

# Trainer's Guide

## Machining Technician (Lathe)



### CNC Operator Machining Technician L3

- ◆ SECTOR: AUTOMOTIVE
- ◆ SUB-SECTOR: MANUFACTURING
- ◆ OCCUPATION: MACHINING
- ◆ JOB ROLE: MACHINING TECHNICIAN LEVEL 3
- ◆ REFERENCE ID: ASC/Q3501



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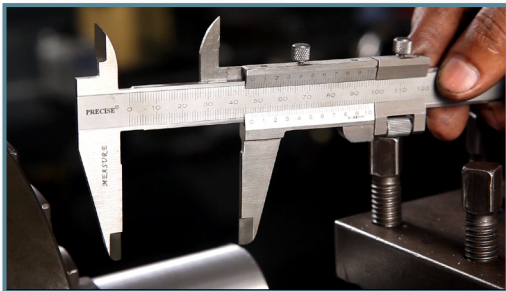
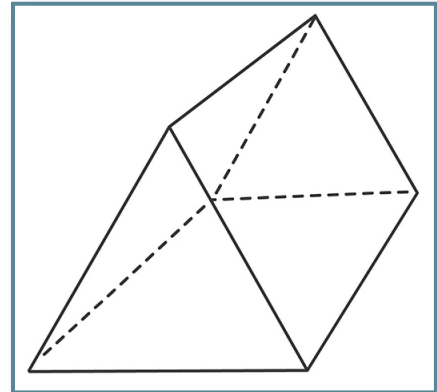
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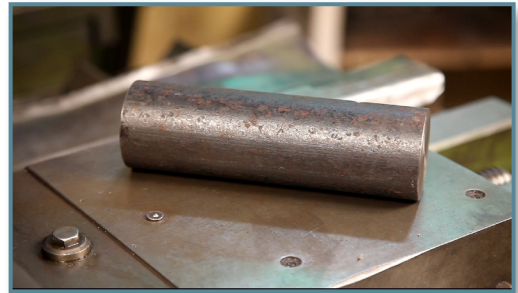


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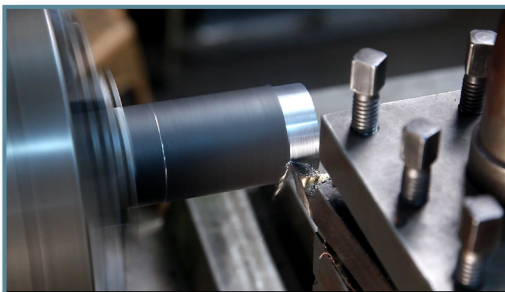


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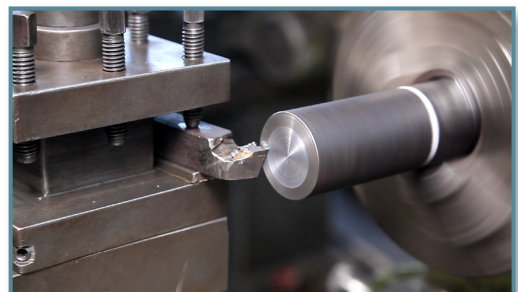


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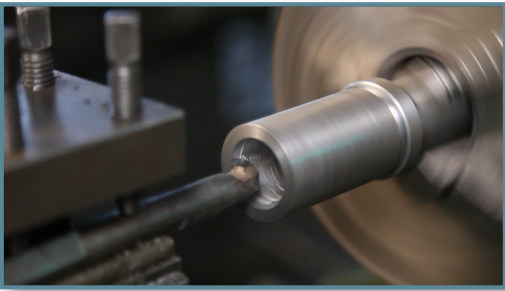
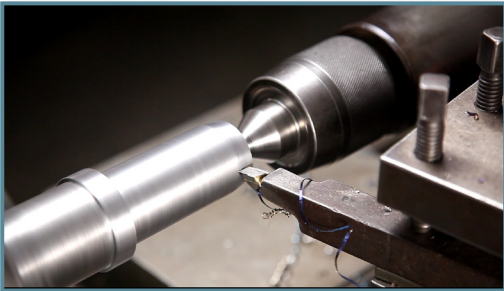


