JAI HIND COLLEGE
BASANTSING INSTITUTE OF SCIENCE
&
J.T.LALVANI COLLEGE OF COMMERCE
(AUTONOMOUS)

"A" Road, Churchgate, Mumbai - 400 020, India.

Affiliated to
University of Mumbai

Program: M.Sc. in Chemistry

Course: Analytical Chemistry II

Semester II

Credit Based Semester and Grading System (CBSGS) with effect from the academic year 2021-22

JAI HIND COLLEGE 'A' Road Churchgate Mumbai-20. AUTONOMOUS

PRINCIPAL
JAI HIND COLLEGE

M.Sc. Chemistry Syllabus

Semester II			
Course Code	Course Title	Credits	Lectures/Week
PSCHE204	Analytical Chemistry II	04	04

PRINCIPAL
JAI HIND COLLEGE

Semester II – Theory

Course: PSCHE204	Course Title: Analytical Chemistry II	Credits: 04 Lectures/Week: 04
	Chromatography, Thermal methods, automation in chemical analysis, Surface Analytical & Electroanalytical methods	
	Objectives: 1. **To understand the concept and instrumentation of chromatography, thermal methods, automation in chemical analysis, surface analytical & electroanalytical methods.** 2. **To identify the application of Chromatography, Thermal methods, automation in chemical analysis, Surface Analytical & Electroanalytical methods** **Outcomes:** 1. **To explain the concept and instrumentation of chromatography, thermal methods, automation in chemical analysis, surface analytical & electroanalytical methods.** 2. **To illustrate the application of Chromatography, Thermal methods, automation in chemical analysis, Surface Analytical & Electroanalytical methods.**	
Unit I	**Chromatography [15L]** **1.1 Basic concepts in chromatography:** Classification of chromatographic methods, theories of separation in chromatography; Optimization of chromatographic conditions. **[3L]** **1.2 Gas Chromatography**: Instrumentation of GC with special reference to sample injection systems – split/splitless, column types, solid/ liquid stationary phases, column switching techniques, temperature programming, detectors in GC- Thermionic, thermal conductivity detector, Flame ionisation detector, mass spectrometric detector, Applications. **[5 L]** **1.3 High Performance Liquid Chromatography (HPLC):** Normal phase and reversed phase with special reference to types of commercially available columns (Use of C8 and C18 columns). Detectors in HPLC: uv detector- Diode array type and fluorescence detector, mass detector, Applications of HPLC. Chiral and ion chromatography. **[7 L]**	**15L**

JAI HIND COLLEGE 'A' Road Churchgate Mumbai-20. AUTONOMOUS

PRINCIPAL
JAI HIND COLLEGE

Unit II	**Thermal Methods, Hyphenation& Automation in Chemical Analysis** **2.1 Thermal Methods [7L]** **2.1.1** Recapitulation of types of thermal methods, comparison between TGA, DTA and DSC. **2.1.2** Applications of DSC - Heat of reaction, Specific heat,Safety screening, polymers, liquid crystals, Percentage crystallinity,oxidative stability, Drug analysis, Magnetic transition. e.g. Analysis of Polyethylene for its crystallinity. **2.1.3** Enthapimetric methods **2.1.4** Thermometric titration **2.1.5** Evolved Gas Analysis **2.2 Hyphenated Techniques [3L]** Introduction, need for hyphenation, possible hyphenation, interfacing devices and applications of the following: GC-MS, GC-IR, MS-MS, LC-MS **2.3 Automation in Chemical Analysis [4L]** Need for automation, objectives of automation, an overview of automated instruments and instrumentation, process control analysis, flow injection analysis, discrete automated systems, automatic analysis based on multi-layered films, gas monitoring equipment, Automatic titrators	**15L**
Unit III	**Surface Analytical Techniques [15L]** **3.1 Introduction:**Principle, Types, Surface Sensitivity & Specificity, Electron scattering, distinction of surface species **[3L]** **3.2 Photoelectron Spectroscopy:**Principle, Instrumentation and Applications of X-ray photoelectron Spectroscopy (XPS,ESCA) & Auger spectroscopy **[3L]** **3.3 Electron Microscopy:** Principle, Instrumentation and Applications of Scanning Electron Microscopy (SEM) and Transmission Electron Microscopy (TEM) **[4L]** **3.4 Scanning Probe Microscopy:** Principle, Instrumentation and Applications of Scanning Tunneling Microscopy (STM) and Atomic force Microscopy (AFM)**[3L]** **3.5 Ion Spectroscopy:** Principle, Instrumentation and Applications of Ion Spectroscopy (ISS & SIMS)**[2L]**	**15L**

JAI HIND COLLEGE 'A' Road Churchgate Mumbai-20 AUTONOMOUS

PRINCIPAL
JAI HIND COLLEGE

Unit IV	**Electroanalytical Methods** **1.1 Ion Selective Potentiometry:** Ion selective electrodes and their applications (solid state, precipitate, liquid –liquid, enzyme and gas sensing electrodes), ion selective field effect transistors, biocatalytic membrane electrodes and enzyme based biosensors. **[6L]** **1.2 Polarography:** Ilkovic equation, derivation starting with Cottrell equation, effect of complex formation on the polarographic waves. **[4L]** **1.3 Electrogravimetry:** Introduction, principle, instrumentation, factors affecting the nature of the deposit, applications. **[3L]** **1.4 Coulometry:** Introduction, principle, instrumentation, coulometry at controlled potential and controlled current. **[2L]**	**15L**

Standard References:

Unit I

1. Fundamentals of Analytical Chemistry, By Douglas A. Skoog, Donald M. West, F. James Holler, Stanley R. Crouch, 9th Edition, 2004.
2. HPLC Practical and Industrial Applications, 2 nd Ed., Joel K. Swadesh, CRC Press

Unit II

3. Instrumental Analysis, 5 th Edition, Skoog, Holler and Nieman.
4. Handbook of Thermal Analsis- Hatakeyama & Liu, Wiley.
5. Hyphenated techniques in Speciation Analysis- Royal Society of Chemistry (2003) Joanna Scpunar and Ryszard Lobinski.

