

**COMPETENCY-BASED CURRICULUM  
FOR THE QUALIFICATION OF**

**ADVANCE DIPLOMA IN CNC PROGRAMMING  
TECHNIQUES & PRACTICES**

**UNDER**

**CENTRAL TOOL ROOM & TRAINING CENTRE,  
BHUBANESWAR**

**Government of India  
Ministry of MSME**

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## 1. INTRODUCTION

Central Tool Room & Training Centre, Bhubaneswar was established on Technical cooperation between Govt. of Kingdom of Denmark and Government of India during the year 1991. The Technical Cooperation Agreement between the two Govts. were signed on 21<sup>st</sup> April 1989 and the Project Agreement was signed on 2<sup>nd</sup> June 1989.

The Centre is a Govt. of India Society registered under Society Registration Act 1860 on dt. 07.05.1990. The management of affairs of the Society rests with the Governing Council constituted by Govt. of India. The Society has its own Memorandum of Association and Rules and Regulations. The Tool Room has been set up to meet the growing demand of tools in the Country and producing skilled man power for the industries. CTTC, Bhubaneswar is on the way of achieving its set goal and within its 24 years of existence could stand as a premier Tool Room and Training Centre in India. The Centre is not confined within the Bhubaneswar region but has expanded beyond by setting up extension Centres at Rayagada (KBK area) and Kalinga Nagar. It has set the bench mark among all the Tool Rooms and Training Centers under the Ministry of MSME for its quality training programmes in the field of tool Design and Manufacturing, precision components manufacturing in Automobile and Aerospace industries, CAD/CAE/ CAM/CNC technology/ Hardware and Networking/ VLSI/ Industrial Automation and Robotics/ Structural Design and Analysis in different level of disciplines. In pursuit of excellence the Tool Room has been awarded with ISO 9001:2008, AS9100C, ISO 14001:2004, ISO 29990:2010, ISO 50001:2011 and OHSAS 18001:2007 certifications. The Tool Room has achieved self-sufficiency in the year 2003 with regard to recurring expenditure and also covering depreciation since 2008.

**Objectives:** The main objectives of the Tool Room are as follows:

As per the DPR the Tool Room was to be set up mainly for upgradation of technology in Small Scale sector as the industries can not afford to have their own Tool Rooms and provide Skill Development training to the workmen. The defined objectives of the Tool Room are as follows :

- To develop production facilities of moulds, jigs, fixtures, gauges & other sophisticated tools and provide common facility centre to MSMEs.
- To train manpower in the field of tool making & other allied engineering trades both for the fresher & for personnel already engaged in the field.
- To provide consultancy primarily for Micro, Small & Medium Enterprises in the field of tool engineering aimed at improvement of quality and productivity.

**Training :** One of the main purposes of establishing the Tool Room was to provide skilled man power to the industries and conduct skill upgradation training programmes for

the personnel already engaged in MSMEs. CTTC Bhubaneswar is Conducting AICTE Approved courses such as 4 year diploma in Tool & Die making , 3 Year Diploma in Mechatronics and NCVT Approved ITI Machinist course. Now the Tool Room is conducting both long and short term, sponsored programmes and International training programmes. Training is now the thrust area and Govt. of India is giving more emphasis in skill development. The Centre is also planning to conduct more skill development programmes in future to meet the growing demand. The fields in which the Tool Room is conducting the training programmes are as follows:

1. Tool Engineering
2. CAD/CAM/CAE/CNC/Industrial Automation and Robotics
3. Mechatronics
4. Structural Design and Analysis
5. VLSI and Embedded system
6. Tailor made courses for foreign nationals/ Ind. & Institute professionals

**Extension Centres** : To meet the growing demand in skill development the Centre is not confined within the Bhubaneswar region but has started its Extension centres at Rayagada (KBK area) and at Kalinga Nagar in the district of Jajpur, Odisha, City Centre at Satya Nagar, Bhubaneswar. Different long and short term training programmes in the field of tool engineering and allied subjects are being conducted.

**Production** : One of the mandate for establishment of CTTC, Bhubaneswar was to manufacture dies, moulds, press tools and provide common facility to the MSMEs. The Centre had started production at the end of 1996 and since then engaged in manufacturing tools and

dies for MSMEs and other industries. CTTC, Bhubaneswar is also engaged in manufacturing sophisticated components for the Automobile and Aerospace industries. The Centre has earned a brand image for high precision machining and critical tool production to bag appreciation from ISRO for outstanding contribution in realizing critical flight hardware for the Mangalyaan Mission. CTTC is supplying high precision components/ sub-assemblies to M/s ISRO, LPSC, Bangalore, M/s ISRO, IISU, Thiruvanthapuram, M/s ADA, Bangalore, HAL, Bangalore and DRDO Hyderabad etc. CTTC, Bhubaneswar has been extending its common facility Centre in the production for benefit of the MSME sector of the State and adjoining States. Revenue collected during the year 2015-16 from Production Department was Rs. 10.33 crores.

