Material Characterization 3 Credits (3-1-0)

Introduction: Meaning/importance/need/role of examination & testing of materials, Scope of various examination and testing methods available viz Microscopic Examination/Metallography, Macroscopic Examination, Chemical Methods, Mechanical methods, Non-Destructive Testing (NDT) Methods, Spectroscopy.

Metallography/Microscopic Examination of Metals: Preparation & Etching of Specimens of metals & alloys. Principle, Construction & working of metallurgical microscope, Various Properties of microscope objectives, Defects in lenses & their remedies, Various types of objectives and eye pieces, TEM and SEM microscope

Macroscopic Examination of Metals: Introduction, Importance & scope of Macro etching, Sulphur/Phosphorus/Oxide Printing. Flow Lines

Chemical Methods: Gravimetric, Volumetric, Colorimetric, Electro-gravimetric, Fire Assaying & Polarographic Methods of Analysis

Mechanical Methods: Hardness testing, Tensile testing, Impact testing, Creep, Fatigue, Fracture, Nano indentation technique.

Non-Destructive Testing: X-ray/Gamma ray radiography, Ultrasonic testing, Magnetic methods- Magnetic particle test/Magna Flux, Zyglo/Die penetration test, Eddy current test, X-ray diffraction.

Advanced Characterization Techniques: Scanning probe microscope, X-ray fluorescence technique, Atomic absorption spectroscopy, Differential thermal analysis (DTA), differential scanning calorimeter (DSC), Thermo gravimetric analysis (TGA), Thermo mechanical analysis (TMA)

Books and References:

1. Qualitative and Quantitative Analysis/Alexive/MIR Publisher 1982.
2. Chemical and Metallurgical Analysis/ Vogel/Longman Scientific and Technical 1999.
3. X-ray Diffraction/B D Cullity/Addison-Wesley 1956
4. Testing of Materials/Davis and Troxell/McGraw-Hill 1998
5. Principles of Metallographic Laboratory Practice/G L Kehl/McGraw-Hill 1980