

Curriculum for
Mechanical Sub Overseer

Council for Technical Education and Vocational Training
Curriculum Development Division
Sanothimi, Bhaktapur
2005

Course Structure of 15 Month Curriculum of Mechanical Sub overseer

Subjects	Class W/Week	Total hours / year			Full Marks
		Theory	Practical	Total	
Mechanical Fitting	12	45	423	468	300
Sheet Metal Fabrication	4	17	139	156	100
Mechanical Drafting	3		117	117	75
Shaper machine Operation	2	8	70	78	50
Milling machine Operation	4	16	140	156	100
Applied Science	2	78		78	50
Applied Mathematics	2	78		78	50
Arc & Gas Welding	6	22	212	234	150
Lathe Machine Operation	4	16	140	156	100
Entrepreneurship Development	1	39		39	25
	40				1000

Course Stage	Areas and Topics	Time - hrs		Remarks
		Th.	Pr.	
1	Introduce entrepreneurship			
	Explain, Importance, Necessity, risks, and challenges of entrepreneurship	√		
	Search chance of innovation,	√		
	Perform decision making in self employed enterprises	√		
2	Select Occupation			
	List occupation	√		
	Group occupation	√		
	Prioritize the occupation	√		
	Select right occupation	√		
3	Decide Enterprise Location			
	Identify Market,	√		
	Identify Transportation facilities	√		
	Identify Raw materials availabilities	√		
	Identify Overhead facilities	√		
4	Survey Market			
	Define demand and supply	√		
	Identify supplier's problems	√		
	Identify consumer's problems	√		
	Identify possible market extension	√		
5	Plan Work			
	Fix production Scale	√		
	List necessary machineries, equipment, materials etc	√		
	List necessary labors	√		
	Prepare staff job- description	√		
6	Calculate the cost of product			
	Calculate product cost	√		
	Calculate per unit cost	√		
7	Manage finance			
	Find out the capital cost,	√		
	Find out running cost,	√		
	Find out overhead cost	√		
	Explain loan sanction banking rules and process	√		
	Maintain necessary documents of Account	√		
	Explain profit & loss calculation methods	√		
8	Sale product			
	Apply different ad. medias	√		
	Visit door to door contact		√	
	Nominate agents/ dealer		√	
9	Prepare scheme			
	Present scheme		√	
	Total	39		

Course Stage	Duties and Tasks	Time - hrs		Remarks
		Th.	Pr.	
1	Perform Cutting and Notching			
1.1	Perform straight cutting by hand	-	√	
	- Introduction of snips and its types.	√		
	- Marking and layout.	√		
1.2	Perform circle cutting by hand	-	√	
1.3	Cut a irregular figure	-	√	
2	Perform Seaming			
2.1	Bend by hand tool	-	√	
	- Hand tools used in sheet metal work	√		
2.2	Bend by folding machine	-	√	
	- Folding machine,	√		
	- Classification and application of folding machine	√		
2.3	Groove single seam	-	√	
	- Seam joint types and performance.	√		
	- Characteristics of seaming.	√		
2.4	Groove edge seam	-	√	
2.5	Perform wiring	-	√	
	- Wiring, its purpose.	√		
	- Method to strengthen the sheet metal fabrication.	√		
2.6	Perform straight beading	-	√	
2.7	Perform round beading	-	√	
2.8	Perform bottom flashing	-	√	
	- Flashing.	√		
	- Properties and methods.	√		
3	Perform Fasting			
3.1	Perform soldering joint	-	√	
	- Introduction of soldering joint	√		
	- Characteristics of solder lead and flux	√		
3.2	Perform rivet joint	-	√	
	- Introduction of Rivet	√		
	- Different rivet joints	√		
	- Calculation of rivet length	√		
4	Develop Pattern			
4.1	Develop pattern of 90° elbow	-	√	
	- Sheet metal development	√		
	- Types and application	√		
	- Pattern development	√		
5	Fabricate Sheet Metal			
5.1	Fabricate container	-	√	
5.2	Fabricate rectangular box	-	√	
5.3	Fabricate truncated joint in 90°	-	√	
	Total	17	139	

