POLITEKNIK MALAYSIA
MUKAH

PORTABLE TUNGSTEN GRINDER MACHINE

SAHFINA BINTI FAIZAN	20DKM15F1124
PUTERI AZWANI BINTI AHMAD	20DKM15F1118
EDDYWARD SUNUS	20DKM14F1096
MUHAMAD MARSHARULL FIRDAUS BIN OMAR	20DKM15F1128
AWANGKU MOHAMMAD SAIFULIZAN BIN AWANGKU ABDULLAH SIRIE	20DKM15F1125

PROJECT SUPERVISOR
ENCIK WAN JAMALILAIL BIN WAN MOHD ZEN

DEPARTMENT OF MECHANICAL ENGINEERING
POLITEKNIK MUKAH

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NAME	REG. NUMBER
1. SAHFINA BINTI FAIZAN	20DKM15F1124
2. PUTERI AZWANI BINTI AHMAD	20DKM15F1118
3. EDDYWARD SUNUS	20DKM14F1096
4. MUHAMAD MARSHARULL FIRDAUS BIN OMAR	20DKM15F1128
5. AWANGKU MOHAMMAD SAIFULIZAN BIN AWANGKU ABDULLAH SIRIE	20DKM15F1125

This report is submitted to the Department of Mechanical Engineering in partial fulfilment of the requirements for graduation Diploma in Mechanical Engineering

PROJECT REPORT VERIFICATION

This report entitled "**PROJECT TITLE**" has been submitted and reviewed as to meet the conditions and requirements of project writing.

Reviewed by:

Supervisor 1 : ENCIK WAN JAMALILAIL BIN WAN MOHD ZEN

Signature :

Date :

"We declare that this report is our own work except each piece that we have explained the source"

1. Signature :
   Name : SAHFINA BINTI FAIZAN
   Registration Number : 20DKM15F1124
   Date : 16 0CTOBER 2017

2. Signature :
   Name : PUTERI AZWANI BINTI AHMAD
   Registration Number : 20DKM15F1118
   Date : 16 OCTOBER 2017

3. Signature :
   Name : EDDYWARD SUNUS
   Registration Number : 20DKM14F1096
   Date : 16 OCTOBER 2017

4. Signature :
   Name : MUHAMAD MARSHARULL FIRDAUS BIN OMAR
   Registration Number : 20DKM15F1128
   Date : 16 OCTOBER 2017

5. Signature :
   Name : AWANGKU MOHAMMAD SAIFULIZAN AWANGKU ABDULLAH SIRIE
   Registration Number : 20DKM15F1125
   Date : 16 OCTOBER 2017

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ABSTRACT

Tungsten grinder machine that been create and produce is a tungsten electrode grinding machine that environmentally friendly way of preparing Tungsten electrodes for TIG welding. This machine is constructed with a unique disposable container which automatically collects all dust particles. There are two angle that always be used to sharpen the tungsten electrode this angle is to producing the high quality of the weld seams and improving productivity and prolonging the life of the electrode. Using this machine ,it is simple to produce the exact angle required and the grinding is carried out in the correct longitudinal direction along the electrode.

CHAPTER 1
INTRODUCTION

1.1 Project Background

Sharpening tungsten is one of the problems faced by mechanical student especially mechanical students in the three semesters. This is because the existing machine has no particular characteristic feature and the existing machine its main function is not designed specifically to sharpen tungsten. Therefore we intend to simplifies the process of tungsten wetting process by specifying the machine that can only sharpen tungsten and incorporates some safety elements and certain characteristic features such as ease of finding angular accuracy to weld and easy to lift and carry around welding area so that time can be saved.

1.2 Problem Statement

There are some problems that we have detected during sharpening the tungsten electrode. One of them is based on the design. The design of the existing tungsten sharpening machine has a high level of injury since its design has no such features of safety. It can be seen through the process of tungsten sharpening where hands are more likely to get injured because the wheel is not covered by anything. Secondly, it is difficult to get the right angle because the machine position that does not fit the body posture causes the tungsten sharpening process to be disturbed. Thirdly, the process of tungsten sharpening cannot be mixed with other substances because tungsten will be contaminated Lastly, the existing machine is designed not portable so the sharpening process is slower as the tungsten sharpening machine position is located far from the welding area.

1.3 Objective of Project

The objective of this project is:

a) To design a bench grinder machine that can sharpen TIG tungsten electrode.

b) To fabricate a bench grinder machine that can sharpen TIG tungsten electrode.

c) To achieve an angle 30 and 45 degree on tungsten electrode.

1.4 Scope of Project

The scope of this project is:

a) The tungsten grinder machine is limited to grind TIG tungsten electrode only

b) The tungsten grinder machine is specifically for Mechanical Workshop Practice 3 during TIG welding session.

c) To create a portable machine.

1.5 Expected Result

The expected result of this project is to produce a machine that can be used for Mechanical Workshop Practice 3 during TIG welding session. The machine is expected to get angle 30 and 45 degree on the tungsten electrode and user can avoid from accident while use this machine.

