GOVERNMENT OF INDIA
MINISTRY OF SKILL DEVELOPMENT & ENTREPRENEURSHIP
DIRECTORATE GENERAL OF TRAINING

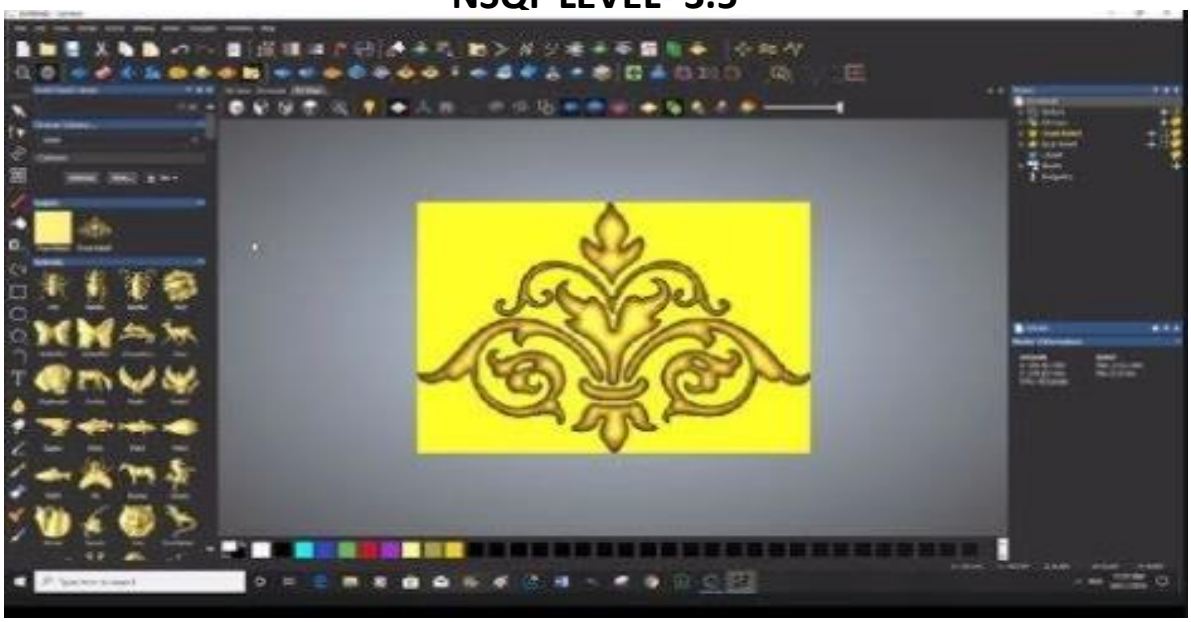
COMPETENCY BASED CURRICULUM

ENGINEERING DESIGN TECHNICIAN

(Duration: One Year)

CRAFTSMEN TRAINING SCHEME (CTS)

NSQF LEVEL- 3.5



SECTOR – CAPITAL GOODS & MANUFACTURING

Directorate General of Training

ENGINEERING DESIGN TECHNICIAN

(Engineering Trade)

(Revised in March 2024)

Version: 3.0

CRAFTSMEN TRAINING SCHEME (CTS)

NSQF LEVEL – 3.5

Developed By

Ministry of Skill Development and Entrepreneurship

Directorate General of Training

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1. COURSE INFORMATION

During the one-year duration of Engineering Design Technician, a candidate is trained on Professional Skill, Professional Knowledge, Engineering Drawing, Workshop Calculation &Science and Employability Skill related to job role. In addition to this, a candidate, is entrusted to undertake project work, extracurricular activities to build up confidence.

The course will start with the safety aspect in general and specific to the trade, identification of tools & equipment, raw materials used. The trainee will perform Measuring &marking by using various Measuring & Marking tools.

Engineering Design Technician – Artisan Software tool is leading design tools, flexible manufacturing features and trusted by organizations and creative professionals around the world. It gives the power to create truly artistic, precision products for a wide variety of applications.

Students will get knowledge of artwork, most common vector and bitmap file formats.

Artisan Software directly supports over 300 CNC machine tools that range from desktop routers, rotary machines and laser engraving units, all the way through to large industrial hardware dedicated to production manufacturing. Artisan Software can also output solid cad model file – widely regarded as the industry standard format and accepted by most CNC machine tools. If you'd like to use a 3D printer, Artisan Software also allows you to export your design in the STL format.

Engineering Design Technician course is designed to give a solid introduction to the key tools and features you'll find in every product within the Artisan software package. The course will help students to understand the importance of Artwork in industry and practical hands on experience on Artisan software includes all its basics fundamental commands, operations and applications includes Basic 2D Machining and tool database and cutting Parameters selection,

Texture flow functions, to develop Rings, Bannisters, Turned Furniture designs, Pillars, Statues, Roller Dies etc., Machine Relief Tool paths, Roughing and Finishing functions, 3D Simulation and NC code Generation, tool Rotary Machining & Modelling Setup and to develop physical components by using 3D printer machine, CNC/VMC machine& laser cutting machine. Also helps student to understand and maintaining the documentation record.

2. TRAINING SYSTEM

2.1 GENERAL

The Directorate General of Training (DGT) under Ministry of Skill Development & Entrepreneurship offers a range of vocational training courses catering to the need of different sectors of economy/ Labour market. The vocational training programmes are delivered under the aegis of Directorate General of Training (DGT). Craftsman Training Scheme (CTS) with variants and Apprenticeship Training Scheme (ATS) are two pioneer schemes of DGT for strengthening vocational training.

CTS courses are delivered nation wide through network of ITIs. The course 'Artisan Using Advance Tool' is of one-year duration. It mainly consists of Domain area and Core area. The Domain area (Trade Theory and Trade Practical) imparts professional skills and knowledge, while Core area (Employability Skills) imparts requisite core skill, knowledge and life skills. After passing out of the training program, the trainee is awarded National Trade Certificate (NTC) by DGT which is recognized worldwide.

Candidates broadly need to demonstrate that they are able to:

- Read and interpret technical parameters/documents, plan and organize work processes, identify necessary materials and tools;
- Perform tasks with due consideration to safety rules, accident prevention regulations and environmental protection stipulations;
- Apply professional skill, knowledge & employability skills while performing jobs.
- Document the technical parameters related to the task undertaken.