Course Stage	Duties and Tasks	Time - hrs		Remarks
		Th.	Pr.	
1	Handling Instruments			
1.1	Set up paper in drawing board	-	√	
	- Paper size for drawing and designing work.	√		
	- Uses of T-sets.	√		
1.2	Prepare a Drawing Sheet Using T Set and Set Square	-	√	
	- Set square and its uses.	√		
1.3	Write Representative Lines	-	√	
	- Introduction of representative lines and its applications	√		
1.4	Draw Circle Using Compass		√	
	- Uses of Compass and circles in workshop drawings.	√		
	- Instruments that uses to draw circles in drawing	√		
1.5	Draw Square / Rectangle		√	
	- Measuring	√		
	- Drawing shapes	√		
	- Instruments that uses to draw square and rectangles.	√		
1.6	Draw Triangle Using T set, Set Square and Protractor		√	
	- Drawing geometrical shapes.	√		
	- Taking a measurement of angles and triangles	√		
1.7	Construct Ellipse		√	
	- Drawing ellipse type	√		
1.8	Write Engineering Letter		√	
	- Importance of writing engineering letter	√		
	- Method of writing engineering letters	√		
2	Representing Drawing	√		
2.1	Determine Pictorial View		√	
	- Introduction.	√		
	- Method of constructing view.	√		
	- Condition of representing view	√		
	- Application of view.	√		
2.2	Draw Isometric Projection		√	
	- Types of drawing represents	√		
	- Pictorial views	√		
	- Trimetric and oblique projections and their applications	√		
3	Draw Orthographic View			
3.1	Draw Three View Drawings in First Angle Projection		√	
	- Method of obtaining orthographic projections in first angle	√		
	- Layout of three view drawing	√		
3.2	Find and Draw Missing Views		√	
4	Draw Intersection View			
4.1	Draw Full Section Views		√	
	- Importance of drawing in section	√		
	- Types of sectional views	√		
4.2	Draw Half Section Views		√	
4.3	Draw Part Section Views		√	
5	Draw in Scale			
5.1	Represent the Dimension in Detail		√	
	- Constructions of scale	√		
	- General principles & rules in dimensioning.			
	- Method of execution			
	- Arrows (depth and length of arrow head)			
5.2	Determine the Tolerances		√	
	- Introduction	√		
	- Limit, fit & allowance	√		
	- Surface tolerance	√		
	- Geometrical tolerance	√		
5.3	Draw the Symbols		√	

	- First angle projection symbol	√		
	- Dimensioning symbols	√		
	- Welding symbols	√		
	- Surface symbols	√		
	- Machine element symbols	√		
6	Develop Sheet metal Drawing			
6.1	Draw Square Box Development		√	
	- Sheet metal development	√		
	- Sheet metal pattern development	√		
6.2	Draw Cylinder Development		√	
	- Area calculation	√		
	- Importance of edge folding	√		
	- Sheet metal folding	√		
6.3	Draw Truncated Cylindrical Development		√	
6.4	Draw Cone Development		√	
	- Importance of notching	√		
6.5	Draw Truncated Cone Development		√	
6.6	Draw a Right Square Prism Development		√	
6.7	Draw a Truncated Right Square Prism Development		√	
6.8	Draw Pyramid Development		√	
7	Draw a Machine Element			
7.1	Draw Hexagon Nut		√	
	- Standards of threads	√		
	- Nomenclature of threads	√		
	- Types of nuts	√		
	- How to construct hexagon.	√		
7.2	Draw Hexagon Bolts		√	
	- Screws,	√		
	- Bolts,	√		
	- Studs,	√		
	- Square & trapezoid.	√		
7.3	Identify Gear Drawings		√	
	- Introduction,	√		
	- Types of gear	√		
	- Representation of different types of gear	√		
	- Application of different gear	√		
8	Draw Assembling Views			
8.1	Copy Simple Assembly View		√	
	- Method of drawing assembly views	√		
8.2	Draw Detail from Assembly View		√	
8.3	Draw Assembly View from Detail Drawing		√	
9	Draw Workshop drawing in Free hand sketch.			
7.1	Construct Workshop Drawing from Sample / Real Object		√	
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Subject Title: Shaper machine Operation**8+70 hrs**

