

## ANNEXURE I

<b>TABLE 1: MODULE-WISE COURSE CONTENT AND OUTCOME</b>				
<b>SL. NO</b>	<b>MODULE NAME</b>	<b>MODULE CONTENT</b>	<b>MODULE LEARNING OUTCOME</b>	<b>DURATION (HRS)</b>
1	Introduction to Rapid Prototyping	<p>Definition and importance in modern product development. Comparison with traditional prototyping methods (time, cost, accuracy).</p> <p>History and Evolution of Rapid Prototyping</p> <p>Timeline from initial research to commercialized 3D printing. Key milestones in additive manufacturing (AM).</p>	Basics of rapid prototyping, its terminologies, needs and uses	10
2	Fundamentals of 3D Printing	<p>Overview of Additive Manufacturing Processes</p> <p>Fused Deposition Modeling (FDM): Material extrusion basics, pros, and cons</p> <p>Stereo lithography (SLA): Liquid resin-based methods.</p> <p>Selective Laser Sintering (SLS): Powder-based approaches.</p> <p>Emerging technologies: Binder Jetting, DMLS, and PolyJet.</p>	Knowledge in types of materials , material selection and properties and exploring the features of software	10

		<p>Understanding 3D Printer Components</p> <p>Extruder, bed, nozzle, motors, and control units. Calibration techniques for consistent quality.</p> <p>Materials in Additive Manufacturing</p> <p>Plastics: PLA, ABS, PETG, nylon, and composites. Metals: Aluminum, titanium, and steel. Other Materials: Ceramics, bio-materials, and carbon fiber.</p>		
3	3D Modeling and Design	<p>Introduction to CAD Software</p> <p>Overview of industry-standard software like TinkerCAD, Fusion 360, or SolidWorks. Basics of 2D sketches and extrusion techniques.</p> <p>Advanced Design Concepts</p> <p>Lofting, fillets, shelling, and patterns. Parametric modeling and constraints. Optimization for Additive Manufacturing</p>	Techniques in designing	10

4	<p>Printing Workflow and Troubleshooting</p>	<p>Printer Setup and Calibration</p> <p>Bed leveling techniques. Loading and changing filaments.</p> <p>Using Slicing Software</p> <p>Overview of Cura, PrusaSlicer, and Simplify3D. Configuring settings: Layer height, infill density, print speed.</p> <p>Understanding and Resolving Print Failures</p> <p>Stringing, warping, layer shifting, and adhesion issues. Adjusting temperature and cooling settings.</p>	<p>Troubleshooting printer settings and usage of 3d printer</p>	<p>10</p>
5	<p>Industrial Applications of Rapid Prototyping</p>	<p>Concept models for new car designs. Functional prototypes for testing aerodynamic performance. Lightweight structural components to improve fuel efficiency.</p>	<p>Applications of 3d printer</p>	<p>5</p>

## ANNEXURE II

<b>OVERALL COURSE LEARNING OUTCOME ASSESSMENT CRITERIA AND USECASES</b>			
<b>LEARNING OUTCOME</b>	<b>ASSESSMENT CRITERIA</b>	<b>PERFORMANCE CRITERIA</b>	<b>USECASES</b>
<ul style="list-style-type: none"> <li>· The role of AI and ML in designing customized prosthetics and implants.</li> <li>· Explain the applications of rapid prototyping technologies, such as 3D printing, in healthcare.</li> <li>· Identify the data and inputs required for creating prosthetics, including patient anatomy, biomechanics, and material properties.</li> <li>· Understand regulatory and ethical considerations in the production of prosthetics and implants.</li> </ul>	<ul style="list-style-type: none"> <li>· <b>Quiz/MCQs:</b> Evaluate knowledge of prosthetics design principles, rapid prototyping technologies, and material selection.</li> <li>· <b>Case Study Analysis:</b> Provide scenarios where students analyze data and select the appropriate prosthetic design and manufacturing method.</li> </ul>	<ul style="list-style-type: none"> <li>· Accurately describe the data preparation process for prosthetics design, including CT/MRI scan interpretation.</li> <li>· Explain the properties of materials suitable for medical-grade prosthetics and implants.</li> <li>· The implications of precision and resolution in rapid prototyping technologies.</li> </ul>	<p style="text-align: right;">Healthcare:</p> <p>Customized Prosthetics and Implants</p> <p>Case Study: A hospital partnered with a 3D printing company to produce prosthetics for amputees. Traditional prosthetics often required weeks to manufacture and cost thousands of dollars. Using 3D scanning and printing, the team developed custom-fitted prosthetics in just 48 hours, reducing production costs by 70%. Patients reported improved comfort and functionality, with prototypes iteratively improved based on feedback.</p> <p>Key Takeaway: Rapid prototyping enables faster production of personalized medical devices, enhancing patient care while reducing costs.</p>
<ul style="list-style-type: none"> <li>· Use computational tools (e.g., CAD/CAE) to design lightweight automotive components.</li> <li>· Employ AI/ML algorithms to optimize the</li> </ul>	<ul style="list-style-type: none"> <li>· <b>Quiz/MCQs:</b> Test knowledge of lightweight materials, manufacturing techniques, and design</li> </ul>	<ul style="list-style-type: none"> <li>· Accurately describe the properties and applications of lightweight materials such as</li> </ul>	<p style="text-align: right;">Automotive:</p> <p>Lightweight Component Development</p> <p>Case Study: A car manufacturer used 3D printing to prototype lightweight</p>

