DEPARTMENT OF MECHANICAL ENGINEERING

Progress Report of Workshop

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# TABLE OF CONTENTS

ACKNOWLEDGEMENT ........................................................................................................... i

CHAPTER 1. ............................................................................................................................... 1
  1.1 INTRODUCTION ............................................................................................................... 1
  1.2 Site Layout ....................................................................................................................... 1
  1.3 ORGANIZATIONAL STRUCTURE OF BUETK ................................................................. 2
  1.4 WORKSHOP organization structure .............................................................................. 3

CHAPTER 2. ............................................................................................................................... 4
  2.1 SERVICES AND MAJOR FUNCTION ............................................................................... 4
  2.2 CLOSE RELATIONSHIPS ................................................................................................. 4

CHAPTER 3. ............................................................................................................................... 5
  3.1 SECTIONS/ SHOPS OF WORKSHOP ............................................................................. 5
  3.2 DIFFERENT SECTIONS/ SHOPS .................................................................................. 5
    3.2.1 Auto Shop .................................................................................................................. 5
    3.2.1.1 CNC Lathe Machine ............................................................................................ 5
    3.2.1.2 G Code AND M Code ......................................................................................... 6
    3.2.1.3 Steps in Using the Machine ................................................................................. 6
    3.2.2 Welding Shop ............................................................................................................ 7
    3.2.3 Sheet Metal Shop ...................................................................................................... 11
    3.2.4 Carpentry Shop ....................................................................................................... 13
    3.2.5 Machine Shop 1 ...................................................................................................... 19
    3.2.6 Machine Shop 2 ...................................................................................................... 24
    3.2.7 Machine shop 3 ...................................................................................................... 28
    3.2.8 Fabrication Shop ..................................................................................................... 35

CHAPTER 4. MATERIAL AND CUTTING SPEED .................................................................. 40

CHAPTER 5. ADMINISTRATION, MANAGEMENT AND WELFARE ................................... 41
  5.1 UNDERSTANDING THE ATTITUDES OF EMPLOYEES ............................................ 41
5.2. JOB DISPATCHING AND ADMIRING THE WORK ............................................................... 41

5.3. GUIDE LINES FOR BETTERMENT .................................................................................. 42

CHAPTER 6. PROBLEMS AND DIFFICULTIES ENCOUNTERED ........................................... 43

CHAPTER 7. .......................................................................................................................... 44

7.1. CONCLUSION .................................................................................................................. 44

7.2. SUGGESTIONS FOR THE IMPROVEMENT OF THE ENGINEERING WORKSHOPS .......... 44

7.3. SUGGESTIONS FOR THE IMPROVEMENT OF TRAINING PROGRAM .............................. 44
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Knowledge is power and unity is strength.
CHAPTER 1.

1.1 INTRODUCTION

Being a public property, the Engineering Workshops is a section of the Mechanical Engineering department, University of BUETK. In collaboration with the other departments, its prime purpose is to provide facilities for the engineering undergraduates to perform the academic activities of the Faculty of Engineering. During the time of training, it comprised a resource crew of ten members directed by Engr. Liaquat Ali Lehri (Assistant Prof ) Chairman Mechanical Engineering Department).

1.2 SITE LAYOUT

![Site Layout Diagram]

Figure 1.1 The Engineering Workshop
1.3 ORGANIZATIONAL STRUCTURE OF BUETK
1.4 WORKSHOP ORGANIZATION STRUCTURE

WORKSHOP STAFF

- Workshop Superintendent (1)
- Instructors (5)
- Carpenter (1)
- Welder (1)
- Helper (2)
CHAPTER 2.

2.1. SERVICES AND MAJOR FUNCTION

The infrastructure of the Engineering Workshops could provide the following listed services to its consumers both in academic and non-academic terms.

i. Machining of metals  
ii. Welding  
iii. Smith and fitting work  
iv. Woodwork  
v. Vehicle repair

Subject to the rules established by the Faculty and the University, deploying the following functions is expected from it.

- Provide above mentioned services to the engineering undergraduates to carry out their academic activities such as practicals, experiments and projects.
- Provide above mentioned services to the Faculty of Engineering and the University as a whole if requested.
- Within the feasibility limits, provide above mentioned services to the public. (Service cost is usually expected to be charged from the service consumers).

It is important to distinctly note that the Engineering Workshops could provide related knowledge wise services to other engineering organizations and to the public who need assistance in their work.

2.2. CLOSE RELATIONSHIPS

The Engineering Workshops has close relationships with the other departments of the Faculty and especially with the Department of Mechanical Engineering through which the academic activities are conducted. On the other hand, machine tools and equipment’s of the Engineering Workshop are also used to carry out the tasks of the maintenance engineering section of the university freely, Specially welding shop, carpentry shop and lathe machines.
CHAPTER 3.

3.1. SECTIONS/SHOPS OF WORKSHOP

The Engineering Workshops itself is a collection of eight different subsections that are interrelated. Brief descriptions about them are given below.

3.2. DIFFERENT SECTIONS/SHOPS

3.2.1. Auto Shop

The Auto shop is the place where I.C. engines are kept. The complete engines are disassembled and assembled for the practice of mechanical students. Wheel balancer, battery starter tester, Spark plug cleaner tester machine are kept here for the study as well as practical purposes.