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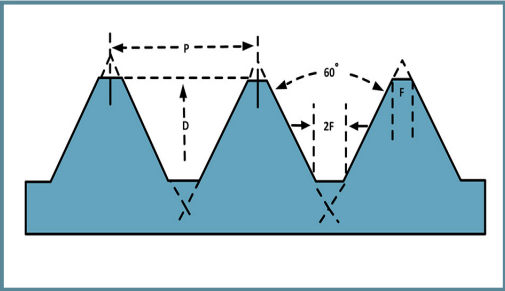
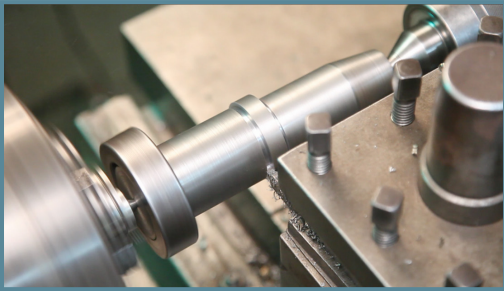


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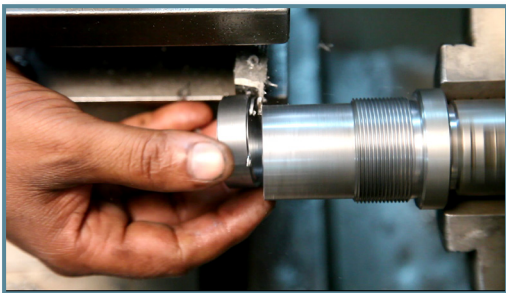
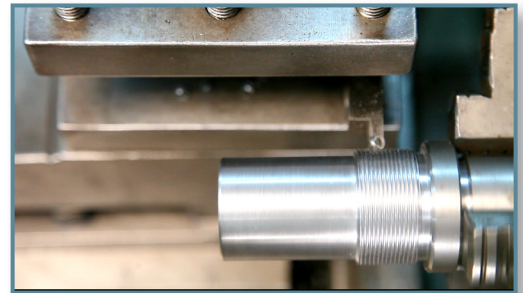


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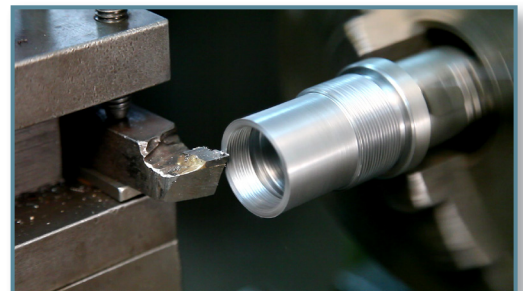


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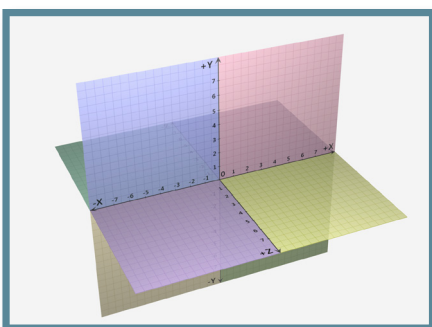
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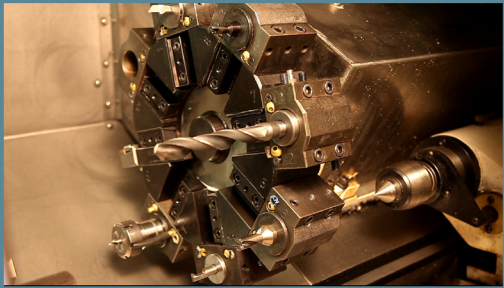
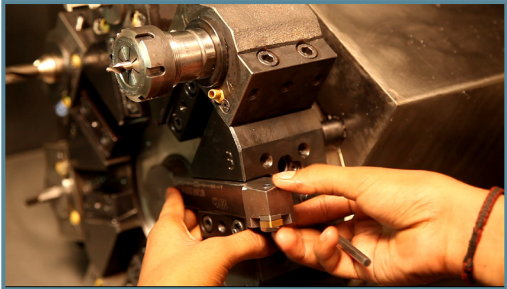
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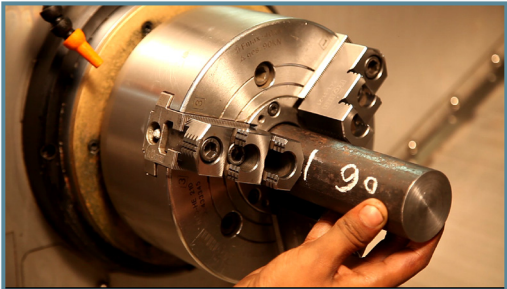
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## Welcome Note

Dear Trainer,

You may be aware that at present, the machine tool sector which is a significant sector of the manufacturing industry is operating at a capacity of 90% and above. Industry experts reported an increase in capacity utilization as compared to 2010 with a growth in capacity in next six months by around 50%. The machinery and equipment sector has expanded by 11.1 percent.