**Consultancy** : Since inception CTTC, Bhubaneswar has been continuously providing consultancy services to the MSMEs in Odisha and adjoining States for improvement of their quality and productivity. Consultancy services is extended to MSMEs and clusters on various National Manufacturing Competitiveness Programme components of DC (MSME) such as QMS, QTT, Design clinic, Lean Manufacturing, IPR, Mini Tool Rooms/ EFC Project review and project report preparation etc. The experts of CTTC, Bhubaneswar visit to MSMEs and conduct several capacity building programmes on the shop floor for MSMEs' workmen, supervisors to promote quality and to improve safety and moral of the employees. It is also conducting several open house public programmes on Quality Management Standards, ISO standards, TQM, TPM, Lean six sigma Green Belt Certification programmes etc. It has created a good demand for unemployed youth and professionals working in both industries and Academic institution/ Universities under Management skill development programmes. The Consultancy services of the Centre has provided service to **1390** MSMEs during the year 2015-16.

#### **About NSQF:**

The National Skills Qualification Framework (NSQF), published in the Gazette of India on 27th December, 2013, is a national framework that aims to integrate general and vocational streams of

education and training. The main goal of the NSQF is to focus on competency-based qualifications, which in turn facilitate and enhance transparency, both within and between general and vocational streams. The National Skill Development Agency (NSDA) under the Ministry is responsible for anchoring and implementation of the Framework, by bringing together the key stakeholders through the National Skill Qualifications Committee (NSQC).

The competency-based framework organizes qualifications into ten levels, with the entry level being 1, and the highest level being 10. Each level of the NSQF is described by a statement of learning outcomes in five domains, known as level descriptors. These five domains are (1) Process, (2) Professional knowledge, (3) Professional skill, (4) core skill, and (5) Responsibility. The paradigm shift from learning focused on inputs to an outcome/competency-based education would help in the Recognition of Prior Learning (RPL), and simultaneously enable the alignment of the Indian qualifications with international ones. Government funding is expected to be on a preferential basis for NSQF compliant courses. The NSQF notification provides a Qualification Register, which is the official national database of all qualifications aligned to NSQF levels. Through this Register, learners can expect access to all NSQF compliant qualifications.

**Introduction to qualification :**

The course is designed to train diploma pass-out students in the areas of mechanical, automotive sectors. The trainees will be exposed to basic turning, milling, grinding and fitting and also in the areas of non-conventional machines like EDM and W-EDM, etc. Trainees will be put to extensive and rigorous theory and practical training on CNC turning programming and CNC milling programming to improve their skill. After completion of the course trainees will be able to generate model, prepare tool path and execute the same on the CNC machine. At the end of the programme trainee will be able to study the drawing given by the customer and do the programming & execute the job within the tolerance assigned with the quality expected from the customer.

## 2. GENERAL INFORMATION

1	Qualification	<b>Advance diploma in CNC programming techniques &amp; practices</b>
2	NSQF Level	Level- 6
3	Duration of the course/qualification	6 months
4	Entry Qualification	Diploma in Mechanical/Production/Tool/Mould Making/Automobile Engg.

Distribution of training hours of the training per week (1-20):

Total Hours/Week	Professional Skill	Professional Knowledge	Metrology	Communication Skill	Material Technology	Engineering Drawing
36	18	12	1.5	1.5	1.5	1.5

Hourly distribution of project work(20-24<sup>th</sup> week): 120 Hrs  
Final examination will be conducted in 25<sup>th</sup> week.

### 3. COURSE STRUCTURE

**Name of the Qualification:** Advance diploma in CNC programming Techniques & Practices.

**Total duration of the course:** 6 months

Training duration details:

<b>Course Elements</b>	<b>Hourly Distribution</b>
Professional Skill	360
Professional Knowledge	240
Metrology	36
Communication Skill	36
Engineering Drawing	36
Material Technology	36
Project work	120
Admission and Examination	36
<b>TOTAL HOURS</b>	<b>900</b>

## 4. JOB ROLES

### 4.1 Brief description

Participants should be confident enough to create program for the CNC machines. Solve day to day problems and the team of machinists, programmers & designers. He also able to know how to lead a team & handle man in industries. Capable of planning a components for manufacturing .Create objects on Drawing Space using toolbars, commands and menus in CAD application software and also creating objects on 3D modeling space in CAD viewing printable drawing and plotting them.

Plan and organize assigned work and detect & resolve issues during execution. Demonstrate possible solutions and agree tasks within the team. Communicate with required clarity and understand technical English. Sensitive to environment, self-learning and productivity.

### 4.2 NOS Mapping:

#### NOS:-

1. CSC/ N 1335 (Use basic health and safety practices at the workplace)
2. CSC/ N 1336 (Work effectively with others)



## 5. NSQF LEVEL COMPLIANCE

The Broad Learning outcomes of Advance diploma in CNC programming Techniques & practices course matches with the Level descriptor at Level 6.

