RAPID PROTOTYPING

Course Code	**22MEMD1T5C**	**Year**	I	**Semester**	I
Course Category	Programme Elective	**Branch**	ME	**Course Type**	Theory
Credits	4	**L-T-P**	4-0-0	**Prerequisites**	Nil
Continuous Internal Evaluation:	40	**Semester End Evaluation:**	60	**Total Marks:**	100

Course outcomes: At the end of the course, the student will be able to:

CO	**Statement**	**BTL**	**Units**
CO1	Understand the Rapid Prototyping principles and apply appropriate tools and techniques in Rapid Prototyping	L2	1
CO2	Get acquainted with the basic kinds of RP-systems understand the progress in RP-technology in the context of shortening lead-time for new production.	L3	2
CO3	Appreciate the concept of Rapid Manufacturing in terms of its potential applicability, practicability, and expedience.	L3	3
CO4	Identify, characterize and select the ideal materials for a given Rapid Prototyping system.	L3	4

Contribution of Course outcomes towards achievement of programme outcomes & Strength of correlations (High:3, Medium: 2, Low:1)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	2	2	1	2	2	1	1						2	1
CO 2	2	2	1	2	2	1	1						2	1
CO 3	2	2	1	2	2	1	1						2	1
CO 4	2	2	1	2	2	1	1						2	1

Syllabus		
Unit	**Contents**	**Mapped CO**
1	**INTRODUCTION:** Prototype fundamentals – Definition, types of prototype, roles of prototype; historical development, development of RP in the primary areas – input,	**CO1, CO2**

	method, materials and applications; advantages of rapid prototyping, categorization of rapid prototyping systems liquid based, solid based, powder based. **Rapid Prototyping Process Chain**- Fundamental Automated Processes - process chain, 3D modeling, data conversion and transmission, checking and preparing, building, post processing.	
2	**LIQUID-BASED RAPID PROTOTYPING:** 3Dsystems Stereo Lithography Apparatus (SLA) - products, process, principle - photo polymers, photo polymerization, layering technology, laser and laser scanning; strength and weaknesses of the SLA, Applications. Example: INCS Prototyping and Manufacturing Services Make Japan a Model for the World Market. Cubital's Solid Ground Curing (SGC)- , products, Advantages and disadvantages, Process, Principle, Applications. Rapid Freeze Prototyping, Micro Fabrication,	**CO2**
3	**SOLID-BASED RAPID PROTOTYPING:** Stratays's Fusion Deposition Modeling (FDM) Products: FDM MC Machines, Dimension Series, Process, Principle, Strengths and Weaknesses, Applications, Example- Toyota Uses FDM for Design and Testing. Cubic Technologies Laminated Object Manufacturing (LOM) Products, Process: Pre Processing, Building, Post-Processing, System Structure, Materials; Principle, Strengths and Weaknesses, Applications. Example: National Aeronautical and Space Administration (NASA) and Boeing Rocket dyne Use of LOM to Create Hot Gas Manifold for Space Shuttle Main Engine. 3D Systems Multi-jet Modeling System (MJM)- , products, process, principles, Advantages and disadvantages, Applications. The shape deposition Manufacturing Process, Introduction, process, Advantages and disadvantages	**CO3**
4	**POWDER-BASED RAPID PROTOTYPING:** 3D Systems Selective Laser Sintering (SLS) - Products, Process - The SLS Process, materials, Principle - Sinter Bonding, Strengths and Weaknesses, Applications. Example: Los-Angeles-Based TEST A Architecture/Design Utilizes SLS for Large-Scale Models of Carbon Tower Prototype OPTOMEC's Laser Engineered Net Shaping (LENS)- , products, Principle, Advantages and disadvantages, Applications and examples.	**CO4**

Learning Resources
Text Book(s): 1. Rapid Prototyping Principles and Applications (3rd Edition) by Chee Kai Chua, Kah Fai Leong, World Scientific Publishing Co. Pt. Ltd. 2. Rapid Manufacturing An Industrial Revolution for the Digital Age by N. Hopkinson, R.J.M. Hague and P.M. Dickens Lough borough University, UK

References:

1. Rapid Manufacturing by Pham, D.T, Dimov, S.S, , Springer, 2001.

2. Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing by Ian Gibsn., David W Rosen., Brent Stucker, Springer, 2010