2.2 PROGRESSION PATHWAYS

- Can join industry as Artisan and will progress further as Senior Artisan, Supervisor and can rise up to the level of Manager.
- Can become Entrepreneur in the related field.
- Can join Apprenticeship Programmes in different types of industries leading to a National Apprenticeship Certificate (NAC).
- Can join Crafts Instructor Training Scheme (CITS) in the trade for becoming an instructor in ITIs.

2.3 COURSE STRUCTURE

Table below depicts the distribution of training hours across various course elements during a period of one year: -

S No.	Course Element	Notional Training Hours
1	Professional Skill (Trade Practical)	840
2	Professional Knowledge (Trade Theory)	240
3	Employability Skills	120
	Total	**1200**

In addition, every year 150 hours of mandatory on the job training (OJT) in the industry, if nearby industry is not available then group project will be mandatory.

On the Job Training (OJT)/ Group Project	150
Optional courses (10th/ 12th class certificate along with ITI certification or add on short term courses)	240

Trainees of One-year or two-year trade can also opt for optional courses of up to 240 hours in each year for 10^{th}/12^{th} class certificate along with ITI certification, or, add on short term courses.

2.4 ASSESSMENT & CERTIFICATION

The trainee will be tested for his skill, knowledge and attitude during the period of course through formative assessment and at the end of the training programme through summative assessment as notified by the DGT from time to time.

a) The **Continuous Assessment** (Internal) during the period of training will be done by **Formative Assessment Method** by testing for assessment criteria listed against learning outcomes. The training institute has to maintain an individual trainee portfolio as detailed in assessment guideline. The marks of internal assessment will be as per the formative assessment template provided on www.bharatskills.gov.in.

b) The final assessment will be in the form of summative assessment. The All India Trade Test for awarding NTC will be conducted by Controller of examinations, DGT as per the guidelines. The pattern and marking structure is being notified by DGT from time to time. **The learning outcome and assessment criteria will be the basis for setting question papers for final assessment. The examiner during final examination will also check** the individual trainee's profile as detailed in assessment guideline before giving marks for practical examination.

2.4.1 PASS REGULATION

For the purposes of determining the overall result, weightage of 100% is applied for six months and one-year duration courses and 50% weightage is applied to each examination for two years courses. The minimum pass percent for Trade Practical and Formative assessment is 60% & for all other subjects is 33%.

2.4.2 ASSESSMENT GUIDELINE

Appropriate arrangements should be made to ensure that there will be no artificial barriers to assessment. The nature of special needs should be taken into account while undertaking the assessment. Due consideration should be given while assessing for teamwork, avoidance/reduction of scrap/wastage and disposal of scrap/waste as per procedure, behavioral attitude, sensitivity to the environment and regularity in training. The sensitivity towards OSHE and self-learning attitude are to be considered while assessing competency.

Assessment will be evidence based comprising some of the following:

- Job carried out in labs/workshop
- Record book/ daily diary
- Answer sheet of assessment
- Viva-voce
- Progress chart
- Attendance and punctuality
- Assignment
- Project work
- Computer based multiple choice question examination
- Practical Examination

Evidences and records of internal (Formative) assessments are to be preserved until forthcoming examination for audit and verification by examining body. The following marking

pattern to be adopted for formative assessment:

Performance Level	Evidence
(a) Marks in the range of 60%-75% to be allotted during assessment	
For performance in this grade, the candidate should produce work which demonstrates attainment of an acceptable standard of craftsmanship with occasional guidance, and due regard for safety procedures and practices	● Demonstration of good skills and accuracy in the field of work/ assignments. ● A fairly good level of neatness and consistency to accomplish job activities. ● Occasional support in completing the task/ job.
(b)Marks in the range of 75%-90% to be allotted during assessment	
For this grade, a candidate should produce work which demonstrates attainment of a reasonable standard of craftsmanship, with little guidance, and regard for safety procedures and practices	● Good skill levels and accuracy in the field of work/ assignments. ● A good level of neatness and consistency to accomplish job activities. ● Little support in completing the task/job.
©Marks in the range of more than 90% to be allotted during assessment	
For performance in this grade, the candidate, with minimal or no support in organization and execution and with due regard for safety procedures and practices, has produced work which demonstrates attainment of a high standard of craftsmanship.	● High skill levels and accuracy in the field of work/ assignments. ● A high level of neatness and consistency to accomplish job activities. ● Minimal or no support in completing the task/ job.

3. JOB ROLE

After completing this course, technician can craft beautifully detailed 3D pieces using flexible starting points. Intricate 3D designs to create from scratch, built from pre-drawn vector artwork or assembled from imported triangle or surface models.

Designs a variety of product from routing wood, creating molds or press tools, laser cutting, engraving hard-wearing metals for production lines, or simply nesting designs to achieve the minimum amount of material waste.

There are many opportunities in different industries for job roles like Artistic CADCAM Technician, Artistic CADCAM Specialist, CNC Router, Sculptor, Modeler, Commercial Artist, Visual Artist in different industries like Automotive, Architecture, Die Mold, Footwear, Toys, Packaging, Lighting, Sign making, Woodworking, Jewelry, Cabinetry, Furniture, Interiors, Patternmaking, Government Mints, Biscuit and Chocolate Making, Theme Park, Film Studio, Textile Industry, Paper Industry, Cutlery, Sanitary, etc.

Sculptor; Carves figures, statues, monuments and other imaginative designs in abstract forms by odeling stone or carving wood or odeling clay or any other material either direct from original or from models prepared by him or Modeller. Selects material such as stone, wood, clay, ivory, marble, wax, etc. according to requirements. Sketches design and makes scale model in wax or plaster. Transfers measurements to block. Carves, or shapes block using different tools achieving unity and harmony. Is designated as Sthapathi if engaged in designing, carving and drilling holes in stones to make Idols for use in temples from mental perception as described in 'Shastras' (holy scriptures of Hindus) by the use of hammer and chisels only. May sharpen tools by hand or on machine. May inscribe decorative lettering and monumental sculptures on models. May make clay or wax models and caste same in plaster of Paris or bronze.

