NAAN MUDHALVAN – POLYTECHNIC – ODD SEMESTER 2025-26

COURSE CURRICULUM

INDUSTRIAL DESIGN TECHNOLOGY

ABOUT THE COURSE

This course equips students with industry-ready skills in product design, engineering drawing, and digital modeling using CATIA on the 3DEXPERIENCE platform. It covers professional practices, user research, 2D sketching and 3D assembly modeling, technical drawing generation, and design documentation. Students learn to apply design thinking, conduct market analysis, and create functional product designs suitable for manufacturing. With hands-on projects like smart wearables, medical devices, and consumer products, the course bridges technical knowledge and real-world application in modern industrial design.

COURSE NAME:	Industrial Design Technology
TOTAL DURATION:	60 HRS
MODE OF DELIVERY	PHYSICAL CLASSROOM TRAINING AT RESPECTIVE COLLEGES
TRAINER TO STUDENT RATIO:	1:60
TOTAL MARKS:	70 (External) + 30 (Internal)

TABLE 1	
OVERALL COURSE OBJECTIVE	• Evaluate the responsibilities of an industrial design technician and demonstrate safe, ethical, and efficient work practices in design environments. • Apply research techniques to collect, analyse, and interpret market and user data, and draw conclusions using inductive and deductive reasoning. • Create constrained 2D sketches and develop profiles suitable for extrusion and revolution features using CATIA in the 3DEXPERIENCE platform. • Assemble components and generate detailed 2D engineering drawings including multiple views, sections, and annotations using CATIA. • Prepare comprehensive design documentation and promotional content that effectively communicates product features, usability, and value.
LEARNING OUTCOME	• Demonstrate the role and responsibilities of an industrial design technician and instil safe, ethical, and organized work practices. • Conduct customer and market research that informs design strategies through primary and secondary data collection methods.

	• Create and constrain accurate 2D sketches in CATIA for developing features using extrusion and revolution techniques. • Develop the ability to assemble components and generate precise technical drawings using CATIA for manufacturing communication. • Apply the skills to produce design documentation, evaluation reports, and promotional materials that meet industrial and regulatory standards.

TABLE 2: MODULE-WISE COURSE CONTENT AND OUTCOME				
SL. NO.	**MODULE NAME**	**MODULE CONTENT**	**MODULE LEARNING OUTCOME**	**DURATION (HRS)**
1	Professional Practices and Work Organization in Industrial Design	Introduction to Industrial Design Technician Role - Differences from craft-based design - Industry expectations - Real-world examples - Safe Working Practices - Safety protocols in labs/studios - Risk assessments and PPE - Workplace ergonomics - Time and Task Management - Prioritization methods (Eisenhower matrix) - Scheduling tools - Creating timelines - Record Keeping and Documentation - Version control - Engineering/design notebooks - File management practices - Professional Ethics and Best Practice - IP & confidentiality - Ethical scenarios in client work - Professional	Analyse the roles and responsibilities of an industrial design technician and instill safe, ethical, and organized work practices.	10

		conduct & integrity.		
2	Market Research and Strategic Design Thinking	Understand the market position, brand identity, and business strategies of a design-driven organization - Identify and analyze sources of design requirements and commissions - Apply ethical and effective methods to gather customer data using primary and secondary sources - Use observational, survey, and analytical tools to study customer satisfaction and market needs - Draw conclusions from research using inductive and deductive reasoning techniques.	Conduct customer and market research that informs design strategies through primary and secondary data collection methods.	10
3	2D Sketching and Part Design Using CATIA	Definition of Design – Steps in Design - 2D sketching in 3DEXPERIENCE CATIA, focusing on creating geometries like lines, circles, arcs, and splines - Geometric and dimensional constraints, such as horizontal, vertical, tangency, and symmetry, are applied to restrict degrees of freedom and stabilize sketches - Editing and transforming	Create and constrain accurate 2D sketches in CATIA for developing features using extrusion and revolution techniques.	15

		elements, including modifying dimensions, trimming, mirroring, and offsetting, are also covered - Practical exercises include creating constrained sketches and building profiles for extruded and revolved features.		
4	Assembly Modelling and Technical Drawing in CATIA	Selecting the choice of components for assembly - Creating and modifying products in CATIA - Assigning or modifying product properties, including material, color, and other attributes - Assigning component properties and reordering a product structure - Methods of assembly in CATIA, including bottom-up, top-down, and mixed assembly approaches - Drafting and documentation capabilities in CATIA, essential for generating detailed drawings from 3D models. - create views for an industry use case, starting with a front view to represent the product accurately	Assemble components and generate precise technical drawings using 3DEXPERIENCE CATIA for manufacturing communication.	15