3.2.1.1. CNC Lathe Machine

Two axis novatur CNC lathe is installed here in the auto shop for the training of the students and others as well, it has been designed with you in mind making the processes involved both safe and easy to use.
Main features:
- Designed for especially for education and training.
- Manufactured to industrial standards.
- Capable of cutting resistant materials such as wax, plastics acrylcs, copper, aluminum, Steels.
- Links to various CAD/CAM software packages totally enclosed high visibility interlocked guarded.
- CE approved for safety
- Programming via international standards organizational format.
- Optional 8 station programmable turret available.
- Option of including in flexible manufacturing cells and computer integrated manufacturing system.

3.2.1.2. G Code AND M Code

The entire functioning of the machine is based on G Code and M Code specifications. G Codes define the preparatory functions of the machine. In simple terms, they control the movement and machining related functions of the machine tool.

3.2.1.3. Steps in Using the Machine

The distinct operations involved in using the CNC machines are listed below in sequence they are done.

1) Generating the program (in G & M Codes)
2) Sending it to the machine
3) Running the program

First a drawing of the machined work piece is created using AutoCAD in a PC. Then using a special routine of AutoCAD, the contours of the cutting tool are generated. This is finally stored as a text file in the hard drive of the PC. Next, the CNC machine is set to retrieve this file. Through the coaxial cable which links the PC and CNC machine, it is then fed into the machine tool. A numeric name for the program is given at the beginning of the file retrieval to figure out the starting point (or the address in the memory) of the retrieving program from earlier read programs. Using this numeric name of the program, it is taken to the front from other programs in the memory and it stays waiting to run. Pressing the "Start" button sequentially executes the listing. The monitor (on the Main Control Panel) displaying a program waiting to be executed. If needed a program can directly be written using the Main Control Panel of the CNC machine and executed. This is tedious and errors may occur easily.
3.2.2. Welding Shop

The Welding shop is the shop comprised of the equipments to deploy following services:
- Arc welding
- Oxyacetylene welding
- Spot welding
- Drilling

Arc Welding

**Specification:**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>B – 300 F</td>
</tr>
<tr>
<td>Rated output current A</td>
<td>300</td>
</tr>
<tr>
<td>Rated duty cycle %</td>
<td>40</td>
</tr>
<tr>
<td>Rated input capacity kvA/kw</td>
<td>24.5/14</td>
</tr>
<tr>
<td>Rated load voltage V</td>
<td>35</td>
</tr>
<tr>
<td>Dimension W<em>L</em>H mm</td>
<td>320<em>495</em>570</td>
</tr>
<tr>
<td>Frequency</td>
<td>50 Hz</td>
</tr>
<tr>
<td>Phase</td>
<td>single</td>
</tr>
</tbody>
</table>
Oxyacetylene Welding

Spot welding
Hand Drill

A hand drill is versatile equipment which can be freely used for drilling holes as well as for some other purposes where a portable rotational prime mover is required. The specifications of the NHP1030 hand drill manufactured by Makita Corporation, Japan are given below.

- Supply 230 VAC, 2.0 A, 50-60 Hz
- Power 430 W
- Speed 0-2700 rpm
- Maximum drill bit size 10 mm

An example of a practical performed at welding shop for the training of the students:

PRACTICAL

OBJECT:
Making a Lap Joint by Gas Welding.

MATERIAL:
Mild Steel Sheet size 140 × 60 × 1.2 mm (02 Pieces)

TOOLS AND EQUIPMENTS:

PROCEDURE:
1. Prepare two pieces of mild steel plate as per size and dimension (140 × 60 × 1.2 mm).
2. Straight and smooth both work pieces.
3. Clean the sides of work pieces with wire brush or emery paper.
4. Mark a centre line on both pieces with help of scriber.
5. Place both strips each other at a centre line then overlap in a horizontal position.
6. Set the proper pressure of the gasses by means of pressure gauges.
7. Support the work pieces on welding table at a correct location and alignment.
8. Set the proper quantity of acetylene and oxygen gas for a required flame on welding torch.
9. With help of spark lighter gently burn the acetylene gas at the end of nozzle after that make a neutral flame.
10. Start welding and fill the edges gapes with filler metal and repeat the same procedure on other side and complete the lap joint.
11. Chip the carbon layer from weld by chipping hammer.
SAFETY PRECAUTIONS:

1. Inspect the hose pipes connections carefully.
2. Always wear goggles, apron and gloves during the welding.
3. Don’t touch the torch tip on the job.
4. Before checking the jobs cool it.
5. Make sure the top of the bench and work piece to be welded are dry and free from dirt, corrosion and grease.
6. To continue welding pool it is necessary to make the neutral flame.
7. Before making the flame carefully check the leakage of gases.
8. Don’t weld without flux.

LAP JOINT

![Diagram of Lap Joint with steps 1, 2, and 3]
3.2.3. **Sheet Metal Shop**

The metal sheet Shop mostly comprised machines (hydraulic press bending machine, vibro sharing machine, Captain saw, Spot welding unit etc.) and some manual machine (rolling machine, slotting machine etc). The study of machines kept in this shop are conveyed to the trainees in their respective classes scheduled by MED for becoming a good engineers in their future ahead.

