

SYLLABUS

**MANONMANIAM SUNDARANAR UNIVERSITY
TIRUNELVELI-627 012, TAMILNADU, INDIA
CHEMISTRY**

Ph.D. Course work papers (SPECIAL ELECTIVE)

1. ANALYTICAL METHODS AND INSTRUMENTATION

Unit-I

Treatment of Analytical data and Interpretation

Accuracy and Precision in measurements. Reliability of Analytical Data – Errors in Chemical analysis, Classification, Determination. Improving accuracy of analysis. Statistical analysis – Student t-test, F-test.

Unit-II

Separation Technique

Chromatographic techniques – paper, thin layer column chromatography, Gas Chromatography (GC)- Instrumentation, application. Principle and application of GCMS, LCMS, ion exchange chromatography. Flash Chromatography (FC) – Principle and application. Extraction Methods – Solvent extraction, Solid Phase extraction (SPE). Microwave Assisted Extraction (MAE), Soxhlet Extraction.

Unit- III

Instrumental Methods of Chemical Analysis

Atomic Absorption Spectroscopy (AAS) and Atomic Emission Spectroscopy (AES) – Principle Instrumentation and Application. X-ray Photoelectron Spectroscopy (XPS) – Theory and Instrumentation, XPS imaging, Surface analytical techniques – XRD, SEM, TEM – applications.

Unit-IV Spectroscopic Analysis

UV-Vis and IR spectroscopy – UV-Vis spectra of enes, enones, arenes, and conjugated systems. Effect of solvent on UV-Vis spectra. IR- Principle, Instrumentation and Application. Characteristic group frequencies and functional group detection using IR.

Mass Spectroscopy (MS) – EI, CI, FAB, ESI and MALDI ion sources. Characteristic EIMS fragmentation and MS rearrangements. Spectral interpretation and structural determining using mass spectrum.

Unit-V

NMR Spectroscopy and Structure elucidation

Basic Principle of NMR –¹H and ¹³C Chemical Shift, spin-spin coupling, Coupling constant, J-value. Applications of NOE, DEPT and 2D techniques – COSY, HSQC and HSBC. Structure elucidation of organic compounds using spectral data – UV, IR, NMR and MS.



References:

1. Douglas A. Skoog. F James Holler; Stanley; R. Cruch, "Principle of instrumental analysis" Cole pub Co, (2006).
2. S.M. Khopkar, " Basic Principles of Analytical Chemistry" 1st Edition, Wiley pub, (1984).
3. W. Kemp, "Organic Spectroscopy", 3rd Edition, Palgrave Macmillan, (1991).
4. D.L. Pavia, G.M. Lampman and G.S. Kriz " Introduction to Spectroscopy" 3rd Edition, Brooks/Cole, (2001).
5. D.H. Williams and I. Fleming " Spectroscopic Methods in Organic Chemistry" 5th Edition, Macraw-Hill (1989).



2. CORROSION SCIENCE AND ENGINEERING

Objectives

1. To study the Principle and mechanism of electrochemical reactions involved in corrosion and preventive methods.
2. To gain knowledge on measurement of various adsorption and thermodynamic parameters related to corrosion.
3. To learn the basic terminology involved in electrochemical cell reaction and their application in some electrochemical based titration.
4. To understand the principles and working of some batteries and fuel cells. To impart knowledge on Classification, properties and uses of alloys.
5. To study the preparation, properties and applications of engineering materials.

Unit-1: Corrosion

Definition – causes - factors – types – chemical, electrochemical corrosion (galvanic, differential aeration), corrosion control – material selection and design aspect – electrochemical protection – sacrificial anode method and impressed current cathodic method. Paints – constituent and function, Electroplating of copper and electroless plating of nickel

Unit-II: Non-Electrochemical methods

Adsorption - Physisorption – Chemisorption - Surface area determination - Mass loss measurements, Corrosion parameters Temperature studies – Adsorption - Temkin – Langmuir adsorption isotherm, Change in entropy, enthalpy, Gibbs free energy, Heat of adsorption, Activation energy - Green inhibitors.

Unit-III: Electrochemistry

Electrochemical cell – redox reaction, electrode potential – origin of electrode potential – oxidation potential – reduction potential – electrochemical series and its significance – Nernst equation. Precipitation titration - Conductometric titration – Potentiometric titration – pH meter.

Unit-IV: Batteries, Fuel cells and Alloys

Batteries - Types of batteries – alkaline battery – lead storage battery – nickel cadmium battery – lithium battery – Fuel cells – Hydrogen oxygen fuel cell. Alloys: Introduction – Definition – Properties of alloys – Significance of alloying, Function and effects of alloying elements – Ferrous alloys – Nichrome and Stainless steel – heat treatment of steel; Non-ferrous alloys – brass and bronze.



Unit-V:**Engineering Materials**

Abrasives: definition, classification or types, grinding wheel, abrasive paper and cloth. Refractories: definition, characteristics, classification properties – refractoriness and RUL, dimensional stability, thermal spalling, thermal expansion, porosity: Manufacture of alumina, magnesite and silicon carbide.

Reference:

1. R. Winston Revie and Herbert H. Uhlig “Corrosion and Corrosion control: An introduction to Corrosion Science and Engineering”, 4th Edition, John Wiley & Sons, Inc, 2008
2. Perez, Nestor “Electrochemistry and Corrosion Science”, 2nd Edition, Springer
3. Principles of Materials Science & Engineering, 2nd Edition by W. F. Smith, 1990
4. Robert G. Kelly, John R. Scully, David Shoesmith, Rudolph G. Buchheit “Electrochemical Techniques in Corrosion Science and Engineering” 1st Edition, 2002
5. Volkan Cicek, Bayan Al-Numan “Corrosion Chemistry” Wiley
6. Pierre R. Roberge, “Handbook of Corrosion Engineering”, McGraw-Hill, 2005
7. B. Siva Shankar, “Engineering Chemistry”, Tata Mc Graw Hill Publishing Limited, 3rd Edition, 2015.
8. S. S. Dara, Mukkanti, “Text of Engineering Chemistry”, S. Chand & Co, New Delhi, 12th Edition, 2006.
9. C. V. Agarwal, C. P. Murthy, A. Naidu, “Chemistry of Engineering Materials”, Wiley India, 5th Edition, 2013.
10. R. P. Mani, K. N. Mishra, “Chemistry of Engineering Materials”, Cengage Learning, 3rd Edition, 2015.
11. S.L.Chawla, R.K.Gupta, “Materials selection for corrosion control, First printing, Dec.1993.
12. P.H.Reiger, “Electrochemistry”, Prentice Hall, 1987.
13. Mars G. Fontana, Corrosion Engineering, McGraw Hill Education, 3rd Edition
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21. Shashi Chawla, “Text Book of Engineering Chemistry”, Dhanpat Rai Publishing Company, New Delhi, 1st Edition.
22. Dr. V. Veeraiyan and Dr. L. Devaraj Stephen, “ Engineering chemistry – II” VRS Publishers Pvt.Ltd, 2015-2016.

