Trainer's Guide

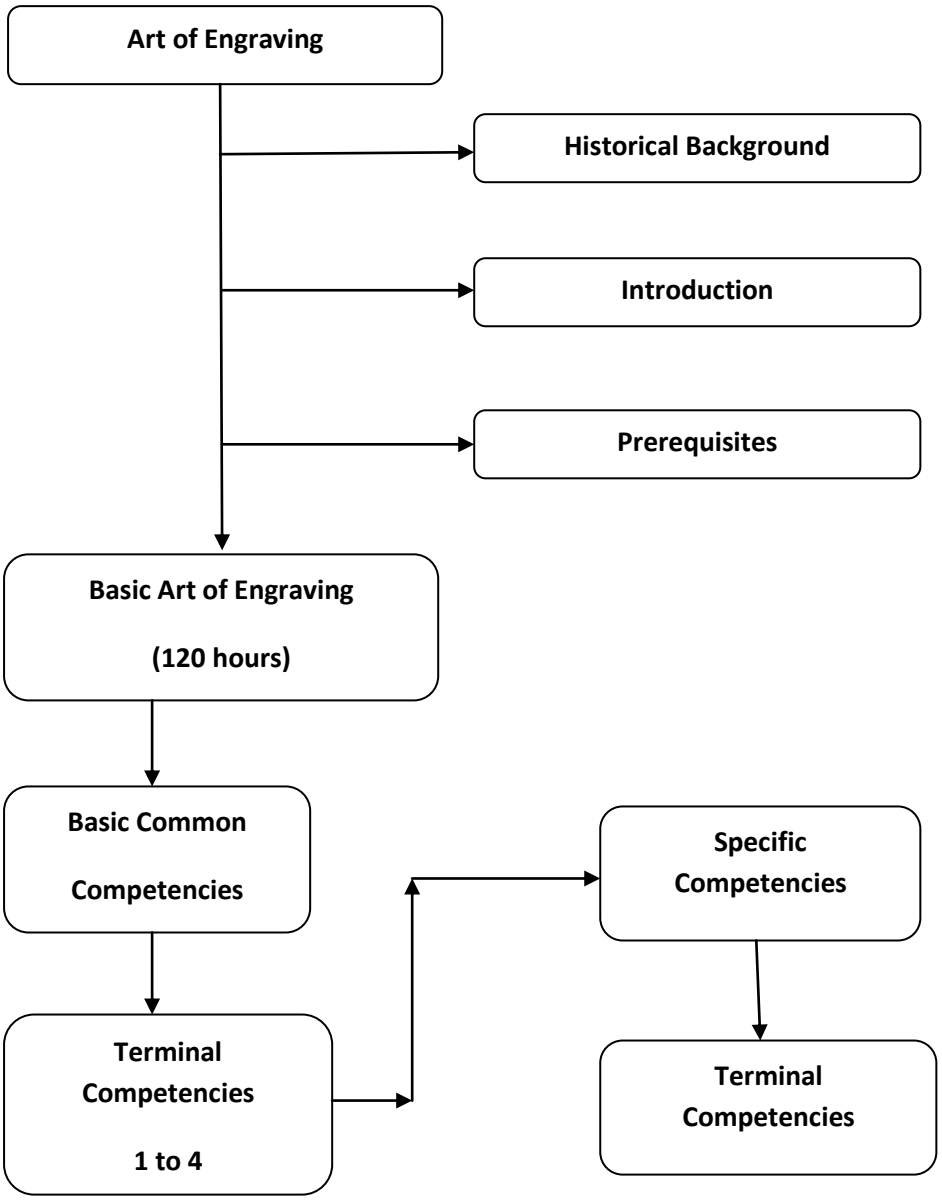
(Basic Art of Engraving)

Topics Covered in MES Training Module on 'Basic Art of Engraving – Level 1

Topic	Related Terminal Competency
Topic 1 – Casting materials, brass, its types and manufacturing methods	1
Topic 2 – Measuring instruments	2
Topic 3 – Correlate between different measuring units	2
Topic 4 – Safety measures and communication skills	3 &4
Topic 5 – Sketching, tracing and replicating designs	5
Topic 6 – Forecasting and planning	6
Topic 7 – Marking and measuring on brass	7
Topic 8 – Types of engraving tools and their selection	8
Topic 9 – Introduction to engraving types and basic engraving	9, 10 & 11

Table of Contents

Course Matrix



Course Syllabus

Level 1 – Basic Art of Engraving (120 hrs)

Introduction to casting materials, brass, types and composition of different brasses, different manufacturing processes. Introduction to unit system and relation between SWG and mm. Difference between plate and sheet. Hand exercises, working posture, preparation of tooling. Fixtures of engraving. Difference between engraving, embossing and etching. Drawing on paper, use of technology in preserving and replicating the drawing, tracing various designs using carbon paper on flat and curved surfaces, patterns and designs, introduction to tools use in engraving. Different operation involved in engraving. Classification of engraving i.e. Japani work (rough), Mehmari Chicken work, Darmiyani work, Bidri work, Super Fine Marodi work. Training to hold engraving tools, training to engrave between two lines, practice assignments for ‘Japani’, ‘Jali’ and ‘Daane’ patterns on flat plates and curved surfaces, post engraving operations.

PREREQUISITES

Age: Not less than 18 years

Entry Qualifications:

Minimum 5th standard pass, perfect vision with or without glasses, no handicap in upper limbs, functionally literate (able to read and write) in local language (Hindi for the pilot project), positive attitude towards learning handicraft work, willingness to sit and work for several house at a stretch.

Training Methodology

- The trainer is expected to review the trainer's guide in detail and in depth.
- He/she shall guide the trainee topic by topic as per the guide.
- Trainer shall discuss and explain the theory to the trainee and attend their queries.
- Trainer shall give demonstration by on job performance for each assignment as per the competency mentioned.
- For explaining any give assignment, the trainer should adopt the following sequence –
    1. Explain the sketch, its minute details, dos and don'ts
    2. Explain the tools and equipment required
    3. Explain the precautions to be taken
    4. Demonstrate sketching, tracing, tool selection, tool sharpening, outlining, fine engraving and finishing operations chronologically
    5. The information given in this trainer's guide is to be used as handbook and shall be given to the trainees also.

Introduction to the training module, syllabus and historical background

Purpose	To explain the course contents to the students, course schedule and training methodology
Suggested duration	2 hours
Resources required	Whiteboard, market, LCD Projector, Laptop
Suggested sitting plan	Tables and chairs (classroom)
Learning Objectives	• Introduction of the students to the trainer(s) and among themselves • To provide overview of the course • To narrate and explain time schedule • To discuss the background of 'Engraving' and future prospects (career oriented) to the students

Learning Objectives	Suggested Delivery Method	Suggested Time
Introduction of the students to the trainer(s) and among themselves	Lecture by the trainer gives his introduction, motivating students to speak about themselves on following points • Name • Reason for joining the training • Expectations from the training • To share hands on experience (if any)	30 minutes
To provide overview of the course	Lecture by the trainer narrating the syllabus course matrix, expectations and dos and don'ts Q & A Session	30 minutes
To narrate and explain time schedule	Lecture by the trainer, step by step proceedings of the modules Q & A Session	30 minutes
To discuss the background of 'Engraving' and future prospects (career oriented) to the students	Lecture, also incorporating the summary of discussion made in the introductory lecture Q & A Session	30 minutes

Background Information: Introduction to Engraving

In an attempt to conserve the art ‘Engraving’ and henceforth, preserve our heritage. ILO has taken initiative in designing a documented training module for the same so that this dying art can be revived and the knowledge for the same is systematically transferred to the next generation in a channelized way. This will not only revive and preserve this art, but shall also improve the demand in market. The engraved articles are clearly different from the etched or embossed ones. One can just touch the engraved product and feel the difference from that of the embossed or etched one. Engraving has got that ‘antique’ value, which is lacking in the articles produced by alternative techniques.

Trainee: The learner who will enrol himself/herself for the course is referred to as ‘trainee’ or student or learner.

Trainee: The expert who will train the trainee under his supervision is referred to as ‘trainer’

The training is phased out in levels, the basic level and the advance level. In basic level training, different casting materials will be discussed with their melting points. Different types of brass, their composition and various manufacturing processes including casting are explained in brief. Different units of length/thickness measurement have been compared. Difference between plate and sheet has been given. Some basic exercises for wrists and hands are also included. Different working postures are discussed so that learners can selected one in which they feel comfortable. The learners are introduced to the set of tools required in ‘engraving’ and fixtures or working tables. Difference between ‘engraving’, ‘etching’ and embossing is explained. Art to draw different patterns on paper and also preserving and replicating sketches with the help of computers is discussed with several examples. Demonstration is given with exercises for learners for tracing the designs on flat and curved surfaces of brassware. The tools used for ‘engraving’ have been displayed with their specialties and selection criterion for a particular work and according to the material of the job. Fabrication is to be provided for holding different tools and striker positions. Different operations in ‘engraving’ viz paper sketching, thickness measurement of job, measuring and making, sketching on job, selection of engraving tools (specially designed chisels, here referred as ‘kalams’), practice session will be given to trainees after demonstration by trainers. Different types of ‘engraving’ will be demonstrated by trainers like japani work (rogh), Mehmari Chicken work, Darmiyani work, Bidri work, Marodi work (basic) and Super Fine work. Training to hold and use different types of tools will be given and practice assignment to engrave straight lines, curved lines (marodi work) at equal distance between two parallel lines will be given to learners. Assignments of Japani work has to be successfully completed by all trainees before qualifying level-1. Repair welding of jobs where a fault has occurred shall also be taught.

Historical background of engraving

Engraving on brass started in around of 1810. Initially engraving was done on stone to prepare sculptures and designs, statues of different kind. Later, this technique was started on wood also and finally engraving started on metals. When artisans worked on wood, they thought engraving can also be done on brass. They made tools of iron and started engraving on brass, which was successful. Yani ustaad who lived in Lal Masjid area (now called New Basti) in Moradabad is reported to be the first who started engraving on brass for commercial purpose. Later this technique was spread out of Moradabad in Aligarh, Agra and Delhi. The artisans wear influenced by the monuments and artistic work of Mughila Sultanat and they started engraving those pictures of horses, elephants, mahals, flowers and leaves on brass, which looked marvellous. This changed the entire market scenario of utensils and handicraft articles. This art was appreciated by Indian and Foreign buyers and articles without engraving were almost out of the market. With the passages of time. Automation started in industries and brass industry also did not remain un-influenced. Some alternate techniques like ‘Etching’ and ‘Embossing’ were introduced on brass and this increased productivity and reduced cost. However, the essence of ‘art’ was missing in the articles made by these techniques. This also led to decrease in skilled engravers. In 1960, there were more than 100 well known famous skilled engravers in Moradabad which reduced to 25 in 2009

Working on any type of material to give it a desired shape is called ‘Manufacturing’. If manufacturing involves melting and then giving a definite shape to the material, it is called ‘Casting’ (Dhalai in Hindi) and when the material is worked upon is solid state (without melting) the operation is called ‘Forming’. The material which is being worked upon is called ‘Job’ and when the operation is complete and the material has taken desired shape. It is ‘Product’ (Addad in Hindi).