**Hydraulic press bending machine**

**Specification:**

MCUB 4525 type oil – hydraulic press bending machine MORI iron company limited. SAGA Japan

- Bending capacity --------------- Max 125 mm
- Size of bend blade -------------- 360 * 3.0 * 40 mm
- Pin hole ------------------------ 63 * 11 * 4
- Blade speed --------------------- 19/38 rpm at 50 hz
- Electric motor ------------------- 1.5 kw 2/4 pole change motor
- Pump motor --------------------- 80 w
- Size of machine ----------------- 1520 mm * 760mm * 720mm
- Wt of machine ------------------- 1000 kg
**Vibrosharing machine**

**Specification:**
- No. of stroke for model ---------- HM -600
- Stroke p/m ----------------------- 60 c/s
- Thickness of materials ----------- 3.2mm

---

**Captain saw**

**Specification :**
- Cutting capacity ------------------ max 125 mm
- Size of saw blade ----------------- 360 * 3.0 * 40 mm
- Pin hole -------------------------- 63 *11* 4
- Blade speed ----------------------- 19/38 rpm at 50 hz
- Electric motor --------------------- 1.5 kw 2/4 pole change motor
- Coolant pump motor --------------- 40 w
- Size of machine ------------------- 1520mm *760mm*720mm
- Wt of machine --------------------- 400 kg
3.2.4. Carpentry Shop
Carpentry shop is comprised of 1 carpenter and 1 helper the carpentry Shop enclosed the following machine tools.

- Circular saw
- Spindle tenoner machine
- High speed slotting and drilling machine
- Universal belt sender
- Bench Drill
- Mortiser
- Router
- Saw and plier
- Thickness planner
- Wood planer

The mentioned shop provides the various services to its consumers both in academic and non-academic terms.

Circular saw

Specification :

- Max dia of circular saw ------------------- 405 mm
- Hole dia of circular saw ------------------- 24.5 mm (1”)
- Work table size -------------------------- 1000 * 900 mm
- Max thickness of work piece -------------- 135 mm
- Tilting angle of saw spindle --------------- – 1 degree 46 degree
- Table height ---------------------------- 800 mm
- Circular saw spindle speed --------------- 2700 4300 rpm at 60 Hz
- Net wt ----------------------------------- 590 Kg
Universal belt sander
Specification:
- Effective sanding area
  - Horizontal n plane types: 610*180 mm
  - Vertical type: 180*470 mm
- Width of belt: 180 mm
- Speed of belt: 920m/min
- Required Hp: 1.5 Kw 2Hp * 4p
- Net: 650 kgS

High speed slotting and drilling machine
Specification:
- Table size: 900* 600 mm
- Range of vertical movement table: 200 mm
- Main spindle chuck dia: 12 n 16 mm
- Main spindle speed: 20,000 RPM
- Main spindle out put: 2.2 Kw
- Range of vertical spindle movement: 120mm
- Height of table above floor: 995mm
Spindle tenoner machine

Specification:
Max stock size
- Tenon length: 120mm
- Tenon width: 300mm
- Thickness: 100mm

Cutter
No.1 circular saw
- Diameter of blade: 250mm
- Diameter of spindle: 25.4mm
- Motor: 0.75 kw*2p
- Revolution speed: 50hz 2880rpm

No.2 No.3 Tenon heads
- Cutting circle: 150mm
- Motor: 0.75 kw*2p*2
- Revolution speed: 50Hz 2880 rpm
  60 Hz 3450rpm

Vertical spindle
- Max dia: 255mm
- Dia of angle cutter: 150mm
- Dia of spindle: 25.4mm
- Motor: 1.0kw*2p
- Revolution: 50hz (2880rpm)

Work table size: 425 W*800 L
Net wt: 850 kg
Universal wood working Machine

Specification:

Motor ---------------------------- 3 phase EFOUP-K 2.2KW
No load rotating speed ------ 6800 rpm
Capacity ------------------ max cutting width 160 mm, Max cutting depth 3mm
Guide turning angle 0 -- 45 degree
Wt ---------------------------- 262 Kg
Machine size ------------------ W 1135 *H 765 *D 1249

Single surface planner

Specification:

Max work size ------------------ 395*295mm
Cutter head speed ------------------ 5400rpm
Feed speed stepless -------------- 9 – 8 m/min
Table up/down stroke n time ---------- 295mm/25sec
Cutter head dia diameter ------------- 100mm
Knife diamensions (T*W*L) ----------- 3.2*32*400mm
Feed roll interval ----------------- 263mm
Spindle drive motor -------------- 0.4kw 4p
Table drive motor ----------------- 0.2 kw 4p
Machine dimensions (WLH) --------- 1000*1095*1142mm
Wt -------------------------------- 580 kg
An example of practical’s performed at carpentry shop is mentioned below:

**PRACTICAL**

**OBJECT:**
To make middle half cross lap joint of wood according to the given drawing.

**MATERIAL:**
Wood deodar size 12.2” × 2.2” × 1.2” inch.

**REQUIRED SIZE:**
6” x 2” x 1” inches.
6” x 2” x 1” inches.

**TOOLS AND INSTRUMENTS:**
Planer, hand saw, carpenter hammer, pencil, try square, measuring tape and chisel.

**PROCEDURE:**
- Plane up the wood in usual way to the width of 2” and thickness of 1”.
- Cut the wood in to two pieces from centre at the length of 6”.
- Mark up at the centre of both pieces for cross joint with pencil on top surface of wood.
- Now mark a line at the distance of 1” inch both sides of centre line on each piece.
- Reference to the above lines again marks half inch deep line on thickness of wood pieces.
- Now carefully cut both mark pieces with the help of saw till required depth and then remove waste wood with chisel.
- Glue the both pieces on inside and place over each other and nail them carefully.

**PRECAUTIONS**
- Never use the chisel with broken handle.
- Select proper size and type of chisel for a work.
- Use proper saws for cutting the wooden pieces.
- Secured work piece properly.
- Place the head of the nails in wood.
CRASS LAP JOINT

All Dimensions are in inches
3.2.5. Machine Shop 1

Machine shop-1 comprised of 10 lathe machines, it provides various services to its consumers both in academic and non-academic terms.

