OJT Syllabus For CNC machining wood working operator

Course Name	**CNC machining wood working operator**
Sector	**Furniture & Fittings**
Course Code	**FAF/2024/CNCO/411**
Level	**4**
Occupation	**CNC machining wood working operator**
Job Description	The CNC machining wood working operator will be responsible for executing intricate 2D and 3D woodworking projects using CNC routers, generating precise toolpaths with CAM software, ensuring quality through meticulous inspection, troubleshooting machine operations, and collaborating with design teams for optimal project outcomes
Course Duration	**Total Duration 390 hrs. (OJT-330 and ES-60)**
Trainees' Entry Qualification	10th Grade with one year NTC in Carpenter Trade and one year NAC in Carpenter Trade OR/ 10th Grade pass with 2 years' experience in the relevant field (Wood Working)
Trainers Qualification	BE/B tech in Mechanical Engineering with one-year experience in the relevant field OR/ 03 years Diploma in Mechanical Engineering or relevant Advanced Diploma (Vocational) from DGT with two years' experience in the relevant field OR/ ITI in carpenter trade +CITS with minimum 03 year experience.

Structure of Course(In OJT Module):

Module No.	Module name	Outcome	Compulsory/ Elective	Total (Hrs) (OJT)
1	**CNC Router Fundamentals**	Execute CNC Router interface/control program screen.	Compulsory	30
2	**2D Programming with CAM Software**	Plan and prepare 2D program with various tool keys, vector keys, etc. With the help of CAM software.	Compulsory	30
3	**CNC Router Toolpath Techniques**	Prepare tool path in 2D and make program with throughout cut.` Z, Material thickness.	Compulsory	30
4	**File Management**	Execute saving of tool path & program file to machine.	Compulsory	30
5	**Programming & Tooling**	Plan and create programs with single and multiple tools, using ATC (Automatic Tool Changing)	Compulsory	60
6	**CNC Router Operation and Job Inspection**	Prepare job operating CNC router machine and inspect job accuracy.	Compulsory	30

Module No.	Module name	Outcome	Compulsory/ Elective	Total (Hrs) (OJT)
7	**CAD/CAM Toolpath Execution**	Check drawing and execute operation with various relief functions.	Compulsory	30
8	**3D CNC Machining**	Prepare 3D object with the CAD/CAM, set machine and make the job.	Compulsory	60
9	**Advanced CAD/CAM Operations**	Describe Complex Job designing on CAD, Editing Program and Inspection Process of Job.	Compulsory	30
10	**Employability Skill**	As per guided curriculum	Compulsory	60
Total				**390**

SYLLABUS:

Module No. 1: CNC Router Fundamentals

Outcome:

Execute CNC Router interface/control program screen.

Content:

- Safety precautions in different hand tools, machineries etc.
- Role of CNC Router in Industries.
- Advantages of CNC Router over Conventional Machines.
- Overview of CNC Technology/CNC router Technology.
- Overview of Construction features of CNC Router Machine.
- Overview of Machine Specification: Hardware, Software & Optional Components.
- Introduction of CNC router interface/control programmed screen and all function key in control panel
- Introduction and Demonstration of CNC router interface/control programmed screen.
- Practice with the framework, start panel, project panel and Tool setting.
- Demonstration all function key in control panel exp state, advanced, program, parameter system, auto mode jog mode refrence handle mode and all running button for various operation.

Module No. 2: 2D Programming with CAM Software

Outcome:

Plan and prepare 2D program with various tool keys, vector keys, etc. with the help of CAM software.

Content:

- Overview of Axis Nomenclature of CNC & work Planes.
- Overview of Co-ordinate systems.
- Overview of Job set up Process.
- Overview of Tooling.
- Overview of Related Parameters.
- Introduce CAM software how to use for drawing.

- Interface of CAM software.
- New model, dimension in inches or mm and set origin of model.
- Practice with the various Tool key, vector key.
- Draw Square, Rectangle, Circle, ellipse, arc, Polygon, star, polyline and text in 2D view window.
- Bitmap to vector

Module No. 3: CNC Router Toolpath Techniques

Outcome: Prepare tool path in 2D and make program with throughout cut.` Z, Material thickness.