‘Casting’ can be done to any type of material as every material have a definite melting point but normally we do not use materials with high (<1000ºC) in normal casting set-ups due to various possible hazards associated with high temperature processing.

Trainer's Guide

Modular Employable Skills (MES)

Basic Art of Engraving (Level-1)

Terminal Competencies: Following terminal competencies are required to successfully complete this level of training

1. Differentiate the properties of brass, quality of brass, type of brass and methods of manufacturing.
2. Differentiate and correlate between different measuring units such as millimetre, soot, microns and SWG by using vernier callipers.
3. Exercise safety measures necessary to avoid hazards and to finally achieve functional success.
4. Apply basic communication skills to develop good relationship at work and with customers.
5. Perform sketching/tracing/replicating/different patterns of engraving on the brass article.
6. Select design/s for engraving suitable to the type and shape of the brass article.
7. Secure the brass article and mark and measure/trace basic lines/pattern on the surface of brass article for engraving.
8. Select tools specific to the design to be engraved.
9. Engrave basic patterns ('Japani') with ease on flat and curved brass surfaces.
10. Engrave filling work ('Jaali' and 'Daane') in between given outlined/pre-engraved patterns.
11. Enlarge a sketch/pattern on the brass article to a desired size and engrave it.

Topic 1: Casting materials, brass, its types & manufacturing methods

Reference: Terminal Competency-1

Purpose	To demonstrate various casting materials including brass, different types of brass, properties and methods of manufacturing
Suggested duration	3 hours
Resources Required	1. Whiteboard, marker 2. Audiovisual aids (LCD Projector, Laptop) 3. Articles made up of MS, Brass, Copper, Aluminium, Cast Iron (popularly called Dekchun in Hindi) etc. 4. Brass articles made by machining (say a bush), sand casting (Vas) and die casting (plate), Tap, Ingot 5. Articles made up of free cutting brass, 70/30, 85/15 or 65/35 brass 6. Paper, Pen & Pencil
Suggested sitting plan	Tables and chairs, like a classroom
Learning Objective	• Introduction of various materials that can be casted • Introduce different types of brass • Properties of brass • Introduce manufacturing techniques to produce brass

Learning Objectives	**Suggested Delivery Method**	**Suggested Time**
Introduction of various materials that can be casted	Lecture on different materials that can be produced by casting, their melting points and types of furnaces in which these can be casted Demonstration of articles made up of different materials (brass and others), produced by casting Q & A session	30 Minutes
Introduce different types of brass	Lecture by the trainer explaining common brass types, their compositions and applications. Tips to differentiate different brasses by visual and physical inspection Demonstration of articles made up of different types of brass Q & A session	30 Minutes
Properties of brass	Lecture by the trainer covering detailed mechanical and physical properties of free cutting brass	30 Minutes

	Q & A session	
Introduce manufacturing techniques to produce brass	Lecture, introducing manufacturing processes of brass like casting, forming etc. Discussing casting in depth Demonstration of products made from different manufacturing processes viz sand casting, machining. Tips to identify the manufacturing process by visual inspection	30 Minutes
	Q & A session	

Assessment of Student: On the basis of work assignments (Exercise)

Assignment: 20 minutes

Element	Exercise
Identify brass out of given pool of material (say 5)	• Trainee shall pick the article made up of brass • Trainee has to explain how he/she has identified the article

Assignment: 20 minutes

Element	Exercise
Identify 70/30 brass from a pool of three types of brass (free cutting, 85/15, 70/30)	• Trainee shall pick the article made up of 70/30 brass • Trainee has to explain how he/she identified the article

Assignment: 20 minutes

Element	Exercise
Identify the manufacturing process of the given brass articles (tap, bush, vas, plate etc.	• Trainee has to write the manufacturing technique of each of the given article by physical and visual inspection • Trainee has manufacturing process of the article

Student satisfactorily completing the assignments have acquired terminal competency-1 and can move forward to achieve next terminal competency

Concluding the session: Give overall summary of the topics discussed and a little introduction on the topics to be covered in next session.

Evaluation by Students:

Evaluation of Topics: Suggested group evaluation and feedback about the topics covered

Evaluation of trainer: Feedback of the trainer from students on following parameters

- Contents discussed
- Ability to explain the topics and remove queries
- Demonstrative ability

Background information: Different casting Materials (Metals and alloys)

Different casting materials, their composition and melting points are given in **Appendix-1A.** The trainees should be well versed with the data particular to brass and can refer this appendix as standard data.

Different Types of Brass

Brass basically refers to a yellowish alloy of copper and zinc, which moreover also comprise a little bit amounts of other metals, but generally 67% copper and 33% zinc. Brass has been widely used in the manufacturing of ornaments, objects, or utensils and so on. As a consequence of aforesaid discussion on can conclude that brass is the only term which is used for the allows of copper and zinc. The strength and versatility of brass objects solely depend upon the proportions and quantity of the zinc and copper. On the bases of brass's usage, application etc. We can categorize the types of brass as mentioned below. Major types of brass are given in **Appendix-1B**

Brass Properties

Due to its resemblance to GOLD and its wonderful castibility and its acoustic properties, brass has become one of the preferred materials (alloy) to be used in numerous applications. Moreover, brass has been widely used indifferent musical instruments. The hardness and softness of the brass entirely depends on its properties, which can be changed by altering the proportions of copper and zinc. In the context of these days, approximately 90% of all brass are recycled. The scraps relating to brass have been widely collected and transported to the foundry where it is melted and recast into billets or ingots. After this process these billets and ingots (silli) are commercially available for sale.

The use of aluminium in brass makes it much robust and more corrosion resistant. Aluminium also causes a highly beneficial hard layer of aluminium oxide (Al2O3) to be formed on the surface this is thin, transparent and self healing. Tin has a similar effect and finds its use especially in sea water applications (navel brasses). The optimum combinations of silicon, aluminium, iron and manganese make brass wear and tear resistant. So we conclude that brass is metal having numerous aesthetic properties, due to what it can be used in different applications.

A typical composition and properties of free cutting brass (most commonly used) is given in **Appendix-1C**

Brass Casting

Casting is a process by which a molten metal is introduced in the mold and kept in it to solidify. It is then taken out and made into a fabricated part. Brass Casting is the process of casting the molten brass. The Brass casting is specially very worthy for the inexpensive production of complicated shapes. The products made by the Brass casting are used in jewelleries, automobiles etc. There exits many number of Brass casting processes like Sand casting. Plaster casting, Die casting etc.

Sand casting is the process by which huge parts of brass are made by pouring the molten brass into the cavity formed out of natural and/or synthetic sand. For a simple Brass casting the beach sand can be used. The Sand casting method offers many advantages like it is not at all costly for low quantities, apart from Brass other ferrous and non ferrous metals can be casted, and huge pats are possible to cast. **Die casting** is the process by which the Brass is injected into the mold (metallic) under very high pressure. Die casting of brass results in a uniform brass part having top class surface finish and accurate dimensions. Die casting is done by two processes, cold chamber and hot chamber. Apart from these, this method of Brass casting has the advantage that the Brass products require a minimal machining afterwards. These exists some limitations too of this method of Brass casting like, it is very costly for small quantities.

Topic 2: Measuring Instruments

Reference: Terminal Competency 2

Purpose	To explain and demonstrate various thickness measuring instruments
Suggested Duration	1 hour 30 minutes
Resources Required	1. Whiteboard and maker 2. Audiovisual aids (LCD projector, Laptop) 3. Vanier callipers 4. SWG guage 5. Metal Scale 6. Brass article (plate, vas, wire) 7. Papers, pencils 8. Table & Chairs
Suggested sitting plan	Table and chairs
Learning Objective	• Understand the working of Vanier callipers & its use • Working and use of SWG gauge

Learning Objective	**Suggested Delivery method**	**Suggested Time**
Understand the working of Vanier Callipers & use it	Explain the construction and working of Vanier Callipers Demonstrate its working Demonstrate how thickness of brass article can be measured using a Vanier Callipers	1 hour
	Q & A session	
Working and use of SWG gauge	Explain the working of SWG gauge and give demonstration by measuring the thickness of brass articles	15 minutes
	Q & A session	

Assessment of Student: On the basis of work assignment (Exercise)

Assignment: 15 minutes

Element	Exercise
Measure the thickness of given brass article by Vanier Callipers and SWG gauge **Resource required** • Brass article (plate, vas, wire) • Vanier Callipers • SWG gauge	• Trainee shall pick the article and measure its thickness with the help of Vanier Callipers as well as with SWG gauge

Concluding the session: Give overall summary of the topics discussed and a little introduction of the topics to be covered in next session.

Evaluation by Students:

Evaluation of Topics: suggested group evaluation and feedback about the topic covered

Evaluation of Trainer: Feedback of the trainer from students on following parameters

- Contents discussed
- Ability to explain the topics and remove queries

Background Information: Measuring instruments

Introduction to Unit System

(use for thickness and length measurements)

1 inch = 8 soot

1 inch = 25.4 mm

1 inch = 25.4/8mm = 3.175 mm

Roughly for safe ‘Engraving’ (with damaging the surface by penetration of engraver or kalam or chisel) of brass plate.

For 10 inch plates weight should be 500 gms.

For 12 inch plates weight should be 700 gms.

Relation between SWG and mm

SWG = Standard Wire Gangu

The SWG or standard wire gage is used to determine thickness of wires and sheets. A typical SWG made up stainless steel is shown if Fig. The thickness of plates of flat surface can be determined by inserting the plate in grooves whereas the thickness of wires can be determined by inserting the wire in circular sections. The section or groove in which the job just fits is its thickness in SWG

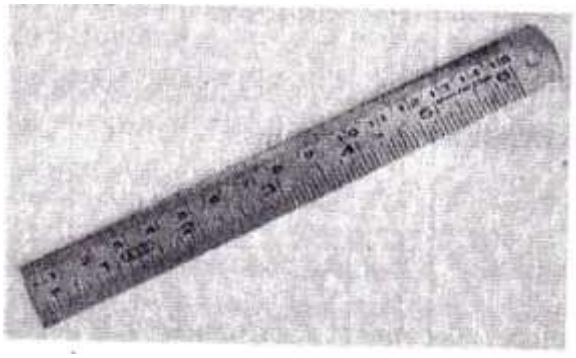
The standard conversion table of SWG into mm and vice versa is given in

Appendix – 1D

Difference between Plate and Sheet

A piece of flat metal is classified as plate if its SWG is in between 1-19 SWG whereas it is called sheet if its thickness is more than 19 SWG. Some standard SWG of sheets and their conversion in mm are given in **Appendix-1E**

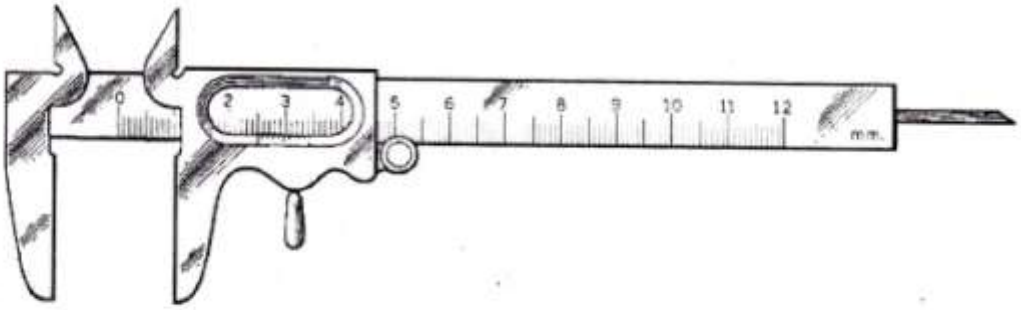
Metal Scale or Ruler:



The metal scale or ruler as shown in the picture is used to measure the length in metric units. The scale can measure length or distance in two alternative units – millimetres (also in centimetres) from one edge and in inches from the other edge.

