

As Per New Syllabus (CBCS Pattern and NEP 2020)

Shivaji University, Kolhapur

B.Sc. Part-II : Semester-III

ANALYTICAL CHEMISTRY

(CHEMISTRY : DSC-4C : PAPER-VI)

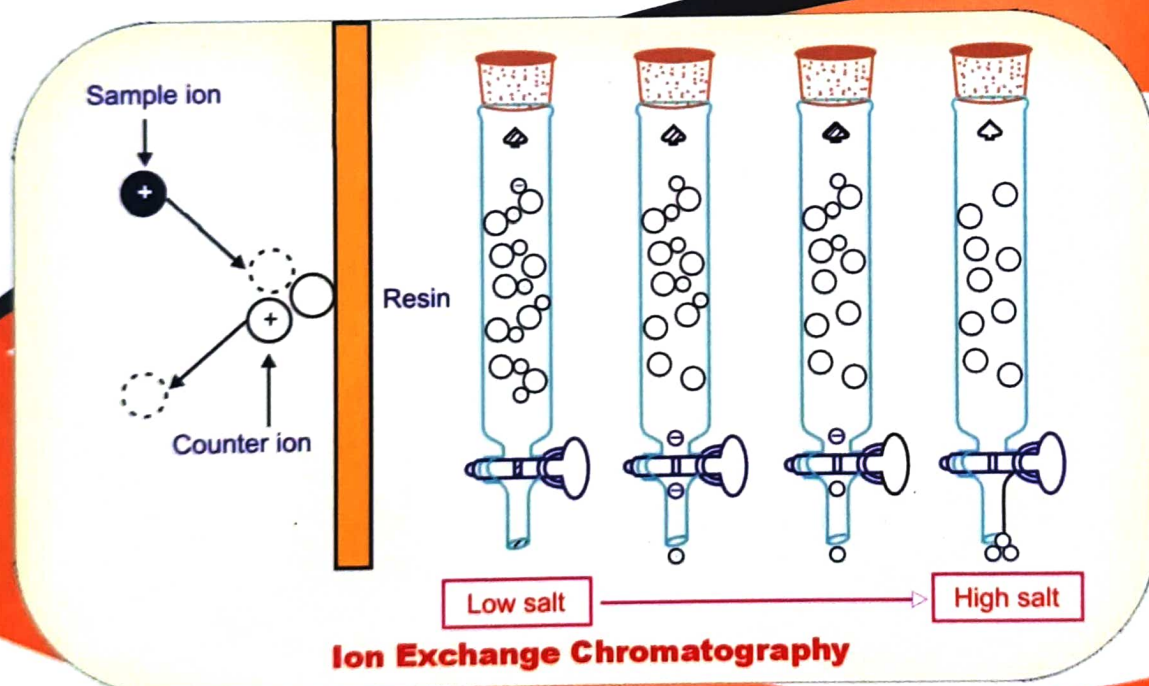
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A TEXT BOOK OF
ANALYTICAL CHEMISTRY

(DSC-4C : Paper - VI)

FOR

B.Sc. Part - II : Semester-III

As Per New Revised NEP - 2020 Pattern

Syllabus of Shivaji University, Kolhapur w.e.f. June 2023

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**Published By :
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Abhyudaya Pragati, 1312, Shivaji Nagar,
Off J.M. Road, Pune - 411005
Tel - (020) 25512336/37/39
Email : niralipune@pragationline.com

Polyplate**YOGIRAJ PRINTERS AND BINDER**

Printed By
Survey No. 10/1A, Ghule Industrial Estate,
Nanded Gaon Road,
Nanded, Pune - 41104

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PREFACE

This book is basically intended for B.Sc. Part-II students for Semester-I Course of Shivaji University, Kolhapur. This book is written according to new NEP-2020 Pattern syllabus being implemented from June 2023 prescribed by Shivaji University, Kolhapur.

It is our great pleasure to present this book to the students and respected teachers in proper time. The subject matter is presented in simple and lucid language. This book covers all the chapters mentioned in the syllabus. The material is presented in a comprehensive way and the sequence of articles in each chapter helps the students to understand the subject with ease.

Different diagrams and illustrative description is provided to enhance the learning and understanding of the matter by students as well as to enable the teachers to explain the difficult concepts properly. The solved numerical examples, long answer type questions, short answer type questions including multiple type questions are given at the end of each chapter.

