Course Number : AR512
Course Name : Rapid Prototyping and Tooling
Credit Distribution : 3-0-2-4
Intended for : UG, PG and PhD
Prerequisite : Consent of faculty advisor
Mutual Exclusion **:** None

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1. Preamble:

Students will be introduced to the main topics in the theoretical and practical aspects of Rapid Prototyping. It involves the study of various processes of Rapid prototyping (RPT) techniques. Students will be introduced to the theoretical principles underlying Rapid tooling and reverse Engineering. Students work in teams to produce the final model for RPT using 3D modelling software.

2. Course Modules with quantitative lecture hours:

Product Development: Manufacturing processes classification, Different manufacturing systems. Introduction, History, Definitions, and evolution of Rapid Prototyping. Need of RPT in context to batch production, FMS, CIM, and its application. Introduction & Need for the compression in Product development Growth of RPT Industry and Classification of RPT. **(6 hours)**

Stereolithography (SLA): System and principles, process parameters, SLA process details, data preparation, data files of SLA, machine details, and applications of SLA. **(4 hours)**

Selective Laser Sintering (SLS): Introduction, SLS operation principle, and machine types, process parameters, and data preparation for SLS. **(4 hours)**

Fused Deposition Modelling (FDM) and Solid Ground curing (SGC): Introduction, FDM principles, process parameters, path generation & application of FDM. Principle of SGC operation, SGC machine details and application. **(6 hours)**

Laminate Object Manufacturing (LOM): Operation principle, materials, process details & application, Concepts modelers – Principle, Thermal Jet Printer, Sander model maker – Explanation, 3-D Printer. **(4 hours)**

Rapid tooling: Indirect rapid tooling, Silicon Rubber tooling, Aluminium filling epoxy tooling, Spray metal tooling, Direct rapid tooling, Quick cast process, copper Polyamide, DMILS – explanation, sand casting tooling, soft tooling & hard tooling. **(6 hours)**

Software for RPT: STL files, Overview of Solid view, software communicator, Internet-based software, Collaboration tools. **(4 hours)**

Other aspects of Rapid Manufacturing: Introduction, factors influencing accuracy, Repetitive masking, and deposition. Beam interference solidification, Holographic interference solidification special topics on RPT using metallic alloys. Programming in RPT modelling, Slicing, Internal Hatching, Surface skin films, and support structure. Data preparation errors, part building errors, errors in finishing, and influence of build orientation. **(6 hours)**

Final project: Student project towards RPT using 3D modelling software. **(2 hours)**

Laboratory/practical/tutorial Modules:

Rapid tooling, Software for RPT

3. Textbooks:

1. Chua. C.K, “Rapid Prototyping”, Wiley.

2. Introduction to Rapid Prototyping, Amitav Ghosh, Northwest Publication, New Delhi.
3. Rapid Prototyping and Engineering Applications, Frank W. Liou, CRC Press.
4. Burns. M, "Automated Fabrication", PHI.
5. Hilton. P.D. et al., "Rapid Tooling", Marcel, Dekker.

4. References:

1. Jacobs P.F, "Stereolithography and other Rapid Prototyping and Manufacturing Technologies", ASME.
2. Beaman. J.J et. al., "Solid freeform fabrication", Kluwer.
3. Pham. D.T and Dimov. S.S, "Rapid Manufacturing; the Technologies and Application of RPT and Rapid tooling", Springer, London.
4. Gibson, I., Rosen, D.W. and Stucker, B., 2014. Additive manufacturing technologies (Vol. 17). New York: Springer.
5. Hopkinson, N., Hague, R. and Dickens, P. eds., 2006. Rapid manufacturing: an industrial revolution for the digital age. John Wiley & Sons.
6. Pham, D. and Dimov, S.S., 2012. Rapid manufacturing: the technologies and applications of rapid prototyping and rapid tooling. Springer Science & Business Media.
7. Kamrani, A.K. and Nasr, E.A., Engineering design and rapid prototyping. Springer Science & Business Media.
8. Gebhardt, A., Understanding additive manufacturing.

5. Similarity with the existing courses:

(Similarity content is declared as per the number of lecture hours on similar topics)

S. No.		Course Code	Similarity Content	Approx. % of Content
1.		None	None	None

6. Justification of new course proposal if cumulative similarity content is >30%: None