Content:

- Overview of router bit used in CNC router for 2d and 3d cutting.
- Specification of router bit use for various kind of operation.
- Introduce router bit name according to its shape. Exp. Flat end mill, ball nose end mill, bull nose end mill, conical, v bit, etc.
- Different between profile toolpath, fluting toolpath, area clearance (emptying), v bit curving, bevel curving, smart engraving, drilling.
- Prepare a model in 2D toolpath.
- Practice with line to throughout cut with using toolpath.
- Practice with profile toolpath, fluting toolpath, area clearance (emptying), v bit curving, bevel curving, smart engraving, drilling. Profile type, cutting depth, profile tool, options and define material thickness.
- Prepare and draw the model with throughout cut. Start the simulation, check the problem in design tool path and make correction.

Module No. 4: File Management

Outcome: Execute saving of tool path & program file to machine.

Content:

- Overview of CNC Programming Methods/ABS INC method/related.
- Overview of CNC G Codes, M codes & Words.
- Overview of CNC Control: Different programming Methods.
- Overview of Editing Keys for Program Writing.
- Methodology of writing of a Simple Programme in a CNC Router MC.
- Practice to save the Tool path.
- Practice to save the Program in “txt” format (machine file format).
- Practice to bring program file from computer to machine control panel.

Module No. 5: Programming & Tooling

Outcome: Plan and create programs with single and multiple tools, using ATC (Automatic Tool Changing)

Content:

- Overview of Program Simulation Prog. Set/Graph page Set/Methodology.
- Over view of Job Zero set/Tool Offset Overview of Auto Run/Methodology.
- Overview of Background Editing.
- Overview of Repetition of Cycle/Part count.
- Overview of Making of 2D drawing with Straight, Circular, Taper & Complex Contour path with the help of related CAD Software.
- Overview of Making of Combination Tooling Program/ concept of unit vector for circular contour.
- Difference between Manual Program & CAM program.
- Practice to make program firstly with single tool and after that multiple tool use in ATC (Automatic Tool changing).
- Installing tool and mount tools in the collets or tool holder and indicate zero offset.

- Mount job on the machine table and indicate zero offset.
- Enter the program and verify the same.
- Set the Spindle speed, Cycle speed.

Module No. 6: CNC Router Operation and Job Inspection

Outcome: Prepare job operating CNC router machine and inspect job accuracy.

Content:

- Overview of Tool nose radius Compensation/Codes/use.
- Overview of Length Compensation/codes & its use.
- Tool parameter set up page/geometry/wear.
- Overview of Multi Operations in a single Program.
- Overview of Multi Tools Set up/offset and ATC parameters set up.
- Overview of In-put/Out-Put process in CNC Interfacing system.
- Overview CNC DNC system/CAM interfacing.
- Select proper switches on control panel.
- Move the slide in jog mode.
- Take slide to reference point to see the program trace.
- Operate the machine tool CNC router.
- Set the starting point on job (origin).
- Start the machine and monitor the program.
- After complete the operation inspect the job accuracy.

Module No. 7: CAD/CAM Toolpath Execution

Outcome: Check drawing and execute operation with various relief functions.

Content:

- Concept of making 2D Object with the help of CAD/CAM software.
- Export the Drg. file to the CAM/MC control Software.
- Generate the Tool Path/set Machining relief Parameters.
- Concept of Program Verification/observe the 2D/3D simulation.
- Concept of Data Transfer/N.C Program from computer to Machine.
- Check drawing in computer by D. vector.
- Practice to change Tool, practice to load a program from computer to machine control panel through LAN cable.
- Operate with the various relief function in program.

Module No. 8: 3D CNC Machining

Outcome: Prepare 3D object with the CAD/CAM, set machine and make the job.

Content:

- Concept of making 3D Object with the help of CAD/ CAM software.
- Export the Drawing file to the CAM / MC control Software.
- Generate the Tool Path / set Machining Parameters.
- Concept of Program Verification/ observe the 3d simulation
- Concept of Data Transfer/N.C Program from computer to Machine.
- Overview of Variable Depth of Operation.