Modeller (Except Stone); makes clay or plaster of Paris models of pottery, porcelain and models of anatomical studies according to drawing and specifications, for mass production. Prepares clay, wax or plaster of Paris foundation. Carves material, using shaping tools, lathe or potter's wheel to resemble model to exact size and other specifications. May prepare model of important persons by observing person's facial expression and features, and carving and shaping material to required size and form. May create own designs.

Stone Modeller; Stone Statue Maker carves out features, statues, models, idols and other artistic designs on stone slabs, blocks or pillars for construction of temples, monuments, fountains, buildings etc. using hand tools. Studies nature of carvings to be done from drawings, photographs, written descriptions etc. or receives instructions from Sthapathi or other appropriate authority. Forms mental picture of carving to be done and selects required type of

stone such as marble, soapstone, granite, green stone, etc. Chips off unwanted portions of stone with hammer and chisel and marks outline of figures with chalk, pencil or ochre solution by free hand sketching using drawing and measuring instruments. Places stone in working position, applies oil over its surface if working on granite and carefully carves out figures, statues, idols, models etc. as designed using hammer and chisels of different sizes. Marks portion with paint otherwise to indicate stages of work and facilitate carving and gives smooth and finishing touches to carved figures using fine chisels. Cuts slits and drills holes as designed using saw blades and hand drills or with hammer and chisels depending on specifications and nature of work done particularly for carvings of idols and images meant for temples. Brushes off dust and waste material from object and sprinkles water on it, as necessary, while carving. May carve numbers and letters and create designs. May make clay model of statue or image to be carved to ensure accuracy and facilitate working.

Commercial Artist; prepares designs for advertising articles or draws illustrations for books, magazines, posters, charts, hoardings etc. in suitable columns. Studies specifications and discusses details and cost with client. Determines subject matter in consultation with client and draws designs and sketches with or without colour to desired effect. Executes approved design in required medium such as paints, oils, water-colour etc.

Visual Artists, Other; Sculptors, Painters and Related Artists, other include all other sculptures, painters and related artists engaged in specialized fields of painting, sculpture, odeling etc. not elsewhere classified.

Reference NCO-2015:

a) 2651.0100 – Sculptor
b) 2651.0200 – Modeller (Except Stone)
c) 2651.0300 – Stone Modeller
d) 2166.0100 – Commercial Artist
e) 2651.9900 – Visual Artists, Other

Reference NOS:

i)	MIN/N1702	ix)	HCS/N0101	xvii)	HCS/N9420
ii)	MIN/N1703	x)	HCS/N5601	xviii)	MIN/N0469
iii)	MIN/N1704	xi)	HCS/N0102	xix)	HCS/N4506
iv)	MIN/N1705	xii)	HCS/N5202	xx)	HCS/N4504
v)	HCS/N9913	xiii)	HCS/N9416	xxi)	CSC/N9401
vi)	HCS/N9902	xiv)	HCS/N9417	xxii)	CSC/N9402
vii)	HCS/N0802	xv)	HCS/N9418		
viii)	HCS/N4406	xvi)	HCS/N9419		

4. GENERAL INFORMATION

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Name of the Trade	**ENGINEERING DESIGN TECHNICIAN**
NCO – 2015	2651.0100, 2651.0200, 2651.0300, 2166.0100, 2651.9900
NOS Covered	MIN/N1702, MIN/N1703, MIN/N1704, MIN/N1705, HCS/N9913, HCS/N9902, HCS/N0802, HCS/N4406, HCS/N0101, HCS/N5601, HCS/N0102, HCS/N5202, HCS/N9416, HCS/N9417, HCS/N9418, HCS/N9419, HCS/N9420, MIN/N0469, HCS/N4506, HCS/N4504, CSC/N9401
NSQF Level	Level-3.5
Duration of Craftsmen Training	One Year (1200 Hrs. + 150 hours OJT/Group Project)
Entry Qualification	Passed 10th class examination
Minimum Age	14 years as on first day of academic session.
Eligibility for PwD	LD, CP, LC, DW, AA, LV, DEAF, AUTISM, MD
Unit Strength (No. of Student)	10 (There is no separate provision of supernumerary seats)
Space Norms	120 Sq. m
Power Norms	3 KW (extended battery backup mandatory)
Instructors Qualification for:	
(i) Engineering Design Technician Trade	B. Voc/Degree in Mechanical/Industrial/Architecture/Design Engineering from AICTE/UGC recognized Engineering College/ university with one-year experience in the relevant field. OR 03 years Diploma in Mechanical/Industrial/ Architecture/Design Engineering from AICTE/ recognized board of technical education or relevant Advanced Diploma (Vocational) from DGT with two years' experience in the relevant field. OR NTC/NAC passed in the trade of "Engineering Design Technician" with three years' experience in the relevant field. **<u>Essential Qualification</u>:**

	Relevant National Craft Instructor Certificate (NCIC) in any of the variants under DGT. ***Note: - Out of two Instructors required for the unit of 2 (1+1), one must have Degree/Diploma and other must have NTC/NAC qualifications. However, both of them must possess NCIC in any of its variants.***
(ii) Employability Skill	MBA/ BBA / Any Graduate/ Diploma in any discipline with Two years' experience with short term ToT Course in Employability Skills. (Must have studied English/ Communication Skills and Basic Computer at 12th / Diploma level and above) **OR** Existing Social Studies Instructors in ITIs with short term ToT Course in Employability Skills.
(iii) Minimum Age for Instructor	21 Years
List of Tools and Equipment	As per Annexure – I

5. LEARNING OUTCOME

Learning outcomes are a reflection of total competencies of a trainee and assessment will be carried out as per the assessment criteria.

