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**A Report
Of
2 Days Skill Development Workshop on CNC Programming**

Host:

Om Engineering College, Junagadh

Venue:

**OM Engineering College Junagadh
&
OM Centre For Research & Innovation**

Organized & Managed By:

Prof A.G.Makati (Head of Department of Mechanical Engineering)
Prof B.M.Garala (Faculty of Department of Mechanical Engineering)
Prof. J.D.Bhakhar (Faculty of Department of Mechanical Engineering)
Prof. B.K.Boghara (Faculty of Department of Mechanical Engineering)
Prof. R.K.Kava (Faculty of Department of Mechanical Engineering)
Prof. V.C.Thakar (Faculty of Department of Mechanical Engineering)

Date: 3rd & 4th February
10th & 11th February

Time: 09:00 am to 5:00 pm

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❖ Objective of Workshop on CNC programming:-

Department of Mechanical Engineering arranged skill development workshop on CNC programming mechanical engineering students. Now in a day's use of CNC Machine in all industries is increase day by day so this course introduces the concepts and capabilities of computer numerical control machine tools. Topics include Introduction about CNC technologies. Part Programming, Geometric dimensioning and Tolerances, setup CNC machine for operation and basic practice on CNC machine in context with industrial applications gives real industrial knowledge to the attendees. With completion of this course students should be able to operate CNC machine as well as able to program any industrial component.



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Content Delivered During CNC Programming Workshop

1	Introduction about CNC Technologies	<p>Classification of CNC Machine</p> <p>Advantage of CNC Machine tool</p> <p>Limitation of CNC Machine tool</p> <p>Application of CNC Machine tool</p> <p>General Construction of CNC Machine tool</p> <ul style="list-style-type: none">• Structure• Spindle and Feed Drives• Actuator Support bearings• Feed Back Systems• Automatic Tool Changers• Tooling• Material Handling System• Pallet Changer System• Lubrication System• Coolant System <p>Comparison between conventional & CNC machine</p>
2	Introduction about Part Programming	<p>Step In Part Programming</p> <p>Terminology used in CNC part Programming</p>



3	Selection of Cutting tools	Introduction about various cutting tools and their cutting angles, tool holders and inserts used in CNC machines
4	Introduction about geometric dimensioning and tolerances and selection of cutting parameters	<p>Introduction about various features of GD & T</p> <ul style="list-style-type: none">• Flatness• Parallelism• Circularity• Eccentricity with use of engineering drawing <p>How to select cutting parameters like spindle speed, feed, axial and radial depth of cut for different machining condition.</p>
5	Input Data in Manual Part Programming	<p>Sequence Number (N code)</p> <p>Preparatory Function (G Codes)</p> <p>Coordinate Function (X,Y,Z,U,V,W and I,J,K)</p> <p>Feed Function (F)</p> <p>Spindle Speed Function (S)</p> <p>Tool Function (T)</p> <p>Miscellaneous Function (M codes)</p>



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6	Manual Part Programming for Turning application	Axes Designation convention Types of CNC Lathes(CNC turning Centre) Zero point and Reference Point Programming Types General Structure of Turning part program Practice of CNC turning Part Programming On CNC Machine
7	Reverse Engineering	Introduction about Reverse Engineering Introduction about Coordinate Measuring Machine Demonstration of Co-ordinate Measuring Machine for the Inspection point of view Demonstration of 3D Scanning of Co-ordinate Measuring Machine

Highlights of 3rd and 10th February 2017

Workshop of CNC programming is divided in two sessions. In first session all students got knowledge about basics of CNC machine and its application. There are many difference of NC and CNC machine and it's more beneficial to work with CNC machine compare to NC machine. In this session giving demonstration of CNC machine as well as CNC classification, advantages, disadvantages and other factors which are related to CNC machine is explained in this session.

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After Completion of this introductory session start with all terminology related CNC machine is explained to students so they will understand all the parameters of CNC part programming easily. The CNC part programming is based on coding so all coding system explain by the respective faculty to student and so that they can understand brief of programming.

