INSTITUTE	**FACULTY OF SCIENCE**
PROGRAM	**MASTER OF SCIENCE (CHEMISTRY)**
SEMESTER	**3**
COURSE TITLE	**ADVANCED ANALYTICAL TECHNIQUES**
COURSE CODE	**02CY1501**
COURSE CREDITS	**6**

Course Outcomes: After completion of this course, student will be able to:

1 students will be able to understand Spectroscopic and spectrometric methods
2 Principle, theory, instrumentation and applications of spectroscopy
3 Aware about analysis and characterization of various compounds.
4 Students will be able to characterize and predict the compounds.

Pre-requisite of course: Students have understanding about the basics of spectroscopy.

Teaching and Examination Scheme

Theory Hours	Tutorial Hours	Practical Hours	ESE	IA	CSE	Viva	Term Work
4	2	0	50	30	20	25	25

Contents : Unit	Topics	Contact Hours
1	**UV-Visible Spectrophotometry** Principles of UV-Visible Spectrophotometry, theory and applications. Theory of electronic spectroscopy, absorption by organic molecules, choice of solvent and solvent effects. Instrumentation, light source sample preparation.	5
2	**Infrared Spectroscopy** Introduction, IR Frequency Range and Spectrum Presentation, Theory of Infrared Absorption, Dispersive Spectrometers, Fourier Transform Spectrometers, Hyphenated Methods Involving Infrared, Analytical Information : Qualitative and Quantitative Applications	15

Contents : Unit	Topics	Contact Hours
3	**Nuclear Magnetic Resonance Spectroscopy** Introduction to NMR, Rules predicting spin numbers of nuclei and calculation of spin numbers of elements responding to NMR, Equivalent and non-equivalent protons, chemical shift, chemical shifts of different types of protons and position of PMR signals, spin spin coupling, coupling constants, instrumentation, solvents used in NMR, interpretation of NMR spectra, Application and limitations of NMR spectroscopy, 13C NMR introduction, position of different types of carbon in 13C NMR spectra, interpretation of 13C NMR spectra, introduction to 2D NMR, COSY, NOESY, HMBC and HSQC	25
4	**Mass spectrometry** Principle, theory, instrumentation, types of ions produced in mass spectrometer, interpretation of mass spectra, examples of mass spectra, quantitative analysis and applications	15
Total Hours		**60**

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
1	**Tutorials** Tutorial-1, Tutorial-2, Tutorial-3, Tutorial-4, Tutorial-5, Tutorial-6, Tutorial-7, Tutorial-8, Tutorial-9, Tutorial-10	
Total Hours		

References:

1. Handbook of Spectroscopy, Handbook of Spectroscopy, Günter Gauglitz, Dr. David S. Moore, Wiley-VCH Verlag GmbH & Co. , 2014
2. Instrumental methods of chemical analysis, Instrumental methods of chemical analysis, Gurdeep R. Chatwal, Sham K. Anand, Himalaya Publishing House, 2011
3. Introduction to instrumental analysis , Introduction to instrumental analysis , R.D.Broun, McGraw Hill , 1987
4. Instrumental methods of chemical analysis , Instrumental methods of chemical analysis , H. willard, L.Merrit, J.A. Dean and F.A. Settle, CBS, 1986
5. Instrumental methods of chemical analysis, In; Introduction to Analytical chemistry, Instrumental methods of chemical analysis, In; Introduction to Analytical chemistry, Sharma BK, Goel Publishing House Meerut, 2004

Suggested Theory Distribution:

The suggested theory distribution as per Bloom's taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery and evaluation

Remember / Knowledge	Understand	Apply	Analyze	Evaluate	Higher order Thinking
10.00	20.00	25.00	25.00	10.00	10.00

Instructional Method:

1. The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.
2. The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.
3. Practical examination will be conducted at the end of semester for evaluation of performance of students in laboratory.
4. Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory.
5. Use of hazardous/toxic chemicals should be avoided as far as possible in laboratory.
6. All students in the laboratory must wear safety goggles and lab coats during lab session.

Supplementary Resources:

1. http://www.nptel.ac.in/courses/104103069/#
2. http://ocw.mit.edu/courses/chemistry/
3. http://vlab.amrita.edu/index.php?sub=2
4. http://www.vlab.co.in/ba_labs_all.php?id=9