

GUJARAT TECHNOLOGICAL UNIVERSITY

MECHANICAL (CAD/CAM) (08) ADVANCED MATERIALS PROCESSING TECHNIQUES SUBJECT CODE: 3710807 M.E. Semester -I

Type of course: Engineering Science

Prerequisite: Zeal to learn the subject

Rationale: 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.

Teaching and Examination Scheme:

| Teaching Scheme | | | Credits C | Examination Marks | | | | Total Marks |
|-----------------|---|---|--------------|-------------------|--------|-----------------|--------|----------------|
| L | T | P | | Theory Marks | | Practical Marks | | |
| | | | | ESE(E) | PA (M) | PA (V) | PA (I) | |
| 3 | 0 | 2 | 4 | 70 | 30 | 30 | 20 | 150 |

Content:

| Sr. No. | Topics | Teaching Hrs. | Module Weightage |
|---------|---|---------------|------------------|
| 1 | Overview: Outline of advanced materials processing techniques: Non-Conventional Materials Removal Processes; Finishing Processes; Forming; Advanced Surface Engineering Processes; Joining Technologies. | 2 | 6 |
| 2 | Advances in Non-Conventional 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. Modelling and simulation of selected processes. A comparative study of various processes. | 10 | 22 |
| 3 | Advanced Fine Finishing Process: Abrasive Flow Machining; Magnetic Abrasive Finishing; Magneto Rheological Abrasive Finishing: Process principle, process equipment; Analysis and modelling of finishing mechanism; Parametric analysis; Applications. | 07 | 15 |
| 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 Isostatic pressing-powder rolling-Tooling and process parameters. | 9 | 22 |
| 5 | Micro-Machining : Introduction to micromachining technologies, Microelectro discharge Machining: Principles of micro-EDM, micro-EDM by Die-sinking and | 06 | 15 |

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|---|---|----|----|
| | 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, Measuring Techniques in micro-machining, surface integrity and other related measurements. | | |
| 6 | Fabrication of Micro-Devices Semiconductors – films and film depurification – Oxidation - diffusion – ion implantation – etching – metallization – bonding – surface and bulk machining – LIGA Process – Solid free form fabrication | 04 | 10 |
| 7 | Laser Materials Processing Fundamentals of industrial lasers. Laser materials interaction theories. Laser processing for various industries such as metals, non-metals, photovoltaic, bio-medical applications. | 04 | 10 |

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

List of Experiments:

1. A comparative study of working principle and applications of various non-conventional machining processes.
2. A comparative study of working principle and applications of various finishing processes.
3. Evaluation effects process parameters in Metal forming processes.
4. A comparative study of working principle and applications of various Micro-Machining processes, and study effects of process parameters of them.
5. Study of process parameters of Laser processing

Course Outcome:

After learning the course the students should be able to

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.