

Chromatographic Techniques (4 credits, 60 hours)

Objective: Basic understanding with hands-on training of the various chromatographic techniques

1) Paper and Thin layer chromatography (TLC)		Hours
	Fundamentals and Principles of paper and Thin Layer Chromatography (TLC), Mobile phases, Stationary phases-Normal phase and Reverse phase, Detectors, Staining solutions (KMnO ₄ , Ninhydrin, PMA and others), Applicability and Importance with examples	6
2) Gas Chromatography (GC)		
	Fundamentals and Principles of Gas Chromatography (GC), Instrumentation, Sample preparation, Mobile phases, Injectors, GC columns, GC detectors ((Thermal Conductivity Detector (TCD), Flame Ionization Detector (FID), Mass Selective Detector (MSD) and others)), Applications and importance with examples, Limitations, Data processing and interpretation, Hands-on training	14
3) High Performance Liquid Chromatography (HPLC)		
	Fundamentals and Principles of High Performance Liquid Chromatography (HPLC), Instrumentation, Types of HPLC–Normal phase HPLC, Reverse Phase HPLC, Ion Exchange Chromatography (IEC), Size exclusion chromatography, Mobile phases, Sample preparation, Limitations of HPLC, HPLC injectors, HPLC pumps, HPLC columns, HPLC detectors (UV-Visible detector, Diode array detector, Refractive index detector and others), Elution systems-Isocratic and Gradient, Applications with examples, Hands-on training	16
4) Gas Chromatography–Mass Spectrometry (GC-MS)		
	Fundamentals and Principles of Gas chromatography–mass spectrometry (GC-MS), Instrumentation, Ionization, Detectors–Mass Selective Detector (MSD), Time of flight (TOF) and others, Data analysis, Applications with examples, Hands-on training	14
5) Liquid Chromatography–Mass Spectrometry (LC–MS)		
	Fundamentals and Principles of Liquid Chromatography–Mass Spectrometry (LC–MS), Instrumentation, Ionization, MS analysis, Applications with examples, Hands-on training	10

Recommended books:

1. An introduction to separation science, B. L. Karger, L. R. Snyder, C. Horvath, 1st edition, Wiley Interscience.
2. Principles and practice of chromatography, Raymond P. W. Scott, Chrom-Ed Book Series.

Methodology: Lectures supplemented with hands on training and case studies that may include visits.

Assessment: Final assessment by written and group discussion. Skill based assessment will be as per the case study.