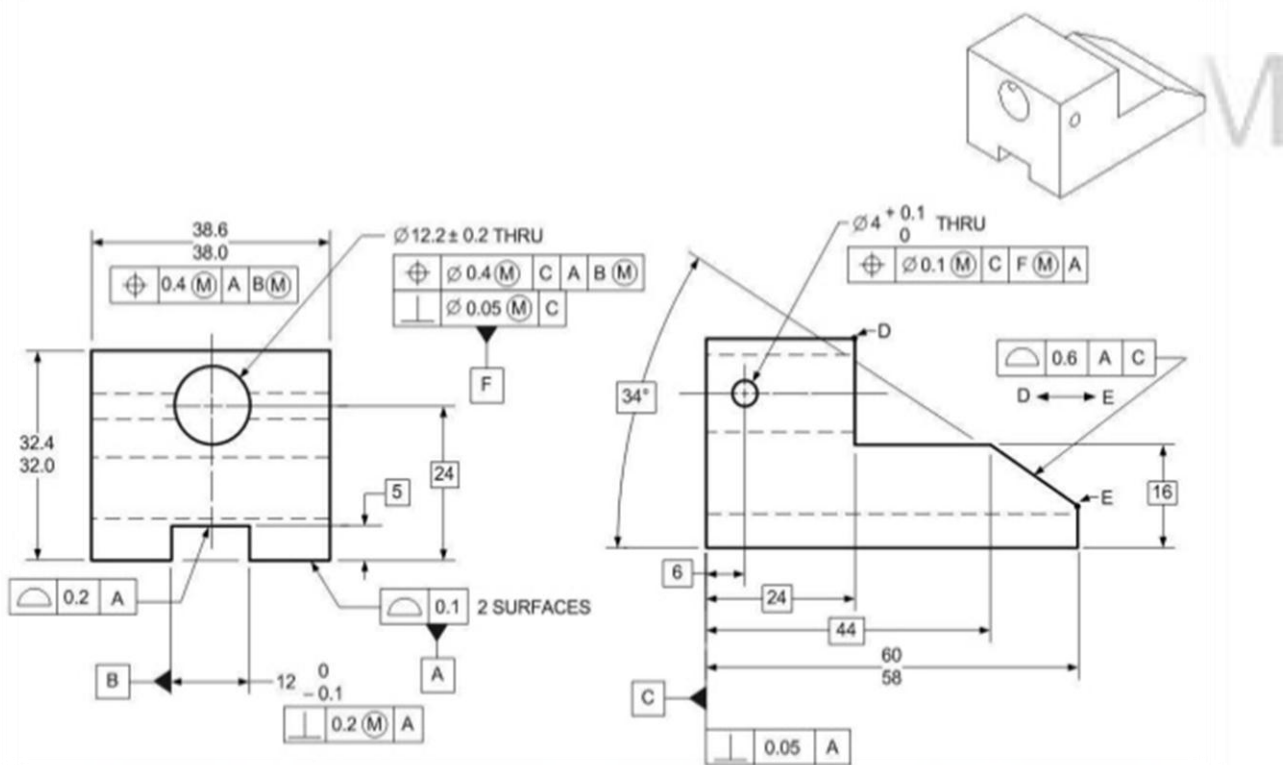
After this session conduct another session for cutting parameter, tool selection and insert selection. There are many parameters for cutting which is feed, speed and depth of cut. All parameters consider for CNC machine which is used in manufacturing process. There are different cutting tool which is use differently for straight turning, taper turning, thread cutting etc. processes.

Inserts are used for cutting which is fitted on tool. If any process or at cutting time suddenly change is there so tool will safe if insert is added on the top of tool so inserts are widely used for CNC machine. Inserts are made from different material as per process required.

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❖ Introduction about various features of GD & T

GD&T in a part design (An example)



Geometric Dimensioning and Tolerance (GD&T) is a system for defining and communicating engineering tolerances. It uses a symbolic language on engineering drawings and computer-generated three-dimensional solid models that explicitly describes nominal geometry and its allowable variation. It tells the manufacturing staff and machines what degree of accuracy and precision is needed on each controlled feature of the part.



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GD&T is used to define the nominal (theoretically perfect) geometry of parts and assemblies, to define the allowable variation in form and possible size of individual features, and to define the allowable variation between features. In this session learn about manufacturing drawing that how to read the drawing and how it is different from basic drawing and manufacturing drawing. The basics of GD&T is that to check circularity, ovality, concentricity and other parameters which is related to drawing reading and manufacturing process.