<p>geometry and material usage of automotive parts.</p> <ul style="list-style-type: none"> <li>Operate rapid prototyping technologies, such as 3D printers, to fabricate lightweight component prototypes.</li> <li>Conduct mechanical testing and evaluation of prototypes for strength, durability, and performance.</li> </ul>	<p>principles.</p> <ul style="list-style-type: none"> <li><b>Case Study Analysis:</b> Provide scenarios where students analyze existing automotive parts and suggest lightweight alternatives.</li> </ul>	<p>carbon fiber, aluminum alloys, and polymers.</p> <ul style="list-style-type: none"> <li>Explain the principles of topology optimization and its application in weight reduction.</li> <li>Understand the impact of weight reduction on vehicle dynamics, safety, and environmental compliance.</li> </ul>	<p>parts for an electric vehicle's suspension system. The design team experimented with lattice structures to reduce weight without compromising strength. Multiple iterations of the component were printed and tested, leading to a 15% reduction in the car's total weight, improving energy efficiency.</p> <p><b>Key Takeaway:</b> 3D printing accelerates innovation in lightweight, high-performance automotive parts, enabling sustainable designs.</p>
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<b>LIST OF FINAL PROJECTS (PROJECTS THAT COMPREHENSIVELY COVER ALL THE LEARNING OUTCOME)</b>	
<b>SL.NO</b>	<b>FINAL PROJECT</b>
1	Create a lightweight and functional car part, such as a gear shifter or air intake component.
2	Develop a personalized gadget, such as a phone stand or ergonomic tool for household use.
3	Build a detailed scale model of a modern building or bridge for presentation and visualization.

### ANNEXURE III

<b>TABLE 3: COURSE ASSESSMENT RUBRICS (TOTAL MARKS: 70)</b>				
<b>ASSESSMENT CRITERIA</b>	<b>DESCRIBE THE CRITERIA OF THE BELOW CATEGORY PERFORMANCE</b>			<b>TOTAL MARKS</b>
	<b>FAIR</b>	<b>GOOD</b>	<b>EXCELLENT</b>	
Presentation skills	15	25	30	70

<b>Category</b>	<b>Assessment Criteria</b>	<b>Performance Levels</b>	<b>Weightage (Marks)</b>
Practical Skills Proficiency	Demonstrates ability to perform job-specific tasks effectively, using relevant tools, techniques, or methodologies (e.g., Tally for accounting, consignment tracking).	Fair, Good, Excellent	15
Technical Knowledge Application	Applies theoretical concepts to practical scenarios with accuracy and relevance (e.g., compliance with GST laws, financial planning, or logistics protocols).	Fair, Good, Excellent	15
Project Execution	Completes assigned projects or use cases demonstrating innovation, thoroughness, and skill application relevant to industry standards.	Fair, Good, Excellent	30
Communication and Reporting	Clearly presents findings, solutions, or project outcomes using professional communication and documentation standards (e.g., reports, presentations).	Fair, Good, Excellent	10