The NSQF Level 6 descriptors given below:

<b>LEVEL</b>	<b>Process required</b>	<b>Profession Al knowledge</b>	<b>Professional skill</b>	<b>Core skill</b>	<b>Responsibility</b>
6	Demands a wide range of specialised technical skill, clarity of knowledge and practice in broad range of activity involving standard and non-standard practices.	Factual and theoretical knowledge in broad contexts within a field of work or study.	A range of cognitive and practical skills required to generate solutions to specific problems in a field of work or study.	Reasonable good in mathematical calculation, understanding of social, political and reasonably good in data collecting organising information, and logical communication.	Responsibility for own work and learning and full responsibility fo other’s works and learning.

## 6. GENERAL TRAINING PLAN, EXAMINATION & PASS REGULATION

### **General Training Plan:**

The knowledge and skill components as stated in the section for 'learning outcomes' are to be imparted in accordance with the instructions in respect of the content and time structure.

### **Assessment:**

The assessment for the qualification is carried out by conducting theory and practical examination after end of the each component, and end-of qualification, as per the guidelines given in the curriculum. The final assessments for theory subjects and practical are conducted for evaluating the knowledge and skill acquired by trainees and the behavioral transformation of the trainees as per the learning outcomes. Theory and practical exams are conducted in accordance with the, professional knowledge and professional Skills respectively by CTTC. The details of the examination and assessment standard are in a latter section. CTTC, Bhubaneswar prepares the question papers for the practical. Candidates are to demonstrate that they can:

1. Read& interpret technical parameters/documentation, plan and organize work processes, and identify necessary materials and tools,
2. Perform a task/job with due consideration to safety rules, accident prevention regulations and environmental protection stipulations,
3. Apply Professional Knowledge, and Skills while performing the task/job.
4. Check the task/job as per the drawing for proper functioning, and identify and rectify errors in the job, if any.
5. Document the technical parameters related to the task/job.

### **Pass regulation:**

Passing criteria is based on marks obtain in attendance record, term works , assignments, practical's performance, viva or oral exam, module test, practical exam and final exam

Minimum Marks to pass practical exam – 60%

Minimum Marks to pass final exam – 70%

Minimum Marks to pass viva / oral exam –60%

Minimum Marks to pass Project report and presentation exam – 80%

## 7. LEARNING OUTCOMES

The following are minimum broad learning outcomes after completion of the Advance diploma in CNC programming Techniques & practices course of 6 months duration:

### **A. GENERIC OUTCOMES**

1. Recognize & comply safe working practices, environment regulation and housekeeping.
2. Work in a team, understand and practice soft skills, technical English to communicate with required clarity.
3. Demonstrate knowledge of concept and principles of basic CAD and CAM, co-ordinate system and apply knowledge of specific area to perform practical operations. .
4. Understand and explain the concept in productivity, quality tools, and labor welfare legislation and apply such in day to day work to improve productivity & quality.
5. Explain energy conservation, global warming and pollution and contribute in day to day work by optimally using available resources.
6. Explain personnel finance, entrepreneurship and manage/organize related task in day to day work for personal & societal growth.
7. Understand and apply basic computer working, basic operating system and uses internet services to get accustomed & take benefit in the industry.
8. Demonstrate polite behavior.
9. Ability to participate in multi-disciplinary team efforts.
10. Competency in letter (official) writing.
11. Communicate technical information in English.

### **B. SPECIFIC OUTCOMES**

1. Work independently on different type of conventional machines.
2. Identify & use of different cutting tool.
3. Do drafting in AutoCAD.
4. Do 3d modeling in AutoCAD.
5. Work with different types of G & M codes.
6. Write programs of lathe & milling in different controller.
7. Do 2d & surface modeling in Master CAM.
8. Generate tool path using Master CAM.
9. Do surface modeling and solid modeling using Unigraphics software.
10. Do assembly, kinematics and manufacturing using Unigraphics software.
11. Work independently on CNC lathe, milling, CMM and wire EDM.
12. Learn about the cutting tools & materials.
13. Work with different measuring instruments.
14. Calculate least count of measuring instruments.
15. Used of comparators & gauges.

## 8. ASSESSABLE OUTCOMES WITH ASSESSMENT CRITERIA

**Note:**

1. The training shall be conducted as per the syllabus.
2. The trainee shall demonstrate the competencies that are defined below in the assessable outcomes highlighted below.
3. The trainee shall be assessed for his/her achievement levels in all the assessable outcomes on the basis of the formative assessment, Theory & Practical examinations, observation, and viva-voce.
4. The trainee shall be assessed for his/her achievement levels in all the assessable outcomes of the METERIAL SCIENCE, METROLOGY, ENGG. DRAWING, BEHAVIOURAL SKILL on the basis of Theory Examinations and for his /her ability to apply the concepts in Practical.
5. The assessable outcomes and assessment criteria will serve as a set of guidelines for trainers and assessors.