5.1 LEARNING OUTCOMES

1. Recognize and comply safe working practices. (NOS: MIN/N1702, MIN/N1703, MIN/N1704, MIN/N1705, HCS/N9913, HCS/N9902)
2. Make different basic drawing and mathematical geometrical calculations. (NOS: HCS/N0802)
3. Plan & perform basic drawing and engineering calculations. (NOS: HCS/N0802)
4. Identify basic materials and product manufacturing process. (NOS: HCS/N4406, HCS/N0101)
5. Perform inspection with different measurement tools & techniques to ensure the quality of product. (NOS: HCS/N5601, HCS/N0102)
6. Plan and execute the user interface and basic set up of artisan design software. (NOS: HCS/N5202)
7. Perform basic setting, layout setup & Interface Customization in artisan software. (NOS: HCS/N5202)
8. Apply standard geometrics and artisan design software (such as circle, rectangular, arcs and text). (NOS: HCS/N5202)
9. Perform artisan software operation to Edit Mode, Scale the Geometries, break the vectors and re-join. (NOS: HCS/N5202)
10. Apply basic 2D machining, Tool Database, Cutting Parameters selection and application. (NOS: HCS/N5202)
11. Observe and create simple and advanced 3D Design which can generate some complex reliefs in artisan operation. (NOS: HCS/N5202)
12. Measure texture flow function use Texture Flow function by creating scales for a relief incorporate with manufacturing standards. (NOS: HCS/N9416)
13. Design cylindrical surface of the model and add the required artistic details. (To develop Rings, Bannisters, Turned Furniture designs, Pillars, Statues, Roller Dies etc.). (NOS: HCS/N5202)
14. Perform on 3D Machining, Tool Database and Machining Parameters (Cutting). (NOS: HCS/N9417)
15. Work on Machine Relief Toolpaths, Roughing and Finishing functions. (NOS: HCS/N9418)
16. Check 3D simulation and NC code Generation using artisan software. (NOS: HCS/N9419)
17. Use of Rotary Machining & Modeling Setup tools. (NOS: HCS/N9420)
18. Assess the laser cutting machine & general tools for develop the physical model. (NOS: MIN/N0469)
19. Carryout processing and painting to finish the component. (NOS: HCS/N4506,

HCS/N4504)

20. Read and apply engineering drawing for different application in the field of work. (NOS: CSC/N9401)
21. Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study. (NOS: CSC/N9402)

6. ASSESSMENT CRITERIA

LEARNING OUTCOME	ASSESSMENT CRITERIA
1. Recognize and comply safe working practices. (NOS: MIN/N1702, MIN/N1703, MIN/N1704, MIN/N1705, HCS/N9913, HCS/N9902)	Follow and maintain procedures to achieve a safe working environment in line with occupational health and safety regulations and requirements.
	Recognize and report all unsafe situations according to site policy.
	Identify and take necessary precautions on fire and safety hazards and report according to site policy and procedures.
	Identify, handle and store / dispose of dangerous/unsalvageable goods and substances according to site policy and procedures following safety regulations and requirements.
	Identify and observe site policies and procedures in regard to illness or accident.
	Identify safety alarms accurately.
	Report supervisor/ Competent of authority in the event of accident or sickness of any staff and record accident details correctly according to site accident/injury procedures.
	Identify and observe site evacuation procedures according to site policy.
	Identify Personal Productive Equipment (PPE) and use the same asper related working environment.
	Identify basic first aid and use them under different circumstances.
2. Make different basic drawing and mathematical geometrical calculations. (NOS: HCS/N0802)	Identify the customer needs.
	By using different strategies improve perceived quality level
3. Plan & perform basic drawing and engineering calculations. (NOS: HCS/N0802)	Identify the drawing projection method.
	Apply Geometric dimensions & Tolerances as per assembly prospect.
	Preparation of Bill of Material.
	Perform basic engineering calculation.
4. Identify basic materials and product manufacturing process. (NOS: HCS/N4406, HCS/N0101)	Select material as per applicability.
	Select appropriate manufacturing processes.
5. Perform inspection with	Select appropriate measuring instruments such as micrometers,

different measurement tools & techniques to ensure the quality of product. (NOS: HCS/N5601, HCS/N0102)	Vernier calipers, etc. (as per tool list).
	Measure dimension of the components observing standard inspection process & record data to analyze with given drawing/measurement.
	Calibrate the measuring instruments.
6. Plan and execute the user interface and basic set up of artisan design software. (NOS: HCS/N5202)	Perform basic set up of Graphic User Interface to Artisan Software.
	Customize the layout of artisan software.
	Customize the toolbars of artisan artisan module.
7. Perform basic setting, layout setup & Interface Customization in artisan software. (NOS: HCS/N5202)	Customize the Docking Toolbars, Panels and Themes for artisan software.
	Customize the shortcut keys for artisan software to improve productivity.
	Interface Customization in artisan Software.
8. Apply standard geometrics and artisan design software (such as circle, rectangular, arcs and text). (NOS: HCS/N5202)	Create artisan work using standard geometries.
	Create Various curves, vector layers & shapes creation.
	Use of Node Mode to convert the spans to Arcs and convert them to free flow shapes.
9. Perform artisan software operation to Edit Mode, Scale the Geometries, break the vectors and re-join. (NOS: HCS/N5202)	Create and Edit mode the geometrics by using artisan software.
	Scale up the geometrics by using artisan software.
	Create and Break the vectors and re-join.
	Crate art work by using Vector Layers.
10. Apply basic 2D machining and Tool Database and Cutting Parameters selection and application. (NOS: HCS/N5202)	Setting up the software for Basic 2D Machining
	2D Machining parameter selection and updating in tool library.
	Create 2D Profiling, 2D Roughing, Drilling, V Bit Carving and Bevel Carving.
11. Observe and create simple and advanced 3D Design which can	Create & Edit the Shape with the help of artisan standard toolbar.
	Add &Subtract the 3D geometries in artisan software.
	Use of smooth relief and sculpting tool.

generate some complex reliefs in artisan operation. (NOS: HCS/N5202)	
12. Measure texture flow function use Texture Flow function by creating scales for a relief incorporate with manufacturing standards. (NOS: HCS/N9416)	Create and edit on 2 Rail Sweep, leaf shape, star shape & Multiple section by using artisan software.
	Applying the texturing and incorporate texture relief.
	Applying the texture flow spacing and texture flow vary scale.
13. Design cylindrical surface of the model and add the required artistic details. (To develop Rings, Bannisters, Turned Furniture designs, Pillars, Statues, Roller Dies etc.) (NOS: HCS/N5202)	Create the cylindrical surface of the model by considering manufacturing constraints.
	Create and edit the ring side vector.
14. Perform on 3D Machining, Tool Database and Machining Parameters (Cutting). (NOS: HCS/N9417)	Applying and updating the 3D Material for 3D Machining.
	Create and upload the Cutting tool Parameter database.
15. Work on Machine Relief Toolpaths, Roughing and Finishing functions. (NOS: HCS/N9418)	Selection of tooling for various operation.
	Generate the machine relief toolpaths for roughing to finishing operation.
	Simulate & optimize the machining toolpath.
16. Check 3D simulation and NC code Generation using artisan software. (NOS: HCS/N9419)	Generate the tool path simulation and NC (Numerical Control) output for Machining.
	Perform 3D Simulation of generated NC (Numerical Control) code.
17. Use of Rotary Machining & Modelling Setup tools. (NOS: HCS/N9420)	Performing setup for Rotary Machining.
	Use of sub commands Ring Design and Pillar Design.