SYMBOL	GEOMETRIC CHARACTERISTIC	TYPE OF TOLERANCE	PRIMARY CONTROL
	FLATNESS	Form No relation between features	Controls form (shape) of size and non-size features.
	STRAIGHTNESS		Datum reference is not allowed
	CYLINDRICITY		Controls form (shape) of size features
	CIRCULARITY (ROUNDNESS)		Datum reference is not allowed
	PERPENDICULARITY	Orientation No relation between features	Controls orientation (tilt) of surfaces, axes, or median planes for size and non-size features Datum reference required
	PARALLELISM		<i>Optional: Angularity symbol may be used for all orientation controls</i>
	ANGULARITY		
	POSITION	Location	Locates center points, axes and median planes for size features. Can also control orientation.
	PROFILE OF A SURFACE		Locates surfaces Can also be used to control size, form, and orientation of surfaces based on datum reference
	PROFILE OF A LINE		
	TOTAL RUNOUT	Runout	Controls surface coaxiality Can also control form and orientation of surfaces.
	CIRCULAR RUNOUT		
	CONCENTRICITY	Location of derived median points.	Locates derived median points of a feature <i>Not common, consider position, runout, or profile.</i>
	SYMMETRY		

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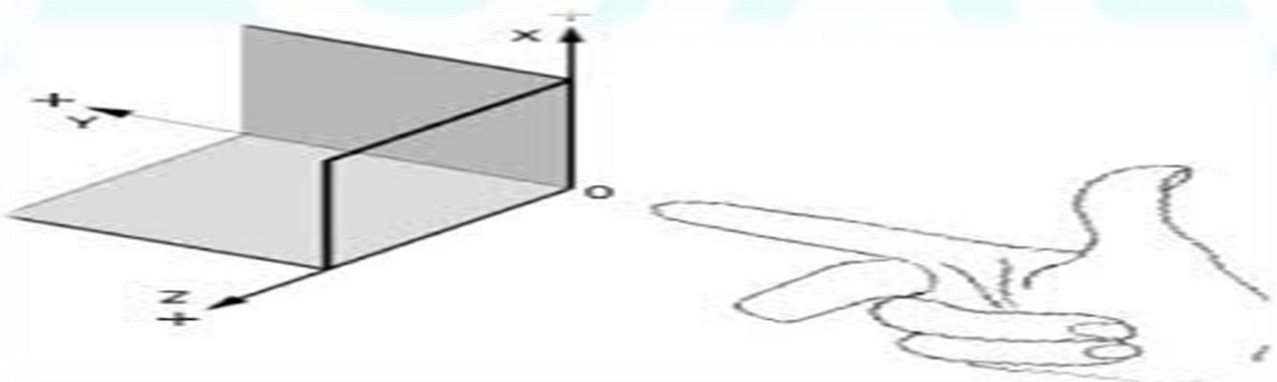


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After completion of all theoretical knowledge about CNC machine start with actual part programming which is used for manufacturing in CNC machine. There are many codes used for CNC machine in which G code, M code, N Code, X,Y,Z code, S code etc. which is used for part programming.

- N - Block number - specifies the start of the block
- G - Preparatory functions
- M - Miscellaneous functions
- X - X-axis coordinate
- Z - Z-axis coordinate
- I - X-axis location of arc center
- K - Z-axis location of arc center
- R - Radius of arc
- S - Spindle speed or Cutting speed
- F - Feed rate
- T - Tool number. CNC machine basically work on thumb rule and for axis designation it is given on that given sign as shown in Image.



