Course Type	Course Code	Name of Course	L	T	P	Credit
DP	NFMC521	Materials Characterization Lab	0	0	3	1.5

Course Objective
Develop a detailed understanding on the working principle of various characterization methods for various materials.
Learning Outcomes
Upon successful completion of this course, students will develop: ● an ability to identify appropriate characterization tools to measure specific properties. ● an idea about the working principle of the method and data interpretation.

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1	Characterization of mild steel using optical microscope	3	This experiment will help learn the principle of working with optical microscope and identify steel microstructure.
2	Characterization of Aluminum alloy using optical microscope	3	This experiment will help learn the principle of working with optical microscope and identify microstructures of Aluminum alloys.
3	Quantitative Metallography of metallic samples	3	This experiment will help learn the principles of quantitative metallography.
4	Identification of ferrite and martensite using colour tint etching	3	This experiment will help learn the principle of working with optical microscope and quantitative metallography using image analysis.
5	Microhardness measurement of steel and Aluminium alloy	3	This experiment will help learn the principle of working with a microhardness tester and generate hardness data from Steel and Aluminum samples.
6	Thermal characterization using DSC and TGA	3	This experiment will help learn the principle of working with Thermal Analysis equipment and identify various transformations during heating or cooling.
7	Identification of BCC and FCC samples using XRD	3	This experiment will help learn the working principle of x-ray diffraction and identify unknown sample from diffraction pattern.
8	Identification of phase composition using SEM EDS	3	This experiment will help learn the principle of working with SEM, EDS and identify local chemistry in a qualitative way.
9	Demonstration of TEM and XRF	3	This experiment will help learn the principle of working with TEM and XRF and interpretation of data.
10	Tensile testing of steel sample	3	This experiment will help learn the principle of working with tensile testing machine and generate, analyze data on mechanical properties of alloys.
11	Impact testing of steel sample	3	This experiment will help learn the principle of working with impact testing machine and measure toughness of alloys.

12	Wear test of steel samples	3	This experiment will help learn the principle of working with wear testing machine and measure the material loss.
13	Demonstration of EPMA/XPS	3	This experiment will help learn the principle of working with EPMA and data interpretation.
	Total	**39**	

Text Books:

1. Yang Leng. *Materials Characterization: Introduction to Microscopic and Spectroscopic Methods*, 2nd Edition, Wiley-VCH Verlag GmbH and Co., 2013.
2. George F. Vander Voort, *Metallography, principles and practice*. ASM international, 1999.

Reference Books:

1. Charles Brundle, Charles Evans (Jr.) and Shaun Wilson, *Encyclopedia of Materials Characterization*, Elsevier, 1992.