Use of vernier callipers:

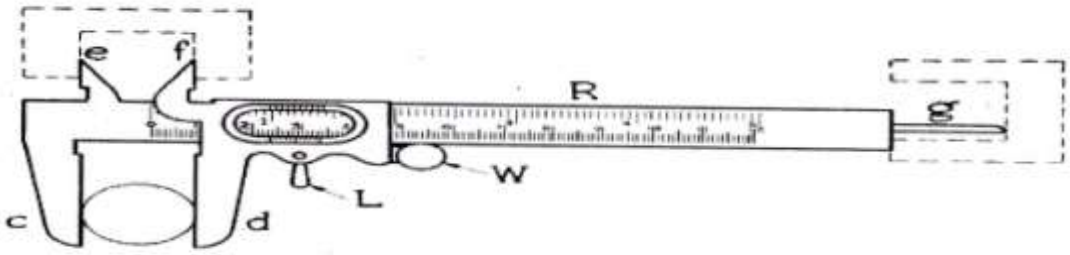
Use of Vernier Calipers:



Vernier Caliper

In 1631 the French mathematician-inventor pierre Vernier invented the measurement principle which bears his name. The Vernier scale has a beautiful simplicity, neatly solving the problem of reading fractions of small divisions on a measuring scale.

Suppose the main scale of a length measuring instrument is divided so that its engraved marks are one millimetre apart. The distance between these marks is so small that it would not be practical to divide them into tenths of millimetres. Even if such small divisions could be engraved accurately, could not be easily read without a magnifying lens.



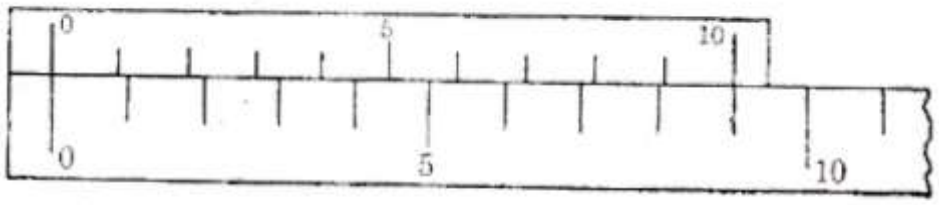
Use of the Vernier Caliper

Parallel to the main scale (R) is a movable scale with a number of engraving marks (L). This is the Vernier scale. One of these, the index mark, points to a position on the main scale indicating the length reading. For example, if the index mark was lined up exactly with the 3.7 mark on the main scale, the length reading is approximately 3.7mm. but we want to do better than this.

The metric Vernier scale has ten or more equally spaced marks. Their spacing is not the same as that of the marks on the main scale. If you look at these closely you will see that ten divisions of the Vernier (millimetres). Obviously, in this case, the Vernier scale marking are engraved 9/10 millimetre apart.

A metric Vernier scale usually has ten divisions, requiring 11 engraved marks (ten plus the index mark). In general, a Vernier scale will have at least one more mark than it has divisions. Sometimes they have a few more marks at one or both ends, just for convenience. An English metric length scale, with the main scale marked in 1/16 inch intervals, may use a one year scale with 8 divisions, capable of measuring to (1/8) (1/16) = 1/128 inch.

In the instrument called the Vernier calliper a movable jaw slides linearly along the main scale. The main scale is rigidly attached to the other jaw. To make measurement, the jaws are gently close down upon the object being measured.



Principle of the Vernier scale.

On most Vernier instruments the scale divisions are not labelled in any way. The index mark may be labelled 0, “zero”. If the “zero” mark is not labelled, it may be easily identified as follows.

When the instrument's jaws are fully closed, the Vernier scale mark which lines up with the main scale "zero" mark is the index mark. This index mark is to be considered the "zero" Vernier mark, and the other Vernier marks are numbered in order from it, one through ten.

Now if the jaws are opened just 1/10 mm, the Vernier marks all move together that far, which brings the first Vernier mark into coincidence with the main scale's 1mm mark. Each time the jaws are moved 1/10 mm wider, the next higher valued Vernier mark lines up with a main scale mark.

This illustrates the principle of the Vernier scale and tells us how to read a Vernier calliper.

- **The jaws are first gently closed on the object to be measured.**
- **Observe where the index mark points to the main scale, and write down this reading, rounded down to the next smaller main scale mark.**

Finally, to read the actual fraction of the main scale division, observe which of the Vernier marks lines up best with a main scale mark. The number of that Vernier mark represents the fraction of a main scale division which must be added. It does not matter which main scale mark lines up best with a Vernier mark. It is the Vernier mark number which you record.

Topic-3: Correlate Between Different Measuring Units

Reference: Terminal Competency-2

Purpose	To Explain And Demonstrate Different Measuring Units Of Thickness And Conversion From One In To Another
Suggested Duration	2 Hours
Resources Required	Whiteboard And Marker, LCD Projector, Laptop, Venires Calipers, SWG Gauge, Metal Scale
Suggested Sitting Plan	Tables And Chairs, Like A Classroom
Learning Objectives	• Relation Between 'Soot ' And 'Mm' • Relation Between SWG Number And 'Mm' • Relation Between 'Inch' And 'Mm'

Learning Objectives	**Suggested Delivery Method**	**Resources**	**Suggested Time**
Relation Between 'Soot' And 'Mm'	Explain And Demonstrate The Conversion Between Popular Thickness Measuring Unit 'Soot' And Millimeters. Demonstrate The Measurement Of Thickness Of A Given Brass Article In 'Mm' Using A Vernire Calipers And Convert It In 'Soot' Q & A Session	Whiteboard, Marker Audiovisual Aids, Data Charts, Vernier Calipers Same As Above Plus Some Brass Articles (Vas, Plate)	30 Minutes
Relation Between SWG Number 'Mm'	Explain And Demonstrate The Conversion Between Thickness Measuring Unit SWG Gauge And Millimeters Demonstrate The Measurement Of Thickness Of A Given Brass Articles In 'SWG Gauge And Convert It In 'Mm'	Whiteboard, Marker, Audiovisual Aids, Data Charts, SWG Gauge, Data Chart Same As Above Plus Some Brass Articles (Vas Plate)	30 Minutes

	Using Data Charts Q & A Session		
Relation Between 'Inch' And 'Mm'	Explain And Demonstrate The Conversion Between Inch And Mm Giving Examples	Whiteboard, Marker, Metal Scale	30 Minutes

Assessment Of Students: On The Basis Of Work Assignments (Exercise)
Assignment: 30 Minutes

Element	**Exercise**
Measure The Thickness Of Given Brass Article By Vernier Calipers And SWG Gauge And Report The Answer In Mm, Inch And Soot **Resource Required** • Brass Articles (Plate, Vas, Wire) • Vernier Caliper • SWG Gauge • Conversion Charts –SWG Gauge To Mm, Inch-Mm, Soot-Mm, Soot-Inch	• Trainee Shall Pick The Given Brass Articles And Measure Its Thickness With The Help Of Vernier Calipers In Mm And Convert It In Soot And Report The Answer • Trainee Shall Pick Another Articles, Measure Its Thickness In SWG Gauge And Report The Answer In Mm As Well As In Soot

Concluding The Session: Give Overall Summary Of The Topics Discussed And Introduce Topics To Be Covered In Next Session.

Evaluation By Student:
Evaluation Of Topics: Feedback About The Topics Covered
Evaluation Of Trainer: Feedback Of The Trainer From Student On Following Parameters—

- Contents Discussed
- Ability To Explain The Topics And Remove Queries.
- Ability To Demonstrate The Concept Of Thickness Measurement

Topic 4- Safety Measurement and Communication Skills
Reference: Terminal Competency-3 And 4

Purpose	To Explain And Demonstrate Necessity Of Safety Precautions, Hazards Which May Result Due To Carelessness, Use Of Safety Glasses. To Explain Importance Of Good Communication Skills In Context Of Profession And Tips Of Develop The Same.
Suggested Duration	**4 Hours**
Resources Required	Whiteboard, Marker, LCD Projector, Laptop, Safety Glasses, Engraving Kalam, Brass Article, Sticker (Thapki)
Suggested Sitting Plan	Tables And Chairs, Like A Classroom
Learning Objectives	• Various Types Of Hazards That May Result While Engraving • Use Of Safety Equipment And Measures To Avoid Hazards • Hand Exercises • Importance Of Communication Skills • Tipes For Good Communication With Clients

Learning Objectives	**Suggested Delivery Method**	**Suggested Time**
Various Types Of Hazards That May Result While Engraving	Explain Different Hazards That May Result While Engraving Viz • Wounds By Kalams, Thapki Due To Wrong Cutting Angles/Directions • Wounds Due To Casual Gripping Tools • Damage To The Eyes Due To Metal Chips Demonstrate Right And Wrong Cutting Directions With The Help Of Demo By An 'Engraver'	30 Minutes
	Q&A Session	

Use Of Safety Equipment And 0Measures To Avoid Hazards	Explain Necessity Of Safety Equipment (Safety Glasses, Gloves) Demonstrate The Technique To Use Safety Equipments	30 Minutes
	Q&A SESSION	
Hard Exercise	Demonstrate Different Hand (Wrist) Exercises To Avoid Fatigue And Pain In Wrist Due To Prolonged And Excessive Working Conduct A Practice Session In Which All Trainee Are Practicing Suggested Exercises Under The Supervision Of Trainer	30 Minutes
	Q& A SESSIONS	
Importance Of Communication Skills	Explain And Demonstrate The Importance Of Communication Skills Giving Examples Of Right And Wrong Communications. Explain Necessary Etiquettes And Importance Of Listening	1 Hour
	Q &A SESSIONS	
Tips For Good Communication With Clients	Give Specific Tips For Effective Communication From The Point Of View Engravers With Clients (Brass Contractors, Exporters, Buyers)	30 Minutes
	Q & A Sessions	

Assessment of Student: On The Basis Of Work Assignments (Exercise)

Assignment: 15 Minutes

Elements	**Exercise**
Use Safety Glasses	• Put On The Given Safety Glass • Write Down The Merits And Demerits Of Using The Safety Glass.

