ANNEXURE I

Module-wise Course Content and Outcome

Sl. No	Module Name	Module Content	Module Learning Outcome	Duration (Hrs)
1	Introduction to Mold Flow Simulation	- Overview of Mold Flow Simulation - Importance in product design and manufacturing - Overview of plastic injection molding processes - 3DEXPERIENCE Environment - Navigating the simulation workspace - Introduction to the Mold Tooling Design Application - Material Properties - Selecting appropriate polymers from the material library - Key properties affecting simulation (viscosity, shrinkage, etc.)	Gain a foundational understanding of mold flow simulation concepts, the 3DEXPERIENCE platform, and material properties.	5
2	Setting Up Mold Flow Analysis	- Mesh Preparation - Types of meshes in 3DEXPERIENCE (surface, volume) - Techniques for generating and refining meshes - Gate and Runner Design - Positioning gates for optimal flow - Creating and modifying runner	Develop skills in mesh generation, gate and runner design, and perform basic flow simulations to analyze injection molding	10

		systems - Flow Simulation - Simulating the filling phase - Analyzing velocity, pressure, and temperature distributions.	behavior.	
3	Packing, Cooling, and Warpage Analysis	- Packing Analysis - Setting packing pressure and time parameters - Minimizing shrinkage through optimized packing - Cooling System Design - Placement of cooling channels - Simulating cooling efficiency and its impact on cycle time - Warpage Prediction - Identifying causes of part deformation - Strategies for minimizing warpage in molded parts	Learn advanced analysis techniques for packing, cooling, and warpage prediction to optimize the molding process.	10
4	Defect Analysis and Optimization	- Defect Prediction - Identifying air traps, weld lines, and short shots - Addressing sink marks and flow imbalances - Design Iteration - Adjusting gate locations and mold geometry - Parameter tuning for defect reduction - Case Study - Analysis of a real-world part for defect prediction and resolution	Develop the ability to identify and address common molding defects through simulation and design optimization.	10

5	Validation and Reporting	- Result Validation - Comparing simulation results with actual molding outcomes - Understanding the limitations of simulations - Integration with CAD - Importing part and tooling designs into 3DEXPERIENCE for analysis - Using simulation data to update part designs - Reporting and Documentation - Creating simulation reports - Communicating findings to design and production teams	Gain proficiency in validating simulation results, integrating with CAD software, and effectively communicating findings through reports.	10

ANNEXURE II

Overall Course Learning Outcome Assessment Criteria and Use Case

Learning Outcome	Assessment Criteria	Performance Criteria	Use Cases
Use the 3DEXPERIENCE platform for comprehensive mold flow simulations.	- Assignments on 3DEXPERIENCE interface and functionalities. - Hands-on exercises in setting up simulation projects.	- Demonstrates proficiency in navigating the 3DEXPERIENCE platform. - Accurately sets up simulation models, including geometry, meshing, and material properties. - Executes simulations and analyzes results.	- Creating basic mold flow simulations for simple parts. - Setting up material properties and process parameters. - Analyzing flow fronts and filling times.
Analyze and optimize mold designs for manufacturability and quality.	- Project-based assignments involving real-world part designs. - Peer reviews and presentations.	- Identifies potential design issues like short shots, air traps, and warpage. - Proposes design modifications to improve part quality and manufacturability. - Optimizes gate locations, runner systems, and cooling channel designs.	- Analyzing the impact of gate location on part quality. - Optimizing cooling channel layout to reduce cycle time. - Modifying part geometry to prevent warpage.
Predict and resolve	- Case studies on common	- Accurately predicts potential defects like sink	- Identifying and addressing sink marks in complex parts. -