**Assessable outcomes along with assessment criteria to be achieved after completion of qualification:**

**Generic assessable outcomes:**

ASSESSABLE OUTCOMES	ASSESSMENT CRITERIA
1. Recognize & comply safe working practices, environment regulation and Housekeeping.	1.1 Follow and maintain procedures to achieve a safe working environment in line with occupational health and safety Regulations and requirements and according to site policy.
	1.2 Recognize and report all unsafe situations according to site Policy.
	1.3 Identify and take necessary precautions on fire and safety Hazards and report according to site policy and procedures.
	1.4 Identify, handle and store / dispose off dangerous goods and substances according to site policy and procedures following Safety regulations and requirements.
	1.5 Identify and observe site policies and procedures in regard to Illness or accident.
	1.6 Identify safety alarms accurately.
	1.7 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.
	1.8 Identify and observe site evacuation procedures according to Site policy.
	1.9 Identify Personal Productive Equipment (PPE) and use the Same as per related working environment.
	1.10 Identify basic first aid and use them under different Circumstances.

	1.11 Identify different fire extinguisher and use the same as per Requirement.
	1.12 Identify environmental pollution & contribute to the avoidance Of instances of environmental pollution.
	1.13 Deploy environmental protection legislation & regulations
	1.14 Take opportunities to use energy and materials in an environmentally friendly manner
	1.15 Avoid waste and dispose waste as per procedure
	1.16 Recognize different components of 5S and apply the same in The working environment.
2. Work in a team, understand and practice soft skills, technical English to communicate with required clarity.	2.1 Obtain sources of information and recognize information.
	2.2 Use and draw up technical drawings and documents.
	2.3 Use documents and technical regulations and occupationally Related provisions.
	2.4 Conduct appropriate and target oriented discussions with higher authority and within the team.
	2.5 Present facts and circumstances, possible solutions & use English special terminology.
	2.6 Resolve disputes within the team
	2.7 Conduct written communication.
3. Read and apply engineering drawing for different application in the Field of work.	3.1 Examination to test basic skills on engineering Drawing. 3.2 Their applications will also be assessed during execution of assessable outcome and also tested during theory and practical Examination.
4. Know about The Standardization of measuring Instruments, Gauges, Limit Gauge, CMM, Height Master, and Profile Projector	4.1 Use linear, angular, precision, non precision, feeler gauge, radius gauge, screw pitch gauge, telescopic gauge, slip gauge, standard wire gauge, plug gauge, thread plug gauge, snap gauge, ring gauge, thread ring gauge, height master, profile projector, comparators as well as hand on practice on CMM.

**Specific assessable outcomes:**

<b>ASSESSABLE OUTCOMES</b>	<b>ASSESSMENT CRITERIA</b>
5. Work safely on different conventional machines for manufacturing different parts.	5.1 Identify Different workshop safety & PPE used
	5.2 Operate different types of conventional machines.
	5.3 Identify different cutting tools used for different machining operation.
	5.4 Identify the different types of job and cutting tool materials.
6. Create objects on drawing space using toolbar, commands and menus in Auto-CAD software.	6.1 Select Drawing limit of the CAD drawing space under supervision
	6.2 Select proper setting and toolbars, choice of system, scale under supervision.
	6.3 Draw object with CAD viz. main Menu, screen menu, command line, model space Drawing layouts, Tool bars, File creation, Save, Open existing drawings, creation of Drawing Sheet as per ISO.
	6.4 Draw 2D drafting by using CAD toolbars under supervision
	6.5 Do solid models using the commands using auto-CAD software.
7. Practice CNC programs for different profile of the parts.	7.1 Use of different G-codes and M-codes while writing a program.
	7.2 Run the CNC lathe machine using turning programme.
	7.3 Write program on different controller for CNC-lathe under supervision.
	7.4 Write program on different controller for CNC-Mill under supervision.
8. Create objects on Drawing Space using toolbars, commands and menus in CAD application Software. Create objects using 3DModeling Space and Print Preview and Plotting in Master-CAM software	8.1 Select Drawing limit of the CAD drawing space under supervision
	8.2 Select proper setting and toolbars, choice of system, scale under Supervision.
	8.3 Draw object with CAD/CAM viz. main Menu, screen menu, command line, model space Drawing layouts, Tool bars, File creation, Save
	8.4 Identify 3D toolbars, tool path menu bar, co-ordinate system under

	Supervision.
	8.5 Create object in 3D, Extrude, Revolve command, Subtract, union 3D drawing by changing User co-ordinate systems.
	8.6 Customize page set up, Print preview and Plotting under supervision.
9. Create objects on Drawing Space using toolbars, commands and menus in CAD application software. Create objects using 3DModeling Space and Print Preview and Plotting in Uni-Graphics software	9.1 Do the solid modeling in Uni-graphics.
	9.2 Do the assembly in Uni-graphics.
	9.3 Do the drafting in Uni-graphics
	9.4 Do the kinematics in Uni-graphics.
	9.5 Do drafting in Uni-graphics.
10.Manufacturing parts in CNC Milling and turning using DNC	10.1Work independently on CNC lathe.
	10.2Work independently on CNC milling.
	10.3Work independently on wire EDM & EDM.
	10.4Know about the cutting tools & materials.