Assignment: 15 Minutes

Element	Exercise
Hand Exercise	• Demonstrate The Hand Exercise

Assignment: 30 Minutes

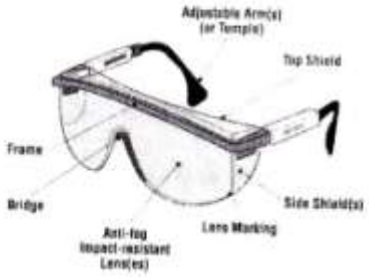
Element	Exercise
Communication Skills	• Write Down The Tips For Good Communication With The Trainer • Write Down The Don 'T' S Communication

Concluding The Session: Give Overall Summery Of The Topics Discussed And Introduce Topics To Be Covered In Next Session.

Evaluation By Student:
Evaluation Of Topics: Feedback About The Topics Covered
Evaluation Of Trainer: Feedback Of The Trainer From Student On Following Parameters-

- Contents Discussed
- Ability To Explain The Topics And Remove Queries
- Ability To Demonstrate The Concept By Live Performance

Background Information: Use of Safety Glasses



Use The Safety Equipments Is Essential In Almost All Manufacturing And Finishing Operation Particularly In Those Which Involve Cutting Tools And Material Removal. In Engraving The Material Is Removed From Using A Special Chisel (Herein Referred Ass Kalam).It Has Been Frequently Reported That The Metal Scrap Removed By Kalam Often Gets In To The Eye Of Engraver And Gets Embedded .Then A Surgical Removal Is The Only Possibility Which Damages The Soft Tissues Of Eyes To A Great Extent And May Even Cause Complete Or Partial Loss Of Vision In That Eye. In Order To Prevent Such Happening, It Is Strongly Recommended That An Engraver Must Use Eye Glass During Working. If A Person Wears Spectacles, That May Also Solve The Purpose.

Background Information: Hand Exercises

Wrists Are Key Body Parts For Engraving. For Any Type Of Specialized Work, Smooth Wrist Movement Is Mandatory. In Young People, The Flexibility In The Wrists Is More But In Order People, Wrists Become Rigid And Stiff. Following Exercises Are Recommended After Every Two Hours Of Engraving And For Older People At Least 10 Min A Day For Getting flexible Wrists. These Exercises Shall Also Make Wrists Stronger And Trainees Will Not Have Pain In Wrists When They Start ‘Marodi’ Work Which Requires 270°Rotation Of Wrists.

A.

Extend and stretch both wrists and fingers acutely as if they are in a hand-stand position. Hold for a count of 5.

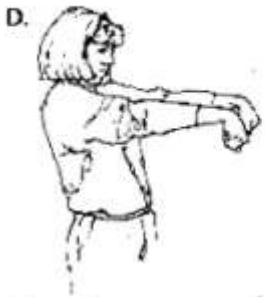
B.

Straighten both wrists and relax fingers.

C.

Make a tight fist with both hands.

Then bend both wrists down while keeping the fist. Hold for a count of 5.



Straighten both wrists and relax fingers, for a count of 5.

The exercise should be repeated 10 times. Then let your arms hang loosely at the side and shake them for a few seconds.

Background Information: Communication Skills

Communication Skills' Training Is An Important Part Of Management Training As It Has A Significant Impact On Personality Developments That Require Changes In Behavior And Thinking.

Communication Skills As Opposed To Technical Skills, Greatly Impacts The Personality Development Of People. Soft Skill Plays An Important Part In Maintain Relationships With Their Customers And Developing A Successful Business.

Soft Skill Such As Culture Sensitivity, Business Etiquette And Good Communication Skill (Telephone Etiquettes, Information Gathering And Listening Skills) Make A Greater Impact On Client Rather Than A High Degree Of Technical Skills.

The Communication Skill Training Program Here Is Limited To Discussion About General Manners, Etiquettes And Politeness In Speaking And Listening. A Person Shall Be Cautious About The Choice Of Wards And Language He Is Using When He Is Specking To Person Who May Bring Business To Him. The Do's And Don'ts Are:

Do’s

- Use Polite And Decent Language In Conversations
- Develop Patience In Listening
- Use Greetings While Meeting And Departing.

Don’ts

- Never Lose Temper While Conversation
- Never Use Indecent Words Or Abuses
- Never Give Wrong Commitments That Can’t Be Fulfilled
- Never Take The Opposite Person In Conversation For Granted.

Topic 5- Sketching, Training and Replicated Designs

Reference: Terminal Competency-5

Purpose	To Explain Use Of Geometric Instruments For Sketching The Engraving Patterns On Paper, Tracing These Patterns, Making Copies, Preserving Them For Future Use.
Suggested Duration	27 Hours 30 Mints
Resources Required	• Whiteboard, Marker • LCD Projector, Laptop, • Drawing Instruments- Compass, Divider, Metal Scale, Protector , Set Square • Drawing Accessories- Pencils,Eraser,Tracing Papers, Plain Paper, Carbon • Working Table (Tripod Stand)
Suggested Sitting Plan	Mattress And Cushions (For Sitting On Ground)
Learning Objectives	• Introduce To The Drawing Instruments And Their Selection • Draw Sketch Precisely And Time Forecasting • Mixing Complex Sketches And Making A New One, Scaling A Sketch • Tracing Accessories And Their Use • Tracing On Paper And On Brass Surface • Replicating And Preserving Methods.

Learning Objectives	**Suggested Delivery Method**	**Suggested Time**
Introduction To The Drawing Instruments And Their Selection	Explain Various Drawing Instruments, And Kind Of Figures That Can Be Drawn Using Them Demonstrate The Use Of Drawing Instruments On Paper	5 Hours
	Q & A Session	

Draw Sketch Precisely And Time Forecasting	Demonstrate Sketching Write From Beginning. Give Drawing Assignment And Evaluate Q & A Session	5 Hours
Mixing Complex Sketches And Making A New One, Scaling A Sketch	Demonstrate Sketching By Mixing More Than One Pattern And Give Assignment To The Students	3 Hours
Tracing Accessories And Their Use	Introduce Tracing Paper, Carbon, Etc. Demonstrate The Tracing Of Sketch With Or Without Drawing Instruments. Give Tracing Assignment Q & A Session	1 Hour
Tracing On Paper And On Brass Surface	Demonstrate Tracing On A Flat Curved Brass Surface And Give Assignment (One Each) Q & A Session	2 Hours
Replicating And Preserving Methods	Introduce Various Replicating Methods And Explain Each One. Explain The Importance Of Preserving A Sketch, Introduce Preserving Methods With Special Weight On Soft Copies Of Sketches (By Scanning)	30 Mints.

Assessment Of Student: On The Basis Of Work Assignments (Exercise)

Assignment: 30 Minutes

Elements	**Exercise**
Explain Geometrical Instruments	• Pick Each Geometric Instrument And Write How It Is Used • Write When A Particular Geometric Instruments Will Be Used

Assignment: 2 Hours

Elements	Exercise
Sketching A Pattern On Paper	• Examine The Sketch Carefully And Write Down The Instruments Required To Draw It And Forecast The Time Required • Select Appropriate Drawing Instruments. • Draw The Sketch

Assignment: 4 Hours

Elements	Exercise
Mixing Complex Sketches And Making A New One, Scaling A Sketch	• Examine The Sketches, Write Down The Instruments Required And Forecast The Time Of Completion • Draw The Sketch Mixing Two Or More Of Them As Instructed • Re-Draw The Sketch Again By Scaling It To Half Its Size

Assignment: 4 Hours

Elements	Exercise
Tracing Accessories And Their Use Tracing On Paper And On Brass Surface	• Examine The Given Sketch And Write Down The Tracing Accessories Required • Trace The Sketch On Tracing Paper • Trace The Given Sketch On Plan (White) Paper Using A Carbon • Trace The Sketch On A Flat Brass Surface • Trace The Sketch On Curved Brass Surface

Assignment: 30 Minutes

Elements	Exercise
Replicating And Preserving Methods	• Write Down The Replicating Methods Of A Sketch • Comment On The Merits And Demerits Of Each Method • Write Down Various Method To Preserve The Sketch

Concluding The Sessions: Give Overall Summary Of The Topics Discussed And Introduce Topics Too Be Covered In Next Session.

Evaluation by Student:

Evaluation to Topics: Feedback About The Topics Covered

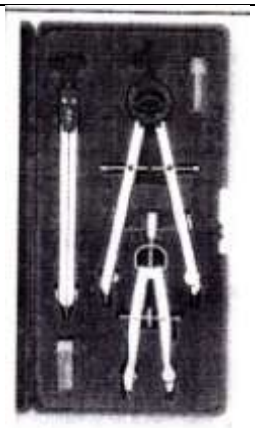
Evaluation of Trainer: Feedback Of The Trainer From Student On-

- Contents Discussed
- Ability To Explain The Topics And Remove Queries
- Ability To Demonstrate The Concept By Live Performance

Background Information: Sketching, Replicating and Preserving

Sketching:

Sketching Is A First Step In Engraving. Trainee Is Required To Be Proficient In Making Any Design On Paper, Which Can Then Be Traced On The Brass Job And Later Engraved. Effective Use Of Drawing Instruments Not Only Enables One To Create Any Type Of Complex Design With Ease But Also Make Sketching Pleasurable And Efficient, Reducing Time Input To A Minimum. With The Use Of Drawing Instruments, Any Person Who Is Not Good In Drawing, Can Also Create Any Type Of Design On Paper. Various Type Of Drawing Instruments Which Can Be Used Are Given Here Under

S.No	Name And Purpose Of Drawing Instrument	Specification/Picture
1	**The Geometry Box** Containing • Compass – To Make Circles • Divider-For Marking And Measuring • Scale-To Measure Length • Protector –To Mark And Measure Angles • Set Squares-To Mark And Measure Inclined Lines, Draw Parallel Lines • Pencil-For Drawing • Eraser-For Erasing • Shapers (Called 'Frame' In Hindi') – To Create Circles Of Different Size In No Time	 

	• Spline Shapers-To Create Splines And For Joining Points And Lines With Smooth Continuous Curves	

Replicating And Preserving The Drawing Are As Important As Creating Them. Drawings Can Be Replicating Using Either Of The Following:

- Photocopying –Can Be Done At Any Photo Copy Center
- Scanning And Taking Print Outs-Can Be Done At Any Computer Typing Center.
- Taking Photograph Using A Camera And Making A Photograph And A Negative-Can Be Done By Photographer.

Preserving The Drawing Enables Us To Store The Drawings For Future Reference And Use. It Is Most Effectively Done By:

- Laminating The Drawing-Can Be Done At Any Computer Typing Center
- Scanning The Drawing And Making A Soft Copy (CD)-Can Be Done At Any Computer Typing Centre.

