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# 322413

**May-2026**

**B.Sc. (CHEMISTRY) IV SEMESTER**

**Statistical Analysis for Chemistry (BCHT–SE–401)**

Time : 3 Hours] [Maximum Marks : 75

*Instructions :*

1. *It is compulsory to answer all the questions (1.5 marks each) of Part-A in short.*
2. *Answer any **four** questions from Part-B in detail.*
3. *Different sub-parts of a question are to be attempted adjacent to each other.*

## PART–A

1. (a) Define limit of detection (LOD). (1.5)

   (b) Define limit of quantitation (LOQ). (1.5)

   (c) What is meant by working range in calibration studies? (1.5)

   (d) Explain propagation of errors with one suitable example. (1.5)

   (e) Define confidence interval and state its analytical significance. (1.5)

   (f) What happens when analytical measurements fall outside control limits? (1.5)

(g) Distinguish between systematic and random errors. (1.5)

(h) Differentiate between detection limit and sensitivity. (1.5)

(i) What is the significance of $R^2$ value in regression analysis? (1.5)

(j) Why is LOQ always higher than LOD? (1.5)

**PART–B**

2. Explain various sources of errors in analytical chemistry. Discuss propagation of uncertainty and methods to minimize analytical errors. (15)

3. Describe statistical process control (SPC) in analytical laboratories. Explain the construction and interpretation of control charts. (15)

4. (a) Discuss the importance of blanks in analytical chemistry. Explain different types of blanks and their applications. (7.5)

   (b) Explain the role of sensitivity, selectivity, and specificity in analytical method validation with suitable examples. (7.5)

5. (a) Explain confidence limits, hypothesis testing, and significance testing with two suitable examples each. (7.5)

   (b) Explain regression analysis in detail. Discuss the use of least-squares method in calibration curve development. (7.5)



6. Two UV-Visible spectrophotometers were used for absorbance measurement of a standard solution. The absorbance readings obtained are: (15)

   Sample A: 0.512, 0.515, 0.514, 0.516, 0.513, 0.517, 0.514, 0.515, 0.516

   Sample B: 0.508, 0.521, 0.507, 0.523, 0.509, 0.522, 0.506, 0.524, 0.508.

   Apply the F-test to evaluate whether there is a significant difference in the variances of the two instruments at the 95% confidence level. (Given The critical F-value from the F-table is 3.44)

7. Discuss the criteria for evaluation of analytical methods with suitable examples:

   (a) Accuracy and Precision. (5)

   (b) Working range. (5)

   (c) *t*-test. (5)

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