## 9. SYLLABUS CONTENT WITH TIME STRUCTURE

### Syllabus for the **Advance diploma in CNC programming Techniques & practices**

9.1 Syllabus content for Professional skill & Knowledge.

Duration: 6 months

**Learning objectives:**

1. Apply safe working practices.
2. Complying environment regulation and housekeeping.
3. Acquiring knowledge of tools and machineries.
4. Drawing machine parts with tolerance dimension and surface finish symbol.
5. Drawing objects in CAD application software.
6. Customizing CAD/CAM toolbar in drawing objects.
7. Manufacturing the parts by using DNC in CNC machine.

**Detailed Syllabus:**

subject	Week no	Professional skill	Professional Knowledge
<b>Production Technology</b>	1	<p>Importance of trade training, List of tools &amp; Machinery used in the trade. Health &amp; Safety: Introduction to safety equipments and their uses. Introduction of first aid, operation of Electrical mains. Occupational Safety &amp; Health cotton waste, metal chips/burrs etc. Basic Importance of housekeeping &amp; good shop floor practices. Health, Safety and Environment guidelines, legislations &amp; regulations as applicable. Disposal procedure of waste materials like safety introduction.</p> <p><b><u>Personal protective Equipments (PPE):</u></b>-Basic injury prevention, Basic first aid, Hazard identification and avoidance, safety signs for Danger, Warning, caution &amp; personal safety message. Preventive measures for electrical accidents &amp; steps to be taken in such accidents. Use of Fire extinguishers.</p>	<p>Importance of safety and general precautions observed in the industry/shop floor. All necessary guidance to be provided to the newcomers 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. Introduction of First aid. Operation of electrical mains. Introduction of PPEs. Introduction to 5S concept &amp; its application. Response to emergencies e.g. power failure, fire, and system failure.</p>



	2	By using milling machine do the peripheral & face milling operation of MS flat. By using lathe do the core pin & dowel pin.	Describe about the different part of milling & turning & Working principle. Different operation of machine. Use of different cutting tools
	3	Do the surface grinding operation over the MS flat & reference grinding at the edges. Make the drilling operation (counter bore & through drill) on the MS flat.	Describe about the different part of Grinding & Drilling & Working principle. Different operation of machine. Use of different cutting tools.
	4	By using lapping paste & oil stone do the super finishing operation of profile. Assembly of hand Injection mould. Examination on workshop Technology practical.	Describe about the super finishing operation mould assembly. Different operation of machine. Examination on workshop Technology Theory.
<b>Auto-CAD</b>	5	Work on limits, line, construction line, ray, trim, extend, erase, circle, Work on rectangle, copy, move, offset, rotate, array, mirror, scale, stretch, polyline, polygon, arc, spline, ellipse, revision cloud, region, explode, join, break, break at a point tools. Do the given exercises according to these tools.	Fundamental of computer & ms office. Coordinate system, introduction to cad & AutoCAD. Interface of AutoCAD, mouse function, functional keys, shortcut keys, paper size. scratch window, limits, line, construction line, ray, trim, extend, erase, circle, Describe about rectangle, copy, move, offset, rotate, array, mirror, scale, stretch, polyline, polygon, arc, spline, ellipse, revision cloud, region, explode, join, break, break at a point
	6	Using of point, point style, divide, measure, fillet, chamfer, blend curve, hatch, gradient, details of sectional view, text, Mtext, text style, arc aligned text, mirror text, block, Wblock, insert block, edit block, attribute, wipeout, multiline, donut, template file.	Describe about the point, point style, divide, measure, fillet, chamfer, blend curve, hatch, gradient, details of sectional view, text, Mtext, text style, arc aligned text, mirror text, block, Wblock, insert block, edit block, attribute, wipeout, multiline, donut, template file .
	7	Practically used dimension toolbar, dimension style & use of gd & t symbols, script file, motion path animation, raster image reference & sketch, introduction to solid modeling, 3d environment & toolbars.	Describe about the dimensioning rules & regulations, dimension toolbar, dimension style & use of gd & t symbols, script file, motion path animation, raster image reference & sketch, introduction to solid modeling, 3d environment & toolbars.

