IASC
SECTOR SKILL COUNCIL
एक कदम आत्मनिर्भरता की ओर

FUNDAMENTAL OF DIGITAL MANUFACTURING (Rapid Prototype, Scanning, Modelling)

Model Curriculum: NM-5.5-AU-03303-2024-VI-IASC

Version: 1.0

NSQF Level: 5.5

Instrumentation, Automation, Surveillance & Communication Sector Skill Council
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Training Parameters

Course	FUNDAMENTAL OF DIGITAL MANUFACTURING (Rapid Prototyping, Scanning & modelling)
Duration	30 Hours
Occupation	Manufacturing
Country	India
Minimum Educational Qualification & Experience	**10th + 3-year Engg. Diploma* with 3 Year Relevant Industry Experience** **Or** **3rd year of UG (B.E/B.Tech) in relevant field*** INSTRUMENTATION/ EEE / ECE/ MECHANICAL / Electrical/ Mechatronics
Pre-Requisite License or Training	NA
Minimum Job Entry Age	18 Years
Minimum Duration of the Course	30 Hours, 0 Minutes
Maximum Duration of the Course	30 Hours, 0 Minutes

Module Details

Module 1: Computer-Aided Design (06 Hours)

Terminal Outcomes:

- Develop expertise in design software for designing, simulating, and optimizing metal additive manufacturing components, ensuring practical and theoretical proficiency.

Duration: *02.5*	**Duration**: *03.5*
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
• Introduction of Product Life Cycle Management & Computer Aided Design (CAD) and 2D Sketching on NX-11. • Exploring different modelling tools & features to make 3D Model. • Learn about the properties of various metals and alloys used in additive manufacturing and how to select appropriate materials in Design Software. • Master advanced modeling techniques in Design Software, such as creating complex geometries and intricate internal structures suitable for additive manufacturing. • Learn how Design Software integrates with different metal additive manufacturing processes, including data preparation and export for various 3D printing technologies.	• Efficiently navigate and utilize the Design Software interface, customizing toolbars and settings for a streamlined workflow. • Develop proficiency in creating both basic and complex geometries, applying features like extrude, revolve, and sweep. • The candidate will have insights of using advance features for designing 3D models in CAD Software • Apply DfAM principles in practical design projects, including optimizing part orientation and minimizing the need for support structures. • Prepare and export CAD models from Design Software for metal additive manufacturing, ensuring proper file formats and settings. • Work collaboratively on design projects, sharing and integrating feedback to refine and improve CAD models. • Conducted design reviews and iterated on CAD models.

Classroom Aids
Whiteboard/blackboard marker/chalk, duster, computer, or Laptop attached to LCD projector
Tools, Equipment, and Other Requirements
Laptop, whiteboard marker, projector, CAD Software

Module 2: Reverse Engineering & 3D printing (14 hours)

Terminal Outcomes:

- Acquire comprehensive skills in reverse engineering using 3D scanners to create accurate, manufacturable CAD models for additive manufacturing and understanding various 3D Printing technologies.

Duration: *05.5*	**Duration**: *08.5*
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
• Understand the fundamental principles and methodologies of reverse engineering and its applications in metal additive manufacturing. • Comprehend the technology behind 3D scanners, including different types of scanners, their working mechanisms, and their suitability for various reverse engineering tasks. • Learn the processes involved in converting 3D scan data into usable CAD models, including point cloud processing, mesh generation, and integration into CAD software for further design and analysis. • Acquire insight on various technologies used in 3D printing and will get a better understanding of terminologies used. • Understand the principles of FDM, POLYJET & SLA technology of 3D Printing. • Understand the application and strength of 3D printing technology. • Understand the parameters required to strategize the part for 3D printing.	• Gain hands-on experience in setting up and operating 3D scanners, including calibration, scanning techniques, and capturing accurate data of metal parts. • Acquire and clean 3D scan data, removing noise and errors to create a high-quality digital representation of the scanned object. • Develop skills in creating and editing 3D models from scan data, including converting point clouds to meshes, refining surface details, and preparing models for additive manufacturing. • Apply reverse engineering techniques to real-world metal additive manufacturing projects, from scanning existing parts to producing optimized and manufacturable designs. • Understand the 3D printing machine interface and its structure. • Understand the 3D printing strategy-making software and its optimization for FDM technology • Understand the 3D printing strategy-making software and its optimization for Polyjet technology • Understand the 3D printing strategy-making software and its optimization for SLA technology • Demonstrate the basic maintenance and material handling for FDM, Polyjet & SLA technologies. • Demonstrate post process after 3D printing of the part in FDM, Polyjet & SLA technology

Classroom Aids
Whiteboard/blackboard marker/chalk, duster, computer, or Laptop attached to LCD projector
Tools, Equipment, and Other Requirements
Laptop, whiteboard marker, projector, 3D scanner, 3D Printers, and their strategy-making software.

Module 3: Computer Controlled Cutting (04 hours)

Terminal Outcomes:

- Develop comprehensive expertise in the theory and practical application of controlled cutting for prototyping & fabrication.

Duration: *01.5*	**Duration**: *02.5*
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
• Understand the laser cutting operation and machine layout. • Acquire insight on various parameter settings and also understand the tool path generation process.	• Demonstrate the laser cutting operation. • Apply laser cutting software tools and features. • Perform on RD works software for laser cutting parameters optimization for tool path generation. • Perform the laser cutting operation smoothly.

Classroom Aids
White board/ black board marker/chalk, duster, computer, or Laptop attached to LCD projector
Tools, Equipment and Other Requirements
Laptop, white board marker, projector, Laser Cutting Machine, measuring tools, Tools

Module 4: Embedded System & IOT (06 hours)

Terminal Outcomes:

- Develop proficiency in the internal working of the Micro-controllers, Development Boards and its Peripherals. Coding for the Peripherals STEP-BY-STEP and Developing embedded hardware and software completely from scratch.

Duration: *02.5*	**Duration**: *03.5*
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
• Understand the basics of embedded system and its significance • Acquire the insight on the applications of Raspberry Pi & Arduino. • Acquire the capabilities of effectively understand the different programming language and serial communication.	• Demonstrate the pin configuration of microcontroller and microprocessor. • Practice surface preparation methods such as cleaning, degreasing, and masking before sandblasting to ensure optimal adhesion and finish quality. • Set up communication and usage of input & output device. • Hands-on exercises on python and Arduino to develop a mini project. • Execute to make simple IOT device using Arduino

Classroom Aids
Whiteboard/blackboard marker/chalk, duster, computer, or Laptop attached to LCD projector
Tools, Equipment, and Other Requirements
Laptop, whiteboard marker, projector, sand blasting machine, Inert gas muffle furnace, Inert gas or nitrogen gas, safety equipment & tools