Topic 6- Forecasting and Planning
Reference: Terminal Competency-6

Purpose	To Enable The Trainee To Estimate The Time Required For Completion Of A Given Engraving Assignment And Also To Estimate The Chargeable Amount For A Particular Work On Man Hour Basis.
Suggested Duration	1 Hour
Resources Required	• Whiteboard, Marker • LCD Projector, Laptop • Engraved Brass Articles • Calculator
Suggested Sitting Plan	Table And Chairs (Like A Classroom)
Learning Objectives	• To Forecast The Time Required For A Given Engraving Assignment • To Estimate The Chargeable Amount For The Same

Learning Objectives	**Suggested Delivery Method**	**Suggested Time**
To Forecast The Time Required For A Given Engraving Assignment	Lecture; Explain With Examples, The Components Which Consume Time In Engraving Give Demonstration By Estimating Time For Engraving A Sketch On A Bras Article Giving Divisions For Each Activity	**30 Mints**
	Q & A Session	
To Estimate The Chargeable Amount For The Same	Demonstration By Calculating The Amount Chargeable For A Given Engraving Assignment And Its Breakup Of The Cost	**15 Mints**
	Q & A Session	

Assessment Of Student: On The Basis Of Work Assignment (Exercise)

Assignment: 15 Mints

Elements	Exercise
Forecast Time Required For Engraving A Given Pattern On Brass And Estimate The Cost Chargeable For The Same	• Examine The Sketch • Write Down Chronologically, The Time Required For Sketching , Tracing And Other Prepositions • Estimate Time Required For Engraving (1.5x Total Time Spent In Sketching And Tracing).

Concluding The Session: Give Overall Summary Of The Topics Discussed And Introduce Topics To Be Covered In Next Session.

Evaluation By Student:

Evaluation To Topics: Feedback About The Topics Covered

Evaluation Of Trainer: Feedback Of The Trainer From Student On-

- Contents Discussed
- Ability To Explain The Topics And Remove Queries
- Ability To Demonstrate The Concept By Live Performance

Background Information:

The Forecasting Of The Time Required Is Extremely Important For Giving Any Type Of Commitment To The Buyer And Also The Cost Chargeable. It Is A Variable And It Largely Depends On Individuals, Their Skill And Sitting Capacity At A Stretch. However, Time Forecasting Shall Be Done Considering The Following:

- Time Required For Preparations (Drawing Instrument, Tools And Equipment)
- Sketching Time
- Time Required For Tracing
- Time For Engraving (Engraving Time Is 1.5 Times The Total Time Required For Sketching And Tracing).
- Overheads And Break Downs (10% Of The Above)

Once The Time Required Is Estimated In Hours, The Cost Estimation Can Be Done On Man Hour Basis. Recommended Rate Of Calculation Is INR 320=00 Per Day (@Rs.40=00 Per Hour For 8 Hours) Which Includes The Cost Of Engraving Material, Replication, Etc.

Topic 7- Marking And Measuring On Brass

Reference: Terminal Competency-7

Purpose	To Educate The Student About Means To Secure A Given Brass Articles On Tripod And Also About Correct Setting Posture. To Familiarize The Student With Marking And Measuring Tools Used On Brass And Give Training For Proper Preliminary Operations To Ensure Error Free Engraving.
Suggested Duration	8 Hours
Resources Required	• Whiteboard Marker • LCD Projector ,Laptop • Brass Plate • Brass Vases • Measuring And Marking Tools (Metal Scale, Divider, Compass, Protractor. Scriber). • Carbon Paper • Pencil, Paper • Working Stool (Tripod) • Rope, Wooden Bricks
Suggested Sitting Plans	Cushions And Mattress
Learning Objectives	• Securing An Article On Tripod Before Any Type Of Operation • Correct Sitting Posture • Identify And Use Measuring And Marking Tools On Brass

Learning Objectives	**Suggested Delivery Method**	**Suggested Time**
Securing An Articles On Tripod Before Any Type Of Operation	Demonstrate Securing Methods Of Flat And Curved Brass Articles On Tripod Stool (Popularly Known As Tipayee)	**30 Mints**
	Q& A SESSION	
Correct Sitting Plans	Lecture; Explain And Demonstrate Different Sitting Postures Possible In Accordance With The Size/Type Of Article To Be Engraved	**1 Hour**

	Demonstrate Comfortable Sitting Posture, While Also Supporting The Article(With Knee)	
	Q & A Session	
Identify And Use Measuring And Marking Tools On Brass	Explain Construction And Working Various Marking And Measuring Instruments And Demonstrate Their Use On Flat And Curved Bras Articles	**2 Hours**
	Q & A SESSION	

Assessment Of Student: On The Basis Of Work Assignment (Exercise)

Assignment: 30 Mints

Elements	**Exercise**
Secure The Given Articles On A Tripod And Demonstrate Correct Sitting Posture	• Carefully Examine The Article • Secure It On The Tripod Using Wooden Bricks And Rope • Sit Upright Facing The Article And Giving It Firm Support From The Bodu(Knee)

Assignment: 2 Hours

Elements	**Exercise**
Mark The Outline Of The Given Sketch On The Brass Plate	• Examine The Sketch • Place Carbon Paper On The Brass Surface And Put Marks • Mark The Outlines And Mark On The Brass Surface Using Measuring And Marking Tools

Assignment: 2 Hours

Elements	**Exercise**
Mark The Outline Of The Given Sketch On Curved Brass Surface (Vas)	• Examine The Sketch • Place Carbon Paper On The Brass

	Surface And Put Marks • Mark The Outline And Marks On The Brass Surface Using Measuring And Marking Tools

Concluding The Session: Give Overall Summery Of The Topics Discussed And Introduce Topics To Be Covered In Next Session.

Evaluation By Student:

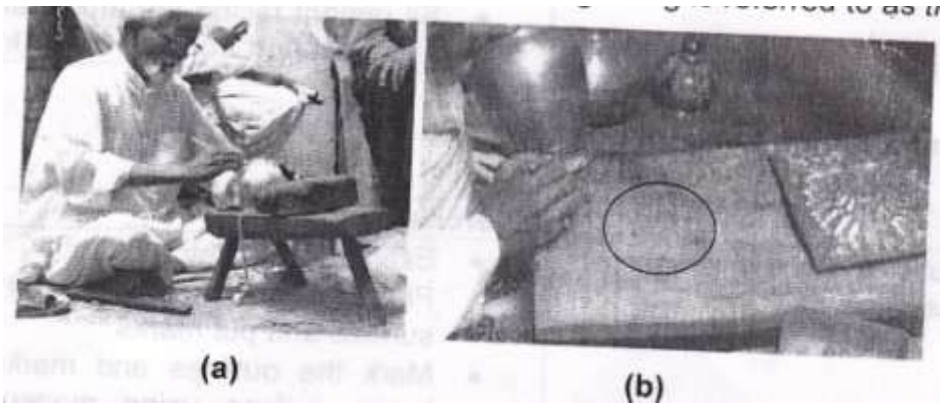
Evaluation To Topics: Feedback About The Topics Covered

Evaluation Of Trainer: Feedback Of The Trainer From Student On-

- Contents Discussed
- Ability To Explain The Topics And Remove Queries
- Ability To Demonstrate The Concept By Live Performance

Background Information

The Working Bench (Basically A Tripod Stand) For Engraving Is Referred To As *Tipayee.*



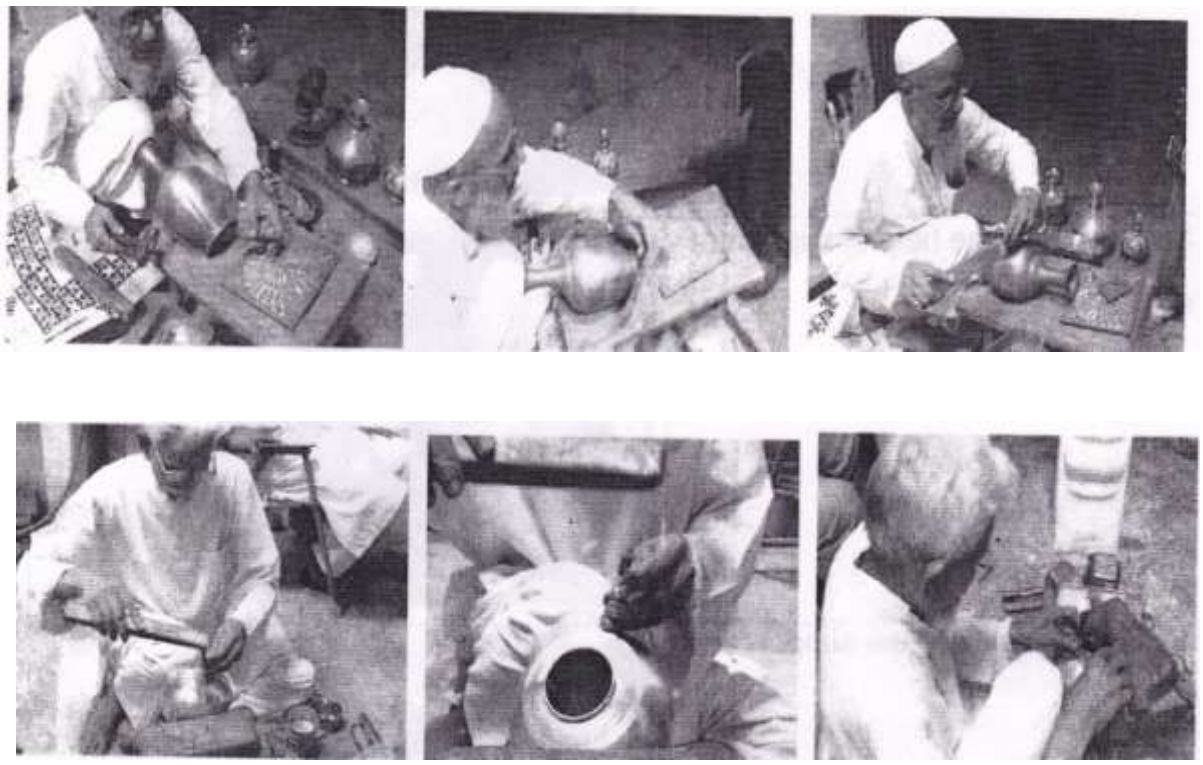
A Typical Tripod Is Drown In Figure (A) And A Groove To Hold Objects Of Circular Cross Section Is Shown In (B)

Securing The Brass Articles Before Any Type Of Operation Is Must Because A Little Deviation In The Position Of Article May Spoil The Entire Operation. Following Securing Methods Can Be Employees:

Securing with the help of rope	
Securing with the help of support of wooden brick	
Securing using both, the support and rope	
Securing using own body (knee)	

Sitting Posture

Sitting posture as shown in the figures below is the most comfortable. The job has to be supported with either of the knee while both hands are engaged in engraving.