Unit III

6. Modern techniques of surface science by D.P. Woodruff, T.A. Delchar, Cambridge Univ. Press, 1994.

Unit IV

7. Electrochemical Methods Fundamentals and Applications, Allen J Bard and Larry R Faulkner, John Wiley and Sons, (1980)
8. Instrumental Methods of Analysis Willard, Merrit, Dean and Settle, 7th edition, CBS publishers.
9. Principles of Instrumental Analysis – Skoog, Holler, Nieman, 5th Edition, Harcourt College Publishers, 1998. Chapters - 23, 24, 25.

Additional References:

10. Physical Principles of Electron Microscopy, An Introduction to TEM, SEM, and AEMAuthors: Ray F. Egerton, ISBN: 978-0- 387-25800- 3 (Print)
11. Introduction to Scanning Tunneling Microscopy by C. J. Chen, Oxford University Press, NewYork, 1993

12. Transmission Electron Microscopy: A text book for Material Science, David B Williams and C., Barry Carter, Springer
13. Modern Spectroscopy, by J.M. Hollas, 3rd Edition (1996), John Wiley, New York
14. Analytical Chemistry Principles – John H Kennnedy, 2nd edition, Saunders College Publishing (1990)
15. Modern Analytical Chemistry David Harvey; McGraw Hill Higher education publishers, (2000).

Evaluation Scheme

- **Continuous Assessment (CA) – 40 Marks**
  - Knowledge and Application based: Objective test of 20 Marks
  - Skill based (20 marks): Learner will be assessed on relevant skills pertaining to the course content of a particular paper which could involve but not limited to
    Oral Presentations on relevant topics
    Review writing/Worksheets etc.
- **Semester End Examination (SEE)- 60 Marks**

JAI HIND COLLEGE 'A' Road Churchgate Mumbai-20 AUTONOMOUS

PRINCIPAL
JAI HIND COLLEGE

JAI HIND COLLEGE
BASANTSING INSTITUTE OF SCIENCE
&
J.T.LALVANI COLLEGE OF COMMERCE
(AUTONOMOUS)

"A" Road, Churchgate, Mumbai - 400 020, India.

Affiliated to
University of Mumbai

Program: M.Sc. in Chemistry

Course: Analytical Chemistry Practical II

Semester II

Credit Based Semester and Grading System (CBSGS) with effect from the academic year 2021-22

JAI HIND COLLEGE 'A' Road Churchgate Mumbai-20. AUTONOMOUS

PRINCIPAL
JAI HIND COLLEGE

M.Sc. Chemistry Practical Syllabus

Semester II			
Course Code	**Course Title**	**Credits**	**Practical/Week**
PSCHEPR204	**Analytical Chemistry Practical II**	**02**	**01**

PRINCIPAL
JAI HIND COLLEGE

Semester II – Practical

Course Code: PSCHEPR204	Course Title: Analytical Chemistry Practical II	Credits: 02, Practical/Week: 01

Objectives:

1. **To develop the skill of determination of d-block elements from solutions mixtures.**
2. **Toacquainted with procedures of standardisation of various instruments.**

Outcomes:

1. **To determine d-block elements from solutions mixtures using different colorimetric instruments.**
2. **To understand spectrometry and practical training of determining the analyte from sample matrix.**

1. To determine percentage purity of sodium carbonate in washing soda pH metrically.
2. To determine the amount of Ti(III) and Fe(II) in a mixture by titration with Ce(IV) potentiometrically.
3. To determine the percentage purity of a sample (glycine/sodium benzoate/primary amine) by titration with perchloric acid in a non aqueous medium using glass calomel system potentiometrically.
4. To determine the amount of nitrite present in the given water sample colorimetrically.
5. To determine the amount of Fe(II) and Fe(III) in a mixture using 1,10-phenanthroline spectrophotometrically.
6. Simultaneous determination of Cr(VI) and Mn(VII) in a mixture spectrophotometrically.
7. To determine the percentage composition of HCl and H2SO4 on weight basis in a mixture of two by conductometric titration with NaOH and BaCl2.
8. To determine the amount of potassium in the given sample of fertilizers using a flame photometer by standard addition method.

REFERENCES:

1. Quantitative Inorganic Analysis including Elementary Instrumental Analysis by A. I. Vogels, 3rd Ed. ELBS (1964)
2. Vogel's textbook of quantitative chemical analysis, Sixth Ed. Mendham, Denny, Barnes, Thomas, Pearson education
3. Standard methods of chemical analysis, F. J. Welcher
4. Standard Instrumental methods of Chemical Analysis, F. J. Welcher
5. W.W.Scott."Standard methods of Chemical Analysis",Vol.I, Van Nostrand Company,Inc.,1939.
6. E.B.Sandell and H.Onishi,"Spectrophotometric Determination of Traces of Metals",Part- II,4th Ed.,A Wiley Interscience Publication,New York,1978.

JAI HIND COLLEGE 'A' Road Churchgate Mumbai-20. AUTONOMOUS

PRINCIPAL
JAI HIND COLLEGE

Evaluation Scheme

- **Semester End Examination (SEE)- 50 Marks**

JAI HIND COLLEGE 'A' Road Churchgate Mumbai-20. AUTONOMOUS

PRINCIPAL
JAI HIND COLLEGE