The increasing use of CNC machine tools in all sectors of the manufacturing industry has increased the demand for computer-controlled machine tool operators. There is a need for skilled machine operators, with the manufacturing industry switching over to computer controlled machines with a focus on increasing productivity. This programme for “CNC Operator” is designed to provide the skills required for an individual to become a professional in the manufacturing sector.

The training programme is spread over 36 days of class room training and covers the following areas:

- ◆ Knowledge requirements – Adequate knowledge of the CNC system, use of CNC machines and other equipment’s.
- ◆ Application – Hands on training to understand and apply the work in a real environment.
- ◆ Soft skills – For effective communication and conduct.

The content of the course is packaged in videos, participant handbook and a workbook for the participants and a trainer’s guide for you. The videos have been especially made keeping in mind the course and the technical application of instruments etc. Through these videos we hope to simplify the learning and make it more interactive.

The trainer’s guide will help you in conducting this program. You will notice that some of the sessions will spill over onto the next day. For convenience sake, we have given the training instructions in the first day of that particular session. The second day will simply ask you to recapitulate the learning s and continue from where you had left.

The assessment guide details the evaluation methodology. As a trainer you will evaluate the trainees’ performance and grade them based on the evaluation parameters given in the guide.

As a trainer you will be the mentors for the participants. We hope you will be able to impart your knowledge with our help to make this programme a success.

All the best!

## Industry Brief

### Overview of Machine Tool and Equipment Sector

At present, the machine tool sector which is a significant sector of the manufacturing industry is operating at a capacity of 90% and above. Industry experts reported an increase in capacity utilization as compared to 2010 with a growth in capacity in next six months by around 50%. The machinery and equipment (other than transport equipment), sector, with a weight of nearly 10 per cent in the IIP index, expanded by 11.1 percent.

### Role of Computer Numerical Control machines (CNC) Machines in the Manufacturing Sector

CNC Computer Numerical Control machines are widely used in manufacturing industry. CNC machines include tools such as lathes, laser cutting machines, roll forms, press brakes and printing presses. CNC machines use the same techniques as many other mechanical manufacturing machines but are controlled by a central computer instead of a **human operator or electric switchboard**.

CNC machines operate by reading the code included in a computer-controlled module, which drives the machine tool and performs the functions of forming and shaping a part formerly done by machine operators. Many old-fashioned machines can be retrofitted with a computer control, which can greatly improve the productivity of a machine. These machines are most commonly used in metalworking industries where precision is imperative, because computers can be more accurate than humans in this work.

### Human Resource Requirement in CNC Machine Operations

*Computer control programmers and operators use computer numerically controlled (CNC) machines to produce a wide variety of products, from automobile engines to computer keyboards. Computer control programmers and operators normally produce large quantities of one part, although they may produce small batches or one-of-a-kind items.*

CNC programmers, also referred to as numerical tool and process control programmers—develop the programmers, develop that run the machine tools. They often review three-dimensional computer-aided/automated design (CAD) blueprints of a part and determine the sequence of events that will be needed to make the part. This may involve calculating where to cut or bore into the work piece, how fast to feed the metal into the machine, and how much metal to remove.

After the programming work is completed, CNC Operators also referred to as computer-controlled machine tool operators, metal and plastic set up the machine for the job. They download the program into the machine, load the proper tools into the machine, position the workpiece on the CNC machine tools like spindle, lathe, milling machine, or other machine and then start the machine.

### 'CNC Operator' - What is the Job All About?

- ◆ A Computerised Numerically Controlled (CNC) machine is automated and run by a computer program used in the engineering industry for cutting metal parts. The CNC machines drill, cut and shape highly precise items that are used in numerous industries, such as the automotive and aerospace industries. They greatly increase the number of products that can be produced in a day. A CNC (Computerised Numerically Controlled) Operator is one who operates a CNC machine.

