

Total number of printed pages-7

14 (BOT-3) 3036

2023

BOTANY

Paper : BOT-3036

(New Course)

**(Research Methodology and
Bioinstrumentation)**

Full Marks : 80

Time : Three hours

***The figures in the margin indicate
full marks for the questions.***

1. Choose the correct answer : $1 \times 8 = 8$
- (i) What is the main aim of interdisciplinary research ?
- (a) To oversimplify the problem of research
 - (b) To bring the holistic approach to research
 - (c) To create a new trend in research methodology
 - (d) To reduce the emphasis on a single subject in the research domain

Contd.

- (ii) What are the core elements of a dissertation ?
- (a) Introduction; data collection; data analysis; conclusions and recommendations
 - (b) Introduction; literature review; research methodology; results; discussions and conclusions
 - (c) Executive summary; literature review; data gathered; conclusions; bibliography
 - (d) Research plan; research data; analysis; references
- (iii) What should be the first step in providing first aid for a chemical splash in the eye ?
- (a) Rinse eyes immediately with running water
 - (b) Rub the eyes to remove the chemical
 - (c) Cover the eyes with bandage
 - (d) Ignore it, as it will heal on its own

- (iv) Parts per million (ppm) is equivalent to :
- (a) 1/100
 - (b) 1/1,000
 - (c) 1/10,000
 - (d) 1/1,000,000
- (v) Which microscope is best suited for observing living, unstained cells in real-time ?
- (a) Light microscope
 - (b) Electron microscope
 - (c) Confocal microscope
 - (d) Dark-field microscope
- (vi) Chromosome banding techniques are used to :
- (a) Stain whole chromosomes
 - (b) Visualize specific regions of chromosomes
 - (c) Observe chromosomes in living cells
 - (d) Study the structure of plant cells

- (vii) AAS is primarily used for :
- (a) Studying molecular vibrations
 - (b) Quantifying metal concentrations
 - (c) Analyzing chiral molecules
 - (d) Measuring circular dichroism
- (viii) GCMS is particularly useful for :
- (a) Separating and identifying volatile compounds
 - (b) Analyzing molecular vibrations
 - (c) Quantifying metal concentrations
 - (d) Studying circular dichroism

2. Write briefly on the following : **(any four)**
3×4=12

- (a) In which situations is a scanning electron microscope (SEM) more advantageous than a transmission electron microscope (TEM) ?
- (b) What is the role of a research hypothesis in a scientific investigation ? Provide a concise definition.
- (c) Define plagiarism and discuss its implications in academic and research settings.

- (d) Explain the basic principle of phase-contrast microscopy.
- (e) Differentiate between differential and density gradient centrifugation.
- (f) What does UV-VIS spectrophotometry primarily measure?
- (g) Why are radioisotopes used in tracer techniques?

3. Write briefly on the following : **(any four)**
5×4=20

- (a) "Research is much concerned with proper fact finding, analysis and evaluation." Do you agree with this statement? Give reasons in support of your answer.
- (b) Why is it important for researchers to adhere to ethical standards in their work? Provide a succinct explanation.
- (c) Explain why the micro-morphological study is essential in plant research.
- (d) Explain the principles of Circular Dichroism (CD) and Optical Rotatory Dispersion (ORD) spectroscopy.

- (e) Differentiate among normality, molarity, and molality.
- (f) Explain the principles of Nuclear Magnetic Resonance (NMR) and Electron Spin Resonance (ESR).
- (g) What does a standard curve represent in analytical chemistry?

4. Answer *any four* of the following :

10×4=40

- (a) Describe the principles of experimental design and the role of randomization. Discuss why randomization is considered a cornerstone in designing controlled experiments. Provide examples of how a well-designed experiment can enhance the validity of research findings. 2+2+6=10
- (b) Define the concept of a buffer solution. Discuss the importance of buffer solutions in chemical analyses and experiments. Outline the step-by-step procedure for preparing a buffer solution, and explain how buffers help maintain a stable pH. 2+2+6=10

- (c) Discuss the steps involved in herbarium techniques. What role do herbarium collections play in plant taxonomy and biodiversity research? 7+3=10
- (d) Compare the principles of Sanger sequencing and next-generation sequencing (NGS). Discuss the advantages and limitations of each method. 8+2=10
- (e) Discuss the principles of High-Performance Liquid Chromatography (HPLC) and Liquid Chromatography-Mass Spectrometry (LCMS). How do they complement each other in analytical chemistry? 8+2=10
- (f) Explain the principle of SDS-PAGE. Discuss the significance of SDS-PAGE in protein analysis, including protein purification and molecular weight determination. 4+6=10
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