		- Creating section views to show internal details of a model and its structure.		
5	Design Documentation, Evaluation, and Communication	Document design outputs using industrial documentation standards and regulatory formats - Develop visual and written promotional materials to support product launch or demonstration - Prepare and format evaluation reports that assess technical, ergonomic, and market aspects of the product - Use professional tools to compile, present, and archive design documents for communication with clients, manufacturers, and marketing teams - Reflect on the completeness, clarity, and professionalism of documentation as a critical design output.	Produce design documentation, evaluation reports, and promotional materials that meet industrial and regulatory standards.	10

TABLE 3: OVERALL COURSE LEARNING OUTCOME ASSESSMENT CRITERIA AND USECASES		
LEARNING OUTCOMES	**ASSESSMENT CRITERIA**	**USE CASES**
Demonstrate the role and responsibilities of an industrial design technician and instil safe, ethical, and	Compare industrial design and craft-based roles with real-world examples.	**Use Case 1: Practicing Safe Work in a Design Lab** **Scenario:** Students begin hands-on

organized work practices.	Apply safety protocols and complete a risk assessment.	work in a fabrication lab. **Task:** Identify and assess hazards and also use appropriate PPE and follow safety protocols. **Use Case 2: Understanding Professional Expectations** **Scenario:** Students compare roles in design to understand their responsibilities. **Task:** Distinguish between industrial and craft-based design roles and analyse real-world examples of professional ethics and conduct.
Conduct customer and market research that informs design strategies through primary and secondary data collection methods.	Maintain organized design records with version control and file management. Maintain organized design records with version control and file management.	**Use Case 1: Planning a Design Project** **Scenario:** Students receive a multi-week design assignment. **Task:** Create a timeline using prioritization and scheduling tools and break down tasks using the Eisenhower Matrix. **Use Case 2: Maintaining Design Records** **Scenario:** Student is required to document all stages of their design work. **Task:** Use notebooks and version control to record and manage design data and practice ethical documentation and file organization.
Create and constrain accurate 2D sketches in CATIA for developing features using extrusion and revolution techniques.	Create fully constrained 2D sketches using CATIA tools. Edit sketches using mirror, trim, offset, and build profiles.	**Use Case 1: Creating a Basic 2D Sketch** **Scenario:** Students begin modelling a product feature in CATIA. **Task:** Use sketch tools to create a base sketch and

		apply constraints to ensure full definition. **Use Case 2: Editing and Finalizing Sketches** **Scenario:** Students revise their sketches before extrusion. **Task:** Use tools like trim, mirror, and offset and prepare sketch profiles for revolved or extruded features.
Develop the ability to assemble components and generate precise technical drawings using CATIA for manufacturing communication.	Assemble components in CATIA with correct properties and structure. Generate detailed drawings with front and section views.	**Unit 5: Assembly and Drafting in CATIA** **Use Case 1: Assembling Components** **Scenario:** Student combine parts to form a complete product model. **Task:** Use top-down or bottom-up methods to assemble parts. and assign materials and adjust component properties. **Use Case 2: Creating Technical Drawings** **Scenario:** Students must produce manufacturing-ready drawings. **Task:** Generate front and section views and add dimensions and annotations according to drafting standards.
Apply the skills to produce design documentation, evaluation reports, and promotional materials that meet industrial and regulatory standards.	Produce clear documentation and promotional materials. Write evaluation reports covering technical and market aspects.	**Use Case 1: Preparing Product Documentation** **Scenario:** Students finalize their product designs for client submission. **Task:** Compile drawings, specifications, and compliance reports. Format

		documentation per industrial standards. **Use Case 2: Developing Promotional and Evaluation Material** **Scenario:** Students present their design for review and promotion. **Task:** Write evaluation reports assessing performance and market fit