18. Assess the laser cutting machine &general tools for develop the physical model. (NOS: MIN/N0469)	Export 3D model to various CAD file formats.
	Develop the physical product by using Additive manufacturing technique.
	Develop the physical product by using laser cutting Machine.
19. Carryout processing and painting to finish the component. (NOS: HCS/N4506, HCS/N4504)	Finish the component using post processing tools.
	By using paint booth apply the painting to make product and work of art is aesthetically good.
20. Read and apply engineering drawing for different application in the field of work. (NOS: CSC/N9401)	Read & interpret the information on drawings and apply in executing practical work.
	Read &analyze the specification to ascertain the material requirement, tools and assembly/maintenance parameters.
	Encounter drawings with missing/unspecified key information and make own calculations to fill in missing dimension/parameters to carry out the work.
21. Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study. (NOS: CSC/N9402)	Solve different mathematical problems
	Explain concept of basic science related to the field of study

7. TRADE SYLLABUS

SYLLABUS FOR ENGINEERING DESIGN TECHNICIAN			
ONE YEAR			
Duration	**Reference Learning outcome**	**Professional Skills (Trade Practical)**	**Professional Knowledge (Trade Theory)**
Professional Skill 25 Hrs.; Professional Knowledge 05 Hrs.	LO-1: Recognize and comply safe working practices.	1. Safety attitude development of the trainee by educating them to use Personal Protective Equipment (PPE) such as use of gloves and goggles. 2. First Aid Method and basic training. 3. Safe disposal of waste materials like cotton waste, metal chips/burrs etc. 4. Hazard identification and avoidance. 5. Safety signs for Danger, Warning, caution & personal safety message. 6. Preventive measures for electrical accidents & steps to be taken in such accidents. 7. Use of Fire extinguishers. 8. Practice and understand precautions to be followed while working in fitting jobs. 9. Safe use of tools and equipment used in the trade by using tweezers for all purposes and handle scrappers.	All necessary guidance to be provided to the new comers to become familiar with the working of Industrial Training Institute system including stores procedures. Soft Skills, its importance and Job area after completion of training. Importance of safety and general precautions observed in the in the industry/shop floor. Introduction of First aid. Operation of electrical mains and electrical safety. Introduction of PPEs. Response to emergencies e.g.; power failure, fire, and system failure. Importance of housekeeping & good shop floor practices. Introduction to 5S concept & its application. Occupational Safety & Health: Health, Safety and Environment guidelines, legislations & regulations as applicable. Material handling equipment.
Professional Skill 120 Hrs.;	LO-2: Make different basic drawing and mathematical	10. Develop a concept of an innovating product to reduce human effort. 11. Define the complete	Introduction to innovation and its necessity. Understanding of product design and development

Professional Knowledge 30 Hrs.	geometrical calculations.	product lifecycle. 12. Use product development phases to develop a new innovative product. 13. Developing a new product concept consider the function, aesthetics, production costs, and usability of products with the help of industrial design study.	process. Concept of product life cycle management. Introduction to Industrial design & its process.
		14. Improve the perceived quality of product with the help of cite research & Ergonomics 15. List out and Practical demonstrations of ergonomic principles 16. Evaluate human factors and ergonomics ranged from simple questionnaires to complex.	Concept of perceived quality Importance of Perceived quality, variety of strategies used to improve perceived quality level Concept of Product based quality. Concept of industrial design rights. Concept of Human factors and Types of ergonomics & its importance
		17. Foundation buildup using SCOPE tool. 18. Generate multiple ideas through brainstorming. 19. Develop a product using SCAMPER tool (Substitute, Combine, Adapt, Modify, Magnify, Minify, Eliminate, Reverse &Rearrange)	Introduction to design challenge. Phases of design thinking. Use of SCOPE tool Explore the problem statement. Concept of Ideation & rules of idea generation. Process & theoretical structure of SCAMPER tool.
		20. Develop a concept model from of Analogous Inspiration. 21. Develop a concept model by Deconstruct & Reconstruct of material tool. 22. Refinement and Evaluation of Ideas.	Refinement and optimum selection of ideas. Analogous and inspiration of model. Construct and deconstruct concept.
		23. Develop a concept model by sharing & integrating the all ideas.	Concept of co-creation with user. Series of activities of the solution idea. Refinement

		24. Draws the touch-point of your idea and describe the activities with the help of story boarding tool. 25. Develop common understanding of review all the user feedback and Finalize the big idea.	and Finalizing through customer or user experience journey. Finalize your big idea concept.
		26. List out the virtual testing platform as per application. 27. Create/Prepare Innovative product concept design with Digital mock up (DMU).	Concept of digital mock up Introduction of product testing Importance of virtual testing & its methodology.
Professional Skill 25 Hrs.; Professional Knowledge 05 Hrs.	LO-3: Plan & perform basic drawing and engineering calculations.	28. Identify the drawing projection method. 29. Use of Geometric dimensions & Tolerances as per assembly prospect. 30. Preparation of Bill of Material. 31. Perform basic engineering calculation.	First angle and third angle projection. Units of dimensioning, System of dimensioning, Method of dimensioning &common features. Concept of Geometric dimensions & Tolerances Introduction to Bill of Material in drawing.
Professional Skill 25 Hrs.; Professional Knowledge 05 Hrs.	LO-4: Identify basic materials and product manufacturing process.	32. Prepare list of appropriate materials by interpreting detail drawings and determine quantities of such materials. 33. Explain Different manufacturing processes 34. List out the benefit of Additive manufacturing technology.	Introduction to Material Science, Different types of materials, its properties and applications Introduction to manufacturing process. Introduction to additive Manufacturing. Benefits of Additive manufacturing. Different types of Additive Manufacturing.
Professional Skill 25 Hrs.; Professional Knowledge 05 Hrs.	LO-5: Perform inspection with different measurement tools & techniques to ensure the quality of product.	35. Perform linear measurements using Vernier Caliper, Vernier height gauge, and Measure Tape. 36. Draw the system with indication of geometrical tolerances 37. Perform Angular Measurement.	Introduction to measurement & quality control. Principle of Vernier scale and least count. Handling of measuring instrument & Calibration importance. Inspecting GD & T on product techniques.