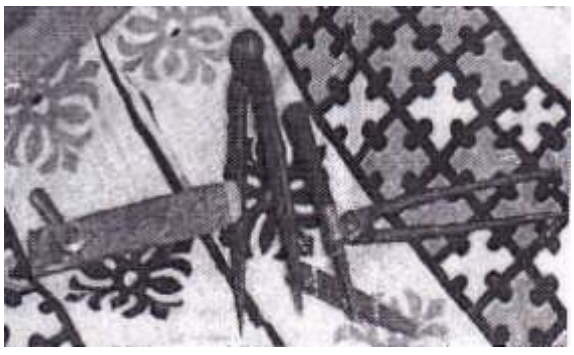


Trainees are required to practice different sitting posture and also to rotate the posture with alternate ones for comfortable working for prolonged hours.

Note:

1. A bigger article can be made heavier by filling it with sand (silt).
2. It is recommended to secure the smaller article using rope.
3. For mid-size articles, body support is recommended.

Marking and measuring

Dividers, compass scribers are used for putting marks and outlines on brass articles. These marking tools are also shown in picture. Metal scale is used for measuring the length.	

Topic 8 – Engraving tools and their selection

Reference: Terminal competence – 8

Purpose	To explain the tools used in engraving and the criterion for their selection.
Suggested Duration	3 hours
Resources required	• Whiteboard, Marker • LCD Projector, Laptop • Engraving tools — Kachhi and pakki kalams — Thin and thick kalams — Kalams with or without handle — Striker (thapki) — Hammer • Brass articles
Suggested sitting plan	Cushions and mattress
Learning objectives	• To identify engraving tools • Criterion to select the relevant one

Learning objectives	Suggested delivery method	Suggested Time
To identify engraving tools	Introduce engraving kalams(kachhi and pakki) and explain the difference between the different kalams. Explain the criterion of selection of a particular kalam Demonstrate holding method of kalams	1 hour 30minutes
	Q & A	
Criterion to select the relevant one	Lecture: explain the criterion for selection of a particular kalam (kachhi or pakki), thin or thick, with or without wooden handle in context of the engraving pattern and material on which engraving is to be done	1 hour

	Q & A	

Assessment of students: on the basis of work assignment (exercise)

Assignment: 30 minutes

Element	Exercise
Identify suitable tool (kalam) for engraving the given pattern on the given brass article	• Carefully examine the design • Carefully examine the article(have an idea of brass type and its hardness) • Pick suitable kalam/s • Pick suitable striker

Concluding the session: Summarize the topic and introduce topics to be covered in next session.

Evaluation by students:

Evaluation of topics: feedback about the topics covered

Evaluation of Trainer: Feedback of the trainer from students on-

- Contents discussed
- Ability to explain the topics and remove queries
- Ability to demonstrate the concept by live performance

Background information:

Engraving Tools

Two types of engraving tools are used in engraving. The Kalam and the Striker. Kalams are basically chisels used for removing the material from the object whereas striker is used to govern the cutting direction of Kalam. The cutting angle of Kalam is maintained by the hand, Kalam id firmly held in hand and the little finger is used to guide the cutting direction. For deep cuttings, the inclination of Kalam is increased and for fine cutting. It is reduced.

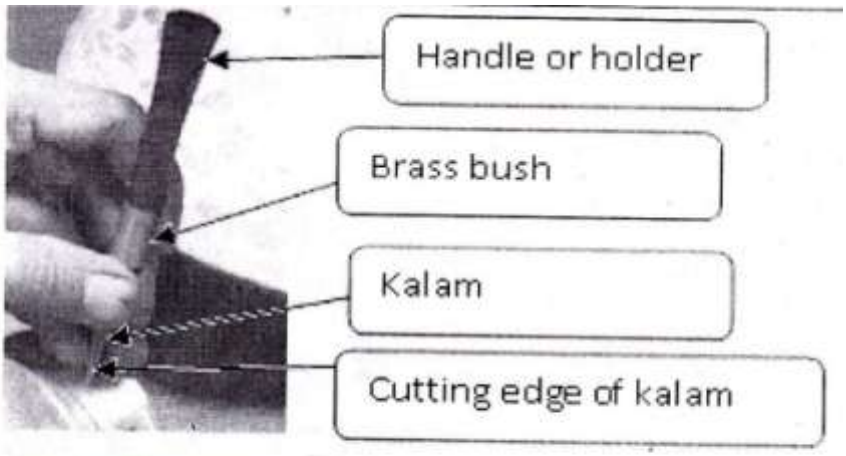
There are two basic engraving tools- The Kalam (a special chisel) and a thapki (striker) Kalams are of different types, categorized broadly in two groups-

- Kachhi Kalam – Made up of mild steel, heat treated (cold water quenched). Used for all kinds of normal engraving works.
- Pakki Kalam – made up of carbon steel or alloy steel. Used for engraving on hard materials for example: engraving on dies, hard brass(80/20 or 85/15). It does not require heat treatment.

As per the prevailing practice, an engraver makes his own tool box. He first purchases steel (mild steel or kachha loha and alloy/carbon steel or heavy steel or pakka loha). Then the engraver visits a black smith and asks him to make kalam(s) from the steel. After the kalam has been satisfactorily prepared by hot working, heat treatment of kachhi kalam is done by heating them to the recrystallizing temperature (around 700^0 C until it appears whitish) and then it is cooled quickly by immediately putting it in coldwater(process is called quenching). No heat treatment is given to pakki kalam. After preparation of the kalam, a wooden base is fixed on one end of it, which will receive the blows of the striker. The kalams which are to be used to engrave on steel (foe die making) are not fitted with wooden handle because the striker in such case is a hammer and it is used directly. Wooden in such case will damage and also will reduce the impact of blow. Various kalams are shown in pictures below:

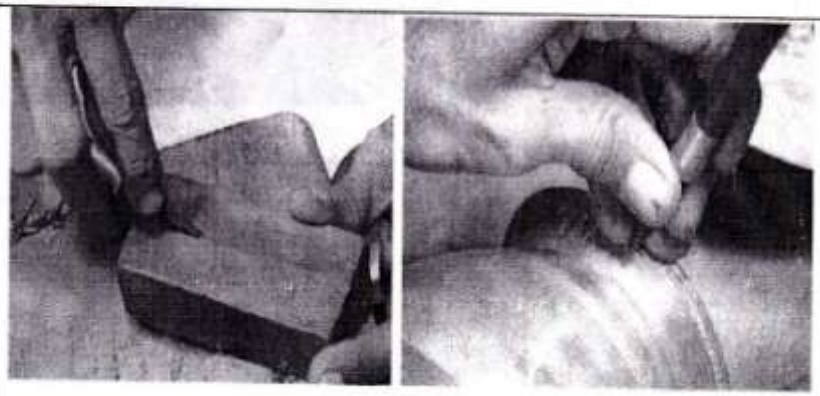
Pictures of Kalam and striker in use are shown here under:

A typical kalam and its parts



(a) A kalam being sharpened before engraving

(b) A kalam in operation



Engraving tools-
Chisels (Kalams)

(a) Various kalams in a tool box

(b) A pakki kalam for engraving on steel

(c) A kachhi kalam for engraving on brass

(a)

(b)

(c)

Engraving tools-
Strikers

(a) A thapki to engrave on brass

(b) A closer view of thapki

(c) A hammer to engrave on steel

(a)

(b)

(c)

Criterion of selection

The selection of kalam and striker depends on two factors; the material on which engraving is to be done and the design which is to be engraved. Some examples are given hereunder.

Material	Kalam and Thapki
For engraving on hard brass(Cu>70wt%	Kalam: pakki kalam with wooden handle Striker: Thapki
For engraving soft brass (Cu<70wt%)	Kalam: kachhi kalam with wooden handle Striker: Thapki
For engraving on steel	Kalam: Pakki kalam without wooden handle Striker: Hammer
For fine work on brass	Kalam: Kachhi kalam with thin cutting edge and wooden handle Striker: Thapki
For deep cutting on brass	Kalam: Pakki kalam with wooden handle Striker: Thapki

Topic 9 – introduction to engraving, types of basic engraving, repair welding

Reference: Terminal competency -9, 10 and 11

Purpose	To train students for engraving basic patterns like ‘Japani work’, ‘Jali work’ and ‘Daana work’. To teach repair welding for corrective actions in case of defects
Suggested Duration	68 Hours
Resources Required	• Whiteboard, Marker • LCD Projector, Laptop • Engraving tools — Kachhi and Pakki Kalams — Thin and thick Kalams — Kalams with or without handle — Striker (Thapki) — Hammer • Brass plates • Brass vases • Measuring and marking tools (metal scale, divider, compass, protractor, scriber) • Working stool (tripod) • Rope, wooden bricks • Drawing instruments – compass, divider, metal scale. Protector, set square • Drawing accessories – pencils, eraser, tracing papers, plain paper, carbon • Brazing setup • Coarse and fine emery papers
Suggested sitting plan	Cushions and mattress
Learning objectives	To engrave the Japani pattern on a given brass article To engrave the Jali pattern on a given brass article To engrave the Daane pattern on a given brass article

Learning objectives	Suggested delivery methods	Suggested Time
To engrave the Japani pattern on a given brass article	Lecture: Explain the classification of engraving and introduce different types of engraving patterns. Summarize and explain the steps in engraving. Explain the Japani pattern. Demonstrate engraving of Japani pattern on a flat and curved brass article starting from sketching to engraving	7 hours
	Q & A	
To engrave the Jali pattern on a given brass article	Lecture: summarize and explain the steps in engraving. Explain the Jaali pattern. Demonstrate engraving of Jaali pattern on a flat and curved brass article starting from sketching to engraving	5 hours
	Q & A	
To engrave the Daane pattern on a given brass article	Lecture: summarize and explain the steps in engraving. Explain the Daane pattern. Demonstrate engraving of Daane pattern on a flat and curved brass article starting from sketching to engraving	3 hours
	Q & A	
Repair welding	Demonstrate the method of welding (brazing) to repair the article damaged due to defective engraving or piercing by Kalam	1 hour
	Q & A	

Assessment of students: on the basis of work assignment (Exercise)

Assignment: 1 hour

Element	Exercise
Classification of engraving on the basis of design	• Write down the classification of engraving • Draw various engraving patterns on paper

Assignment (5 numbers): 2 hours

Element	Exercise
Engrave the given pattern between two lines on a given brass article	• Select suitable engraving tools • Engrave two straight lines on brass surface • Engrave the given pattern in between two lines

Assignment (5 numbers): 2 hours

Element	Exercise
Engrave the given Japani pattern on the brass article	• Select suitable engraving tools • Trace the design using carbon paper • Place outlines and marks • Engrave the given pattern on the brass article

Assignment (5 numbers): 3 hours

Element	Exercise
Engrave the given Jaali pattern on the brass article	• Select suitable engraving tools • Place outlines and marks • Engrave the Jaali pattern on the brass article

