

Semester	JAN 2022
Open to semester	4
Course code	<b>CH2213</b>
Course title	<b>Analytical Chemistry</b>
Credits	3 /
Course Coordinator & participating faculty (if any)	M. Jayakannan
Nature of Course	Lectures and Tutorials
Pre-requisites	NIL
Objectives (goals, type of students for whom useful, outcome etc)	<p>This course will be focused on teaching fundamentals in analytical chemistry concepts, methodologies, and instrumentation techniques for the analysis of chemical and biological molecules. Advanced material characterization tools and its application to research and modern technology will be emphasized. Problem solving abilities and exposure to advanced instrumentation facilities in the institute will be incorporated to get hands-on experience in sample preparation and analysis to gain necessary Skill-development in student's UG curriculum. This course will be highly beneficial to the undergraduate students who are highly inclined and motivated to become experimental scientist in the branches of chemistry, biology, physics and interdisciplinary subjects.</p>
Course contents (details of topics /sections with no. of lectures for each)	<p>Course Content</p> <p>Total number of Lectures: 28</p> <p>Topic-1: Introduction to Analytical Chemistry: (3 Lectures): The need of Analytical chemistry, Quantitative and qualitative analysis, density and gravity of solutions, Chemical stoichiometry, volumetric calculations-normality and molarity, Determination of errors- Precision and Accuracy, Standard deviation, Student T-test, etc</p> <p>Topic-2: Separation of Chemical compounds: (7 Lectures): Solvent and solid-phase extraction, Extraction in laboratory and industrial scale, Chromatography-principles and theory; Column, Gas and liquid chromatography techniques, Various type of Chromatography instruments (HPLC, chiral-HPLC,</p>

GPC) for both purification and estimation of organic compounds, proteins and polymers, etc. Size and shape-dependent, molecular weight-dependent, and charge-dependent isolation of proteins and polymers, natural products, etc. Extraction of medicinal products by imprinting technology, etc.

Topic-3: Spectro-analytical Chemistry (7 Lectures): Application of spectroscopy for the structural characterization of compounds by Absorbance spectroscopy, Fluorescence spectroscopy, NMR spectroscopy, FT-IR spectroscopy, and various mass spectrometry techniques such as GC-MS, LC-MS, HRMS, MALDI-TOF, ESI-LS, different ionization techniques, and their application for molecular weights ranging from 200 Da to 100,000 Da. Electrochemical cells and electrode potential, Glass pH electrodes, accuracy of pH measurements, electroanalytical tools for advanced sensing technology, etc. (Please Note: only minimum amount of theory part will be discussed in order to understand the instrumentation part. Students are requested to take the spectroscopy course for in-depth knowledge).

Topic-4: Advanced Material Characterization (7 Lectures): Thermal phase transitions in solids and amorphous materials, thermal stability and decomposition, determination of thermodynamic parameters: enthalpy and entropy in phase reversible transitions, determination of association or binding constants by Isothermal calorimetric methods, determination of 2D layers and percent crystallinity by X-ray diffraction, determination of solution aggregates by light scattering (dynamic and static) and surface charges by Zeta potential, Imaging of micron and nano-sized objects by electron microscopy (SEM and TEM) and atomic force microscopy (AFM), etc.

Topic-5: Bio-analytical Methods (4 Lectures): Ultracentrifugation, Gel electrophoreses, Enzyme catalysis, DNA Sequencing, Imaging of micro-organism and cellular compartments by confocal microcopy, estimation of errors in imaging and quantification.

Guidelines for Hands-on-Experience Sessions

- This session will be planned on Saturday or other working

	<p>days depending upon the availability of the technical staff. It is not included in regular lectures/tutorials.</p> <ul style="list-style-type: none"> <li>• This session is not compulsory to all the students and it is based on voluntary basis. Only interested students will be allowed</li> <li>• Number of hours spend time in this training session will not be counted as part of the main lectures for attendance purpose.</li> <li>• No questions will be asked based on the hand-on-experience session and related materials in the examinations.</li> <li>• This session will be conducted with the help of Technical personals/senior Ph.D. students/TAs. In the current academic year 2021, these sessions may be conducted after the students come back to campus.</li> </ul>
Evaluation /assessment	<p>End-Sem Examination-50%  Mid-Sem Examination-50%  Others-%</p>
Suggested readings (with full list of authors, publisher, year, edn etc.)	<ol style="list-style-type: none"> <li>1. Gary D. Christian, Analytical Chemistry, Sixth Edition, Wiley (Indian Edition is available). (Most of the topics will be covered from this book)</li> <li>2. Douglas A. Skoog, Donald M. West, F. James Holler, Stanley R. Crouch, Fundamentals of Analytical Chemistry, Eight Edition, Cengage Learning (Copy Available in the IISER Library)</li> <li>3. Notes and Materials from latest Review Articles in Scientific Journals will be provided for specialized topics.</li> </ol>