Course Stage	Duties and Tasks	Time		Remarks
		Th.	Pr.	
1	Control Machine			
1.1	Clean, maintain and lubricate the machine	-	√	
	- Introduction and Safety	√		
1.2	Set up shaper vice on machine table	-	√	
	- Types of machine	√		
1.3	Set up work-piece on machine table	-	√	
	- Parts and function of machine	√		
1.4	Hold HSS cutting tool bit	-	√	
	- Shaping tool	√		
1.5	Adjust stroke length	-	√	
	- Stroke adjustment / Feed mechanism	√		
1.6	Position stroke length in center of the work-piece	-	√	
	- Quick return mechanism	√		
2	Perform Plain Surface			
2.1	Produce flat even surface	-	√	
	- Work holding devices	√		
2.2	Prepare a square block	-	√	
	- Shaper Operation	√		
2.3	Produce shoulder	-	√	
3	Perform Angular Surface			
3.1	Produce angular surface tilting shaper head	-	√	
3.2	Produce angular surface tilting machine table	-	√	
3.3	Produce angular surface setting the work-piece on machine table or vice	-	√	
	Total	8	70	

Course Stage	Duties and Tasks	Time		Remarks
		Th.	Pr.	
1	Set Up Machine			
1.1	Set up machine controls		√	
	- Introduction of milling machine	√		
	- Types of milling machines	√		
	- Main parts and their functions	√		
	- Factors governing machine control	√		
1.2	Set up milling vice on machine table		√	
	- Methods of holding works on milling vices	√		
1.3	Set up workpiece on machine table		√	
	- Types of work holding devices	√		
1.4	Set up milling cutter on long arbor in horizontal spindle		√	
	- Milling accessories	√		
	- Cutter holding devices	√		
	- Different cutter used in horizontal milling machines	√		
	- Fundamental of milling process	√		
1.5	Set up milling cutter on short arbor in vertical spindle		√	
	- Cutting geometry of milling cutter	√		
1.6	Set up milling cutter in collect chuck.		√	
	- Different shank type cutters and their uses	√		
2	Mill Plain Surface			
2.1	Mill plain surface on horizontal milling.		√	
	- Machining time calculation	√		
2.2	Mill plain surface on vertical milling.		√	
	- Different types of milling attachments	√		
	- Calculation of cutting speed, feed and depth of cut	√		
3	Mill Shoulders			
3.1	Mill step surface in vertical milling with shell end mill cutter.		√	
	- Types of milling operation.	√		
4	Mill Angular Surface			
4.1	Produce angular surface tilting vertical head		√	
4.2	Perform angular surface with angular cutter		√	
4.3	Perform angular surface setting the workpiece on machine table or vice.		√	
6	Mill Grooves			
6.1	End milling a slot		√	
6.2	Mill vee groove		√	
7	Mill Key Way			
7.1	Mill key-way in a round workpiece		√	
8	Mill Indexing			
8.1	Mill hexagonal shape in round workpiece		√	
	- Introduction of indexing.	√		
	- Direct indexing method	√		
	Total	16	140	

Course Stage	Areas and Topics	Time - hrs		Remarks
		Th.	Pr.	
1	Introduce applied science			
1.1	Introduce science and chemistry	√		
1.2	Introduce material science	√		
2	Matter			
2.1	Explain mechanical properties	√		
2.2	Explain state of matter	√		
2.3	Explain elements	√		
2.4	Explain atom	√		
2.5	Explain formula of a compound	√		
3	Bonding of Solids			
3.1	Explain forces between atoms	√		
3.2	Explain type of bonds and their energies	√		
4	Ferrous Metal			
4.1	Explain iron ore	√		
4.2	Explain blast furnace	√		
4.3	Explain cast iron	√		
4.4	Explain steel making process	√		
4.5	Explain forming of steel	√		
4.6	Explain of steel	√		
4.7	Explain alloy steel	√		
4.8	Explain effects of alloying elements in steel	√		
4.9	Explain common alloy steels	√		
5	Mechanical Testing			
5.1	Explain destructive tests	√		
5.2	Explain factors affecting in mechanical properties of steel	√		
6	Heat Treatment			
6.1	Explain annealing	√		
6.2	Explain normalizing	√		
6.3	Explain hardening	√		
6.4	Explain tempering	√		
6.5	Explain case/surface hardening	√		
7	Corrosion and its Prevention			
7.1	Introduce corrosion	√		
7.2	Explain specific types of corrosion	√		
7.3	Explain control and prevention of corrosion	√		
8	Non Ferrous Metal and Alloys			
8.1	Introduce aluminium and its alloys	√		
8.2	Introduce copper and its alloys	√		
8.3	Introduce lead and its alloys	√		
8.4	Introduce zinc and its alloys	√		
9	Organic Material			
9.1	Introduce polymers	√		
9.2	Introduce plastics	√		
9.3	Introduce rubbers and elastomers	√		
	Total	78		

