

OHLONE COLLEGE
Ohlone Community College District
OFFICIAL COURSE OUTLINE

I. Description of Course:

- | | |
|---|--|
| 1. Department/Course: <u>CHMT - 104B</u> | 7. Degree/Applicability:
Credit, Degree Applicable, Not Transferable (D) |
| 2. Title: <u>Gas Chromatography</u> | 8. General Education: |
| 3. Cross Reference: Gas Chromatography
BIOT - 104B | 9. Field Trips: <u>Not Required</u> |
| 4. Units: <u>0.5</u>
Lec Hrs: <u>0.25</u>
Lab Hrs: <u>0.75</u> | 10. Requisites: |
| 5. Repeatability: <u>No</u> | |
| 6. Grade Options: Grade Only (GR) | |

12. Catalog Description:

This course is designed for beginners and intermediate-level practitioners who want practical laboratory experience in gas chromatography. This course provides the fundamentals needed to understand the technique and instrumentation involved in this powerful analytical tool and covers basic gas chromatography theory, different columns, phases, qualitative identification, data-capture, quantitation, integration, practical applications, and troubleshooting. At the end of the class, the student will have mastered the fundamentals of GC, participated in extensive hands-on laboratory sessions, and learned specialized techniques based on the student's specific interests.

13. Class Schedule Description:

Hands-on training in Gas Chromatography instrumentation, useful in analyzing a wide array of compounds and samples.

14. Counselor Information:

A course designed for ChemTech and/or Biotech students requiring hands-on skills as needed by the chemical, pharmaceutical, and biotech industry for analyzing a wide array of compounds and samples.

II. Student Learning Outcomes

The student will:

1. Describe and discuss the basic principles of the Gas Chromatographic process.
2. Identify the functions of different system components.
3. Perform column installation; describe and discuss the roles of key attributes, including carrier flow, temperature, program, injector temperature, split flow, and split ratio.
4. Describe and discuss the main mechanisms of gas chromatography, including solute-stationary phase interactions, temperature/retention relationships, and the influence of column length on retention time and efficiency.
5. Describe and demonstrate sample preparation and sample introduction protocols.
6. Describe the use and function of various types of detectors used in GC, including FID, ECD, TCD, and NPD.

7. Describe and demonstrate how to optimize chromatographic parameters (R , N , A , k).
8. Describe and demonstrate proper protocols for system maintenance and troubleshooting.
9. Describe and demonstrate methods of quantitation.
10. Develop methods that can be used with GC that are appropriate for a given set of circumstances.

III. **Course Outline:**

GC Overview

Introduction to GC

Identifying and describing the functions of different system components

Main mechanisms of gas chromatography (solute-stationary phase interactions)

Temperature/retention relationship

Injection techniques

Sample preparation protocols

Sample introduction techniques - principles, choice of technique, operation (split/splitless, on-column)

Inlet troubleshooting & maintenance

Comparing injection techniques, troubleshooting injector problems, internal vs. external standard techniques.

Columns

Column theory and stationary phase considerations

Packed column overview

Column choice

Column theory & selectivity

Column temperature operation

Column dimension and phase selection

Detectors

Overview of available detectors (FID, ECD, TCD, NPD)

Choice and operation

Details of FID & TCD

GC/MS

GC detector operation, maintenance, and troubleshooting of FID and TCD

GC Method development

Fundamentals of method development

Develop a method for a completely unknown mixture

Mechanisms of separation

Equilibrium and the distribution constant

Solute-stationary phase interaction

Sample preparation protocols

injection system choice - split/splitless, on-column, direct, PTV, headspace

Carrier gas choice

Column choice

Detector system choice

Optimizing chromatographic parameters

Capacity factor (k), efficiency (N), selectivity (α), and resolution (R)

Temperature effects

Appropriate methods of quantitation

quantitative and qualitative analysis

Data acquisition

GC Troubleshooting and maintenance

Symptoms, causes, diagnosis and solution

Approaches to troubleshooting

Gas delivery systems

Hardware troubleshooting and maintenance (solvent, sample, temperature, and pressure control, injection systems, column and detector systems)

Chromatographic troubleshooting (based on chromatographic parameters and the chromatogram - baseline problems, peak shape, retention stability, etc.)

Diminished peak size

Unsymmetrical peak shapes

Altered retention times

Baseline drift

Baseline perturbations

Appearance of unexpected peaks

Problems with quantitation

IV. **Course Assignments:**

A. Reading Assignments

1. Textbook
2. Handouts

B. Projects, Activities, and other Assignments

1. Lab-based activities such as loading and analyzing of samples, checking system suitability, system parameters, systems components, and troubleshooting.

C. Writing Assignments

1. Maintain laboratory notebook according to acceptable industry protocols.

V. **Methods of Evaluation/Assessment:**

A. Lab-based exams and quizzes

B. Instructional laboratory monitoring and supervising and/or individual observations and conferences with students

C. Objective and practical evaluation of students' laboratory skills as demonstrated by the appropriate use of the GC including the selection of appropriate GC parameters, method development, conducting successful separation(s), and troubleshooting.

VI. **Methods of Instruction:**

A. Lecture

B. Laboratory

C. Discussion

D. Demonstration

E. Audiovisual

F. Computer Assisted Instruction

G. Collaborative Learning

H. Other

1. Individual assistance

2. PowerPoint presentations enhanced by electronic notes made available on instructor's web page

3. Hands-on industry-based lab separations

VII. **Textbooks:**

Required

1. John Kenkel *Analytical Chemistry for Technicians* 3rd Edition, CRC Press, 2003 ISBN: 1-56670-519-3

Optional

VIII. Supplies:

- A. Goggles with indirect venting and side shielding
- B. Lab coat
- C. Lab gloves
- D. Lab notebook
- E. Scientific calculator

CID 2810