		38. Inspection data recorded to analyze with given drawing/measurement.	
Professional Skill 25 Hrs.; Professional Knowledge 05 Hrs.	LO-6: Plan and execute the user interface and basic set up of artisan design software.	39. Customize the layout of artisan software. 40. Customize the toolbars of artisan software module. 41. Creation and selection of work directory. 42. Selection of units and screen resolution for new model	Introduction to GUI (Graphical user Interface). Industrial application of artisan software. Orientation of selection bar and the importance of unit selection for creation of new model.
Professional Skill 25 Hrs.; Professional Knowledge 05 Hrs.	LO-7: Perform basic setting, layout setup & Interface Customization in artisan software.	43. Customize the Docking Toolbars, Panels and Themes for artisan software. 44. Use of shortcut keys &Mouse buttons application, Picking and selecting & Additional functions like Import export, save, new model, cut, pest etc. 45. Selection of working plane. 46. Importing and aligning the existing model.	Various settings to personalize the software configurations to suit the user's requirements. Create 2D artistic designs The list of available toolbars and panels can be accessed from the Window pull down menu and choosing Toolbars and Docking Windows.
Professional Skill 50 Hrs.; Professional Knowledge 10 Hrs.	LO-8: Apply standard geometrics and artisan design software (such as circle, rectangular, arcs and text)	47. Create Standard Geometries by using line, Circle, Arcs and Text, etc. 48. Create standard geometries Square, Rectangle, Parallelogram, Rhombus, Trapezium, etc. 49. Create smooth curves by using node editing median smooth curve option. 50. Create smooth curves by using node editing virtual midpoint option. 51. Create vector layers by using Recess, window, outside, default layer option. 52. Perform shapes creation	Introduction Create Standard Geometries, Orientation of basic sketchers tool like line, Circle, Rectangle, Arcs and Text. Concept of Various curves, vector layers NS Shapes creation Importance & need of free flow shapes. Manufacturing consideration and feasibility verification of design.

		operation. 53. Node Mode to convert the spans to Arcs 54. Convert Spans/Arcs to free flow shapes.	
Professional Skill 62 Hrs.; Professional Knowledge 13 Hrs.	LO-9: Perform artisan software operation to Edit Mode, Scale the Geometries, break the vectors and re-join.	55. Restore the tool bar for basic geometry. 56. Select appropriate tool bar and create 2D design (use size, corner or center of geometry options) 57. Rotate the 2D design into specific angle. 58. Use of vector tool to align the model to left, right, top, bottom and center. 59. Create the vector text with the help of style tool. 60. Editing the existing text like changing the size & style of vector text. 61. Use of vector text spacing tool to edit the existing art work model. 62. Create the duplicate mirror design by using mirror tool (Horizontal/vertical) 63. Constraint the complete model using constraint tool. 64. Create and Edit mode the geometrics by using artisan software. 65. Scale the geometrics by using artisan software. 66. Create &break the vectors and re-join. 67. Crate art work by using Vector Layers 68. Exercises on Vector Preview – Print for approval.	Orientation of Tool setting. Use and selection method of various tools. Importance of plane selection for art work in software. Vector tool and its importance. Orientation of style tool and its importance for increasing the productivity. Concept of mirror modeling. Application of spacing tool and its importance for increasing the productivity. Concept of constraint tool to correct the geometry. Selection and use of On a Curve tool to edit specific geometry. Use Scale option. Edit the Geometries, break the vectors and re-join. Use of Vector Layers to manage the artwork. Vector Preview – Print for approval.
Professional Skill 35 Hrs.;	LO-10: Apply basic 2D machining and Tool Database and Cutting	69. Setting up the software for Basic 2D Machining 70. Create 2D art shape for machining	Introduction to Machining – Material Setup Introduction to cutting tools. Types of cutting tools and their

Professional Knowledge 10 Hrs.	Parameters selection and application.	71. Create area clearance toolpath on 2D geometry. 72. Selection of vector and cutting depth for 2D machining. 73. 2D Machining parameter selection from library. 74. Selection of tool from library for 2D machining. 75. Create 2D Roughing path for curve & square path using 2D machining tools. 76. Create Drilling operation set up and generate 2D tool path.	application. Selection criteria for cutting tools. Uploading Tool Database for library. Selection of appropriate tool as per application and material properties. Cutting Parameters Use of various 2D Toolpath Strategies. Use 2D Profiling, 2D Roughing, Drilling, V Bit Carving and Bevel Carving.
Professional Skill 35 Hrs.; Professional Knowledge 10 Hrs.	LO-11: Observe and create simple and advanced 3D Design which can generate some complex reliefs in artisan operation.	77. List out the Basic 3D Modelling functionalities 78. Create & edit the Shape Spherical, Conical, Flat 79. Importing of 3D model and placement on working plane 80. Use 3D boundary frame from existing library and adjust according to the model 81. Add & Subtract the 3D geometries in artisan software. 82. Create merger by Using Tool Merge High and Merge Low 83. Create Smooth Relief & generate the profile. 84. Perform Sculpting operation and create Tool profile.	Introduction to 3D Modelling functionalities. Use of Shape Editor – Spherical, Conical Flat. Importance of importing and exporting of art work. Updating of frame library and its importance. Use of Add, Subtract. Concept of design merging. Importance of design relief points and its machining importance. Concept of Sculpting & its industrial case study.
Professional Skill 76 Hrs.; Professional Knowledge	LO-12: Measure texture flow function use Texture Flow function by creating scales for	85. Import the model and use select whole tool for texturing. 86. Import the model and select the selected vector tool for texturing.	Tool orientation of texture & their selection criteria. Types of texture and its application. Create freeform three-dimensional shapes using vector artwork and Vector