Course Stage	Areas and Topics	Time - hrs		Remarks
		Th.	Pr.	
1	Basic Mathematics			
1.7	Calculate Pythagoras' Theorem	√		
1.9	Calculate trigonometric functions	√		
1.12	Calculate sheet metal requirements and wastage	√		
1.13	Calculate rivets	√		
1.16	Calculate taper and inclination	√		
1.17	Calculate thermal expansion	√		
1.21	Calculate screws and bolts	√		
1.22	Calculate processing time for drilling	√		
1.24	Calculate Stress	√		
1.25	Calculate Bending	√		
2	Applied Mathematics			
2.1	Calculate Effects of force	√		
2.4	Calculate lever forces	√		
2.6	Calculate uniform / average speeds	√		
2.9	Calculate pressure and force	√		
2.10	Calculate shearing and punching	√		
2.13	Calculate Simple V- belt drive	√		
2.14	Calculate Multiple belt drive	√		
2.16	Calculate gear wheel dimensions	√		
2.17	Calculate Simple gear drive	√		
2.18	Calculate Multiple gear drive	√		
2.19	Calculate change gear	√		
2.20	Calculate torque and power	√		
2.24	Calculate processing time for turning	√		
2.26	Calculate processing time for planning and slotting (<i>shaping</i>)	√		
2.27	Calculate processing time for milling	√		
2.28	Calculate Indexing (indirect indexing)	√		
	Total	78		

Course Stage	Duties and Tasks	Time - hrs		Remarks
		Th.	Pr.	
1	Handle welding equipments			
1.1	Perform striking		√	
	- Introduction of welding	√		
	- State the Arc welding machines	√		
1.2	Perform tack weld		√	
	- Use of welding tools	√		
1.3	Perform surface weld in flat position		√	
	- Definition of current	√		
	- Types of welding position.	√		
	- Types of the electrodes	√		
	- Striking method	√		
1.4	Weld edge joint		√	
	- State the term penetration, reinforcement, root gap, leg etc.			
	- Characteristics of welding beads	√		
1.5	Weld corner joint		√	
	- Determine the welding symbols	√		
	- Interpret the workshop drawings	√		
2	Weld Butt Joint Horizontal Position			
2.1	Weld square butt joint		√	
	- State the types of joints	√		
	- State the term penetration, reinforcement, root gap leg etc	√		
	- State the methods of destructive testing	√		
2.2	Weld "V" butt joint (single)		√	
	- Welding defects	√		
3	Fillet Weld Horizontal Position			
3.1	Weld tee joint		√	
	- State the methods of non destructive tests.	√		
3.2	Weld lap joint		√	
4	Perform Pipe Joint			
4.1	Weld pipe to pipe joint		√	
4.2	Weld pipe to metal joint		√	
1	Set up Gas Welding Equipment			
1.1	Prepare acetylene gas		√	
	- Introduction of gas welding.	√		
	- Introduction of Acetylene gas	√		
	- Introduction of acetylene generator	√		
1.3	Set up welding nozzles		√	
	- Introduction of oxygen.	√		
2	Run Beads in a Line			
2.1	Run fusion without filler rod		√	
	- Gas welding nozzles and their types.	√		
	- Size and selection of welding nozzles.	√		
2.2	Run fusion with filler rod		√	
	- Types of flames	√		
	- Characteristic and uses of gas welding flame	√		
3	Fillet Weld			
3.1	Weld edge joint		√	
	- Procedure for running a line of fusion or puddling without a filler rod	√		
	- Position and motion of the torch.	√		
	- Backfire and flashback	√		
3.2	Weld square butt joint		√	
	- Laying beads with a filler rod.	√		