## Role of the Trainer

As a trainer, keep in mind the following guidelines:

### Know Your Job Thoroughly

Before you begin your training programme, you must be well-versed with the theory and practical aspects of the job. Prepare well before each session. Study and teach each exercise/activity with respect to these six key points:

- ◆ Method – the best practices
- ◆ Quality – the awareness of quality
- ◆ Waste – minimisation of waste
- ◆ Safety – the practice of safety measures
- ◆ Ergonomics – the care given to body posture and other work place ergonomics
- ◆ Housekeeping – the importance of cleanliness at workplace

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- ◆ Ergonomics – the care given to body posture and other work place ergonomics
- ◆ Housekeeping – the importance of cleanliness at workplace
- ◆ Practise These Common Courtesies
- ◆ Greet the trainees.
- ◆ Be warm and friendly. Watch your tone of voice, do not scare them.
- ◆ Introduce yourself.
- ◆ Ask their names.
- ◆ Explain the purpose and goals of the training programme.
- ◆ Ask them what their expectations are.
- ◆ Always ask questions.
- ◆ Listen to them patiently and answer their questions.
- ◆ In case you are unable to respond to a query say that you will get back to them. Do remember to follow up; do not make promises that you cannot keep.

### Respect the job of the trainees

- ◆ Do not lean over them, their work, or get in their work space.
- ◆ Do not take their work or move it without asking for their permission.
- ◆ Be a good observer. Watch the trainees while they are at work. Make notes of their performances.
- ◆ Offer remediation for weaker trainees.
- ◆ Correct the faulty practices of trainees on the job before they turn into habits.
- ◆ Do not criticise. Be positive while giving feedback.
- ◆ Show appreciation where it is due.
- ◆ Always say “**Please**”, “**Thank You**” and “**Sorry**”. This helps create a good impression.
- ◆ Be a mentor to the trainees.

It has been found that those who are already in the industry do not follow standardised practices. Different methods/techniques are practiced by different operators across the country for the same task/job. To add to this, there is little or no quality consciousness. The challenges are many, be it to learn, unlearn, relearn the skills or to be able to build the right attitude, work-place etiquette and behaviour. Therefore, in order to develop the learner holistically, a blend of both technical as well as soft skills is a must and will go a long way in helping the learner find a place for themselves in the industry.

### Use of Multimedia Content on K-Yan

#### About K-Yan

K-yan is an innovative teaching aid that eliminates the need for other teaching aids such as computers, projectors and others. The K-yan, developed and patented by IL&FS Education and Technology Services Ltd. (IETS), is a fully integrated unit that contains a high-performance computer, projector, CD/DVD writer and audio system all rolled into one.



#### Multimedia Content

Multimedia is a combination of multiple media such as text, audio, video, graphics and sound.

#### Advantages of Multimedia Content:

- ◆ **Video-Based Step-By-Step Learning Process:** The entire training content has been presented through video demonstrations. Each task/process has been broken down into a series of very simple steps supported by text and voice. Learning through practical video demonstrations has been found to be the most effective tried and tested method of learning a skill such as this.
- ◆ **Standardisation of Content:** The multimedia content has been developed keeping in mind the best practices of the trade. Therefore, trainees from all regions are exposed to standardised best practices.
- ◆ **Increased Training:** Multimedia content, when projected through K-yan can reach out to more number of trainees at a given point in time.
- ◆ **Flexibility:** The content has been developed with adequate controls given to you to play, replay, or pause the content depending on the learning capabilities of your trainees.
- ◆ **Language of Your Choice:** The content is available in 9 regional languages. You may choose the language depending on your audience.



## Suggested Batch Size

The suggested batch size for this course is around 25 participants.

## Methodology

It is recommended that you follow a particular method while conducting the training. You should blend your classroom and practical sessions with the training content that has been provided to you. Technical content provided to you has been developed primarily using multimedia technology. Multimedia uses multiple media mixes such as video, text, voice and varied patterns of learning to gain a meaningful learning experience. While you play the multimedia content in the classroom, you, as the Trainer, must provide supporting inputs. Therefore, your contribution in the classroom while the multimedia is being played is very crucial.

All the multimedia modules have been organised in the following manner beginning with objectives and ending with a summary:

- ◆ Objectives
- ◆ Introduction
- ◆ Show
- ◆ Tell
- ◆ Try
- ◆ Test
- ◆ Summary

The detailed module structure is as follows:

Module Structure  
Module Objectives  
Introduction  
Learning Screens  
Summary  
Show See and Listen  
Tell Work with Me  
Try Work without Me  
Test Check Your Progress

## Show (See)

This screen, as the name suggests, shows in one glance the entire procedure. The idea is to give you and the learner the big picture in one glance. While you play this screen, observe the learners and gauge them through non-verbal cues. Once the screen ends, ask them whether they have understood the content and respond to their queries, if required.