Assignment (5 numbers): 2 hours

Element	Exercise
Engrave the given Daane pattern on the brass article	• Select suitable engraving tools • Place outlines and marks • Engrave the Daane pattern on the brass article

Final Assignment: 5 Hours

Element	Exercise
Engrave the given Japani pattern on the brass article after scaling	• Draw the given sketch on paper using suitable drawing instruments • Scale the pattern using replication (reduced photocopy) or redraw it by scaling • Trace the pattern on brass using carbon • Place outlines and marks • Engrave the given pattern on the brass article

Assignment: 5 Hours

Element	Exercise
Engrave the given Japani pattern on the brass article after scaling	• Draw the given sketch on paper using suitable drawing instruments • Scale the pattern using replication (reduced photocopy) or redraw it by scaling • Trace the pattern on brass using carbon • Place outlines and marks • Engrave the given pattern on the brass article

Assignment: 1 Hour

Element	Exercise
Repair the given damaged brass article with brazing	• Inspect the articles • Locate the areas to be repaired • Repair them by brazing • Rough polishing • Fine polishing

Concluding the session: summarize the topic and introduce topics to be covered in next session

Evaluation by students:

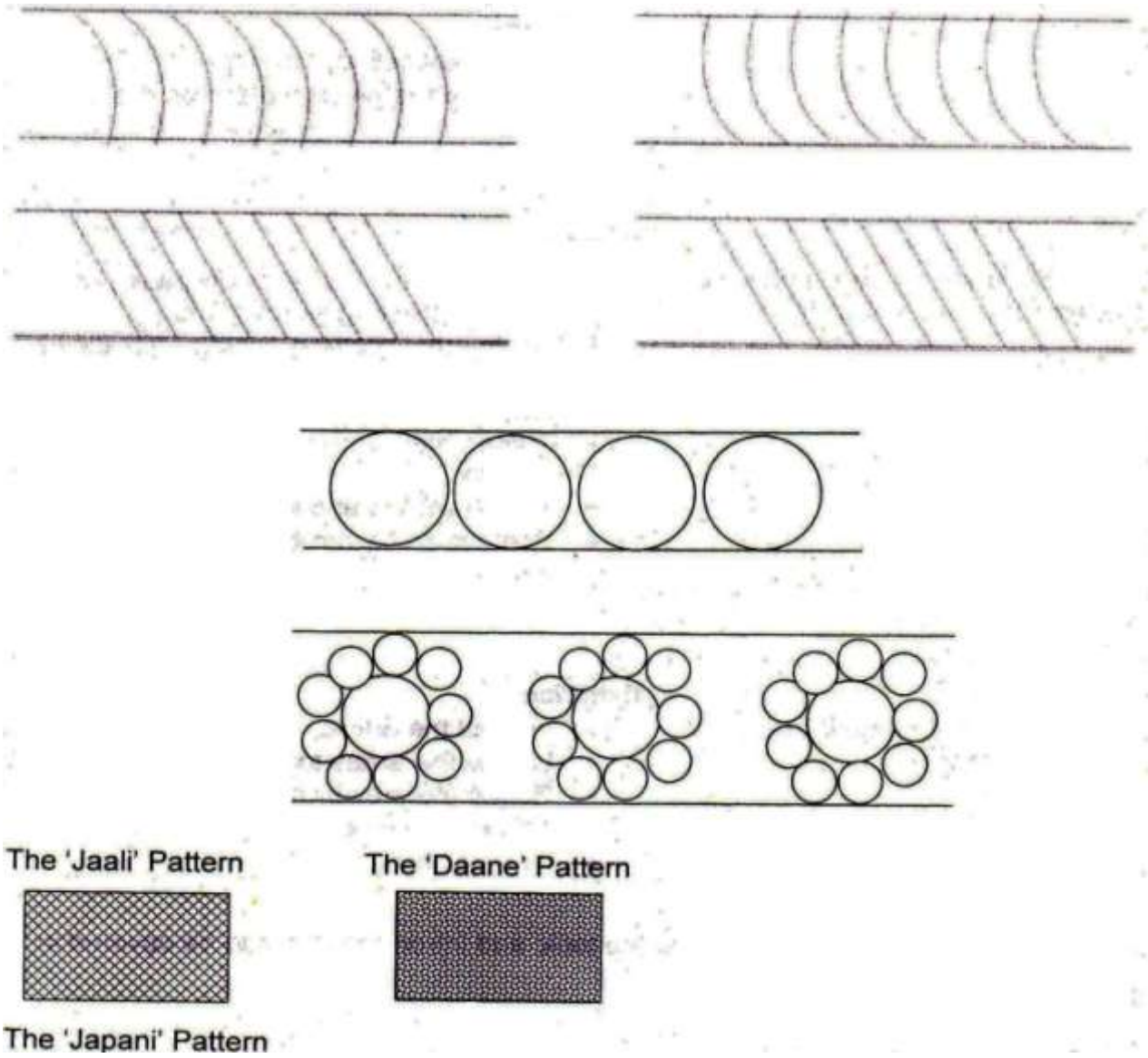
Evaluation of topics: feedback about the topics covered

Evaluation of Trainer: Feedback of the trainer from students on-

- Contents discussed
- Ability to explain the topics and remove queries
- Ability to demonstrate the concept by live performance

Background information:

Following practice assignment shall be given to a trainee before giving him actual engraving job.



Training Module

(Basic Art of Engraving)

COMPETENCY BASED MODULAR EMPLOYABLE SKILLS (MES)

Sector: BRASSWARE TECHNICUES

MODULE: Basic art of engraving

(Competence level-1)

Age: Not less than 18 years

Entry level requirement:

The abililty to read and write, perfect vision with or without glasses, no handicap in upper limbs. Functionally literate (able to read and

write) in local language (Hindi- for the pilot project), willingness to sit, learn handicraft work for several hours at a stretch.

Desirables:

Good drawing skills, exposure to various processes of brass work

Terminal Competency:

To achieve a qualification at this level, the trained person must have demonstrative competency in the required “Basic and Specific Common Competencies” and must successfully clear the assessment against the test of terminal competencies.

Basic common competency:

1. Differentiate between properties lf brass, quality of brass, type of brass and methods of manufacturing.
2. Differentiate and correlate between measuring units such as mm. “soot”, microns and SWG by using vernier calipers and SWG guage
3. Exercise safety measures necessary to aboids hazards and to finally achieve functional success.
4. Apply basic communication skills to develop good relationship at work with customers.

Specific competency:

1. Perform sketching/tracing/replicating/different patterns of engraving on the brass article.
2. Select design/s for engraving suitable to the type and shape of the brass article.
3. Secure the brass article and mark and measure / tree basic lines/ pattern on the surface of brass article for engraving
4. Select correct tools specific to the design to be engraved .

5. Engraved on the market lines/ pattern on the surface of brass article uniformly through correct handling of selected tools.
6. Engraving basic pattern (“japan”) flat and curved brass surface.
7. Engrave filling work (“ jalli” and “dane”) in between given outline /pre- engraved patterns
8. Enlarge s sketch/pattern to a desired and engraved it.

PATHWAY

At the completion of the level 1 engraving on brassware qualification, a student may enter:

Level 2 E ngraving on brassware

Level 1 Etching on brassware

DURATION: 120 hours

Curricula contens:

Comprises the following skills.

Practical Competencies (Theory) I mnimal	Underpinning Knowledge Knowledge in the area is of an introductory nature with Analysis
Differentiate the properties Brass, quality of brass and used - methods of manufacturing	. knowledge of different combination/grades of alloy Zinc and copper

	. knowledge of different grades of Material with different levels of Combination and types of Material such as brass sheet Metal, ingot. Knowledge of various methods of Manufacturing such as sand Casting, die casting pressing Spinning of sheet metal etc.
Different, and correlate, Between, different measuring Units such as milimter, “soot” Microns and SWD by using Vernier calipers	. knowledge of scale of units to determine the minimum thickness of metal required for engraving . Awareness of minimum units Of thickness of brass which Which can be work upone
Exercise safety measure Necessary to avoid hazards And to finally achieve Functional success engraving	. knowledge of various methods Of measurement . Awareness about likely accident and hazards of not using a particular safety equipment . Awareness about hazard of not Holding the chisel/kalam properly (Away from the body) for
Apply basic communication Skill develop good relationship At work and with the	. Congenial behavior and etiquette . Presentation skill . Awareness of how to discuss

Customers	. business exporters, contractors, Clients
Perform sketching/tracing/ pattern Replicating different patterns instrument On the brass article	. Ability to sketch any type of on paper using drawing
Select design/s for engraving Suitable to the type and shape Of the brass article	. Awareness of minimum thickness of brass required for engraving a particular sketch/ pattern . Ability to forcast time (give an estimate of time) require for engraving for a given pattern
Secure the brass article; mark posistioning and measure/trace basic lines pattern of the surface of brass article for engraving pattern	. Knowledge of placing a brass article for engraving on a wooden tripod . knowledge of securing the brass article on the wooden tripod with a wire so that it does not move while engraving . Ability to engrave different

	In between lines. Ability to engrave basic straight/ Curved lines work on brass.
Select correct tools specific to the design to be engraved when	. knowledge of different engraving kalams . knowledge of kachhi and pakki pakkki kalam and conditions to use which one . knowledge of striking tools
Engrave on the marked lines/ Pattern on the surface of brass article uniformly through correct handling of selected tools sharpen	knowledge of how much pressure To put on the kalam with the Striking tools to get the required Eveness of lines/pattern Knowledge of and how to The engraving tool/kalam to get a Uniform line on the brass article Knowledge of correct posture so That pressure of kalam for Engraving is even
Engraving basic pattern (japani)	. Ability to r basic pattern

With ease on flat and curved Brass surfaces	(“japani”)- lines and curved brass surface with synchronized Movement of the hands and The engraving tools (kalam And thappi)
engrave filling work (jalli and Danne) in between given out Line/pre-engraved patterns	. knowledge of different patterns which can be filled in between two lines

Enlarge s sketch/pattern to Desired size and engrave it portion without	knowledge of taking forward a design engraved in a small Of the brass article (through Marking/measurement, tracing) To the whole brass article A break in pattern being evident.

Resources required:

- Working Table (Tripod Stand – preferably wooden with slight curved surface at the centre to hold the brass article in place during the process of engraving)
- Geometrical tools – Compass, divider,metal scale, protector, set square

- Drawing accessories – pencils, eraser, tracing papers, plane paper, corbon papers.
- Measuring tools – Vernier caliper, wire gage
- Engraving tools- Kachhi (non-treated) and pakki (heat treated) kalam
  (chisels)
- Striking tools- wooden flat hammer(Thapki and iron hammer
- Fixture – rope, wooden bricks
- Cleaning accessories- cloth, solvent (acetone/gasoline/kerosene)
- Finishing tools – files, emeny papers

Assessment :

To achieve the terminal competences, a competency based assessment must be undertaken against the performance criteria Detailed in each terminal competency as below:

1. Terminal Competency: Differentiate the properties of brass, quality of brass, type of brass and methouds of manufacturing.