	- Introduction of filler rod.	√		
3.3	Weld outside corner joint in flat position		√	
	- welding techniques.	√		
3.4	Weld lap joint in the flat position.		√	
	- Types of basic welding joint	√		
	- Flux – characteristic, types and application	√		
3.5	Weld T – joint in the flat position.		√	
	- Distortion in welding causes and control.	√		
	- Common welding defects in gas welding	√		
3.6	Weld pipe + pipe		√	
4	Weld in Position			
4.1	Run beads in vertical position		√	
4.2	Run beads in horizontal position		√	
6	Cut Metal by Oxy-Acetylene Flame			
6.1	Cut MS plate with gas welding equipment manual		√	
7	Perform Hard Soldering (Brazing)			
7.1	Braze brass in mild steel plate		√	
7.2	Weld Butt joint in Copper plate		√	
	Total	22	212	

Course Stage	Duties and Tasks	Time - hrs		Remarks
		Th.	Pr.	
1	Set Up Machine			
1.1	Set up round work piece on three jaw chuck	-	√	
	- Introduction of Lathe machine	√		
1.2	Set up turning tool on tool post	-	√	
1.3	Set up machine controls	-	√	
	Main parts and their functions of the lathe m/c	√		
1.4	Set up round work piece on four jaw chuck	-	√	
	- Cutting speed, feed and depth of cut	√		
	- RPM calculation	√		
1.5	Set up machined work piece on collect chuck	-	√	
	- Types of Lathe machine	√		
	- Lathe accessories	√		
1.6	Set up irregular work piece on face plate	-	√	
	- work-holding devices	√		
1.7	Set up work piece center to center	-	√	
	- Cutting tool material	√		
	- Types of cutting tool	√		
	- Cutting tool geometry	√		
2	Perform Machining Operation			
2.1	Perform facing	-	√	
2.2	Perform center drilling	-	√	
	- Operation: Center drill & center drilling	√		
2.3	Perform plain turning	-	√	
2.4	Perform step turning	-	√	
2.5	Perform grooves	-	√	
2.6	Perform taper turning	-	√	
	- Tapers and its application	√		
	- Manufacturing process of the tapers	√		
	- Types of taper turning on lathe machine.	√		
	- Taper calculation for setting on the machine	√		
2.7	Perform plain boring	-	√	
	- Boring and drilling on lathe machine	√		
2.8	Perform knurling on machined surface	-	√	
	- Knurling its type and applications	√		
2.9	Perform parting off machined part	-	√	
	- Lathe attachments	√		
2.10	Perform internal grooves	-	√	
2.11	Perform internal tapers	-	√	
2.12	Perform eccentric shaft	-	√	
3	Perform Thread Cutting			
3.1	Cut threads using threading die/taps	-	√	
	- Threads, Screws, bolts and nuts	√		
3.2	Cut external 'V' m/c thread	-	√	
	- Manufacture a thread on lathe machine	√		
	- Taking a measurement of thread element	√		
3.3	Cut internal 'V' m/c thread	-	√	
4	Perform Off Hand Grinding			
4.1	Grind facing or corner tool in HSS bit	-	√	
4.2	Grind roughing tool in HSS bit	-	√	
4.3	Grind grooving tool	-	√	
4.4	Grind thread cutting tool	-	√	
5	Perform Project			
5.1	Manufacture spindle	-	√	
5.2	Manufacture taper fitting component	-	√	
5.3	Manufacture knurled head screw 60°	-	√	
	Total	16	140	