	8	Prepare the model using extrude, revolve, Boolean operation, sweep, loft, press pull, 3d move, 3d rotate, 3d array, 3d align, solid editing toolbar, primitives, plotting.	Describe about the extrude, revolve, Boolean operation, sweep, loft, press pull, 3d move, 3d rotate, 3d array, 3d align, solid editing toolbar, primitives, plotting.
<b>CNC PROGRAMMING</b>	9	Generate the program of contouring, chamfer, circular movement, label setting, pocketing (rectangular & circular), polar movement, peck drilling, mirror cycle, datum shift. Use simulator for all this operation and ensure the tool path by simulation.	Introduction Of CNC Milling Machine Advantage & Disadvantage , G & M-Code For CNC Milling, Part Programming Fundamentals, Functional Keys & Steps To Write A Program, Contouring, Used Compensation, How To Prepare Program, Chamfer, Circular Movement Label Setting, Pocketing (Rectangular & Circular) ,Polar Movement, Peck Drilling, Mirror Cycle, Datum Shift.
	10	Generate the program of rough turning cycle, facing, chamfer, circular movement, grooving, peck drilling, threading (internal & external), boring, CD, sub program. Also simulation of all this operation. Examination on practical.	Introduction of CNC lathe machine advantage & disadvantage, g & m-code for CNC lathe, homing process, rough turning cycle, facing, chamfer, circular movement, grooving, peck drilling, threading (internal & external),boring, CD subprogram. Examination on theory.
	11	Practices on axis homing. Datum setting and tool offsetting. Zigzag facing operation, Tool Radius Compensation contouring operation by single depth of cut, Circular contouring operation by single depth of cut. Practices on contouring operation by incremental depth loop. Straight line and circular pocketing operation, tangential arc and polar contouring, drilling, polar drilling, boring, reaming. Practices on tapping operation, datum shift operation, rotation operation, multi tool operation by using ACT, combination of all operations i.e. contouring, pocketing, drilling, combination of all operations double side. Practices On DNC and CAM Post Processor Setup and Data Transmission	History, What Is CNC Machine, Its Advantages & Disadvantages, Parts Of CNC Machine, Cutting Tools, Controllers Languages, Co-Ordinate System, Code With Description, Axes Of CNC Milling Machine's Origin Position, Work piece's Origins Position, Homing, Programming Procedure, Hands On Practice On CNC Panel Board, Zigzag Facing ,Contouring ,Pocketing ,Peck Drilling In Cartesian Co-Ordinate, Peck Drilling In Polar Co-Ordinate ,Milling With All Operation ,Slow Milling In Polar Co-Ordinates ,Datum Shift & Rotation.

	12	Practice on panel board and axis homing. Job offset setting and Tool offsetting. Facing operation, Plane Turning operation. Practice on Step Turning operation, Tapper Turning operation, Radius and Chamfer Turning operation, Drilling operation, Plane Boring operation. Practices On Plane Boring operation, Step Boring operation, Tapper Boring operation, Radius and Chamfer Boring operation, External Grooving operation, Practices On Internal Grooving operation, External Thread Cutting operation, Internal Thread Cutting operation, Combination of all internal & external operations. Practices On Combination of all external & internal double side operations, Turn-Mill multi axis operations.	Parts Of CNC Machine, Cutting Tools Controllers , Languages, Co-Ordinate System, Codes With Description, Axes CNC Milling , Machine's Origin Position Work piece's Origins Position, Homing Programming Procedure , Hands On Practice On CNC Panel Board, Simple Rough Cutting Cycles, Complex Rough Cutting Cycles With Finishing Cycle , Pec Drilling Cycle ,Complex Rough Cutting Cycles For Boring With Finishing Cycle Face Grooving Cycle , Surface Grooving Cycle , External Threading Cycle , External Threading Cycle With All Operations.
<b>MASTERCAM</b>	13	Practices On Using Line , Rectangle , Rectangle Shape , Circle , Arc ,Fillet ,Fillet Chain, Chamfer , Chamfer Chain , Polygon , Ellipse , Translate , Mirror ,Rotate ,Trim , Spline Tools .	Introduction To Cam Technology & Benefits, Interface Of Master CAM, Use Of Toolbars, Functional Keys , Mouse Functions , Line , Rectangle , Rectangle Shape , Circle , Arc ,Fillet ,Fillet Chain , Chamfer , Chamfer Chain , Polygon , Ellipse , Translate , Mirror ,Rotate ,Trim , Spline
	14	Practices On Using Tools Scale , Move To Origin , Offset ,Offset Contour ,Rectangular Array, Letter ,Point , Spiral , Helix, Break Two Pieces , Trim Many Joint Entity ,Close Arc , Break Manny Pieces , Simplify ,Break At Intersection , Break Circle ,Break Drafting Into Line , Convert To NURBS , Modify Spline, X Hatch , Dimension Tools , Dimension Option , Note.	Explain about The Scale , Move To Origin , Offset ,Offset Contour ,Rectangular Array ,Letter ,Point , Spiral , Helix, Break Two Pieces , Trim Many Joint Entity ,Close Arc , Break Manny Pieces , Simplify ,Break At Intersection , Break Circle ,Break Drafting Into Line , Convert To <b>NURBS</b> , Modify Spline, X Hatch , Dimension Tools , Dimension Option , Note , Introduction To Surface Modeling , 3d Environment Used Of 3d Tool Bar.