14 Hrs.	a relief incorporate with manufacturing standards.	87. Use of standard texture Sphere, Ellipse, Cone, Pyramid, etc. 88. Create 2 Rail Sweep &leaf shape. 89. Create star shape. 90. Change the height of art work using boundary relief option	Based Relief Creation and Relief Editing tools. Concept of geometric patterns and organic textures directly from artwork.
		91. Create smooth boundaries of art work using boundary relief option 92. Setting up the machine area by using machine relief option. 93. Selection of vectors to create machine tool relief. 94. Perform the texture Relief operation. 95. Exercise on Texture Flow tool 96. Exercise on Texture scale up and Flow Spacing	Concept and importance of art work boundaries. Library overview of boundaries. Use of texture flow tool and relief constrain. Concept of Scale up in design.
Professional Skill 50 Hrs.; Professional Knowledge 10 Hrs.	LO-13: Design cylindrical surface of the model and add the required artistic details. (To develop Rings, Bannisters, Turned Furniture designs, Pillars, Statues, Roller Dies etc.)	97. Create the cylindrical surface of the model by considering manufacturing constraints. 98. Create & edit the ring side vector. 99. Create & edit the Bannister. 100. Create & edit the roller dies.	Concept of cylindrical surface. Concept of ring side vector & Bannister
Professional Skill 25 Hrs.; Professional Knowledge 05 Hrs.	LO-14: Perform on 3D Machining, Tool Database and Machining Parameters (Cutting).	101. Import the tool library for roughing to finishing operation. 102. Create and update the Tool Database. 103. Create and update the Cutting Parameters. 104. Selection of Tools and editing the parameters as per 3D art work operation.	Introduction to 3D Machining – 3D Material Setup Tool Database and Cutting Parameters. Selection of Tools.

Professional Skill 25 Hrs.; Professional Knowledge 05 Hrs.	LO-15: Work on Machine Relief Toolpaths, Roughing and Finishing functions.	105. Perform Roughing operation set up in artisan software. 106. Create End mill and Finishing set up of Ball Nose 107. Generate Machine Relief Toolpaths artisan software. 108. Setting up the material thickness and model position of in material. 109. Export toolpath summary information of finalize toolpath.	Concept of Machine Relief Toolpaths. Material thickness and its importance. Importance of model position.
Professional Skill 76 Hrs.; Professional Knowledge 14 Hrs.	LO-16: Check 3D simulation and NC code Generation using artisan software.	110. Import the model and set to the co-ordinate. 111. Select the model or 3D art work and set the tooling data for simulation. 112. Run the simulation tool and virtually verification of tool path. 113. Export the 3D generated tool path for future references. 114. Generate the NC code of art work design. 115. Export the NC code for machining purpose.	Difference between 3D simulation and 2D simulation and their industrial application. Toolpath Simulation and its importance. Modify the toolpath and its importance. Orientation of NC code & Generate the NC code and machining purpose.
		116. Modify the tool path by changing tooling and reference points. 117. Update the tool library and tooling database. 118. Virtual verification of machining by using simulation tool to confirm the tooling data and machining relief 119. Create complex product by using artisan software and generate the NC code by using advanced 3D machining toolbar.	Customize the 3D machining toolbar. Orientation of machining operation and machining limitation. Importance machining cycle time & their optimization technique.

Professional Skill 35 Hrs.; Professional Knowledge 10 Hrs.	LO-17: Use of Rotary Machining & Modelling Setup tool.	120. Performing Rotary Machining Setup 121. Use of sub commands Ring Design. 122. Develop Pillar Design and perform machining setup	Understanding toolbars Rotary Machine Setup, Ring Design, Pillar Design, Rotary machining setup, Ring Machining, Pillar Machining.
Professional Skill 76 Hrs.; Professional Knowledge 14 Hrs.	LO-18: Assess the laser cutting machine & general tools for develop the physical model.	123. Export 3D model to various CAD file formats. 124. Prepare and optimize the model design using Slicing software. 125. Create the physical product by using Additive manufacturing machine	Working principle of Additive manufacturing. Application of additive manufacturing with the help of case studies. Orientation of 3D Printer machine & its basic maintenance. Process of preparing 3D model and exporting it to desired format.
		126. Prepare laser cutting machine (Setting of cutting parameters and adjusting of work holding device) 127. Create the physical product by using Laser cutter equipment's. 128. Perform Preventive maintenance and basic troubleshooting of 3D printing, and laser cutting machine.	Operating & Programming on CNC/VMC operations. Study of laser cutter equipment's, making vectors for laser cutter with artisan software Design & drawing documents.
Professional Skill 25 Hrs.; Professional Knowledge 05 Hrs.	LO-19: Carryout processing and painting to finish the component.	129. Finish the component using post processing tools. 130. Setting up the paint booth. 131. By using paint booth apply the paint to make product/ work of art is aesthetically good and adds value.	Industrial standards for Post processing operations. Orientation of post processing tool &their application. Types of painting and industrial application.
ENGINEERING DRAWING:			
Professional Knowledge ED: 30 Hrs.	LO-20: Read and apply engineering drawing for different application in the	Introduction to Engineering Drawing and Drawing Instruments – ● Conventions ● Sizes and layout of drawing sheets ● Title Block, its position and content ● Drawing Instrument	

	field of work.	Lines- Types and applications in drawing Free hand drawing of – ● Geometrical figures and blocks with dimension ● Transferring measurement from the given object to the free hand sketches. ● Free hand drawing of hand tools and measuring tools. Drawing of Geometrical figures: ● Angle, Triangle, Circle, Rectangle, Square, Parallelogram. ● Lettering & Numbering – Single Stroke. Dimensioning ● Types of arrowhead ● Leader line with text ● Position of dimensioning (Unidirectional, Aligned) Symbolic representation – ● Different symbols used in the related trades. Concept and reading of Drawing in ● Concept of axes plane and quadrant ● Concept of Orthographic and Isometric projections ● Method of first angle and third angle projections (definition and difference) Reading of Job drawing related to trades. ●
WORKSHOP CALCULATION & SCIENCE:		
Professional Knowledge WSC: 30 Hrs.	LO-21: Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study.	**Unit, Fractions** ● Classification of unit system ● Fundamental and Derived units F.P.S, C.G.S, M.K.S and SI units ● Measurement units and conversion ● Factors, HCF, LCM and problems ● Fractions - Addition, substraction, multiplication & division ● Decimal fractions - Addition, subtraction, multiplication & division ● Solving problems by using calculator **Square root, Ratio and Proportions, Percentage** ● Square and square root ● Simple problems using calculator ● Applications of Pythagoras theorem and related problems ● Ratio and proportion ● Ratio and proportion - Direct and indirect proportions ● Percentage ● Percentage - Changing percentage to decimal and fraction **Material Science** ● Types metals, types of ferrous and non-ferrous metals ● Physical and mechanical properties of metals ● Introduction of iron and cast iron