Lathe Machine

Specification:

Model: TSL 550D
General:
Swing over bed: 360mm
Swing over cross slide: 210 mm
Distance between centers: 550mm
Head stock
Number of speeds: 6ch
Range of speed: 83 – 1800 rpm
Spindle taper: MT 5
Spindle nose: Al 5”
Center taper: MT No 3
Hole through spindle: 35 mm
Carriage
No. of feeds: 36 ch
Longitudinal feed range: 0.041 – 2.22mm
Cross feeds: ½ of long feeds
Cross slide travel: 190 mm
Compound rest travel: 100mm
Threads
No of metric threads: 24ch
Range of metric threads: 0.5 – 14mm
No. of inch threads: 2 – 56 TPI
Lead screw dia n pitch: 30mm 4mm p
Tail stock
Spindle dia: 50mm
Size of center: MT No 3
Spindle travel: 100mm
Bed
Length: 1360mm
Width: 275mm
Depth: 250mm
Motor
Main drive: 2.2 Kw
Wt: 950 Kg
An example of study and practice at machine shop -1 is mentioned:

PARACTICAL

OBJECT: To study the Operation of lathe machine and cutting tools.

INTRODUCTION:
Lathe was basically developed for turning of jobs however with the passage of time many other jobs have been successfully performed on it they are,

i. Facing
ii. Turning
iii. Taper Turning
iv. Boring
v. Threading
vi. Knurling
vii. Chamfering
viii. Centre drilling
THEORY

i. **Facing:**
   Large amount of material can be removed by facing operation in which we remove the material from end of the work piece to making a square with its axis. Generally we use right and left hand tools for facing operation.

![Proper position for Side or Facing tool](https://example.com)

ii. **Turning:**
   It is the process in which we machined the diameter of the work piece, for the turning operation rough turning tool and finish turning tool can be used the rough tool has 80sa clearance and 10 as top rake angle while a finish turning tool is given sharp angle and less nose radius

![Workpiece rotation](https://example.com)

iii. **Taper Turning:**
   After turning, taper turning is most important operation performed on lathe. The taper turning can be performed by various methods which can be chosen as per the requirements of job and accuracy desired.
   1. broad nose tool method
   2. compound rest swiveling method
   3. Tail stock set over method.
   4. Taper turning attachment method.
iv. **Boring:**
Boring tool is held in place of dead centre or tool post it is fed into the job held by chuck or crass slide. It is the operation of enlarging the hole which is previously made by drilling or some other means.

v. **Threading:**
After turning, thread cutting is another operation which is very commonly performed on a lathe. Basically threads are classified into two group left hand and right hand threads can be further classified as per No, of start i.e. single, double and multiple threads.
Thread Cutting Setup On Lathe

The thread cutting on lathe is based upon the relationship between pitch of lead screw and pitch of the job required.

\[
\frac{\text{Pitch of threads on the job}}{\text{Pitch of the lead screw}} = \frac{\text{Speed of lead screw}}{\text{Speed of the job}}
\]

**Gear Ratio.**

For different kinds of threads we use different tools according to the requirement of work piece.

vi. **Knurling:**

the process of rolling depression of various shapes such as micrometer handle gauges handle etc can be handle with a better grip into metal by use of different revolving hardened steel wheels pressed against the word piece.

vii. **Chamfering:**

Chamfering is the process of removing the sharp edges of the work piece usually the chamfering is done by compound slide at 45 angle.

viii. **Center Drilling:**

It is the operation of special drilling and center sinking each ends of work piece to be turned between centers. Center drilling provide bearing surface for lathe centre for different provide operations such as turning, threading and also for proper drilling at centre.
3.2.6. Machine Shop 2

Machine shop 2 comprises of machines (Axial boring and drill Machines 2 Nos. bench drill Machine 2 Nos. Up right drill machine, High speed threading machine, power hacksaw 2 Nos. bench grinder) The mentioned shop provides different sort of operations such as drilling, boring, counter sinking, grinding, square threading, metal cutting etc.

Radial drilling Machines

Specification:

- Column dia: 350mm 13 ¾”
- Max distance from column to spindle: 1500mm
- Horizontal travel of spindle head: 1210 mm
- Max distance from spindle to base: 1315 mm
- Arm vertical travel: 620mm
- Spindle dia: 75mm
- Spindle speed: 1300rpm
- Main motor: 3.75Kw 5Hp
- Arm elevating motor: 1.5kw
- Net wt: 3000kg
**Up right drill machine**

**Specification:**

- Column dia: 150mm (13 ¾”)
- Max distance from column to spindle: 150mm
- Horizontal travel of spindle head: 110 mm
- Max distance from spindle to base: 115 mm
- Arm vertical travel: 60mm
- Spindle dia: 35mm
- Spindle speed: 1300rpm
- Main motor: 2.75Kw 2Hp
- Arm elevating motor: 1.5kw
- Net wt: 800kg
**High Speed Threading Machine**