- Overview of 3D Planes / Operational process. Overview for Cutting of a 3D Job with Rough & Finish operations.
- Concept of Job set up/ Tool set up for 3D Job making. Concept of Job Cutting in DNC system / Data Transferring process.
- Verify 3D program and observe simulation.
- Make 3D object in CAD/CAM Software.
- Practice with shape editor, two rail sweep, extrude, spin, turn, 3d blend, contour blend, angle plane etc.
- Draw various complex shapes in the program.
- Make bitmap to relief.
- Set the machine to cut the required material.
- Run the program and monitor the process.

Module No. 9: Advanced CAD/CAM Operations

Outcome: Describe Complex Job designing on CAD, Editing Program and Inspection Process of Job.

Content:

- Overview of Complex Job design with the help of CAD/CAM software.
- Concept of Making of Tool Path/set parameters/set tool parameters.
- Process of Editing Program/ optional stop & Back ground editing at the time of Auto mode.
- Overview of Inspection Process / methods/instruments used / report making.
- Overview of Inspection Process over of Finished Job/making of Inspection Report.
- Overview of Complex Job design with the help of CAD/CAM software.
- Concept of Making of Tool Path/set tool parameters.
- Process of Editing Program/ optional stop & Back ground editing at the time of Auto mode.
- Overview of Inspection Process / methods/instruments used / report making.
- Overview of Inspection Process over Finished Job/making of Inspection Report

Module No :10 Employability Skills (60 Hrs)

Key Learning Outcomes

Introduction to Employability Skills Duration: 1.5 Hours

After completing this programme, participants will be able to:

1. Discuss the Employability Skills required for jobs in various industries
2. List different learning and employability related GOI and private portals and their usage

Constitutional values - Citizenship Duration: 1.5 Hours

3. Explain the constitutional values, including civic rights and duties, citizenship, responsibility towards society and personal values and ethics such as honesty, integrity, caring and respecting others that are required to become a responsible citizen
4. Show how to practice different environmentally sustainable practices.

Becoming a Professional in the 21st Century Duration: 2.5 Hours

5. Discuss importance of relevant 21st century skills.
6. Exhibit 21st century skills like Self-Awareness, Behavior Skills, time management,

critical and adaptive thinking, problem-solving, creative thinking, social and cultural awareness, emotional awareness, learning to learn etc. in personal or professional life.

7. Describe the benefits of continuous learning.

Basic English Skills Duration: 10 Hours

8. Show how to use basic English sentences for everyday conversation in different contexts, in person and over the telephone
9. Read and interpret text written in basic English
10. Write a short note/paragraph / letter/e -mail using basic English

Career Development & Goal Setting Duration: 2 Hours

11. Create a career development plan with well-defined short- and long-term goals

Communication Skills Duration: 5 Hours

12. Demonstrate how to communicate effectively using verbal and nonverbal communication etiquette.
13. Explain the importance of active listening for effective communication
14. Discuss the significance of working collaboratively with others in a team

Diversity & Inclusion Duration: 2.5 Hours

15. Demonstrate how to behave, communicate, and conduct oneself appropriately with all genders and PwD
16. Discuss the significance of escalating sexual harassment issues as per POSH act.

Financial and Legal Literacy Duration: 5 Hours

17. Outline the importance of selecting the right financial institution, product, and service
18. Demonstrate how to carry out offline and online financial transactions, safely and securely
19. List the common components of salary and compute income, expenditure, taxes, investments etc.
20. Discuss the legal rights, laws, and aids

Essential Digital Skills Duration: 10 Hours

21. Describe the role of digital technology in today's life
22. Demonstrate how to operate digital devices and use the associated applications and features, safely and securely
23. Discuss the significance of displaying responsible online behavior while browsing, using various social media platforms, e-mails, etc., safely and securely
24. Create sample word documents, excel sheets and presentations using basic features
25. utilize virtual collaboration tools to work effectively

Entrepreneurship Duration: 7 Hours

26. Explain the types of entrepreneurship and enterprises
27. Discuss how to identify opportunities for potential business, sources of funding and associated financial and legal risks with its mitigation plan
28. Describe the 4Ps of Marketing-Product, Price, Place and Promotion and apply them as per

requirement

29. Create a sample business plan, for the selected business opportunity

Customer Service Duration: 5 Hours

30. Describe the significance of analyzing different types and needs of customers
31. Explain the significance of identifying customer needs and responding to them in a professional manner.
32. Discuss the significance of maintaining hygiene and dressing appropriately

