COURSE TITLE	**ADVANCED MATERIAL PROCESSING TECHNIQUES**
COURSE CODE	**01CA1121**
COURSE CREDITS	**3**

Objective:

1 Intention is to develop an understanding of the principles, capabilities, limitations and applications of commonly used advanced materials processing technologies; and in-depth knowledge
of non-traditional materials processing, metal forming and micro-machining.

Course Outcomes: After completion of this course, student will be able to:

1 Apply non-conventional machining, forming, surface engineering, and joining processes to given manufacturing tasks.

2 Analyse micro-machining techniques to evaluate their suitability for fabrication of micro-devices.

3 Evaluate laser material processing parameters and their interaction effects for diverse industrial materials and applications.

4 Apply advanced fine finishing processes to analyse surface quality improvements in metallic materials.

Pre-requisite of course: Engineering Materials

Teaching and Examination Scheme

Theory Hours	Tutorial Hours	Practical Hours	ESE	IA	CSE	Viva	Term Work
3	0	0	50	30	20	0	0

Contents : Unit	Topics	Contact Hours
1	**Overview** Outline of advanced materials processing techniques: Non-Conventional Materials Removal Processes, Finishing Processes; Forming; Advanced Surface Engineering Processes; Joining Technologies.	2
2	**Advances in Nonconventional Machining Processes** A brief review of non-conventional machining processes, Analysis of mechanical, thermal and Electrochemical type non-traditional machining processes, Tool design for selected non-traditional machining processes. Modeling and simulation of selected processes, A comparative study of various processes	10

Contents : Unit	Topics	Contact Hours
3	**Advanced Fine Finishing Process** Abrasive Flow Machining; Magnetic Abrasive Finishing, Magneto Rheological Abrasive Finishing: Process, Principle, process equipment; Analysis and modeling of finishing mechanism, Parametric analysis; Applications.	7
4	**Advances in Metal Forming** Conventional processes-High Energy Rate Forming techniques, Explosive forming, Electro hydraulic forming, magnetic pulse forming, super plastic forming, rubber forming, flow forming-Principles and process parameters, Advantages , Limitations and Applications. , Overview of powder metal forming technique, Advantages, applications,, Powder perform forging, Hot and cold Iso-static pressing-powder rolling, Tooling and process parameters.	9
5	**Micro-Machining** Introduction to micromachining technologies, Micro electro discharge Machining, Principles of micro-EDM, micro-EDM by Die-sinking and WEDG, micro-WEDM, micro-WEDG, micro-ECM, Principles of micro-turning, micro-drilling and micro-milling, micro grinding, , Hybrid micro-machining method, on-line measurement by machine vision and integrated probe.	6
6	**Fabrication of Micro-Devices** Semiconductors – films and film de purification , Oxidation - diffusion – ion implantation – etching – metallization – bonding, Surface and bulk machining , LIGA Process – Solid free form fabrication	4
7	**Laser Material Processing** Fundamentals of industrial lasers, Laser materials interaction theories, Laser processing for various industries such as metals, non-metals, photovoltaic, bio-medical applications.	4
Total Hours		**42**

Textbook :

1 Fundamentals of Modern Manufacturing: Materials, Processes, and Systems, Mikell P. Groover, John Wiley & Sons, 2010

2 Manufacturing Engineering and Technology, Serope Kalpakjian, Steven R Schmid, Pearson Education, 2018

References:

1 Manufacturing Processes for Engineering Materials, Manufacturing Processes for Engineering Materials, Serope Kalpakjian , Pearson, 2007

2 Modeling of Metal Forming and Machining Processes: by Finite Element and Soft Computing Methods , Modeling of Metal Forming and Machining Processes: by Finite Element and Soft Computing Methods , P M Dixit, U M Dixit , Springer, 2010

3 Modern Machining Processes, Modern Machining Processes, Pandey, P.C., and Shan, McGraw-Hill Education, 2018

References:

4 Micromachining of Engineering Materials, Micromachining of Engineering Materials, J.A. McGeough, CRC Press, 2001

5 Fundamentals of Microfabrication: The Science of Miniaturization, Fundamentals of Microfabrication: The Science of Miniaturization, Marc J. Madou, CRC Press, 2002

Suggested Theory Distribution:

The suggested theory distribution as per Bloom's taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery and evaluation					
Remember / Knowledge	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Higher order Thinking / Creative**
15.00	15.00	20.00	15.00	20.00	15.00

Instructional Method:

1 Lecture and Discussion

Supplementary Resources:

1 https://nptel.ac.in/courses/113/105/113105081/