We are thankful to Nirali Prakashan, Pune for making us a part of their team of Authors. We thank Mr. Dineshbhai Furia and Mr. Jignesh Furia for publishing this book.

Last but not the least we are very much indebted to Mr. Virbhaval Chinde (Marketing Executive, Kolhapur District) and Mr. Ashok Nanavare (Marketing Executive, Sangli District) for their nice co-operation. We are very much thankful to Mr. Kiran Kamble (Proof Reading), Mrs. Shraddha Chitambar (Graphic Design) and Mr. Malik Shaikh for a neat and error free D.T.P. of this book.

We hope that this book will be found useful by students and teachers. We will appreciate any suggestions for the improvement of the book.

Authors

SYLLABUS

B.Sc. Part II - DSC 4C : ANALYTICAL CHEMISTRY (PAPER-VI)

Theory: 30 Hours, Marks-40 (Credits: 02)

Unit I : Gravimetric Analysis [6 Hrs.]

Introduction, Gravimetric analysis by precipitation: Nucleation, Crystal growth, Digestion/Ageing, Filtration, Drying, Ignition, Weighing, Optimum conditions for good precipitation, Physical nature of precipitate, Purity of precipitate: Co-precipitation, Post-precipitation, Organic precipitates and their applications.

Unit II : Water Analysis [4 Hrs.]

Physical analysis of water : pH, Conductance, Colour, Odour, Turbidity and Taste, Chemical analysis, Total dissolved solids, Hardness and its determination, Salinity, Alkalinity, Acidity, Sulphates, Nitrates, Dissolved oxygen, Chemical oxygen demand, Biological oxygen demand.

Unit III : Corrosion and Electroplating [6 Hrs.]

A) Corrosion: Introduction of corrosion, Electrochemical theory of corrosion, Factors affecting on corrosion

- (i) Position of metals in the electrochemical series on the basis of standard reduction potential
- (ii) Purity of metal
- (iii) Effect of moisture
- (iv) Effect of oxygen (differential aeration principle)
- (v) Hydrogen overvoltage, Methods of protections of metals from corrosion, Alloy formation, Making metal cathodic, Controlling external condition. Coating - Galvanising, Tinning, Electroplating, Metal cladding, Organic coating.

(B) Electroplating:

Electrolysis, Faraday's laws, Cathode current efficiency, Basic principles of electroplating, Cleaning of articles, Electroplating of chromium, Anodising.

Unit IV : Chromatographic Techniques [7 Hrs.]

Introduction, Classification. Column chromatography: Introduction, Types, Principle of adsorption column chromatography, Solvent system, Stationary phases, Methodology-Column packing, Applications of sample, Development, Detection methods, Recovery

of components, Applications. Ion exchange chromatography
Introduction, Principle, Types and Properties of ion exchanger
Methodology-Column packing, Application of sample, Elution
Detection/Analysis, Applications.

Unit V : Petroleum Industry, Biofuels and IPR

[7 Hrs]

[A] Petroleum Industry : Introduction, Occurrence, Composition of petroleum, Resources, Processing of petroleum, Calorific value of fuel, Cracking, Octane rating (Octane number), Cetane number, Flash point, Petroleum refineries, Applications of petrochemicals, Synthetic petroleum, Lubricating oils and additives.

[B] Biofuels: Biodiesel, Bio-ethanol.

[C] IPR: Introduction to Copyright and Trademark.

REFERENCE BOOKS:

1. Principles of Physical Chemistry by Puri, Sharma and Pathania Vishal Publishing Company Jalindhar.
2. Essentials of Physical Chemistry by Bahl B.S., Tuli G.D. and Bahl Arun, S. Chand and Company Ltd. New Delhi.
3. Modern Analytical Chemistry by David Harvey, Mc Graw-Hill International Edition, 2000.
4. Industrial Chemistry by B. K. Sharma, Goel Publishing House 16th Edition 2011.
5. Advanced Inorganic Chemistry, Vol. No. 1, by Gurudeep Raj Krishna Prakashan Media Ltd., Goel Publication, Meerut.
6. Analytical Chemistry by B. K. Sharma, Krishna Prakashan Media Ltd, Meerut, Edition 3rd, 2011.
7. Principles of Electroplating and Electroforming by Blum and Hogaboom.
8. Chemical Process Industries by Shreve and Brink.
9. Industrial Chemistry by Loutfy Madkor and Helen Njenga.
10. Elementary Principles of Chemical Processes by Richard Felder and Ronald Rousseau, John Wiley and Sons.

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