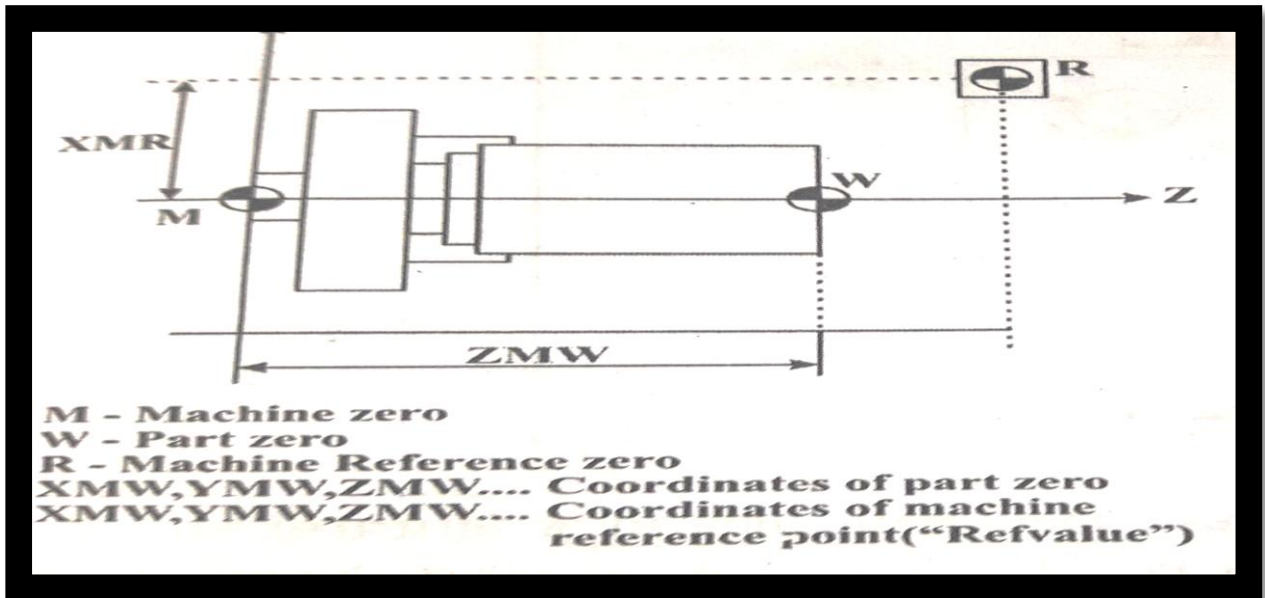
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❖ Zero Points and Reference Points



There are different G codes and M codes which is generally used for part programming in which following codes are most important for CNC machines like linear interpolation, rapid traverse, spindle rotation etc. codes are used for programming and in M code spindle start, stop coolant on off etc will be done from the M code.



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Highlights of 4th and 11th February 2017

On this date practical work of CNC machine is done by the students and which program is done by student they load on the machine by them self and they see simulation of the part program.

Simulation is need for safety purpose as well as tool life of machine. If simulation is not seen and direct execution of program is done than more chance of accident will occurs on machine so simulation is needed for CNC machine.



After see the simulation of part programming actual machining process is teach to students and they are perform practically as per instruction given by faculty. Moreover they perform practically they seen that this is actual manufacturing on CNC machine and they are quite confident about their learning of part programming. They make 4-5 practical of CNC part programming and manufacturing and program loading on CNC machine.

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❖ Reverse Engineering

Reverse engineering is a process in which we can produce CAD model from the Hard material model. In this process CMM is used for measuring all the dimensions and parameters which is related to based on drawing. From this if we want to manufacture same parts of hard material we can make drawing with reverse engineering and manufacture copy part from this system.



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After completion of all the process of CNC part programming and manufacturing certificate distribution is done by HOD sir. All students got CD of material of CNC part programming and Certificate which is used in future to students for job purpose as well as other training of the CNC programming.



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❖ Industrial Visit @ V.V.Engineering Junagadh

The real application of CNC machine is in industry for different purposes of manufacturing processes. For that all students are visited at industry for practical of real CNC machine programming and manufacturing.

At this industry 10 different CNC machines are there and all machines are in working with different cutting parameters and different processes of manufacturing. So they are seen more about CNC machine.



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❖ Conclusion Of this Workshop:-

After completion of this workshop 86 students of different regions got training about CNC machine and Manufacturing with CNC machine. All parameters which is related to CNC machine is known by the students and they are happy after attending this fabulous program which is conducted by Mechanical Department.

The basic feedback of student is that they want to extend this workshop and learn more of CNC and in future if it is possible than they want to learn of VMC machine also. So it is great success of this workshop that students are happy to attending this 2 Days workshop of Skill Development program On CNC Machine.

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