**Specification:**

- **Distance between centers** : 1000mm
- **Bed length width** : 2170mm *370*85.5mm
- **Spindle speed** : 2 – 20 rpm non stop
- **Taper in spindle nose bushing** : 6MT
- **Taper in spindle center bushing** : 4 MT
- **Hole through spindle** : 52mm
- **Lead screw** : 38 mm
- **Threading range**
  - Matric threads : 23 types 2 – 14 mm
  - Inch threads : 24 types 14 -2 TPI
  - Module threads : 18 types 1-5 module
- **Motor and gear box** : 4p0.75kw220v
- **Model** : SM3A
- **Center height** : 115 mm
- **Cutting tool speed** : 1540 rpm
- **Dimension (LWH )** : 2513 *1003*1166mm
- **Wt** : 2000kg
An example of a practical performed at welding shop for the training of the students:

**PRACTICAL**

**OBJECT:**
Drilling, boring and counter sinking operations on a metal slab.

**Material:**
Rectangular mild steel slab(90 *65 *8 mm)

**TOOLS AND EQUIPMENTS:**
Hammer, Center punch, Vernier height gauge, Anvil, Brush, Bench drill machine, drill bits.

**PROCEDURE:**
- Take a metal slab having the above mentioned dimensions.
- With the help of vernier height gauge mark lines on metal slab.
- Punch the lines intersecting each other with the help of center punch.
- Clamp the work piece in the drill machine vice.
- Clamp a drill bit of 10mm diameter in the drill chuck.
- Place the work piece at the proper position for drilling.
- Make the holes of punched positions on the slab of 10 mm dia.
- In this process the outer corner holes are drilled by 15mm dia, which is called boring.
- In the final process the outer corner drilled holes are to be counter sunked by using 18 mm Drill bit, it is drilled on the outer corner edges only for counter sinking.

**SAFTY PRECAUTIONS:**
1. Use the leather gloves.
2. Always wear goggles, apron during the drilling.
3. Don’t touch the drill bit while drilling.
4. Before checking the jobs cool it.
5. Do not touch the chips without gloves.
3.2.7. MACHINE SHOP 3

Comprised of 1 instructor and 1 helper the machine Shop 3 enclosed the following machine tools.

i. Universal milling machine
ii. Shaper machine
iii. Surface grinding machine
iv. Universal tool grinder
v. Band sawing and filing machine

i. UNIVERSAL MILLING MACHINE
The universal milling machine in the machine shop 3 has a horizontally swivel bed and can be used in both vertical and horizontal milling arrangements. The detachable milling head is used when vertical milling is performed and can be turned vertically to mill at any other inclination.

Specifications:
Model NK-65 (1#)

Table
Working surface 210 * 950mm
Size and number of T-slots 16mm * 3
Table travel 520mm
Saddle travel 200mm
Knee travel 400mm
Number of table federates 6 steps
Range of table federates 0.136 ~ 0.922mm/rev
Table rapid travers rate 2,500mm/min

Spindle
Type of spindle nose N.T. No. 40
Number of spindle speeds 18 steps
Range of spindle speeds 50 ~ 1,500rpm

Motor
Main motor 1.5 Kw(6P)
Motor for rapid traverse 60w (12P)
Motor for coolant pump 40w (60Hz)60w (50Hz)
Machine height 1,430mm
Required floor space 1,300 * 2,000mm
Manufacturer IWASHITA INDUSTRIAL COMPANY LIMITED, JAPAN
ii. SHAPER MACHINE

A shaper contains a table on which the work piece is mounted. The linear movement of the cutting tool wipes away the excess material. This is exactly the opposite of what happens in the planning machine where the tool is fixed and the work piece is linearly moved a fully mechanical one and a hydraulic operated one.

The mechanical shaper has a constant speed prime mover which turns it to convert rotational movement of the prime mover into reciprocal motion of cutting tool.

SPECIFICATION

- Model: SUD - 650
- Max. stroke: 650mm
- Number of strokes: 8 ch 9 - 102
- Max. treating width: 650 mm
- Vertical movement distance of table: 310mm
- Size of table: 610 * 400 * 400
- Automatic feed volume of table: 7 ch 0.2 – 1.4 mm
- Vertical movement distance of blade stand: 200mm
- Max. opening between upper surf of table And lower surface of ram: 430mm
- Max. opening of vise: 350mm
- Width and depth of vise: 350 * 218
- Required horse power: 2.2Kw 4P
- Rough weight: 2.5 tons
Rotational Into Reciprocal Motion Conversion too

This arrangement allows quick return motion. Further more this allows feed rate change without any gear arrangement or control of speed of motor. This is done by varying the eccentricity e. The higher the e, the higher the feed rate is. A simple trade off of this feed rate control system is that as the feed rate is reduced, the stroke of the ram also gets reduced. The hydraulic type shaper does not have this problem and the feed rate and the stroke can be independently controlled. Manufacturer UCHIDA MACHINE INDUSTORY COMPANY LIMITED TOKYO, JAPAN.

iii. SURFACE GRINDING MACHINE

Specification:
Capacity
- Electrical magnetic chuck size: 600 * 300
- Max table longitudinal feed: 750
- Max saddle cross feed: 340
- Max distance spindle center to table surface: 520

Table
- Surface length * width: 650 * 340
- Hydraulic feed speed: 3 20m/min

Cross feed
- Max saddle cross feed: 340 mm

Vertical feed
- Max distance from spindle center to table: 520mm

Grinding wheel
- Rotation speed 60 Hz: 1700 rpm
- Size of grinding wheel: D*W*Bore 305*38*127mm

Motor
- Grinding spindle motor: 3.7 kw 4hp
- Floor space L*W*H: 2590*2050*1850
- Wt: 2300 kg
iv. **UNIVERSAL TOOL GRINDER**

