ENSC-302: ANALYTICAL TECHNIQUES IN ENVIRONMENTAL SCIENCES (THEORY) (02 Credit hrs)

PRE-REQUISITES: ENSC-112

LEARNING OUTCOMES

Upon completion of this Unit-, students will have

- A clear idea about sampling procedures, precise measurement and analysis of environmental pollution using different Instruments.
- Understand and apply the fundamental principles of analytical chemistry
- Understand and follow standard documented procedure of analysis.

CONTENTS

Sampling procedures, Preservation and sample digestion**.** Analytical techniques in Environmental Sciences, Spectroscopic methods (UV/VIS, IR, AAS, FES), Chromatographic techniques and Gravimetric analysis.

Unit-1: Introduction to Analytical Chemistry

1.1. Role of Analytical chemistry in environment
1.2. Analytical process
1.3. Errors and its types
1.4. Qualitative and Quantitative analysis

Unit-2: Classical methods of analysis

2.1. Volumetric analysis and its types
2.2. Gravimetric analysis
2.3. Classical methods versus instrumental analysis

Unit-3: Instrumental methods of analysis

3.1 Types of instrumental analysis their advantages and disadvantage

Unit-4: Spectroscopic analysis

4.1. Electromagnetic spectra
4.2. Absorption and Emission phenomenon
4.3. Lambert Beer's law
4.4. Flame Emission photometry and its applications in environment
4.5. Atomic Absorption spectrophotometry
4.6. Molecular analysis UV/VIS and IR Spectrometry

Unit-5: Chromatographic analysis

5.1. Adsorption and Partition chromatography
5.2. Paper, Column and Thin Layer Chromatography
5.3. Principle and working of Gas chromatography and GCMS
5.4. High Pressure Liquid Chromatography (HPLC).

TEACHING – LEARNING STRATEGIES

- Lecture based examination
- Presentation/seminars
- Class discussion
- Quizzes

ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR

It is continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes:

- classroom participation,
- attendance, assignments and presentation,
- homework
- attitude and behavior,
- hands-on-activities,
- short tests, quizzes etc.

ASSESSMENT AND EXAMINATIONS:

Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

RECOMMENDED TEXT BOOKS / SUGGESTED READINGS

1. Daniel, C. H., & Charles A. L. (2020). *Quantitative Chemical Analysis*. W.H. Freeman & Company, New York
2. Dunkle, M. N., & Winniford, W. L. (Eds.). (2020). *Analytical Techniques in the Oil and Gas Industry for Environmental Monitoring*. John Wiley & Sons.
3. Lucio, P. (2019). *Analytical Chemistry: Processes and Techniques*. Willford Press
4. Bhatti, H. N. (2017). *Principles of Analytical Chemistry.* Carvan Book House, Lahore.
5. Greenberg, A. (2005). *Standard Methods for the Examination of Water & Wastewater.* American Public Health Association.

Further Reading: As suggested by the Instructor.

ENSC-302: ANALYTICAL TECHNIQUES IN ENVIRONMENTAL SCIENCES (PRACTICAL) (01 Credit hr.)

PRE-REQUISITES: ENSC-112

LEARNING OUTCOMES

Upon completion of this Unit-, students will have

- A clear idea about sampling procedures, precise measurement and analysis of environmental pollution using different Instruments.
- Understand and apply the fundamental principles of analytical chemistry
- Understand and follow standard documented procedure of analysis.

CONTENTS

Sampling procedures, Preservation and sample digestion**.** Analytical techniques in Environmental Sciences, Spectroscopic methods (UV/VIS, IR, AAS, FES), Chromatographic techniques and Gravimetric analysis.

Unit-1: Sampling techniques for chemical analysis of Air, Water and Soil

Unit-2: Pre-concentration methods

Unit-3: Different digestion methods and sample preparation

Unit-4: Cationic estimation by Flame photometry

Unit-5: Estimation of metal ions by Atomic Absorption Spectrophotometer in different of samples

Unit-6: Determination of anions and other colored pollutants by UV/VIS Spectrophotometry

TEACHING – LEARNING STRATEGIES

- Lecture based examination
- Presentation/seminars
- Class discussion
- Quizzes

ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR

It is continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes:

- classroom participation,
- attendance, assignments and presentation,
- homework
- attitude and behavior,
- hands-on-activities,
- short tests, quizzes etc.

ASSESSMENT AND EXAMINATIONS:

Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

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Further Reading: As suggested by the Instructor.