common injection molding defects.	molding defects. - Simulation-based defect analysis and troubleshooting.	marks, weld lines, and voids. - Proposes corrective actions to eliminate or mitigate defects. - Analyzes the root causes of defects and implements preventive measures.	Optimizing packing and cooling parameters to reduce warpage. - Preventing short shots and air traps in intricate designs.
Integrate simulation results into the product development process.	- Collaborative projects involving design and manufacturing teams. - Presentation of simulation results to stakeholders.	- Effectively communicates simulation findings to design and manufacturing teams. - Integrates simulation results into the design iteration process. - Uses simulation data to make informed decisions about part design and manufacturing process.	- Collaborating with designers to optimize part design for manufacturability. - Providing feedback to tooling engineers for mold design improvements. - Using simulation results to identify potential process issues before physical prototyping.
Deliver actionable insights to improve tooling and part designs.	- Reports and presentations on simulation results and recommendations. - Implementation of simulation-based recommendations in real-world	- Generates clear and concise simulation reports. - Provides actionable recommendations for design and process improvements. - Quantifies the impact of design changes on part quality and manufacturing	- Identifying cost-saving opportunities through optimized designs. - Reducing product development time by minimizing physical prototyping. - Improving product quality and reducing defects.

	projects.	efficiency.	

List of Final Projects (20 projects that comprehensively cover all the learning outcomes)

Project Title	Description
Single Cavity Analysis for Smoke Alarm	- Simulate the filling, packing, and cooling phases of a single cavity mold for a smoke alarm enclosure. - Optimize gate location and cooling channel design to minimize warpage and ensure uniform part quality.
Electrical Cover with Insert	- Simulate the injection molding process for an electrical cover with an insert. - Analyze the flow of molten plastic around the insert to avoid defects like short shots and air traps. - Optimize the insert design and placement for successful molding.
Two Cavity Mold Flow Analysis	- Simulate the filling and packing phases of a two-cavity mold for a specific part. - Balance the flow between the cavities to ensure uniform filling and prevent defects. - Optimize the gate and runner system for efficient material distribution.
Multi-Shot Injection Flow Simulation for Mobile Cover & Keypad	- Simulate the multi-shot injection molding process for a mobile phone cover and keypad. - Optimize the injection sequence and material flow to ensure accurate part dimensions and surface finish. - Analyze the potential for part distortion and propose design modifications.
Multi-Injection Location Flow Analysis for Drill Machine Encloser	- Simulate the injection molding process for a drill machine enclosure with multiple injection points. - Balance the flow from different injection points to ensure uniform filling and minimize defects. - Optimize

	the gate locations and runner system for efficient material distribution.
Mold Flow Analysis for Complete Single Cavity Mold for Plastic Encloser	- Conduct a comprehensive mold flow analysis for a single cavity mold for a plastic enclosure. - Analyze the filling, packing, and cooling phases to identify potential issues. - Propose design modifications to improve part quality and reduce cycle time.
Automotive Industry: Designing aerodynamic car exteriors and body structures.	- Simulate the injection molding process for complex automotive components like bumpers and hoods. - Optimize the design to improve aerodynamic performance and reduce drag. - Analyze the impact of different cooling strategies on part quality and cycle time.
Aerospace Industry: Creating precise fuselage, wing, and nacelle designs for optimal aerodynamics.	- Simulate the injection molding process for aerospace components with tight tolerances. - Optimize the design to minimize warpage and ensure dimensional accuracy. - Analyze the impact of different materials and processing conditions on part performance.
Marine & Shipbuilding: Hydrodynamic hull designs for fuel efficiency and performance.	- Simulate the injection molding process for marine components like propeller blades and hull sections. - Optimize the design to improve hydrodynamic performance and reduce drag. - Analyze the impact of different materials and processing conditions on part strength and durability.
Consumer Electronics: Ergonomic and visually appealing designs for smartphones, laptops, and gadgets.	- Simulate the injection molding process for consumer electronics enclosures. - Optimize the design for thin-wall sections and complex geometries. - Analyze the impact of different materials and processing conditions on part aesthetics and functionality.
Medical Devices: Developing	- Simulate the injection molding process for medical devices with complex shapes and tight tolerances. -

