



Course Syllabus
Gyanmanjari Science College
Semester-1(M.Sc.)

Subject: Instrumental Techniques-I – MSCFS11504

Type of course: Major

Prerequisite: Students should have a basic knowledge of advanced analytical technique used in forensic science.

Rationale: The Prerequisite provides the foundation for understanding the concepts of basic instrumental technique.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks					Total Marks
CI	T	P		C	Theory Marks		Practical Marks		
			ESE		MSE	V	P	ALA	
4	0	0	4	60	30	10	00	50	150

Legends: CI-Class Room Instructions; T – Tutorial; P - Practical; C – Credit; ESE - End Semester Examination; MSE- Mid Semester Examination; V – Viva; CA - Continuous Assessment; ALA- Active Learning Activities.



Course Content:

Unit No.	Course content	Hrs	% Weight age
1	General spectroscopic techniques : Spectroscopy, spectrometry and spectrum. Electromagnetic radiation, wavelength, wave numbers and frequency, electromagnetic spectrum. Regions of electromagnetic spectrum and types of molecular spectrums. Types of molecular energies- translational, rotational, vibrational and electronic. Types of molecular spectroscopy IR, microwave, UV, visible, NMR, ESR and Mass.	15	25
2	Ultraviolet spectroscopy: Various spectral regions of electromagnetic spectrum in terms of frequency and wave number, Morse potential energy curve, Frank Condon principle, electronic excitation, simple Chromophoric groups, Oxochromic groups, conjugated systems, systems of extended conjugation, aromatic systems, red and blue shifts, Hyperchromic and Hypsochromic effects, Woodward, Fieser Scott rules for predesigning of organic functional groups viz conjugated dienes, unsaturated carbonyl compounds, aromatic compounds.	20	25
3	Visible spectroscopy: d-d transitions, selection rules and intensities of the transitions, hole formalism, Jahn teller theorem, visible spectra of transition metal complexes, spectrum for d^1 and d^9 (Ti^{+3} and Cu^{2+}) systems, Orgel diagram, derivation of Russell Sounder's terms (spectral terms) with example.	10	25
4.	Infrared Spectroscopy: Introduction to IR and FTIR, principle & theory of Infrared absorption spectrometry, Infrared sources and transducers, Sample handling, Instrumentation, Interpretation of IR spectra, Applications, and limitations of IR spectroscopy.	15	25



Continuous Assessment:

Sr. No	Active Learning Activities	Marks
1.	Electromagnetic Radiation: Ask students to draw attractive EMR in drawing sheet with details of frequency and upload it on GMIU Web portal	10
2.	Chromophore and Oxochrome: Ask student to provide ten names of Chromophores and ten names of Oxochrome. Prepare a list and uplod it on GMIU Web portal.	10
3.	Applications: Provide details of how modern spectroscopic techniques used in Forensic Science. Give atleast two examples where these techniques used to solve the crime.	10
4.	Molecule identification from IR Graph: Assign student 5 IR graphs and ask them to systematically identify the molecule.	10
5.	Literature Review: Provide atleast 3 research papers to students and tell them to prepare a short note from the papers and upload it on GMIU Web portal.	10
Total		50

Suggested Specification table with Marks (Theory):60

Distribution of Theory Marks (Revised Bloom's Taxonomy)						
Level	Remembrance (R)	Understanding (U)	Application (A)	Analyze (N)	Evaluate (E)	Create (C)
Weightage	30%	30%	30%	10%	00	00

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcome:

After learning the course the students should be able to:	
CO1	Define terminology associated to spectroscopic technique
CO2	Analyze samples through UV spectroscopic technique



CO3	Examine samples in colourimeter through concept of visible spectroscopy
CO4	Investigate samples through infra red spectrometric techniques

Instructional Method:

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.

From the content 10% topics are suggested for flipped mode instruction.

Students will use supplementary resources such as online videos, NPTEL/SWAYAM videos, e-courses, Virtual Laboratory

The internal evaluation will be done on the basis of Active Learning Assignment
Practical/Viva examination will be conducted at the end of semester for evaluation of performance of students in laboratory.

Reference Books:

- [1] Instrumental methods of chemical analysis; 5th edition, Ewing G. W.; McGraw Hill Higher Education
- [2] Spectroscopy of organic compounds; 6th edition, P. S. Kalsi; New Age International Publishers
- [3] Spectroscopy, 12th edition, B K Sharma; Goel Publishing House, Meerut