Getting Ready for apprenticeship & Jobs Duration: 8 Hours

33. Create a professional Curriculum Vitae (CV)
34. Use various offline and online job search sources such as employment exchanges, recruitment agencies, and job portals respectively
35. Discuss the significance of maintaining hygiene and confidence during an interview
36. Perform a mock interview
37. List the steps for searching and registering for apprenticeship opportunities

List of Tools, Equipment & materials needed for 30 Trainees (Practical)

LIST OF TOOLS & EQUIPMENT			
WOOD CNC ROUTER WOOD WORKING AND CNC MACHINING OPERATOR			
S No.	**Name of the Tools and Equipment**	**Specification**	**Quantity**
A. Trainees Tool Kit			
1	Steel Measuring Scale	Twelve inches	4
2	Steel Tape	6 mtrs.	4
3	Marking Knife	200 mm length	4
4	Bebel Square	150 mm	4
5	Carpenter Marking/Mortise Gauge		4
6	Hand Saw	450 mm	4
7	Metal Jack Plane	335 mm x 50 mm Cutter	4
8	Bevel Edge Firmer Chisel	(6, 10, 15, 20, 25) mm width	4 each
9	Screw Driver Set		2
10	Mallet	Medium size	4
11	Claw Hammer	500 gms	4
12	Ball Pien Hammer	500 gms	4
13	Oil Stone	Carborundum Universal Selicon Carbide combination rough and fine	4
14	Hand Brush For Cleaning	450 mm	4
15	SPANNER SET	4-32 MM	4
16	ALLEN KEY SET	-	4

17	FRET SAW		4
B. Shop Tools & Equipment –			
(i) List of Tools & Accessories			
18	File Half Round	2nd Cut 250 Mm	4
19	File Slim Tapper	100 Mm	4
20	Pincer	200 Mm	4
21	Nails		
(Ii) List Of Equipment			
22	Carpenter Vice	300 Mm Jaws	4
23	Saw Sharpening Vice	250 Mm Jaws	4
24	Carpenter Work Bench	1500 X 600 X 800 Mm	2
25	"G" Clamp	150 Mm	4
26	Blower		2
27	PPE kit		4
28	Trainer's chair		1
29	Trainer's computer table		1
C. Shop Machinery -			
30	Wood Working CNC Router Machine	1. HSD/HSK Electro Spindle 9 KW (Min) 2. Boring Or Drilling Head- 5(Min) 3. Servo Motor/ Induction Motor- Double 4. Vacuum Pump-Multi Zone 5. Dust Collector 6. Air Compressor	1
31	Portable Machinery	7. Hand Drill 8. Disk Sander 9. Planner 10. Jig Saw	**1** **1** **1** **1**
32	Computer System For Trainer	11. Computer System Minimum 8 Gb Ram And 512 Gb SSD With Latest WINDOW UPDATE 12. COLOR PRINTER HIGH QUALITY	

Marks Distribution

Outcome	Outcome Code	Total Th marks	Total Pr marks
Execute CNC Router interface/control program screen.	INT/1207/OC1	20	70
Plan and prepare 2D program with various tool keys, vector keys, etc. With the help of CAM software.	INT/1207/OC2	20	70
Prepare tool path in 2D and make program with throughout cut.` Z, Material thickness.	INT/1207/OC3	20	70
Execute saving of tool path & program file to machine.	INT/1207/OC4	20	70
Plan and create programs with single and multiple tools, using ATC (Automatic Tool Changing)	INT/1207/OC5	40	120
Prepare job operating CNC router machine and inspect job accuracy.	INT/1207/OC6	20	70
Check drawing and execute operation with various relief functions.	INT/1207/OC7	20	70
Prepare 3D object with the CAD/CAM, set machine and make the job.	INT/1207/OC8	40	120
Describe Complex Job designing on CAD, Editing Program and Inspection Process of Job.	INT/1207/OC9	20	70
Employability Skills – 60 Hrs	DGT/VSQ/N0102	50	0