TABLE 4: LIST OF FINAL PROJECTS (20 PROJECTS THAT COMPREHENSIVELY COVER ALL THE LEARNING OUTCOME)	
SL.NO	**FINAL PROJECT** **(The Training Partner shall cover all the steps to complete a given project)**
1	**Rapid Prototyping** • Task 1: Design a digital model of the product or component. • Task 2: Slice the model into layers using slicing software. • Task 3: Print the prototype using a 3D printer. • Task 4: Perform a functional test on the prototype to check its design. • Task 5: Refine the design based on feedback and print the revised Prototype
2	**Custom Medical Implants** • Task 1: Obtain a 3D scan of the patient's anatomy (e.g., CT or MRI). • Task 2: Design a custom implant based on the scan data. • Task 3: Export the design as an STL file for printing. • Task 4: Print the implant using biocompatible materials. • Task 5: Conduct post-print quality control tests and prepare the implant for surgery.
3	**Aerospace Components** • Task 1: Design complex, lightweight parts for aerospace applications. • Task 2: Optimize the part for strength and material usage using software. • Task 3: Slice the design for 3D printing and choose the appropriate material. • Task 4: Print the part using metal 3D printing or another suitable method. • Task 5: Conduct performance testing, including stress and thermal tests.
4	**Aerospace Components** • Task 1: Design complex, lightweight parts for aerospace applications. • Task 2: Optimize the part for strength and material usage using software.

	• Task 3: Slice the design for 3D printing and choose the appropriate material. • Task 4: Print the part using metal 3D printing or another suitable method. • Task 5: Conduct performance testing, including stress and thermal tests
5	**Customized Footwear** • Task 1: Scan the customer's feet to capture shape and size. • Task 2: Design a custom shoe or sole using CAD software. • Task 3: Choose materials suitable for footwear (e.g., TPU for flexibility). • Task 4: Print the customized footwear. • Task 5: Perform a wear test to ensure comfort and performance.
6	**Jewellery Design** • Task 1: Design intricate jewellery pieces using CAD tools. • Task 2: Create a 3D model of the piece, incorporating design features like texture. • Task 3: Convert the model into an STL file for 3D printing. • Task 4: Print the jewellery using a resin printer or metal printer (for casting). • Task 5: Post-process the printed jewellery, including polishing and finishing.
7	**Spare Parts on Demand** Task 1: Identify the broken or obsolete part needed. Task 2: Design a digital model of the replacement part. Task 3: Choose the correct material for the part (e.g., metal, plastic). Task 4: Print the part to specifications. Task 5: Install the part in the machinery or equipment.
8	**Tooling and Jigs** • Task 1: Design custom tooling, jigs, or fixtures based on production requirements. • Task 2: Create 3D models of the parts using CAD software. • Task 3: Print the tools using durable materials such as nylon or carbon fibre. • Task 4: Test the functionality and accuracy of the tools. • Task 5: Adjust the design if necessary and reprint for further testing.
9	**Construction and Architecture** • Task 1: Design building models or architectural elements using CAD tools. • Task 2: Use 3D printing to produce scaled models for presentations. • Task 3: Optimize design structures for material efficiency and strength. • Task 4: Print detailed architectural models with concrete or composite materials. • Task 5: Assemble the printed components in a construction setting for full-scale implementation.

10	**Aerospace Heat Exchangers** Task 1: Design complex heat exchanger components with optimized airflow. • Task 2: Use software to simulate thermal performance. • Task 3: Choose the material (e.g., titanium or aluminium) for heat resistance. • Task 4: Print the heat exchanger with intricate lattice structures. • Task 5: Test the heat exchanger's performance under operating conditions.
11	**Educational Models** Task 1: Identify the educational need for a specific 3D model (e.g., anatomy, molecular structure). • Task 2: Design or source educational 3D models. • Task 3: Print the models using educational-grade materials. • Task 4: Conduct classroom demonstrations with printed models. • Task 5: Update or iterate on designs based on feedback and new learning objectives.
12	**Customized Eyewear** Task 1: Take precise measurements of the customer's face and eyes. • Task 2: Design a custom eyewear frame using CAD software. • Task 3: Choose suitable materials (e.g., flexible polymers or lightweight metals). • Task 4: Print the eyewear frame using 3D printing technology. • Task 5: Fit the lenses into the frame and test for comfort and Functionality
13	**Art and Sculpture** • Task 1: Design the artwork or sculpture using 3D modeling software. • Task 2: Choose the appropriate material for the sculpture (e.g., resin, PLA). • Task 3: Slice the design for 3D printing. • Task 4: Print the artwork layer by layer. • Task 5: Post-process the printed sculpture, including sanding, painting, and finishing.
14	**Consumer Electronics Enclosures** • Task 1: Design protective enclosures for electronics. • Task 2: Optimize the design for airflow, heat dissipation, and accessibility. • Task 3: Choose materials that are durable and heat-resistant (e.g., ABS, polycarbonate). • Task 4: Print the enclosure and assemble it with the internal electronic components. • Task 5: Test the enclosure's performance, including temperature regulation and durability.
15	**Low-Volume Manufacturing** • Task 1: Design a product for low-volume production. • Task 2: Create a digital model and select the best material for the product. • Task 3: Use slicing software to prepare the model for printing. • Task 4: Print multiple units of the product in one print session. • Task 5: Inspect the parts for quality and prepare them for shipping.