Element	Performance Criteron
Identify brass c	* Identify brass from a pool of 4 to 5 Material by visual inspection (through Color, appearance, weight (density) and Feel of the material
Differentiate a particular Type of brass from a pool Articles say 3 made from Different types of brass	* Identity a particular type of brass say 70/30 by visual inspection and acoustic testing from a pool of different brasses commonly used (3 types viz free Cutting, 70/30,65/35 etc)

Identify the manufacturing Technique of a brass article And comment upon its Hardness	. Identify the manufacturing technique of a given brass article by visual inspection (from a pool o f sand cast, and machine brass samples) . Ascertain the hardness of the
enough	Given brass sample if it is thick For engraving material

2. **Terminal Competency**: differentiate, and correlate between, Such as millimeter, soot, microns and SWG by using vernier Calipers.

Eliment	Performance Criterion
Correlate different measuring Units of brass Calipers millimeter	. Measure thickness of a given brass article with scale and Vernier The readings Convert SWG in mm using data chart Provided in trainers handbook Recognize relations between SWG, microns and soot

3. **Terminal competency**: Exercise safety measure necessary to

Avoid hazards and to finally achieve functional success.

Element	performance Criterion
Use safety glasses Identify correct cutting method	. explain need to use safety glasses . Identify the correct method of
Direction incorrect	Removal out of the correct and One (The chip shall be thrown in out Wards direction, away from the eyes Of engraver)

4. **Terminal Competency**: Apply basic communication skills to develop good relationship at work and with customers.

Element	Performance Criterion
Communication skills	. Demonstrate congenial behaviour During interaction with peers, Supervisors, customers Communicate/ explain his/her ideas Clearly Convince the other person about his/ Her ability to complete and deliver the The specific/ assigned task in a given/ Specific time period

5. **Terminal competency**: Perform sketching/tracing/replicating/

Different patterns of engraving on the brass article.

Element	Performance Criterion
Selection of pattern on Paper manner specified	. Select appropriate drawing instruments . Draw sketch in a clear and precise . forecast time to be taken to create a Given sketch . complete a drawing assignment by By mixing and joining parts of different Patterns evenly without any trace of Disjointedness . Enlarge a given pattern to cover a Area
Tracing a sketch on brass tracing	. Select appropriate instruments for Trace with a steady hand on the brass Article Clear pattern on the brass article visible For engraving
Replicating techniques	Identify and explain replicating Of a sketch

. explain available preserving technique for future replication of sketches like

Lamination, scanning etc.

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6. **Terminal Competency**: Select design/s for engraving suitable to
   The type and shape of the basic article.

Element	Performance Criterion
Selection of Engraving tools kalam respect	. Select proper engraving tools from The tool box for a given job . Decide and select kachhi or pakki For a particular pattern and with To given brass surface
Forecast whether or not a Given pattern can be Engraved on a given article	. Identify sketch which require deep engraving and excess material (Jameen) removal Select a given sketch to be engraved on A Brass article with aminimum SWG (And also soot) requirement

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7. **Terminal competency**: secure the brass article and mark and measure/trace basic lines/pattern on the surface of brass article for engraving.

Element	**Performance Criterion**
Secure base article	**Secure** brass article on a tripod with wire and the area to be worked upon tilted at an angle for the comfort of the artisan
sitting posture	Adopt proper sitting posture which is comfortable and can support the brass object while working
mark and measure on the surface of brass article for engraving	Identify and using marking and measuring tools Evaluate a given sketch assess minimum SWG (and soot)of a brass article on which it has to be engraved

8. **Terminal Competency**: Select tools specific to the design to be engraved

Element	Performance Criterion
Select tools specific to the design to be engraved	Select proper engraving tools from the tool box for a given job . Decide and select kachhi or pakki kalam/chisel for a particular pattern with respect

	To a given brass surface

9. **Terminal Competency**: Engrave basic patterns (“japani”) with ease on flat and curved brass surface.

Element	Performance Criterion
Basic engraving (japani work)	Perform basic engraving “japani” work in an accurate and consistent manner . Perform “japani” work in a specified time

10. Terminal competency: Engrave filling work (Jaali and Dane) in between given outlined/pre-engraved patterns.

Element	Performance Criterion
Filling work- “Jali”	. perform “jaali” work in between a pre- engraved outlined in an accurate and consistent manner
Filling work- “Dance”	. perform ‘ Dance” work in between in pre- engraved outlined in an accurate and consistent manner Perform through consistent flow of the pattern with no evident break

11. Terminal Competency: Enlarge a sketch /pattern on the brass article toa desired size and engraved it.

Element	**Performance Criterion**

Enlarge a sketch/pattern on the brass article	**P**erform through enlarging a sketch / pattern on a larger sueface area which has already been engraved in a small area of the brass article . Perform through consistent flow of the pattern with no evident break

PATHWAY:

At the completion of level 1, i.e; moduled based on “Basic Art of Engraving” to finally achieve self sufficiency in the subject Art or he/she may enter specific competency of “Etching on Brass.

Appendix

Appendix – 1A Different Casting Materials

Elements	Symbol	Melting point Celsius	Melting point Fahrenheit
Brass (85 Cu 15 Zn)	Cu+Zn	900-940	1652-1724
Copper	Cu	1083	1981
Zinc	Zn	419	786
Nickel	Ni	1452	2646
Aluminium	Al	659	1218
Cast iron	C+Si+Mn+Fe	1260	2300
Iron	Fe	1530	2786
Gold	Au	1063	1946
Tin	Sn	232	450
Bronze (90 Cu 10 Sn)	Cu+Sn	850-1000	1562-832
Carbon	C	3600	6512
Chromium	Cr	1615	3034
Hydrogen	H	-259	-434.2
Inconel	Ni+Cr+Fe	1393	2540
Lead	Pb	327	621
Magnesium	Mg	670	1240
Manganese	Mn	1260	2300
Monel	Ni+Cu+Si	1301	2400
Phosphorous	P	44	111
Silicon	Si	1420	2588
Silver	Ag	961	1762
Stainless steel	Cr+Ni+Mn+C	1363	2550
Steel high carbon	Cr+Ni+Mn+C	1353	2500
Medium carbon	Cr+Ni+Mn+C	1427	2600
Low carbon	Cr+Ni+Mn+C	1464	2700

Titanium	Ti	1795	3263
Tungsten	W	3000	5432

Appendix – 1B

Major types of brass

Brass type	Composition	Use
Admiralty Brass	30% zinc and 1% tin, Balance Cu	Utensils flower vas, Mehtaba and other decorative articles, nanal applications.
Alpha brasses (prince's Metal)	Less that 35%zinc, bal Cu	Used in forging, pressing etc.
Alpha-beta Brass (Duplex brass)	Zinc form 35% to 45%	Suitable for hot working, it is hard and strong
Aluminium Brass	Comprises huge amount of Al (>10%)	Aluminium brass has been widely known for its ability to improve corrosion resistance
Arsenical Brass	Contains small amount of arsenic (about 3-5%),Al (about 5%), Zn 30% and Bal. Cu	Arsenical brass has been widely used for boiler fireboxes
Beta Brasses	Zinc quantity up to 45-50%	Beta brasses are relatively harder, stronger and suitable for casting. These can only be worked hot
Cartridge Brass	30% of zinc brass	Having good cold working properties
Common brass (Rivet Brass)	37% zinc	Cheap and standard for cold working
DZR Brass Dezincification resistant Brass	Small percentage of arsenic	Corrosion resistant brass
High brass	65% of copper and 35% of zinc	Screws, springs, rivets and many more. High brass has a high tensile strength
Leaded Brass	It is alpha-beta brass having an addition of lead	Superb machine ability, plumbing fittings
Red Brass	85% Cu, 15% Zn	Utensils, bushes

Muntz metal	59-63% Cu, 0.3% Pb, 0.7% Fe, Bal. Zn	Bells, chimes etc.

Appendix – 1C

Properties of free-cutting brass

(Cu 60-63%, Zn35.5%, Fe 0.35% max., Pb 2.5-3.7%)

Physical Properties	**Metric**	**Comments**
Density	8.49 g/cc	At 20^0 C (68^0 F)
MECHANICAL PROPERTIES		
Tensile strength	338-469 MPa	--
Yield strength	124-310 MPa	Depending on temper
Elongation at break	53%	In 457.2 mm
Modulus of elasticity	97 GPa	--
Bulk modulus	140 GPa	Typical for steel
Poisson's Ratio	0.31	Calculated
Machine ability	100%	UNS C36000 (free-cutting brass)= 100%
Shear modulus	37 GPa	
THERMAL PROPERTIES		
CTE, linear 250^0 C	20.5 µm/m-^{0} C	From 20-300^0 C
Thermal conductivity	115 W/m-K	At 20^0 C (68^0 F)
Melting point	885-900^0 C	--
Solidus	885^0 C	--
Liquids	900^0 C	--

Appendix – 1D

Relation between SWG and mm

SWG = Standard Wire Gauge

SWG	Dia (mm)	SWG	Dia(mm)	SWG	Dia(mm)	SWG	Dia(mm)
1	7.6200	14	2.0320	27	.04166	40	0.1219
2	7.0104	15	1.8288	28	0.3759	41	0.1118
3	6.4008	16	1.6256	29	0.3454	42	0.1016
4	5.8928	17	1.4224	30	0.3150	43	0.0914
5	5.3848	18	1.2192	31	0.2946	44	0.0813
6	4.8768	19	1.0160	32	0.2743	45	0.0711
7	4.4704	20	0.9144	33	0.2540	46	0.0610
8	4.0640	21	0.8128	34	0.2337	47	0.0580
9	3.6576	22	0.7112	35	0.2134	48	0.0406
10	3.2512	23	0.6096	36	0.1930	49	0.0305
11	2.9464	24	0.5588	37	0.1727	50	0.0254
12	2.6416	25	0.5080	38	0.1524		
13	2.2368	26	0.4572	39	0.1321		

Appendix - 1E

Some standard SWG of sheets and their conversion in mm

Plates*		Sheets*	
Thickness (SWG)	**Thickness (mm)**	**Thickness (SWG)**	**Thickness (mm)**
10 swg.	3.25 mm	20 swg.	0.91 mm
11 swg.	2.94 mm	21 swg.	0.81 mm
12 swg.	2.64 mm	22 swg.	0.71 mm
13 swg.	2.33 mm	23 swg.	0.61 mm
14 swg.	2.03 mm	24 swg.	0.60 mm
15 swg.	1.80 mm	25 swg.	0.50 mm
16 swg.	1.62 mm	26 swg.	0.45 mm
17 swg.	1.42 mm	27 swg.	0.41 mm
18 swg.	1.21 mm	28 swg.	0.37 mm
19 swg.	1.00 mm	29 swg.	0.34 mm
		30 swg.	0.31 mm

Measured for standard width of 700 mm