of DNA and RNA. Estimation of G+C content. Nucleic acid hybridization. Blotting techniques. Sequencing: principles and methods. Fingerprinting, biochips, genomic and cDNA libraries- gene banks.
7. Autoradiography, immunofluorescence and ELISA.
8. Bioinformatics- analysis of molecular data.
9. Tissue culture- principles and methods. Different types of cultures- applications.
10. Histochemical techniques- tissue processing, localization of metabolites and quantification.
11. Methods in microbiology- types of culture media, their preparation, maintenance of microbial cultures and their analysis.
12. Designing and analysis of quantitative experiments- experimental designs and analysis of numerical data- central tendencies, dispersions, testing significance of variations, analyzing correlation of variables, regression analysis, study of factor loading and its implications, cluster analysis and its use in biological research.
13. Domestic and industrial pollution- toxic and hazardous agents of pollution- their identification, quantification and analysis.
14. Collection and compilation of scientific literature- presentation of scientific data- preparation of scientific reports, papers and dissertations.

# Ph.D. PRELIMINARY QUALIFYING EXAMINATION

## Paper I - RESEARCH METHODOLOGY (**Botany**)

Time : Three Hours

Maximum : 70 Marks

I. Answer any *two* of the following :

1. Write about the advantages of image capturing and analysis using digital photography.
2. What are the similarities and differences in specimen preparation in TEM vs. SEM
3. Give a detailed account on microbial culturing and its maintenance.
4. Comment on the methods to measure central tendencies and dispersion and its relevance in biological research.

(2 x 10 = 20 marks)

II. Answer any *ten* of the following :

5. Image quality – Pixel.
6. Numerical Aperture.
7. Inverted microscope and its application.
8. Polarized light and its application.
9. Differential centrifuge : Explain with suitable example.
10. Principles of colorimeter in quantification.
11. Sterilization using autoclave
12. Molecular sieving.
13. ELISA.
14. stains used to localize components in histochemistry
15. Blotting techniques.
16. Cluster analysis.
17. Persistence of hazardous compound.
18. Components of dissertation.

(10 x 3 = 30 marks)

III. Answer any ten of the following :

19. Chromatic aberration.
20. Stage micrometer.
21. Cathode.
22. Sedimentation.
23. Biochips.
24. NCBI, DDBJ and EMBI.
25. Axenic culture.
26. Micropropagation.
27. Sequencing.
28. Regression analysis.
29. Bioremediation.
30. Impact Factor.

(10 x 2 = 20 marks)