KAE 345/3 – Special Topics in Analytical Chemistry

Course Objective: Students will be exposed to the statistical methods in analytical chemistry and methods of water treatment and industrial wastewater treatment

Topic	Content	Number of lecture hours	Expected outcome – upon completion of this course, the student should be able to:
1. The Importance of Statistics in Analytical Chemistry	• Definition of statistics • Types of analytical problems • Steps in designing experiments	1	• Understand the concept of statistics. • Know the various problems in analysis. • Solve the problems.
2. Overview of Sets of Data	• Small set of data • Large set of data	1	• Explain the small set of data. • Explain the larger set of data.
3. Accuracy and Precision	• Terms to explain accuracy and precision • Errors in quantitative analysis	1	• Write the various terms used to explain accuracy and precision. • Know the various types of errors involved in analysis.
4. Error Distribution and Probability	• Normal distribution • Area under normal distribution curve • Normal distribution and random error • Sampling distribution for mean • Estimation of population mean from sample mean • Null hypothesis • One-side and two-sided tests	4	• Understand the meaning of normal distribution. • Know the relationship between normal distribution and random error. • Know how sample is taken from a min distribution. • Know the meaning of hypothesis and various types of hypothesis. • Apply the various types of hypothesis test.

Topic	Content	Number of lecture hours	Expected outcome – upon completion of this course, the student should be able to:
5. Significance Tests: Comparison of The Means and Standard Deviations	• Types of comparisons of the means	4	• Understand the various types of significance tests. • Perform each of the tests.
6. Statistics in Quality Control	• Types of quality control charts: Shewhart and Cusum charts	2	• Understand the meaning of statistics in quality control. • Know how quality control chart can be performed.
7. Comparison of More Than Two Means	• One-way variance analysis (one-way ANOVA) or one-way classification of variables • Two-way variance analysis (two-way ANOVA) or two-way classification of variables.	3 3	• Understand the one-way variance analysis. • Know how the treatment and the conclusion are made after performing the one-way variance analysis. • Know how the treatment and the conclusion are made after performing the two-way variance analysis.
8. Calibration: Errors in Instrumental Analysis, Regression and Correlation	• Linear relationships between two variables • Slope and intercept value for straight line • Errors in slope and intercept of the regression line • Calculation of a concentration from regression graph • Limit of detection for regression line • Use of regression lines for comparing analytical methods	3	• Understand the errors in calibration. • Calculate the terms involved in calibration curve. • Calculate the errors involved in regression line.

Topic	Content	Number of lecture hours	Expected outcome – upon completion of this course, the student should be able to:
9. Water Pollution and Treatment processes of Industrial Wastewater	• Definition of water pollution • Types of water pollutants	2	• Understand the meaning of water pollution. • Know the various types of water pollutants. • Know the various types of wastewater treatment.
10. Physical Treatment Process	• Screening • Clarification and sedimentation • Floatation • Filtration	2	• Understand the various types of physical treatment. • Explain how physical treatment processes can be performed.
11. Chemical Treatment Processes	• pH adjustment • Coagulation and flocculation • Oxidation and reduction • Adsorption • Ion exchange • Electrodialysis • Reverse osmosis • Ultrafiltration	5	• Understand the various types of chemical treatment. • Explain how the chemical treatment processes can be performed.
12. Biological Treatment Processes	• Aerobic treatment • Anaerobic treatment	2	• Know the various types of biological treatment. • Explain how the biological treatment processes can be performed.
13. Special Chemicals for Corrosion, Slime, Foaming and Fouling	• Cooling water treatment • Boiler water treatment	3	• Know the various examples of water treatment using special chemicals. • Write examples of the chemicals that can be used. • Know the function of the special chemicals
	TOTAL	**36**	