23CE803   Environmental sample preparation and Analysis   3-1-0-4

Course Description and Objectives:

To provide concepts on the environmental sample preparation, detection and analysis of contaminants and to further characterize the material for Environmental applications.

Learning objectives :

1.To understand and apply the environmental sample preparation, detection and analysis of contaminants

2. To understand the principles and operation of a range of advanced techniques used in characterization of various materials and compounds.

3.To apply appropriate characterization techniques for microstructure examination at different magnification level for materials and water analysis.

4. To analyse the data and results obtained from advanced characterization techniques.

Pedagogy: Conceptualising, applying & analysing

Syllabus:

Pollutants in the environment and their sources ; general classifications of pollutants and their chemical structures, properties and toxicity; units of measurement errors in quantitative analysis, precision and accuracy in measurement, statistics in microanalysis, control charts, and detection limit

Environmental sample Preparation techniques and methods. Sample collection, Sample extraction, preservation and analysis of the data.

Sample Quantification methods: Wet methods: Titrimetric and colorimetric procedures, Beers law and spectroscopic methods; Gas chromatography: Principles of chromatography; peaks separation; quantification methods, external and internal standard methods; High performance liquid chromatography -ion chromatography. Mass spectrometry: Interpretation of mass spectra, basic GC/MS instrumentation, Atomic spectroscopy: flame and furnace atomic absorption spectroscopy, inductively coupled plasma emission spectroscopy

Sample characterization techniques; Spectroscopic methods-UV-Visible and vibrational spectroscopy- Infrared and Raman, Electron spectroscopies- X-ray photoelectron spectroscopy.Raman spectroscopy. Principle of X-ray diffraction (XRD), Importance of Rietveld refinement in XRD (fundamental), X-ray fluorescence (XRF), Energy dispersive X-ray analysis (EDAX),Ultraviolet-visible spectroscopy, Fourier transform infrared (FTIR) spectroscopy,.

Term projects with real time case studies : Sample extraction and analysis for real time samples

References:
1. ASM Handbook: Materials Characterization, ASM International, 2008.

2. Yang Leng: Materials Characterization-Introduction to Microscopic and Spectroscopic Methods, John Wiley & Sons (Asia) Pte Ltd., 2008.

3. Advanced Techniques for Materials Characterization, Materials Science Foundations (monograph series) A.K. Tyagi, MainakRoy,S.K.Kulshreshtha and S.Banerjee;, Volumes 49 – 51 (2009)

4. Materials Characterization Techniques Sam Zhang, Lin Li, Ashok Kumar;CRC press,(2008)

Course Outcomes:

1.Understand and apply the environmental sample preparation, detection and analysis of contaminants

2.Understand the principles and operation of a range of advanced techniques used in characterization of various materials and compounds.

3.Apply appropriate characterization techniques for microstructure examination at different magnification level for materials and water analysis.

4. Analyse the data and results obtained from advanced characterization techniques

Evaluation Criteria

1. Midterm -30%
2. Continuous Assessment: 30%
3. End semester exam: 40%

Employability: Design Consultancies