LOK JAGRUTI UNIVERSITY (LJU)

L J INSTITUTE OF ENGINEERING AND TECHNOLOGY

Department of Mechanical Engineering

Master of Engineering (M. E) - Semester – I

Course Code:	**49050106**
Course Name:	**Advanced Materials Processing Techniques**
Category of Course:	Elective
Prerequisite Course:	UG level course in Manufacturing

Teaching Scheme				
Lecture (L)	**Tutorial (T)**	**Practical (P)**	**Credit**	**Total Hours**
3	**0**	**2**	**4**	**40**

Course Objectives	
1	To develop an understanding of the principles, capabilities, limitations and applications of commonly used advanced materials processing technologies.
2	To provide knowledge of non-traditional materials processing, metal forming and micro-machining.
3	To provide insight for the latest developments in materials processing.
4	To cultivate the ability to develop and implement new improved manufacturing processes resulting in creation and distribution of value in engineering applications.

Syllabus

Unit No.	Topic	Prerequisite Topic	Teaching Hours
01	**Introduction**		**02 (6%)**
	1.1 Outline of advanced materials processing techniques: Non-Conventional Materials Removal Processes	---	
	1.2 Finishing Processes		
	1.3 Forming		
	1.4 Advanced Surface Engineering Processes		
	1.5 Joining Technologies		
02	**Advances in Non-Conventional Machining Processes**		**09 (22%)**
	2.1 A brief review of non-conventional machining processes	---	
	2.2 Analysis of mechanical, thermal and Electrochemical type non-traditional machining processes		
	2.3 Tool design for selected non-traditional machining processes		
	2.4 Modeling and simulation of selected processes		
	2.5 A comparative study of various processes		
03	**Advanced Fine Finishing Process**		**06 (15%)**
	3.1 Abrasive Flow Machining	---	
	3.2 Magnetic Abrasive Finishing		
	3.3 Magneto Rheological Abrasive Finishing: Process principle, process equipment		
	3.4 Analysis and modeling of finishing mechanism		
	3.5 Parametric analysis		
04	**Advances in Metal Forming**		**09 (22%)**
	4.1 Conventional Processes-High Energy Rate Forming Techniques-Explosive forming, electro hydraulic forming, magnetic pulse forming, super plastic forming, rubber forming, flow forming	---	
	4.2 Principles and process parameters		
	4.3 Advantages -Limitations and Applications		
	4.4 Overview of powder metal forming technique, Advantages, applications		
	4.5 Powder perform forging		
	4.6 Hot and cold Isostatic pressing, powder rolling		
	4.7 Tooling and process parameters		
05	**Micro-Machining**		**06 (15%)**
	5.1 Introduction to micromachining technologies	---	
	5.2 Micro electro discharge Machining: Principles of micro- EDM		
	5.3 Micro-EDM by Die-sinking and WEDG		
	5.4 Micro-WEDM, micro-WEDG, micro-ECM		
	5.5 Principles of micro-turning, micro-drilling and micro-milling, micro grinding, hybrid micro-machining method		
	5.6 On-line measurement by machine vision and integrated probe		
	5.7 Measuring Techniques in micro-machining		
	5.8 Surface integrity and other related measurements.		
06	**Fabrication of Micro-Devices**		**04 (10%)**
	6.1 Semiconductor surface and bulk machining	---	
	6.2 Films and film depurification		
	6.3 Oxidation		
	6.4 Diffusion		
	6.5 Ion implantation, etching, metallization, bonding		

	6.6 LIGA Process 6.7 Solid free form fabrication		
07	**Laser Materials Processing** 7.1 Fundamentals of industrial lasers 7.2 Laser materials interaction theories 7.3 Laser processing for various industries such as metals, non-metals, photovoltaic, bio-medical applications.	**---**	**04 (10%)**

Course Outcome	
1	Students will learn various non-conventional machining processes and will be able to select their respective parameters.
2	Students will learn fine finishing processes, micro-machining and fabrication of micro-devices.
3	Students will also learn materials processing using lesser.
Suggested Reference Books	
1	Fundamentals of Modern Manufacturing: Materials, Processes, and Systems, M P Groover Wiley India.
2	Manufacturing Engineering and Technology, 4/e, SeropeKalpakjian, Steven R Schmid, Pearson Education.
3	Manufacturing Processes for Engineering Materials, 5/e, SeropeKalpakjian Pearson Education.
4	Modeling of Metal Forming and Machining Processes by Finite Element and Soft Computing Methods, P M Dixit, U M Dixit Springer.
5	Modern Machining Processes, Pandey, P.C., and Shan, H.S.Tata McGraw-Hill Education.
6	Micromachining of Engineering Materials J.A. McGeough. CRC Press.
7	Fundamentals of Microfabrication Mark Madou CRC Press.
8	Advance Method of Machining McGeough, J.A Springer.
9	Laser Processing of Materials: Fundamentals, Applications and Developments, Peter Schaaf Springer.

Proposed Evaluation Scheme by Academicians (Percentage of Weightage out of 100%)					
Theory Descriptive Test		**MCQ Test**		**Hands on Project**	
Formulas and Derivation Test		**Numerical Test**		**Seminar**	

Practical Project/Hands on Project		
Sr. No.	**List of Practical Projects**	**Linked with Unit**
1	A comparative study of working principle and applications of various non-conventional machining processes.	Unit 1, 2
2	A comparative study of working principle and applications of various finishing processes.	Unit 3
3	Evaluation effects process parameters in Metal forming processes.	Unit 4
4	A comparative study of working principle and applications of various Micro-Machining processes, and study effects of process parameters of them.	Unit 5, 6
5	Study of process parameters of Laser processing.	Unit 7

List of Recommended MOOC Courses:

1) **https://www.coursera.org/learn/material-science-engineering**
2) **https://ocw.mit.edu/courses/materials-science-and-engineering/**
3) **https://onlinecourses.nptel.ac.in/noc19_mm13/preview**
4) **https://onlinecourses.nptel.ac.in/noc21_mm15/preview**