

## Hands on training of sophisticated instruments Syllabus

### Learning Objective:

The objective of this course is to understand the working mechanism and details of sophisticated instruments, and to perform experiments/ testing for characterization and important analysis.

### Course Outcomes:

CO No.	Expected Course Outcomes	CL
1	At the end of the course, the students will be able to : Handle X-Ray diffraction and FTIR instruments.	Ap
2	Perform the Thermal Analysis using TGA and DSC and Electrical analysis by EIS.	An
3	Operate spectro fluorophotometer and TLD reader.	An
4	Perform astronomical observations using Telescope	An

CL: Cognitive Levels (**R**-Remember; **U**-Understanding; **Ap**-Apply; **An**-Analyze; **E**-Evaluate; **C**-Create).

### Detail Syllabus

#### Unit 01:

**Structural Analysis:** X-Ray and its interaction with matter, X-Ray diffraction and Bragg's Law, X-Ray beam Production techniques, Methods of structural analysis using X-Ray diffraction: 1) Laue's Method, 2) Rotating crystal method and 3) Powder Method; X-Ray diffractogram of crystalline and amorphous phases, Crystallite size determination using Scherrer's formula, Various components of XRD machines.

**Compositional Analysis:** Infrared radiation (IR) and its interaction with matter, IR production, Fourier Transform IR: Principle and instrumentations.

#### Unit 02:

**Thermal Analysis:** Thermal Gravimetric Analysis (TGA): principle and instrumentation, Differential Scanning Calorimetry (DSC): principle and instrumentation.

**Electrical Analysis:** Electrochemical Impedance Spectroscopy (EIS): principle and instrumentation, Nyquist Plot and determination of electrical Conductivity.

#### Unit 03:

**Thermoluminescence:** Luminescence, classification of luminescence, fluorescence, phosphorescence, phosphors; thermoluminescence, theory and working, instrumentation, TL glow curve, kinetic parameters, methods using for TL study, applications of thermoluminescence.

**Photoluminescence:** Introduction, types of photoluminescence, spectro fluorophotometer, block diagram, emission and excitation spectra, theory and working mechanism, applications of photoluminescence.

#### Unit 04:

**Telescope:** Types of Telescope: Refracting telescope and Reflecting telescope, Astronomical Telescopes: why Reflectors?, Telescope designs: Prime-focus, Newtonian, Cassegrain and Schmidt-Cassegrain. Telescope mounts: Altitude-azimuth mount and Equatorial mount. Celestial sphere and constellations.

*Amelia*  
25/24

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