### **Tell (Work with Me)**

After the learners are familiar with the procedure, they must be shown the entire procedure once again, but this time step by step. The screen that follows the “Show” screen is the “Tell” screen. Observe that this screen gives a step-by-step breakup of the entire procedure supported with text, voice and video. Replay the step, if need be. Proceed to the next step only when you are convinced that all participants have understood.

### **Try (Work under Guidance)**

Next is the “Try” screen. This screen will have instructions as to what the trainees must do during their practical session. During the practical session, ensure that trainees practice on the workpiece given.

## Session Plan

<b>Program Name</b>	Machining Technician (Lathe)		
<b>Name of Client</b>	NSDC		
<b>Version No.</b>	5.3	Version No.	1.0
<b>Pre-requisites to Training</b>	Minimum qualification – 8 th pass		
<b>Training Outcomes</b>	<p>By the end of the program, the participants will be able to:</p> <ul style="list-style-type: none"> <li>◆ read and understand engineering drawings of simple parts.</li> <li>◆ read and understand CNC part programs.</li> <li>◆ develop part programs for simple components.</li> <li>◆ produce parts or components in auto cycle.</li> <li>◆ adjust the tool or offset data to correct the deviations in part dimensions.</li> <li>◆ change the cutting tools or carbide insets after full wear.</li> <li>◆ do preventive maintenance of the machine.</li> </ul>		

Sr. No.	Module	Session	Objectives	Methodology	Tools	Time
<b>Day 1</b>						
1	Morning Energizer	Morning starter song/ Stretching Exercises/ Prayer/Moral stories	<ul style="list-style-type: none"> <li>◆ To energize the participants.</li> </ul>	<ul style="list-style-type: none"> <li>◆ Group participation</li> </ul>	<ul style="list-style-type: none"> <li>◆ Songs provided in Trainer's Guide</li> </ul>	10 minutes
2	Icebreaker	Icebreaker and Setting Ground Rules	<ul style="list-style-type: none"> <li>◆ To recognize and build rapport with fellow participants/ trainer.</li> <li>◆ To recognize the importance of rules and regulations for working effectively.</li> </ul>	<ul style="list-style-type: none"> <li>◆ Icebreaker/Activity</li> <li>◆ Multimedia based learning (Show and tell)</li> <li>◆ Trainer led discussion</li> </ul>	<ul style="list-style-type: none"> <li>◆ Interactive Game</li> <li>◆ Trainer's Guide</li> </ul>	1 hour 50 minutes
3	Metrology	Unit Conversion	<ul style="list-style-type: none"> <li>◆ To explain measurements terms (length, weight, time, etc )</li> <li>◆ To explain the different measurement systems.</li> <li>◆ To convert values between the measurement systems.</li> </ul>	<ul style="list-style-type: none"> <li>◆ Trainer led discussion</li> </ul>	<ul style="list-style-type: none"> <li>◆ Participant Handbook</li> <li>◆ Trainer's Guide</li> <li>◆ Metre Tape</li> <li>◆ Scale</li> <li>◆ Unit Conversion Table</li> </ul>	6 hours



Sr. No.	Module	Session	Objectives	Methodology	Tools	Time
<b>Day 35</b>						
1	Morning Energizer	Morning starter song/ Stretching Exercises/ Prayer/Moral stories	<ul style="list-style-type: none"> <li>◆ To energize the participants.</li> </ul>	<ul style="list-style-type: none"> <li>◆ Group activity</li> </ul>	<ul style="list-style-type: none"> <li>◆ Songs provided in Trainer's Guide</li> </ul>	10 minutes
2	Summative Evaluation	Practical Test	<ul style="list-style-type: none"> <li>◆ To evaluate the participant on the competencies learnt in the training program</li> </ul>	<ul style="list-style-type: none"> <li>◆ Practical Evaluation</li> </ul>	<ul style="list-style-type: none"> <li>◆ Assessment Guide</li> </ul>	8 hours
<b>Day 37 – 51 On Job Training (OJT)</b>						

## Day 2

Session	Resources Used	Suggested Duration
Morning Energiser	◆ Morning Energiser Booklet	10 minutes
Unit Conversion	◆ Trainer's Guide ◆ Participant Handbook ◆ Metre Tape ◆ Scale ◆ Unit Conversion Table	2 hours
Basic Geometry-2D	◆ Trainer's Guide ◆ Participant Handbook	2 hours
Basic Geometry- 3D	◆ Trainer's Guide ◆ Participant Handbook	3 hours
Reading Engineering Drawings	◆ Trainer's Guide ◆ Participant Handbook ◆ Engineering drawing ◆ Work piece finished on a lathe machine	1 hour

## Morning Energiser

### Resources to be used

Please refer to the "Morning Energisers" section in the Trainer Guide. You may pick the energiser that is recommended for the day of the week.