**Specification:**
- Swing of workhead on table: 260mm
- Swing of tail stock on table: 220mm
- Longitudinal movement of table: 250 mm
- Distance between right and left tail stock center: 400mm
- Vertical movement of wheel head: 170mm
- Drive wheel dia: 305mm
- Butt welder capacity: 2KvA
- Power source: AC 400V 3 Phase 50hz
- Motor: 250w 220v Kw
- Net wt: 260kg
v. Band Sawing and Filling Machine

Specification:
Max thickness of work piece ------------------------- 180mm
Table size ------------------------------------------ 500m * 500mm
Table tilting angle --------------------------------- right n left 15 degree
Blade length ---------------------------------------- 2400mm
Blade width ---------------------------------------- 2 mm to 13mm
Drive wheel dia ------------------------------------- 305mm
Butt welder capacity ------------------------------- 2KvA
Power source -------------------------------------- AC 400V 3 Phase 50hz
Motor ---------------------------------------------- 0.75 Kw
Net wt --------------------------------------------- 320kg
An example of practical performed at machine shop-3

PRACTICAL

OBJECT:
Making V-Block according to the drawing on milling and shaper machine

APPARATUS:
Milling machine and shaper machine.

TOOLS & INSTRUMENTS:
Vernier caliper, Vernier height gauge, surface plate, Side cutter, shaper cutting tools.

MATERIAL:
MS rectangular block size (48.2 x 35.2 x 85.2 mm)

PROCEDURE:
1. Fix the work piece on shaper vice and finish all the faces according to the given dimensions 48 mm x 35 mm x 85 mm.
2. Now with the help of height gauge mark a center line on Surface plate.
3. Referring to center line mark two parallel lines on 19 mm Distance on both sides of center line.
4. Again clamp work piece on shaper machine vice and make a slot of 4 mm wide and 20 mm deep at the center of top surface.
5. Stop the machine and swing the tool head counter clock wise direction at the angle of 45° and then start machining till the required depth.
6. Again swing the tool head counter clock wise direction
7. At an angle of 45° start machining on other side of center till the required Depth.
8. Set the zero position of tool head and start the slotting until the 2 mm deep and 4 mm wide.
9. With help of surface plate and height gauge mark a slot of 10 mm wide 2 mm deep at the distance of 15 mm from top to bottom on both side of work piece.
10. Now mark a center on bottom surface then mark two parallel lines at the distance of 12 mm from center line.
11. Now clamp the work piece on milling machine, with the help of side milling cutter make a slot of 10 mm wide x 2 mm deep x 85 mm Long after, after completion repeat it on the other side.
12. Now make a slot of 24 mm deep on the bottom surface on whole length of the surface and remove sharp edges with the help of smooth File.

SAFETY PRECAUTIONS:
1. Do not check the sharpness of milling cutters with hands
2. Do not touch the cutter during machining.
3. Avoid over feeding which may cause the damage of Cutter and then accident may cause in result.
4. During machining on shaper do not come in front of Machine because the hot chips may cause serious injury.
5. Set the nozzle of coolant at proper position to avoid over heating of cutter and work piece.
6. Clean the marking on work piece which may an error.
Step 1

Step 2

Dimensional view

Step 3
3.2.8. Fabrication Shop

Comprised of 1 instructor and 1 helper the mentioned Shop enclosed the following machine tools.

- 2 power hacksaw
- Hydraulic press cutter
- 20 Bench vice
- Gauges
- Measuring instruments

Specification:

Model: Kilser 250
Max work round bar / square bar: 250mm / 225 mm
Bias cutting angle: 45 degree 120 mm
Saw blade: 450*38*1.65*6T*8.5 pi
Saw stroke /m: 90.130
Saw stroke distance: 100 150 mm
Motor: 1.5Kw 2Hp – 6p 200v
Size of machine: LWH (1250 * 430*880)
Net wt: 400kg
Square shearing machine

Specification :

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>MS – S44</td>
</tr>
<tr>
<td>Max shearing thickness</td>
<td>3.2 mm</td>
</tr>
<tr>
<td>Max shearing length</td>
<td>1300 mm</td>
</tr>
<tr>
<td>Stroke p/m</td>
<td>60</td>
</tr>
<tr>
<td>Upper blade angle</td>
<td>120</td>
</tr>
<tr>
<td>Blade type</td>
<td>single edge</td>
</tr>
<tr>
<td>Back guage type</td>
<td>BH</td>
</tr>
<tr>
<td>Lubricating</td>
<td>electrical oil pump</td>
</tr>
<tr>
<td>Required Horse power</td>
<td>3</td>
</tr>
<tr>
<td>Overall weight</td>
<td>2100 kg</td>
</tr>
</tbody>
</table>
Hand tools such as (flat rough file, flat smooth file, round file, half round file, hammer.) An example of study for the students is mentioned at mentioned shop:

**PRACTICAL**

**OBJECT:**
To study the common types of tools which are used in the workshop.

**INTRODUCTION:**
Large number of tools are used in workshop for laying out, measuring and marking etc. These tools are valuable to help in different jobs and operations. A person who works in workshop, must be known about these tools.