	15	Practices on using surface modeling tool like draft , extrude , fillet , trim , ruled / lofted , revolved , offset , swept ,net surface , fence ,extend , flat boundary ,fill holes ,remove boundary , split , untrim , 2 surface blend , 3 surface blend , 3fillet blend , project. Also create the tool path & generate the CNC programs.	Explain about The Draft , Extrude , Fillet Trim , Ruled / Lofted , Revolved , Offset Swept ,Net Surface , Fence ,Extend , Flat Boundary ,Fill Holes ,Remove Boundary Split , untrim , 2 Surface Blend , 3 Surface Blend , 3fillet Blend , Project ,Types C Tool Path , Step To Generate A Tool Path Used Of Machining Tool Bars, 2 Countering & Pocketing, 2d Drilling & Facing
	16	Using 3d tool path & generate. Programs... Practically used the CNC. Examination on practical.	Explain about the surface rough ( pocket parallel , radial ) surface finish (parallel radial ) ,flow line , contour , shallow project , pencil ,how to generate program & lathe tool path . Examination on theory
<b>UNIGRAPHICS</b>	17	Practices On Using Solid Modeling Tools Like Extrude, Revolve, Edge Blend, Chamfer , Face Blend, Datum Axis ,Datum Plane, Datum Points	Introduction Of UG, Interface Of UG Functional Keys & Toolbars, Sketched Environment & Tools, Constraints Extrude, Revolve, Edge Blend, Chamfer Face Blend, Datum Axis, Datum Plane Datum Points.
	18	Practices On Using Solid Modeling Mirror Feature, Mirror Face, Trim Body, Split Body, Hole Tools, Rib, Thread, Pattern Feature, Pattern Face, Pattern Geometry, Ruled, Shell, Through Curve , Draft, Scale Body, Sweep Along Guide , Swept, Variable Sweep, Tube.	Study About The Mirror Feature, Mirror Face, Trim Body, Split Body, Hole Tools, Rib, Thread, Pattern Feature, Pattern Face, Pattern Geometry, Ruled, Shell, Through Curve , Draft, Scale Body, Sweep Along Guide , Swept, Variable Sweep, Tube.
	19	Practices On Assembly & Kinematics Exercises.	Study About The Use Of Assembly, Types Of Assembly, Assembly Toolbars, Used Constraints, Bottom Up Assembly, Top Down Assembly, Use Of Kinematics & Motion Path Animation.
	20	Practices on manufacturing & drafting exercises. Used the CNC machine. Examination on practical.	Introduction Of Manufacturing Environment, Toolbars, Facing, Pocketing Contouring, Dimension Type, Used Constraints Dimensioning, Paper Set, Placement Of Base View, Sectional View ,Paper Set Placement Of Base View, Sectional View Dimensioning Placing & Gd&T Symbols Examination On Theory.

<b>PROJECT WORK</b>	21-24	PROJECT WORK by using DNC and CAM Post Processor
<b>EXAMINATION</b>	25	<b>EXAMINATION</b>

## 9.2 SYLLABUS CONTENT OF CORE SKILLS

### LEARNING OBJECTIVES:

1. Understand about engineering materials, their classification.
2. Properties and applications in the day to day technical application.
3. Preparation of materials by using furnace.

<b>Sl. No.</b>	<b>Professional Knowledge</b>
	<b>Material Technology</b>
<b>1.</b>	<b>Introduction to material</b>
<b>2.</b>	<b><u>Classification &amp; properties of materials:</u></b> Malleability, Tenacity, Toughness, Elasticity, Plasticity, Hardness, Ductility, Fatigue, Brittleness, Opaque
<b>3.</b>	<b>Compositions of materials:</b> Types of Steels, types of ferrous & non-ferrous metals
<b>4.</b>	<b>Steel making process:</b> Blast Furnace, Cupola Furnace, Paddling Furnace

### LEARNING OBJECTIVES:

1. Draw orthographic Projections giving proper dimensioning with title block using appropriate line type and scale.
2. Sectional views showing Orthographic, Isometric and Oblique projection.
3. Drawing of detailed and assembled production and process tools with conventional sign and symbols.

<b>Sl. No.</b>	<b>Professional Knowledge</b>
	<b>ENGINEERING DRAWING</b>
<b>1.</b>	What is drawing, Engg. Drawing, introduction of Engg drawing. Types of line, line group, arrow head, type of paper size, title block, out boundary.
<b>2.</b>	Types of scale dimension, dimension rules & it's used. Angle of projection, different type of view, sectioning, orthographic view.
<b>3.</b>	Surface roughness symbol & it's used. Limits, fits and tolerances.
<b>4.</b>	Drawing study of assembly drawing.