prosthetics, implants, and tools with patient-specific anatomical accuracy.	Optimize the design for biocompatibility and mechanical strength. - Analyze the impact of different materials and processing conditions on device performance and safety.
Industrial Machinery: Smooth and functional surface profiles for optimized machinery operation.	- Simulate the injection molding process for industrial machinery components. - Optimize the design for smooth surfaces and accurate dimensions. - Analyze the impact of different materials and processing conditions on part performance and durability.
Furniture Design: Creating stylish and comfortable furniture with pleasing contours.	- Simulate the injection molding process for furniture components like chair legs and tabletops. - Optimize the design for aesthetics and functionality. - Analyze the impact of different materials and processing conditions on part strength and durability.
Jewelry and Accessories: Designing intricate and elegant surfaces for watches, jewelry, and fashion items.	- Simulate the injection molding process for jewelry and accessory components. - Optimize the design for intricate details and high-quality surface finishes. - Analyze the impact of different materials and processing conditions on part appearance and durability.
Packaging Design: Developing attractive and functional packaging with custom textures and branding.	- Simulate the injection molding process for packaging components like bottle caps and containers. - Optimize the design for functionality and aesthetics. - Analyze the impact of different materials and processing conditions on packaging performance and recyclability.
Footwear Design: Stylish and ergonomic	- Simulate the injection molding process for footwear components like soles and heels. - Optimize the design for comfort, durability, and aesthetics. - Analyze the

footwear for comfort and aesthetics.	impact of different materials and processing conditions on footwear performance.
Building Design: Modeling buildings and structures with realistic textures and materials.	- Simulate the injection molding process for building components like window frames and door handles. - Optimize the design for durability and weather resistance. - Analyze the impact of different materials and processing conditions on part performance.
Interior Design: Accurate 3D modeling of spaces with detailed surface finishes.	- Simulate the injection molding process for interior components like furniture and decorative items. - Optimize the design for aesthetics and functionality. - Analyze the impact of different materials and processing conditions on part appearance and performance.
Art & Sculpture: Designing intricate and unique sculptures and artistic installations.	- Simulate the injection molding process for art and sculpture components. - Optimize the design for complex shapes and intricate details. - Analyze the impact of different materials and processing conditions on part appearance and durability.
Sports Equipment: Aerodynamic and performance-optimized designs for bicycles, helmets, and rackets.	- Simulate the injection molding process for sports equipment components. - Optimize the design for performance and durability. - Analyze the impact of different materials and processing conditions on equipment performance.
Film & Animation: Creating realistic textures and detailed models for movies and games.	- Simulate the injection molding process for props and models used in film and animation. - Optimize the design for realistic appearance and durability. - Analyze the impact of different materials and processing conditions on part performance.
Consumer Appliances: User-	- Simulate the injection molding process for consumer appliance components. - Optimize the design for

friendly and visually appealing designs for household devices.	functionality and aesthetics. - Analyze the impact of different materials and processing conditions on part performance and durability.
Sustainable Design: Eco-friendly products with resource-efficient surface forms.	- Simulate the injection molding process for sustainable products. - Optimize the design for recyclability and energy efficiency. - Analyze the impact of different materials and processing conditions on product sustainability.
Product Design: Developing sleek designs for electronics, appliances, and tools.	- Simulate the injection molding process for product components. - Optimize the design for aesthetics and functionality. - Analyze the impact of different materials and processing conditions on product performance and durability.

ANNEXURE III

ASSESSMENT CRITERIA					
Assessment Criteria	**Describe the Criteria of the Below Category Performance**	**Total Marks**	**Fair**	**Good**	**Excellent**
Demonstrates ability to perform job-specific tasks effectively, using relevant tools.	- Uses 3DEXPERIENCE platform for basic mold flow simulation setup. - Applies knowledge of material properties.	20	10	15	20
Applies theoretical concepts to practical scenarios with accuracy and relevance.	- Analyzes simulation results to identify potential issues. - Proposes solutions for mold design optimization.	15	7	12	15
Completes assigned projects or use cases demonstrating innovation.	- Conducts a comprehensive mold flow analysis for a given part. - Proposes innovative solutions to address molding defects.	25	20	25	25
Communication and Reporting	- Creates clear and concise simulation reports. - Effectively communicates findings to a technical audience.	10	5	7	10