**TYPES:**

a. Surface Plate
b. Height Gauge
c. Scribers
d. Punches
e. Hammers
f. Dividers
g. Wrenches
h. Pliers
i. Screw Drivers
j. Bench Vice

a. **Surface Plate:**
A surface plate is very important and expensive piece of equipment used for marking, laying out and inspecting work pieces. The importance of surface plate is that it provides true, smooth, plain surfaces from which accurate measuring and marking may be made. These plates are made of either cast iron or granite.

b. **Height Gauge:**
Height gauge is used for measuring or in layout work for accurately scribing lines in relation to a given faces or surfaces. In using this tool caution must be exercise to see that reading are taken from the proper side of the blade. Different shapes of work pieces can easily be marked with the help of angle plate and V- blocks.

c. **Scribers:**
A scriber is sharp pointed steel tool used to scribe lines on metal work pieces. The scriber point usually made from carbon tool steel, hardened and tempered then honed on an oil stone to a needle point so it produce a fine sharp line. There are different types of scribers such as double end, plain, pocket and carbide point pocket scriber.

d. **Center Punch:**
It is use to mark indent the intersections of laying out lines to locate hole centers, and to provide a small center mark so a drill can be started in the exact location. A center punch point is grounded to a cylinder point having a 90° angle. A center punch is made of hardened tool steel.
e. Hammers:
The hammers are used in workshop for different purposes such as striking punches, chisels, riveting, bending, stretching, straitening etc. Hammers are available in many sizes and shapes and classified into two kinds:

i. Soft Hammer

ii. Hard Hammer

i) Soft Hammer: A soft hammer may have the entire head made of soft material such as lead, copper, brass, rubber, plastic etc. These are used for striking finished or semi finished surfaces of work pieces to prevent from any damaging, scratching or denting.

ii) Hard Hammer: A hard hammer is used for striking punches, cold chisels, steel letters and figures. It is also use for forging hot metal, riveting, bending, straitening, penning, stretching and swaging. These hammers are made of carbon steel and forged to shape and size. It is heat treated to make the striking faces hard. There are three types of hard hammers which are mostly used in work shops such as; straight-peen, ball-peen and cross-peen.

f. Dividers:
Dividers are used for measuring between points, for transferring or laying out distances, or for scribing arcs of circles. The legs of scriber usually round and drawn to a fine point; they are hinged at the head end on a hardened stud, the opening and closing of the legs being controlled by the knurled nut and the screw.

g. Wrenches:
A wrench is a tool for turning nuts or bolts. It is usually made of steel. There are many kinds of wrenches. They may consist of a slot, sockets, pins, moveable jaws for griping the nut, with the rest of the tool serving as a handle for applying the torque. The following are some of the wrenches use for assembling work.

⇒ Single ended wrench
⇒ Double ended wrench
⇒ Close end wrench
⇒ Adjustable wrench
⇒ Combination wrench
⇒ Check nut wrench
⇒ Lever jaw wrench
⇒ T-Socket wrench
⇒ Offset-socket wrench
⇒ Pipe wrench
⇒ Socket wrench
⇒ Allen-Key wrench

H. Plier:
Pliers are used for griping, holding, tightening and loosening, bending and cutting. There are many types of pliers such as;

Combination pliers: It can be use for various purposes e.g. bending, cutting and holding. The plastic and rubber covered handle pliers are used by electricians to protect them against dangerous shocks.

Flat-nose Pliers: Flat – Nose pliers are used for light bending work

Round-Nose Pliers: The round nose pliers are used for bending curved and round shapes like eyes in metal wire.
i. **Screw Driver:**

   The screw drivers are designed to turn the screws. The shank is made of steel with a wooden or plastic handle. Generally screw drivers are available in different shapes such as Philips Head screw driver, Offset screw driver, Flat head screw driver etc.

j. **Bench Vice:**

   In work shop a number of operation like filing, sawing, cutting, threads by hand, reaming and debarring are carried out by hand. Bench vise is most commonly used for holding jobs.
CHAPTER 4. MATERIAL AND CUTTING SPEED

Production of an item with desired qualities inherently involves the knowledge of the materials that should be used for the product and the qualities of them. A simple example is using stainless steel for a product that should not get stained. Furthermore the effective processing of these materials until a finished product is obtained requires the knowledge of processing characteristics of the materials. For example consider machining stainless steel. Some important points to be considered are:

- The tool material that should be used.
- The level of machining (i.e. rough or finish)
- The cutting speed
- Requirement of coolants

Cutting Speeds
Work piece Material Cast iron Mild Steel Malleable iron
Cast iron Bronze Aluminium Stainless steel Brass
Rough cut (ft/min) 50-60 40-50 80-110 45-60 110-150 400 100-120 200-300
HSS tools
Finish cut (ft/min) 80-110 65-90 110-130 70-90 150-180 700 100-120 200-300
Carbide tools
Rough cut (ft/min) 120-200 140-160 250-300 150-180 600 800 140-200 600-1000
Finish cut (ft/min) 350-400 250-300 300-400 200-250 1000 1000 240-360 600-1000
CHAPTER 5. ADMINISTRATION, MANAGEMENT AND WELFARE

5.1. UNDERSTANDING THE ATTITUDES OF EMPLOYEES

Understanding the attitudes of employees is one of the most important aspects an engineer should gain in his career. Collaborating with employees with different mentalities is inherently difficult. Some of the points that were possible to discover are listed below.

- Different employees have different expectations from their jobs:
  - Faithful earning to live the life.
  - Just earning money to live the life.
  - Earning some extra money.
  - Acquiring experience for a better job position.
  - Acquiring the name of the current working organization in his curriculum vitae for a better job.
- While coming to the work, employees come with different mentalities:
  - Fresh mind and pleasure to work.
  - Burdened mind and unpleasant to work.
  - Different personalities:
    - Living with the community.
    - Showing the existence.

