

COURSE WISE BREAKUP

Fourth Year Eighth Semester

SPECILIZATION

ANALYTICAL CHEMISTRY

THEORY

COURSE CODE	TITLE	CREDIT HOURS	MARKS
CHEM-414	PAPER-IV: ANALYTICAL CHEMISTRY	03	100
CHEM-415	PAPER-V: ANALYTICAL CHEMISTRY	03	100
CHEM-416	PAPER-VI: ANALYTICAL CHEMISTRY	03	100

PRACTICALS

COURSE CODE	TITLE	CREDIT HOURS	MARKS
CHEM-412	ANALYTICAL CHEMISTRY (RESEARCH PROJECT)	06	200

- Total Credits of the Semester = 15 (theory 09 & practicles 06 credits)
- Maximum Marks = 500 (theory 300 & practicles 200 marks)

4th Year; 8th Semester

PAPER-IV

Title of the Course: **ANALYTICAL CHEMISTRY**

Code: **CHEM-412**

Credit Hours: **03**

Marks: **100**

Course Contents:

Hyphenated Techniques

- A. Introduction to Hyphenated Techniques
- B. **Hyphenated Techniques for Complex Organic Mixtures and {harmaceutical Analysis**
 - 1. Gas Chromatography-Mass Spectrometry (GC-MS)
 - 2. Gas Chromatography-Mass Spectrometry-Mass Spectrometry (GC-MS-MS)
 - 3. Liquid Chromatography-Mass Spectrometry (LC-MS)
 - 4. Liquid Chromatography-Fourier Transform Infrared Spectroscopy (LC-FTIR)
- C. **Hyphenated Techniques for Elemental Speciation Studies**
 - 1. ICP-MS
 - 2. LC-ICP-MS
 - 3. LC-AAS
 - 4. LC-AFS
 - 5. IC-ICP-MS
- D. **Hyphenated Techniques in Polymer Characterizations**
 - 1. TG-IR
 - 2. TG-MS
 - 3. DSC-FTIR

4th Year; 8th Semester

PAPER-V

Title of the Course: **ANALYTICAL CHEMISTRY**

Code: **CHEM-412**

Credit Hours: **03**

Marks:100

Course Contents:

Advanced Chromatography

- 1. **General Description of Chromatography**

Migration rate of solutes, retention time, column efficiency, zone shapes, effect of column variables on zone broadening and column efficiency.

2. Gas Chromatography (GC)

Basic principle and instrumentation; Carrier gas, Injection systems: valve method, head-space method, injection through septum. Columns: Packed columns, open tubular columns, support coated open tubular columns, wall coated open tubular columns and porous layer column preparation, Detectors: Electron capture detector (ECD), thermal conductivity detector (TCD), flame ionization detector (FID), flame photometer as a detector (FPD), Nitrogen-Phosphorous detector (NPD), mass spectrometer as a detector (MS). Capillary gas chromatography. Types of chromatogram. Qualitative and Quantative analyses in gas chromatography

3. High Pressure/Performance Liquid Chromatography (HPLC)

Principle, choice of column materials for HPLC, preparation of column, selection of the support, selection of the mobile phase. Instrumentation of HPLC, Pumps, columns, injection systems, detectors (U.V., Refractive index, fluorimetric and electrochemical detectors). Normal and reverse phase chromatography. Isocratic and gradient elution chromatography. Applications of HPLC. High-pressure/performance thin layer chromatography (HP-TLC).

4. Ion Chromatography

Ion exchange resins, applications of ion exchange resins to chromatography, ion chromatography based on suppressors, single column ion chromatography, detectors in ion chromatography, selection of the mobile phase. Applications of ion chromatography. Comparison of HPLC with gas liquid chromatography (GLC).

4th Year; 8th Semester

PAPER-VI

Title of the Course: **ANALYTICAL CHEMISTRY**

Code: **CHEM-412**

Credit Hours: **03**

Marks: **100**

Course Contents:

Special Topics

1. Electrochemical Sensors

Biosensors, enzyme-based electrode, affinity biosensors, gas sensors, solid state devices, sensor arrays, new material for sensors.

2. Mass Spectrometry (MS)

Basic principle, instrumentation, various sources of ionization, analyzers and detectors. Types of mass spectrometry. Applications to biological and environmental chemistry.

3. Process, Instrument and Automzation in Chemical Analysis

Principle of automation, automated instruments in process control, automatic instruments, flow-injection analyzers, micro-processor coltrolled instruments.

4th Year; 8th Semester

Title of the Practicals: **ANALYTICAL CHEMISTRY (RESEARCH PROJECT)**

Code: **CHEM-412**

Credit Hours: **06**

Marks: **200**

RECOMMENDED BOOKS:

1. Analytical Chemistry by Gary D. Christian; 6th ed. 2004; John Wiley & Sons, Inc.
2. Fundamentals of Analytical Chemistry by Douglas A. Skoog, Donald M. West, F. James Holler, Stanley R. Crouch; 8th ed. 2003; Saunders College Publishing, Philadelphia.
3. Instrumental Methods of Analysis by Hobert H. Willard D.L. Merrit & J.R.J.A. Dean, Frank A. Settle; 7th Sub edition 1988; Wadsworth Publishing Company.
4. British Pharmacopoeia
5. United States Pharmacopoeia
6. Laboratory Manual of Analytical Chemistry by C. Reilly; Allyn and Bacon, London
7. Quantitative Analysis by W. J. Blaedal and V. W. Medloche; Harper & Row, N. Y.
8. Most of the experiments prescribed can be found on various websites.