

Syllabus (CBCT from FET for Ph D students only)

FP 702: Advanced Analytical Techniques

Gas liquid chromatography: principle; different types of detectors and its applications: discharge ionization detector (DID), electron capture detector (ECD), flame photometric detector (FPD), Hall electrolytic conductivity detector (EICD), helium ionization detector (HID), Nitrogen phosphorous detector (NPD), mass selective detector (MSD), photo-ionization detector (PID), pulsed discharge ionization detector (PDD), thermal energy analyzer (TEA); various applications of GLC.

High performance liquid chromatography (HPLC): different types of HPLC and their principles; Normal phase chromatography, Reverse phase chromatography, Size exclusion chromatography, Ion exchange chromatography, Bioaffinity chromatography, Isocratic flow and gradient elution, various Applications of HPLC.

High performance thin-layer chromatography (HPTLC): principles and applications. Electrophoresis: current tools used to assess the safety of food and feed derived from modern biotechnology.

Amino acid analysis by different techniques like Amino acid analyzer, etc.

Rapid Visco Analyser (RVA): its application as a laboratory scale rheological tool.

Differential scanning calorimetry: principles and its applications.

Atomic absorption spectroscopy: principles and its applications.

Inductively coupled plasma atomic emission spectroscopy (ICP-AES): principles and its applications.

Gas chromatography-mass spectrometry (GC-MS): principles and applications in foods, flavors and fragrances, residue analysis of veterinary hormonal substances and endocrine disruptors, identification of terpenes.

Liquid chromatography-mass spectrometry (LC-MS): principles and applications, plant phenols, proteins, proteomics, LC-MS for identification of post-translational modifications, oligosaccharides, lipids and phospholipids, nucleic acids.

Scanning Electron Microscopy principles and applications, study of the structure of a variety of food gels.

Non Destructive Techniques in Food Analysis: optical methods like visible, NIR, and FTIR spectroscopy; computer vision, delayed light emission and fluorescence; X-ray imaging for classifying food products based on internal defects; nuclear magnetic resonance techniques ; ultrasonics; firmness-measurement methods; linear viscoelastic methods; biosensors in food quality evaluation, new techniques for food quality data analysis and control

Microbial techniques in food analysis: Infectious and toxigenic agents of food borne diseases: detection, identification and control methods. Antibiotic resistant strains; methods of detection-conventional, modern, rapid methods, genetic approaches.

Molecular based techniques in food analysis: Gel Electrophoresis of Plasmid DNA, Polymerase Chain Reaction (PCR) & Sequencing; Setting up a Gene-Specific Polymerase Chain Reaction, Gel Electrophoresis of Gene-Specific PCR Products, Determining DNA Concentration Using Fluorometer, Amplification of cDNA Using PCR, Sequencing of Gene-Specific Products. Real-time PCR assay for detection of microbial spoilage of foods.

Practicals: Practical will be performed on most of the above referred methods will depend on equipment available. .

Books:

1. Francis Rouessac and Annick Rouessac. *Chemical Analysis: Modern Instrumentation Methods and Techniques*, John Wiley & Sons Ltd. 2007
2. C. Moir. *Spoilage of Processed Foods: Causes and Diagnosis..* AIFST Inc. (NSW Branch) Food Microbiology Group, Sydney. 2001
3. C. Blackburn. *Food Spoilage Microorganisms*. CRC Press, 2006
4. D. Tagu and C. Moussard, *Techniques of Molecular Biology*, Science Publishers, 2006
5. Lawrence Jack Bradshaw, *Introduction to Molecular Biological Techniques*, Prentice-Hall, 1966
6. Julian Burke, *PCR: Essential Techniques*, John Wiley & Sons, 1996

References:

1. B. Welz, *Atomic Absorption Spectrometry*, Third Edition, Wiley-VCH, Weinheim, Germany 1998
2. Eugene F. Barry; Grob, Robert Lee. *Modern practice of gas chromatography*. New York: Wiley-Interscience. 2004
3. Wilfried M.A. Niessen, Wilfried M. Niessen. *Liquid Chromatography-Mass Spectrometry*, Third Edition (Chromatographic Science). Boca Raton: CRC. 2006
4. M.P. Doyle and M. Doyle, *Food Microbiology: Fundamentals and Frontiers*, 3rd ed. ASM Press. 2007.
5. Querol and G.H. Fleet. *Yeasts in Food and Beverage*. Springer Publishing, 2006
7. Kary B. Mullis, François Ferré and Richard A. Gibbs, *The Polymerase Chain Reaction: A Textbook*, Birkhäuser, 1994