Mechanical Engineering Department
B. Tech. Semester VI

Course Name: **Advanced Manufacturing Processes** **Course Code: BTME14616**

Type of course : **Professional Elective Course**
Prerequisite : Basic Knowledge of Manufacturing Processes and Materials
Rationale of course : This course is designed to acquaint and motivate the student with the complex and interdisciplinary nature of advance manufacturing processes through a balanced coverage of relevant fundamentals and real-world problems.

Teaching and Examination Scheme:

TEACHING SCHEME				Theory Marks			Practical Marks		Total
L	T	P	C	TEE	CA1	CA2	TEP	CA3	
3	0	2	4	60	25	15	30	20	150

CA1: Continuous Assessment (assignments/projects/open book tests/closed book tests). **CA2**: Sincerity in attending classes/class tests/ timely submissions of assignments/self-learning attitude/solving advanced problems. **TEE**: Term End Examination. **TEP**: Term End Practical Exam (Performance and viva on practical skills learned in course). **CA3**: Regular submission of Lab work/Quality of work submitted/Active participation in lab sessions/viva on practical skills learned in course.

Contents:

Sr. No.	Content	Total Hrs	Module Weightage
1	**Advanced Materials:** Super alloys, ferro electric and piezoelectric materials, advanced magnetic materials, advanced engineering polymer materials, advanced ceramic and composite materials, smart materials.	5	10%
2	**Non-Conventional Machining Processes:** Introduction, different non-conventional machining process principal, material removal mechanism, parametric analysis and applications of processes such as ultrasonic machining (USM), abrasive jet machining (AJM), water jet machining (WJM), electrochemical machining (ECM), electro discharge machining (EDM), electron beam machining (EBM), laser beam machining (LBM) processes.	11	25%

3	**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 micromachining method.	**9**	**20%**
4	**Advanced Metal Forming Processes:** Principle, machines, process variables, characteristics, advantages, limitations and application of high energy rate forming process (HERF), high velocity forming (HVF), explosive forming, magnetic pulse forming, electro hydraulic forming, metal spinning, flow forming, stretch forming, incremental sheet metal forming.	**7**	**15%**
5	**Additive Manufacturing Process :** Additive manufacturing -evolution, the principle of layer-based technology, stereo-lithography, selective laser sintering, fused deposition modelling, laminated object manufacturing, LIGA process, materials and materials processing, rapid tooling, CAD modeling and data processing for RP , machine setup process parameters, errors in RP processes, application of additive manufacturing in various field.	**13**	**30%**

Percentage Distribution of Marks as per Revised Bloom's Taxonomy (Theory/Practical):

Percentage Distribution of Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
20	**30**	**30**	**10**	**05**	**05**

Legends: R: Remembrance, **U:** Understanding; **A:** Application, **N:** Analyze, **E:** Evaluate, **C:** Create and above Levels

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference/Text Books:

Sr. No.	Title of book /article	Author(s)	Publisher	Publication year	Publication Edition
1.	Unconventional Machining process	Dr. Senthil	A R S Publishers	2017	3rd
2.	Modern Machining Processes	P. C. Pandey, H. S. Shan	Tata McGraw-Hill	2017	-
3.	Design for Advanced Manufacturing: Technologies and Processes	LaRoux K. Gillespie	Tata McGraw-Hill	2017	1st
4.	Micromachining of Engineering Materials	J.A. McGeough	CRC Press	2001	1st
5.	3D Printing and Additive Manufacturing: Principles and Applications	Chee Kai Chua and Kah Fai Leong	World Scientific	2017	5th

Course Outcomes (CO's):

CO No.	CO Statement After learning this subject, students will be able to	Marks % Weightage
CO-1	Explain the different types of advanced materials.	10
CO-2	Distinguish various metal removing processes based on surface finish.	25
CO-3	Select appropriate micro machining processes as per materials and surface finish.	20
CO-4	Identify appropriate forming processing techniques for different requirements and applications.	15
CO-5	Apply techniques for processing of CAD models for rapid prototyping.	30

Mapping of (CO's) with Program Outcomes (PO's) and Program Specific Outcomes (PSO's):

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO-1	2	1	0	0	1	0	2	0	0	0	0	1	2	0	0
CO-2	2	2	1	1	1	0	0	0	1	1	0	0	3	1	0
CO-3	2	2	2	1	3	1	0	0	1	0	0	0	3	2	1
CO-4	3	2	1	1	1	1	0	0	1	0	0	1	3	2	1
CO-5	2	3	2	2	3	1	1	0	1	1	1	1	3	3	1
Rationale*	**11**	**10**	**6**	**5**	**9**	**3**	**3**	**0**	**4**	**2**	**1**	**3**	**14**	**8**	**3**

Rationale - Mapping of CO's with PO's and CO's with PSO's:
It will help to give fundamental knowledge about different types of material as well as hybrid machining processes also for manufacturing of complex components by using rapid prototyping and students will able understand different material removing processes by various energy sources and also additive manufacturing of complex geometry.

This course highly maps with Program outcomes 1, 2,3,4,5 and Program Specific Outcomes 1, It states that the course will develop engineering knowledge, problem analysis, design / development of solutions, conduct investigations of complex problems, modern tool usage and finally it will lead to, convert conceptual knowledge of mechanical engineering to real life application.

List of Practical:

1. Analyze the influence of process parameters on the Wire EDM.
2. Demonstration of Electrochemical machining process.
3. A comparative study of working principle and applications of various micro-machining processes, and study effects of process parameters of them.
4. Observations of Rapid Prototyping and CAD Modelling Techniques.
5. Prepare a CAD model with complex geometry and study effect of slicing parameters on final product manufactured through RP.
6. Development of physical part on a RP machine using Fused Deposition Modelling Process.
7. Demonstration of Selective laser sintering process.

Major Equipment:

1) Computational facility
2) 3D Printer.

List of Open Source/learning website:

1) https://nptel.ac.in/courses/112103202
2) https://nptel.ac.in/courses/112107078
3) https://nptel.ac.in/courses/112104028

List of Open Source Software:

Nil