16	**Automotive Tooling & Prototyping** • Task 1: Design automotive components or tools using CAD. • Task 2: Choose materials that match the functional needs of the part (e.g., strong composites). • Task 3: Print prototypes or low-volume parts for testing. • Task 4: Assemble the parts into an automotive prototype or production model. • Task 5: Test the prototypes for fit, function, and performance in Real world automotive conditions.
17	**Food Production** • Task 1: Design 3D printable food items using CAD software. • Task 2: Select appropriate edible materials (e.g., chocolate, dough, or sugar). • Task 3: Print the food products layer by layer using food-safe 3D printers. • Task 4: Ensure food safety and hygiene during the production process. • Task 5: Package and present the food products for consumption or sale.
18	**Metal 3D Printing for Tooling** • Task 1: Design specialized metal tools for specific manufacturing needs. • Task 2: Choose the appropriate metal for the tool (e.g., steel, titanium). • Task 3: Slice the design to optimize it for metal 3D printing. • Task 4: Print the metal tools using a laser or electron beam melting process. • Task 5: Post-process the printed metal tools with heat treatment or finishing.
19	**Spare Parts for Obsolete Machinery** • Task 1: Identify obsolete or damaged machinery parts that need replacement. • Task 2: Reverse engineer the part by scanning or measuring it. • Task 3: Create a 3D model of the part using CAD software. • Task 4: Print the replacement part using the same material or a suitable alternative. • Task 5: Install and test the replacement part in the machinery for proper functionality.
20	**Development of Custom Prosthetics Using 3D Printing** Task 1: Understand the functional and aesthetic needs of prosthetic users. Task 2: Create a 3D design of a custom prosthetic limb based on user-specific data. Task 3: Print and assemble the prosthetic limb based on the CAD design. Task 4: Test the prosthetic limb's performance and gather feedback from the user. Task 5: Choose suitable materials for 3D printing that balance strength, flexibility, and cost.

TABLE 5: COURSE ASSESSMENT RUBRICS (TOTAL MARKS: 70)				
ASSESSMENT CRITERIA	**DESCRIBE THE CRITERIA OF THE BELOW CATEGORY PERFORMANCE**			**TOTAL MARKS**
	FAIR	**GOOD**	**EXCELLENT**	
Demonstration of Additive Manufacturing Principles	Basic demonstration of key AM technologies, but lacks depth.	Solid demonstration of AM principles with some application examples.	Deep demonstration of AM technologies, clear articulation of process, and real-world examples.	10
Design for Additive Manufacturing (DFAM)	Able to design simple parts but struggles with optimization for AM.	Designs functional parts considering some DFAM principles.	Demonstrates advanced design skills, optimizing parts for 3D printing.	20
Material Selection and Application	Limited knowledge of material properties and selection for AM.	Correct material selection based on properties and application needs.	Expert material selection, considers performance, cost, and application suitability.	10
3D Printing and Slicing Software Usage	Basic operation of slicing software and printer setup.	Able to slice models and set up printers with few errors.	Expert use of slicing software and printer configuration with minimal issues.	20
Post-Processing Techniques	Limited understanding of post-processing methods.	Knowledge of basic post-processing techniques.	Comprehensive understanding and application of advanced post-processing methods	10
Total				70