Course Type	Course Code	Name of Course	L	T	P	Credit
DE	NFMD505	Advanced Materials and Applications	3	0	0	3

Prerequisites: Students with B Tech inMetallurgy/Materials/Mechanical/Production/Chemical/Electrical/ Mineral/Mining or BSc/MSc in Chemistry/Physics

Course Objective
The main objective of the course is to understand various advanced materials, their processing, microstructure, and properties
Learning Outcomes
Upon completion of this course, students will be able to • Identify the advanced materials used for various applications • Understanding the physical metallurgy of advanced materials • Design new materials for future applications • Learn the properties and microstructural characteristics of materials

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1	Structure of Materials, Advances in ferrous and non-ferrous alloys	8	Students will learn an overview of the subject, details of ferrous and non–ferrous materials
2	Advanced Aluminium alloys, Shape memory alloys	8	Students will learn about the light weight alloys, shape memory alloys, and their properties
3	High-temperature materials- properties, structure, and applications, Superalloys- Fe-based, Ni-based, and Co-based alloys.	8	Students will learn about the high-temperature materials and their properties
4	High Entropy alloys, Ti-based alloys	6	Students will learn about the High entropy design strategies and advances in Ti alloys
3	Ceramics- structure and properties, Introduction to polymers, Composites and *In-situ* composites, Energy materials (fuel cells, batteries, energy storage systems, etc.),	4	Students will learn about the polymers, composites, ceramics, and their properties
4	Magnetic materials-properties and applications, Nanomaterials—synthesis, processing, and applications	5	Students will learn about the nanomaterials, magnetic materials, and their properties and synthesis
5	Materials Selection and Design Considerations, Introduction to Material Informatics and data-driven science, Application of machine learning in material design and development	3	Students will learn about the application of machine learning in alloy design and materials informatics
	Total	**42**	

Text Books:

1. Physical Metallurgy Principles, Reza Abbaschian, Lara Abbaschian, Robert E. Reed-Hill, Cengage Learning, Fourth Edition
2. Materials Science and Engineering, W.D. Callister, David G. Rethwisch, John Wiley & Sons, New York, USA, Tenth Edition.
3. Principles of Materials Science and Engineering, William F. Smith, McGraw-Hill, Fifth Indian Edition, New Delhi, 2017.

Reference Books:

1. Nanotechnology: A Gentle Introduction to the Next Big Idea, Mark Ratner and Daniel Ratner, Pearson Education, First Edition
2. Titanium, G. Lütjering, J.C. Williams, Second edition, Springer (2007)
3. The Superalloys Fundamentals and Applications, R.C. Reed, Cambridge University Press (2006)