## Unit Conversion(Contd.)

### Objectives

At the end of this session, you will be able to:

- ◆ explain measurement terms (length, weight, time, etc.
- ◆ explain the different measurement systems;
- ◆ convert values between the measurement systems.

**Do**

Recapitulate the key learnings of the previous day and continue the session from where you had left.

## Basic Geometry-2D

**Objectives**

At the end of this session, you will be able to:

- ◆ identify the different 2D geometrical shapes.

**Do**

Review the learning objective. Draw a line on the whiteboard and start by explaining what a line is.

**Say**

This is a line that is one of the basic shapes of geometry.

**Do**

Incorporate a small quiz game at this point. Ask them about the simple shapes you see in the classroom around you for instance you could ask them to identify the shape of white board, an orange, a chalk piece, etc. This will arouse participant interest you can then take them through the two shapes mentioned in their participant handbook.

**Do**

Being a common topic, you can expect students to show excitement. Try to keep students involved in the topic and do not go beyond the scope. Remember these key points:

- ◆ Use a combination of presentation and interactive methods.
- ◆ Solicit participant discussion and ideas.

## Basic Geometry- 3D

**Objectives**

After completing this session, trainees will be able to:

- ◆ identify the different 3D geometrical shapes;
- ◆ differentiate between 2D and 3D shapes.

**Do**

Review the learning objectives. Begin the session by drawing a square on the board along with a cube and ask them to identify both the shapes.

**Ask**

What is the difference between the two shapes that I have drawn on the board?

**Responses**

Mostly the participants will identify both the shapes as square.

**Do**

Begin the discussion by telling them about the shapes you have drawn on the board. Go on to explain how the cube here is a 3D shape. Using these two figures help them differentiate between 2D and 3D object.

**Do**

Using the picture given in the participant Handbook under 'X Y and Z Axis'. Elaborate X, Y,Z axis and the point of origin. Then tell them how 3 dimensional shapes have an additional axis called Z axis. Take them through the various shapes given in the participant handbook. Conclude the session by asking the participants to draw various 3 D shapes on a chart and put them up in the class.

## Reading Engineering Drawings

**Objectives**

After completing this session, trainees will be able to:

- ◆ read engineering drawings.

**Do**

You can initiate your discussion by conducting this quick activity. Ask them to stencil out the shape of their pencil box or lunch box. Once they finish the drawing ask them to use a common ruler to measure its various dimensions (length and breadth). Now, tell them how this drawing will help the builders to get the exact dimensions of the pencil box if this pencil box was to be created from scratch.

Continue the discussion on these lines. Tell them how an engineering drawing of a component will tell the lathe operator exactly what to build. Show them a simple work piece finished on lathe machine and an engineering drawing of the same. Elaborate on the engineering drawing showing the various lines used. Tell them how engineering shows both 2 D and 3 D images of the work piece.

Explain about scale specification by using simple examples. For instance, if the exact measurements of a table were to be put on paper it would take whole lot of space and still the exact measurement would not fit on a paper. This is where scale specifications are needed. A convenient scale would be used to show the measurements on a piece of paper. Now, the builder will know the exact dimensions of a table looking at the small scaled drawing.



Explain the concept of sectioning by taking an apple and cutting it in half. Go on to tell them how the kernel of the apple is now visible in contrast to when the apple was whole. Similarly, sectioning is used to show the insides of the work piece components in engineering drawings. Sectioning shows the lathe operator exactly what to make even from the interior side.

Explain the concept of projection. Continue the discussion by elaborating on the different projections as explained in the participant handbook.

Bring some fun elements into the class by conducting a pop up quiz. Distribute a slice of apple for a correct answer.

### Notes for Facilitation

This is an extremely important session therefore spend a great deal of time to elaborate the various concepts of engineering drawing.



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