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## SECOND-YEAR OF MASTER OF SCIENCE CHEMISTRY REVISED SYLLABUS ACCORDING TO CBCS NEP2020

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COURSE TITLE: ADVANCE INSTRUMENTAL TECHNIQUES-II  
SEMESTER-IV  
W.E.F. 2024-2025

**RECOMMENDED BY THE BOARD OF STUDIES IN CHEMISTRY  
AND  
APPROVED BY THE ACADEMIC COUNCIL**

Devrukh Shikshan Prasarak Mandal's  
Nya. Tatyasaheb Athalye Arts, Ved. S. R. Sapre Commerce, and  
Vid. Dadasaheb Pitre Science College (Autonomous), Devrukh.  
Tal. Sangameshwar, Dist. Ratnagiri-415804, Maharashtra,  
India

Academic Council Item No:

Name of the Implementing Institute	:	Nya. Tatyasaheb Athalye Arts, Ved. S. R. Sapre Commerce, and Vid. Dadasaheb Pitre Science College (Autonomous), Devrukh. Tal. Sangameshwar, Dist. Ratnagiri-415804,
Name of the Parent University	:	University of Mumbai
Name of the Programme	:	Master of Science
Name of the Department	:	Chemistry
Name of the Class	:	Second Year
Semester	:	Four
No. of Credits	:	04
Title of the Course	:	Advance Instrumental Techniques-II
Course Code	:	S611CHT
Name of the Vertical in adherence to NEP 2020	:	Compulsory Major
Eligibility for Admission	:	Chemistry Graduate learner seeking Admission to Post Graduate Programme in adherence to Rules and Regulations of the University of Mumbai and Government of Maharashtra
Passing Marks	:	40%
Mode of Assessment	:	Formative
Level	:	PG
Pattern of Marks Distribution for SEE and CIA	:	60:40
Status	:	NEP-CBCS
To be implemented from Academic Year	:	2024-2025
Ordinances /Regulations (if any)	:	

## Syllabus for Second Year of Master of Science in Chemistry

(With effect from the academic year 2024-2025)

**SEMESTER-IV**

**Paper No.- II**

**Course Title: Advance Instrumental Techniques - II**

**No. of Credits - 04**

**Type of Vertical: Compulsory Major**

**Course Code: S611CHT**

**Learning Outcomes Based on BLOOM's Taxonomy:**

After completing the course, the learner will be able to...		
Course Learning Outcome No.	Blooms Taxonomy	Course Learning Outcome
CLO-01	Understand	Explain principle, instrumentation and applications involved in spectral method, radiochemical – thermal and hyphenated technique.
CLO-02	Understand	Describe working of interface used in hyphenated techniques
CLO-03	Apply	Illustrate applications of spectral method , radiochemical – thermal and hyphenated technique.
CLO-04	Analyze	Distinguish between TG-DTA and TG-DSC as well as TG-MS and TG-FTIR.

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(With effect from the academic year 2024-2025)

**SEMESTER-IV**

**Paper No.- II**

**Course Title: Advance Instrumental Techniques - II**

**No. of Credits - 04**

**Type of Vertical: Compulsory Major**

**Course Code: S611CHT**

COURSE CONTENT			
Module No.	Content	Credits	No. of Hours
1	<b>Unit 1: Spectral Method - III</b> <ul style="list-style-type: none"><li>NMR Spectroscopy : Theory and Instrumentation- recapitulation, FTNMR, 2D NMR,- FID signal generation mechanism, Techniques in 2D NMR- homo nuclear correlation spectroscopy (COSY), total correlation spectroscopy (TOCSY), heteronuclear correlation (HETCOR)</li><li>Radio waves in imaging- principle instrumentation and applications of MRI</li><li>Application of NMR to other nuclei C<sup>13</sup>, P<sup>31</sup> and F<sup>19</sup> spectroscopy</li></ul>	01	15
2	<b>Unit 2: Spectral Method -IV</b> <ul style="list-style-type: none"><li>Mass spectroscopy: recapitulation, correlation of mass spectra with molecular structure- interpretation of mass spectra, analytical information derived from mass spectra- molecular identification, metastable peaks, Fragmentation Reactions</li><li>Raman spectroscopy: Principle Theory Instrumentation , techniques(SERS and Resonance Raman) and Applications of Raman spectroscopy</li></ul>	01	15
3	<b>Unit 3: Radiochemical and Thermal Method</b> <ul style="list-style-type: none"><li>Activation analysis- NAA, radiometric titrations and radio-release methods.</li><li>Thermal analysis- Principle, Interfacing, instrumentation and Applications of Simultaneous Thermal Analysis- TG-DTA and TG-DSC</li></ul>	01	15
4	<b>Unit 4: Hyphenated Techniques</b> <ul style="list-style-type: none"><li>concept of hyphenation, need for hyphenation, possible hyphenations.</li></ul>	01	15

	<ul style="list-style-type: none"> <li>• Interfacing devices and applications of GC – MS, ICP-MS, GC - IR,</li> <li>• Tandem Mass Spectrometry, LC – MS: HPLC-MS, CE-MS .</li> </ul>		
	<b>Total</b>	<b>4</b>	<b>60</b>

### Access to the Course

The course is available for second year students admitted for Master of Science.

### Methods of Assessment

The assessment pattern would be 60:40, 60% for Semester End Examination (SEE) and 40% for Continuous Internal Assessment (CIA). The structure of the SEE and CIA would be as recommended by the Board of Studies and approved by the Board of Examination and the Academic Council of the college.

### References:

1. Analytical Chemistry, G. D. Christian, 4<sup>th</sup> Ed. John Wiley, New York (1986)
2. Fundamentals of Analytical Chemistry, D. A. Skoog and D. M. West and F. J. Holler 6<sup>th</sup> Edition (1998)
3. Principles of Instrumental Analysis, D. A. Skoog, F. J. Holler and J.A. Niemann 5<sup>th</sup> Ed.
4. Instrumental methods of Analysis, H. H. Willard, L. L. Merritt Jr, J. A. Dean and F. A.
5. Thermal methods of Analysis, P. J. Haines, Blackie Academic & Professional, London (1995)
6. Thermal Analysis, 3<sup>rd</sup> Edition W. W. Wendlandt, John Wiley, N.Y. (1986)
7. Principles and Practices of X-ray spectrometric Analysis, 2<sup>nd</sup> Ed E. P. Bertain, Plenum Press, NY, (1975)
8. Nuclear Analytical Chemistry, D. Bane, B. Forkman, B. Persson, Chartwell - Bratt Ltd (1984)
9. Standard Methods of Chemical Analysis, Eds. F. J. Welcher, Robert E. Krieger Publishing Company, A series of volumes
10. A Complete Introduction to Modern NMR Spectroscopy 1<sup>st</sup> Edition by Roger S. Macomber
11. Spectrometric Identification of Organic Compounds Hardcover – by Robert M. Silverstein Wiley
12. Encyclopedia of Analytical Science, Editors-in-Chief: Paul Worsfold, Alan Townshend, and Colin Poole ISBN: 978-0-12-369397-6
13. Introduction to Thermal Analysis Techniques and Applications Edited by Michael E. Brown