5.2. JOB DISPATCHING AND ADMIRING THE WORK

Faithful job dispatching among the employees in the organization makes the environment pleasant for the employees to work and the administration becomes easier. In the Engineering Workshops job dispatching is done by the Workshop supervisor. Though the organization had excessive human resources and workmen were given less tasks than they could carry, in some cases it was seen that some workmen saying “I have been given more work than others”. Some even said, “Since I am the only person who knows the subject I am always burdened with the work”. It was interesting to find out whether they state the truth.

In response to these statements a secret survey was conducted. Four workmen were selected including the ones who said that they were burdened and their work was observed in intervals of 15 minutes for two days. The results showed that they just lie. Some were not even possible to find for hours. One just signed the attendance register in the morning and evening and did nothing at all. Not a single was found to work at least quarter the nominal time period.
On the other hand, persons in the tool stores were truly burdened with work. They had to serve others all the times. In fact they disliked working there. Whatever the case it was seen that workmen always tried to show the Workshops superintendent that they work. When the superintendent was not nearby, workmen did their work in lethargy. This was discussed and the final point was: “Yes, they want to show their boss that they work. Though a very little work is done, they are quite happy to be admired by me.” In any case, accepting feedback from the employees and acting on them necessarily upholds the productivity of any organization.

5.3. GUIDE LINES FOR BETTERMENT

In some places of the Engineering Workshops guidelines for improving the performance of workmen could be found. Among them the ones that most people did not follow and the ones that should be followed are listed below:

Keep your eyes on the man ahead – you may be called on to take his place someday. Read one or two of the technical magazines related to your line of work. It was unfortunate to say that most guidelines were in English and many workmen did not understand them. Furthermore a discussion with the Chairman revealed that earlier there were some sessions for the employees about implementing the Japanese S5 Concepts in the Workshops and they just died. Later he was seen refreshing it by dividing the Workshops area among the workmen and allocating each area to several employees to maintain the enclosed machines.

5.4. FREEDOM AND WELFARE SOCIETIES WITH POLITICS

In the Engineering Workshops several welfare societies could be found. The Engineering Workshops Welfare Society united all the workmen in the Engineering Workshops. Furthermore some welfare societies formed at the university level could be found. Unfortunately these societies were heavily based on the political parties of the country. Depending on the political party one likes, he may join the related society. Freedom is lost and people get framed with the political party they like.
CHAPTER 6. PROBLEMS AND DIFFICULTIES ENCOUNTERED

Several problems and difficulties that were encountered during the training are listed below.

⇒ Getting a job done by a lazy workmen:
⇒ Sometimes it was very difficult to find some workmen and get something done. Some workmen were inherently lazy and they seemed to be postponing their work giving various excuses. Following are some of their own words:
⇒ Now it is the teatime.
⇒ We will do it after the lunch.
⇒ Mr. X may be working in the machine now and ask him to do the work.
⇒ I will come soon.
⇒ Steeling tools:

Sometimes it was found that tools suddenly disappear from the Workshops. It was not possible to find the person who took them and it was usual to see people pointing others leading to unpleasant situations. Sometimes some workmen temporarily borrowed others’ equipment and later just left them in the place they worked without returning them. When they were asked about them it was common to get the answer “I kept it right here. Somebody seems to have taken it”.

⇒ Collaboration problems with the workmen:

People differ. Some wanted to do their job disregarding others’ jobs. On the other hand some just wanted to learn all the things in the Workshops doing nothing. Collaborating with them was difficult.
CHAPTER 7.

7.1. CONCLUSION

The profit of an organization entirely depends on the way the top chairs manage the resources the organization has. Whatever the other aspects may be, it was seen that managing human resource was extremely difficult. The stability or the sustainability of the organization mostly depends on this factor. On the other hand, it was prominently seen that thinking should precede doing. In most cases it could be seen that there exists easier or better ways to do something. As far as the above mentioned factor is considered, continuous knowledge mining followed by experience in a cycle upholds the entire system in every aspect. Earning and living a satisfactory life is the desire of all.

7.2. SUGGESTIONS FOR THE IMPROVEMENT OF THE ENGINEERING WORKSHOPS

The experiences I had in the Engineering Workshops suggest me the following to be implemented for the improvement of the place.

1. Maintain a simple booklet on materials that are used in the Engineering Workshops.
2. This should contain the properties and the processing aspects (cutting speeds, coolants, etc.)
3. Maintain a booklet on each machine about the capabilities of them and the current condition.
4. Implement a method to return the unused consumable goods to the stores.
5. Maintain a training program for the employees at least one session a month.
6. Teach the employees how to collaborate with others.

7.3. SUGGESTIONS FOR THE IMPROVEMENT OF TRAINING PROGRAM

A group of 14 undergraduates including myself had the first year in-plant training at the Faculty Workshop together and all of us did what we were supposed to do separately. Though we discussed what we were doing among ourselves a little, I feel it would have been better if we were explicitly encouraged by the Industrial Training Unit to had formal discussions at least once a week. Some of the undergraduates (I feel I was one of that group)
were seen to work harder gaining more knowledge and the real taste of engineering and some
were not. If discussions of this nature were conducted, all of us could have gained a better
knowledge and improved ourselves collectively. The participation of the training supervisor
would have been a further encourage. Furthermore I suggest that it would have been better if
all the undergraduates were exposed to some presentations on the in-plant training before we
were released. Some illustrative aspects of practical engineering could have been discussed
widening the openness of the eyes of us. Though we knew what engineering was, we were
not exposed to any sort of practical engineering when we went for the training.