

**THE COLLEGE OF THE BAHAMAS
SCHOOL OF NATURAL SCIENCES AND ENVIRONMENTAL STUDIES
DEPARTMENT OF CHEMISTRY**

CHEM 325 – ANALYTICAL CHEMISTRY – INSTRUMENTAL ANALYSIS

3 Semester Hour Credits

COURSE DESCRIPTION

This course provides students with theoretical knowledge of selected analytical techniques in chromatography, spectroscopy, electrochemistry and thermal methods of analysis. These techniques are used to identify and quantify the substances in a sample.

SPECIFIC OBJECTIVES

Upon successful completion of this course, students will be able to

- 1) validate the theoretical basis for chromatographic, spectroscopic, electrochemical and thermal methods of analysis;
- 2) evaluate the suitability of specific methods for the analysis of selected samples; and
- 3) design the appropriate protocol for the analysis of unknown samples.

COURSE CONTENT

1. INTRODUCTION

- a) Definition of analytical chemistry
- b) Review of classical wet methods versus modern methods of analysis
- c) Data analysis and reporting

2. CHROMATOGRAPHY

- a) Concepts
 - i) Partition ratio migration rate
 - ii) Capacity factor
 - iii) Selectivity factor
 - iv) Retention times
 - v) Plate height
 - vi) Resolution
 - vii) Column efficiency
- b) Instrumentation
 - i) Gas chromatography (GC)
 - ii) High performance liquid chromatography (HPLC)
 - iii) Size exclusion (gel) chromatography
 - iv) Ion chromatography
 - v) Supercritical fluid chromatography
- c) Applications, limitations and detection limits

3. SPECTROSCOPY

- a) Concepts
 - i) Wave and particle description of light
 - ii) Energy levels
 - iii) Transitions
 - iv) Basic emission and absorption
 - v) Fluorescence and phosphorescence
 - vi) Quantum numbers
- b) Beer-Lambert Law and limitations
- c) Nature of transitions producing fluorescence and phosphorescence
- d) Instrumentation for quantitative luminescence measurements
- e) Instrumentation for Atomic Emission Spectroscopy (AES)

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- f) Instrumentation for Atomic Absorption Spectroscopy (AAS)
 - g) Performance comparison for AAS and AES
 - h) Applications, limitations and detection limits
- 4 ELECTROCHEMISTRY
- a) Electrochemical interface
 - b) Instrumentation
 - i) Potentiometry
 - ii) Voltammetry
 - iii) Coulometry
 - c) Applications, limitations and detection limits
- 5 THERMAL METHODS OF ANALYSIS
- a) Instrumentation
 - i) Differential scanning calorimetry
 - ii) Thermogravimetry
 - iii) Differential thermal analysis
 - b) Applications, limitations and detection limits

ASSESSMENT

Class tests	25%
Assignments	25%
<u>Final examination</u>	<u>50%</u>
Total	100%

REQUIRED TEXT

Skoog, D. A., West, D. W., Holler, F. J., & Crouch, S. R. (2003). *Fundamentals of analytical chemistry (with CD-ROM and InfoTrac)* (8th ed.). California: Brooks Cole.

SUPPLEMENTARY READING

Rouessac, F., & Rouessac, A. (2000). *Chemical analysis: Modern instrumental methods and techniques* (English ed.). New York: John Wiley & Sons.

Journals

Analytical Chemistry
**Journal of Chemical Education

Websites

<http://www.separationsnow.com/basehtml/SepH>
<http://www.spectroscopynow.com/Spy/basehtml/SpyH>

** Available in the College of The Bahamas Library