**LEARNING OBJECTIVES:**

1. Polite behavior. Ability to participate in multi-disciplinary team efforts.
2. Fluency in English. Competency in letter (official) writing. Able to communicate technical information in English.
3. Communicate in written and oral and with required clarity ensuring that the information communicated is clear, concise and accurate.

Sl. No.	Professional Knowledge
	COMUNICATION SKILL
1.	Informal Introduction Through Interactive Session, Body Language Or Formal Introduction
2.	Public Speaking, Presentation Skill, Resume Writing or Letter Writing, Role Plays On Verbal and Non-Verbal, Psychometric Test.
3.	Know about the GD rules discussion, HR question discussion
4.	Life skill session, programs. Examination on skill.

**LEARNING OBJECTIVES:**

1. Used all types of measuring instruments, calculate all list count of measuring instruments.
2. Application and used of different gauges , comparator

Sl. No.	Professional Knowledge
	METROLOGY
1.	Used of different types standardization of measuring instruments.( Linear & Angular)
2.	Identified and used of different types of Gauges.( Feeler Gauge, Radius Gauge, Screw Pitch Gauge, Telescopic Gauge, Slip Gauge, Standard Wire Gauge, Plug Gauge, Thread Plug Gauge, Snap Gauge, Ring Gauge, Thread Ring Gauge)
3.	Used of Height Master, Profile Projector, Comparators
4.	Practice On CMM.

## 10. ASSESSMENT STANDARD

### 10.1 ASSESSMENT GUIDELINES:

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 shall be given while assessing for teamwork, avoidance/reduction of scrap/wastage and disposal of scarp/wastage as per procedure, behavioral attitude, sensitive to environment and regularity in training. The sensitivity towards OSHE and self-learning attitude shall be considered while assessing competency.

#### A. CRITERIA OF ASSESSMENT:

Criteria for assessment based on each learning outcomes, will be assigned marks proportional to its importance.

The assessment for the theory & practical part is based on knowledge bank of questions created by trainers and approved by Examination cell (CTTC, Bhubaneswar)

For each Individual batch, Examination cell will create unique question papers for theory part as well as practical for each examination.

To pass the Qualification, every trainee should score a minimum of 70% cumulatively (Theory and Practical)

Assessment comprises the following components:

- Job carried out in labs/workshop
- Record book/ daily diary
- Answer sheet of assessment
- Viva –voce
- Progress chart
- Attendance and punctuality

#### B. ASSESSORS:

CTTC, Bhubaneswar faculty teaching the Advanced diploma in CNC programming and technique course, also assesses the students as per guidelines set by Examination cell of CTTC, Bhubaneswar. Faculties are been trained from time to time to upgrade their skills on various aspects such as conduct of assessments, teaching methodology etc. These training are usually conducted at XIMB, Bhubaneswar and XLRI, Jamshedpur and other renowned organization/ institution of the country .

#### 3. ELIGIBILITY TO APPEAR IN THE EXAM:

Minimum 80% attendance is compulsory for the students to appear for the assessments.



**C. MARKING SCHEME:**

Sr. No.	Method of Assessments	Weightage (Max. marks)	Evaluator
1	Written test	20	<b>Trainer + Course coordinator + Examinee nominated by Examination cell of CTC, Bhubaneswar</b>
2	Practical test	40	
3	Oral test/viva voce	10	
4	Class/Workshop/Lab performance	10	
5	Project	20	
<b>Total</b>		<b>100</b>	

**D. PASSING MARKS:**

Passing criteria is based on marks obtain in attendance record, term works , assignments, practical's performance, viva or oral exam, module test, practical exam and final exam

Minimum Marks to pass practical exam – 60%

Minimum Marks to pass final exam – 70%

Minimum Marks to pass viva / oral exam –60%

Minimum Marks to pass Project report and presentation exam – 80%

**E. RESULTS AND CERTIFICATION:**

The assessment results are backed by evidences collected by assessors. Successful trainees are awarded the certificates by CTC, Bhubaneswar.

## 10.2 FINAL ASSESSMENT

1. There shall be an Examination paper for the each subjects.
2. The Examination for both theory and practical shall be conducted by CENTRL TOOL ROOM AND TRAINING CENTRE, BHUBANESWAR.

<b>MARKING PATTERN</b>		
<b>Sl.No.</b>	<b>Subject</b>	<b>Maximum marks</b>
1	Workshop Technology	100
2	Auto CAD	100
3	CNC programming	100
4	Master CAM	100
5	Unigraphics	100
6	Material Science	50
7	Engineering Drawing	50
8	Communication Skill	50
9	Metrology	50
10	Project	100
<b>TOTAL:</b>		<b>800</b>