		● Difference between iron & steel, alloy steel and carbon steel ● Properties and uses of rubber, insulating materials **Mass, Weight, Volume and Density** ● Mass, volume, density, weight and specific gravity, **numericals related to sections L, C, O.** ● Related problems for mass, volume, density, weight and specific gravity **Speed and Velocity, Work, Power and Energy** ● Speed and velocity - Rest, motion, speed, velocity, ● difference between speed and velocity, acceleration and retardation ● Speed and velocity - Related problems on speed & velocity **Heat & Temperature and Pressure** ● Concept of heat and temperature, effects of heat, difference between heat and temperature, boiling point & melting point of different metals and non-metals ● Heat &Temperature - Transmission of heat - Conduction, convection and radiation ● Co-efficient of linear expansion and related problems with assignments ● Concept of pressure - Units of pressure, gauge pressure and gauges used for measuring pressure **Basic Electricity** ● Introduction and uses of electricity, electric current AC, DC their comparison, voltage, resistance and their units **Mensuration** ● Area and perimeter of square, rectangle and parallelogram ● Area and perimeter of Triangles ● Area and perimeter of circle, semi-circle, circular ring, sector of circle, hexagon and ellipse ● Surface area and volume of solids - cube, cuboid, cylinder, sphere and hollow cylinder ● Finding the lateral surface area, total surface area and capacity in litres of hexagonal, conical and cylindrical shaped vessels Trigonometry ● Measurement of angles ● Trigonometrical ratios Trigonometrical tables
Project work / Industrial visit: - Project work involving preparing cad models of different art work in artisan software and to make it in 3D printer machine, CNC/VMC Machine, laser cutting machine, Paint booth & general tools.		

SYLLABUS FOR CORE SKILLS
Employability Skills (Common for all CTS trades) (120 Hrs)

Learning outcomes, assessment criteria, syllabus and Tool List of Core Skills subjects which is common for a group of trades, provided separately in www.bharatskills.gov.in

List of Tools & Equipment			
ENGINEERING DESIGN TECHNICIAN (For batch of 10 Candidates)			
S No.	**Name of the Tools and Equipment**	**Specification**	**Quantity**
A. TRAINEES TOOL KIT			
1.	Steel rule	30 cm & 60 cm graduated both in English & Metric units	20 Nos.
2.	Measuring Tape	05 Meter	02 Nos.
3.	Vernier Caliper	0- 15 cm	02 Nos.
4.	Hand Gloves	_	10 Nos.
5.	Safety Shoes	_	10 Nos.
6.	Helmet	_	10 Nos.
B. GENERAL MACHINERY / SOFTWARE INSTALLATIONS			
7.	Latest version compatible for running ARTISAN software, preloaded with latest configurations and Internet connection with standard operating system.	over 500 Relief models available for practice and learning exercises	2 Nos.
		Technology tools for Artisan and Handicraft	3 Nos.
8.	Laser Cutter	100 WATT. Table Size 1200x1200 mm	1 No.
9.	Air Compressor	Deep: 3 HP	2 Nos.
10.	Painting Spray Booth,	DB 15 Dry type technology, ground mounted, side draft type, Suction Chamber, Hood & Damper for Velocity control, Illumination System, Electrical controls, Pressure feed Spray Gun, Pressure feed container with stirrer, Paint hose and air hose	1 No.
11.	UPS (Common to other trades)	3 KVA With Battery & Trolley	1 No.
12.	Industrial Workstation (Common to other trades)	32 GB RAM, NVIDIA Qtr. 4GB, Intel XeonW-2123 3.6 4C, 1TB HDD, USB Keyboard, Monitors IPS 20” or more & USB Optical	20 Nos.

		Mouse	
13.	Server with rack (Common to other trades)	Intel Xeon Silver 4114 2.2G, 10C/20T, 9.6GT/s, 14M Cache, Turbo, HT (85W) DDR4-2400, 600GB x 5nos. 10K RPM SAS, 12Gbps 512n 2.5in Hot plug Hard Drive	1 No.

Note: -

1. *All the tools and equipment are to be procured as per BIS specification.*
2. *Internet facility is desired to be provided in the class room.*

The DGT sincerely acknowledges contributions of the Industries, State Directorates, Trade Experts, Domain Experts, trainers of ITIs, NSTIs, faculties from universities and all others who contributed in revising the curriculum.

Special acknowledgement is extended by DGT to the following expert members who had contributed immensely in this curriculum.

List of Expert Members participated for finalizing the course curriculum of Engineering Design Technician.			
S No.	**Name & Designation Sh/Mr./Ms.**	**Organization**	**Remarks**
1.	G.C. Saha, Jt. Director/HoD	CSTARI, Kolkata	Chairman
2.	Dr. Ishtiaq Khan	TATA Technologies Ltd., Pune	Member
3.	Prashant Handigund	TATA Technologies Ltd.	Member
4.	Ronny Gunjal	3D Systems, Goa	Member
5.	N Prem Kumar	Govt. ITI, Tindivanam	Member
6.	Srinivasan G.	Govt. ITI, Ulundurpet	Member
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22.	Budhaditya Biswas	CSTARI, Kolkata	Member
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ABBREVIATIONS

CTS	Craftsmen Training Scheme
ATS	Apprentice ship Training Scheme
CITS	Craft Instructor Training Scheme
DGT	Directorate General of Training
MSDE	Ministry of Skill Development and Entrepreneurship
NTC	National Trade Certificate
NAC	National Apprentice ship Certificate
NCIC	National Craft Instructor Certificate
LD	Locomotor Disability
CP	Cerebral Palsy
MD	Multiple Disabilities
LV	Low Vision
HH	Hard of Hearing
ID	Intellectual Disabilities
LC	Leprosy Cured
SLD	Specific Learning Disabilities
DW	Dwarfism
MI	Mental Illness
AA	Acid Attack
PwD	Person with disabilities


कौशलं बलम्