



# MATERIAL CHARACTERIZATION

**PROF. SANKARAN.S**

Department of Metallurgical and Materials Engineering  
IIT Madras

**TYPE OF COURSE** : Rerun | Core | UG/PG

**COURSE DURATION** : 12 weeks (24 Jan' 22 - 15 Apr' 22)

**EXAM DATE** : 23 Apr 2022

**INTENDED AUDIENCE** : Undergraduate students of Metallurgical and Materials, Physics, Chemistry and biological sciences

**INDUSTRIES APPLICABLE TO** : All the Metallurgical and automotive industries will be interested in this course

**COURSE OUTLINE :**

It is the first course at the under graduate level on microstructural characterization of materials. This course will cover the basic principles and techniques of X-ray diffraction, optical, scanning electron and transmission electron microscopy along with demonstrations of the instrument details and imaging experiments through videos. This course also deals with the sample preparation techniques for the microstructural analysis with practical examples through videos.

**ABOUT INSTRUCTOR :**

Prof. S.Sankaran is presently Associate Professor in the Department of Metallurgical and Materials Engineering, IIT Madras. His research interests are deformation processing of materials, mechanical behavior of materials and electron microscopy. He is also presently the faculty in-charge of central electron microscopy of IIT Madras.

**COURSE PLAN :**

**Week 1:** Fundamentals of optics

**Week 2:** Variants in the optical microscopes and image formation

**Week 3:** Sample preparation and applications of optical microscopes

**Week 4:** Introduction to Scanning electron microscopy (SEM)

**Week 5:** Instrumental details and image formation of SEM

**Week 6:** Various imaging techniques and spectroscopy

**Week 7:** Fundamentals of X-ray scattering

**Week 8:** Crystallite size, effect of strain on the intensity

**Week 9:** Quantitative analysis, residual stress analysis

**Week 10:** Introduction to transmission electron microscopy (TEM)

**Week 11:** Diffraction and image formation

**Week 12:** Sample preparation and applications of TEM