Course Stage	Duties and Tasks	Time - hrs		Remarks
		Th.	Pr.	
1	Perform Filing			
1.1	File flat surface (Plain)	-	√	
	- Work-piece clamping devices	√		
	- Position of body & arm for guiding the file	√		
	- General safety precaution of Tool room.	√		
	- Introduction of files	√		
	- Common methods of filling flat surface	√		
1.2	File external radius	-	√	
	- Introduction of marking and layout.	√		
	- Radius gauge.	√		
	- Methods of Filing radius surface.	√		
1.3	File internal profiles		√	
	- Checking flatness and square ness	√		
	- Types of filling	√		
2	Perform Hand Punching			
2.1	Stamp Letters and Numbers	-	√	
	- Letters and Numbers punches	√		
	- Stamping and its process.	√		
2.2	Punch Dot and Center	-	√	
	- Dot and Center punch	√		
3	Perform Sawing			
3.1	Saw the metals	-	√	
	- Introduction of Hacksaw	√		
	- Types of hacksaw	√		
	- Selecting blades for different metal & sections	√		
	- Holding different sections of work-piece for hack sawing.	√		
	- Procedure of sawing the metal by hand	√		
4	Perform Chiseling			
4.1	Perform chipping flat	-	√	
	- Introduction of chisel and its types.	√		
	- Fundamental of chipping.	√		
	- Use of chisels.	√		
4.2	Perform chipping Groove	-	√	
5	Perform Drilling			
5.1	Drill a hole	-	√	
	- Introduction of drill machine	√		
	- Types of drill machine.	√		
	- Twist drills and its types.	√		
	- Cutting speed feed and RPM.	√		
	- RPM calculation	√		
5.2	Countersunk on hole	-	√	
	- Introduction to Countersink.	√		
	- Types of countersink	√		
	- Uses of countersink.	√		
5.3	Counter bore on hole	-	√	
	- Introduction to Counter bore	√		
	- Types of counter bore.	√		
	- Uses of counter bore	√		
5.4	Ream drilled hole using hand reamers	-	√	
	- Introduction of reamer and its types.	√		
	- Determine the drill size for reamer	√		
5.5	Perform coordinate drilling		√	
6	Perform Threads by Hand			
6.1	Perform internal threads using hand taps	-	√	
	- Introduction of taps and its types.	√		
	- Introduction of threads.	√		

6.2	Perform external threads using threading dies	-	√	
	- Introduction of threading dies and die handle	√		
	- Identify blank size.	√		
	- Nomenclature of threads	√		
	- Types of threads	√		
	- Application of threads.	√		
7	Perform Off Hand Grinding			
7.1	Grind center punch.	-	√	
	- Abrasive and their types.	√		
	- Specification of grinding wheel	√		
	- Introduction of center punch	√		
	- Uses of Center punch.	√		
7.2	Grind flat chisel	-	√	
	- Introduction of Chisels	√		
	- Application of chisels	√		
	- Distinguish the features of chisels.	√		
7.3	Grind marking scriber	-	√	
	- Features of Marking Scriber	√		
7.4	Grind twist drill		√	
8	Handle Measuring Instrument			
8.1	Check square ness using back square	-	√	
	- Introduction of Back square.	√		
	- Features of Back square	√		
	- Checking the Back square before use.	√		
8.2	Check with radius gauge		√	
	- Introduction of the radius gauge	√		
	- Features of radius gauge.	√		
	- Self made radius gauge	√		
8.3	Measure angular surface using bevel protector	-	√	
	- Introduction of Bevel protractor	√		
	- Types of protractor	√		
	- Features of bevel protractor	√		
	- Uses of Bevel protractor	√		
	- Importance of measuring angular surface	√		
	- Uses of angular gauges.	√		
8.4	Measure the dimensions using Vernier caliper.	-	√	
	- Introduction of Vernier caliper	√		
	- Features of Vernier caliper.	√		
	- Reading the scale	√		
	- Uses of Vernier caliper	√		
	- Least count of Vernier caliper	√		
	- Care and maintain of Vernier caliper	√		
9	Perform Project			
9.1	Manufacture steel hammer of 500gm	-	√	
9.2	Manufacture C – clamp	-	√	
9.4	Manufacture Center square		√	
9.6	Manufacture Flat Chisel		√	
	Total	45	423	