CHAPTER 2
LITERATURE REVIEW

2.1 Introduction

A literature review is a text of a scholarly paper, which includes the current knowledge including substantive findings, as well as theoretical and methodological contributions to a particular topic. Literature reviews are secondary sources, and do not report new or original experimental work. Most often associated with academic-oriented literature, such reviews are found in academic journals, and are not to be confused with book reviews that may also appear in the same publication. Literature reviews are a basis for research in nearly every academic field. A narrow-scope literature review may be included as part of a peer-reviewed journal article presenting new research, serving to situate the current study within the body of the relevant literature and to provide context for the reader. In such a case, the review usually precedes the methodology and results sections of the work. Producing a literature review may also be part of graduate and post-graduate student work, including in the preparation of a thesis, dissertation, or a journal article. Literature reviews are also common in a research proposal or prospectus (the document that is approved before a student formally begins a dissertation or thesis).

2.2. Theory of Tungsten Electrode

Tungsten is a rare metallic element used for manufacturing gas tungsten arc welding (GTAW) electrodes. The GTAW process relies on tungsten's hardness and high-temperature resistance to carry the welding current to the arc. Tungsten has the highest melting point of any metal, 3,410 degrees Celsius. These non-consumable electrodes come in a variety of sizes and lengths and are composed of either pure tungsten or an alloy of tungsten and other rare-earth elements and oxides. Choosing an electrode for GTAW depends on the base material type and thickness and whether you weld with alternating current (AC) or direct current (DC). Which one of three end preparations you choose, balled, pointed, or truncated, also is crucial in optimizing the results and preventing contamination and rework. Each electrode is color-coded to eliminate confusion over its type. The color appears at the tip of the electrode.

Pure Tungsten (Color Code: Green)-Pure tungsten electrodes (AWS classification EWP) contain 99.50 per cent tungsten, have the highest consumption rate of all electrodes, and typically are less expensive than their alloyed counterparts. These electrodes form a clean, balled tip when heated and provide great arc stability for AC welding with a balanced wave. Pure tungsten also provides good arc stability for AC sine wave welding, especially on aluminium and magnesium. It is not typically used for DC welding because it does not provide the strong arc starts associated with thoriated or ceriated electrodes.

Thoriated (Color Code: Red)-Thoriated tungsten electrodes (AWS classification EWTh-2) contain a minimum of 97.30 per cent tungsten and 1.70 to 2.20 per cent thorium and are called 2 per cent thoriated. They are the most commonly used electrodes today and are preferred for their longevity and ease of use. Thorium increases the electron emission qualities of the electrode, which improves arc starts and allows for a higher current-carrying capacity. This electrode operates far below its melting temperature, which results in a considerably lower rate of consumption and eliminates arc wandering for greater stability. Compared with other electrodes, thoriated electrodes deposit less tungsten into the weld puddle, so they cause less weld contamination. These electrodes are used mainly for specialty AC welding (such as thin-gauge aluminium and material less than 0.060 inch) and DC welding, either electrode negative or straight polarity, on carbon steel, stainless steel, nickel, and titanium. During manufacturing, thorium is evenly dispersed throughout the electrode, which helps the tungsten maintain its sharpened edge—the ideal electrode shape for welding thin steel—after grinding. Note: Thorium is radioactive; therefore, you must always follow the manufacturer's warnings, instructions, and the Material Safety Data Sheet (MSDS) for its use.

Ceriated (Color Code: Orange)-Ceriated tungsten electrodes (AWS classification EWCe-2) contain a minimum of 97.30 per cent tungsten and 1.80 to 2.20 per cent cerium and are referred to as 2 per cent ceriated. These electrodes perform best in DC welding at low current settings but can be used proficiently in AC processes. With its excellent arc starts at low amperages, ceriated tungsten has become popular in such applications as orbital tube and pipe fabricating, thin sheet metal work, and jobs involving small and delicate parts. Like thorium, it is best used to weld carbon steel, stainless steel, nickel alloys, and titanium, and in some cases it can replace 2 per cent thoriated electrodes. Ceriated tungsten has slightly different electrical characteristics than thorium, but most welders can't tell the difference. Using ceriated electrodes at higher amperages is not recommended because higher amperages cause the oxides to migrate quickly to the heat at the tip, removing the oxide content and nullifying its process benefits.

Lanthanated (Color Code: Gold)-Lanthanated tungsten electrodes (AWS classification EWLa-1.5) contain a minimum of 97.80 per cent tungsten and 1.30 parent to 1.70 per end lanthanum, or lanthana, and are known as 1.5 per cent lanthanated. These electrodes have excellent arc starting, a low burn off rate, good arc stability, and excellent reignition characteristics—many of the same advantages as ceriated electrodes. Lanthanated electrodes also share the conductivity characteristics of 2 per cent thoriated tungsten. In some cases, 1.5 per cent lanthanated can replace 2 per cent thoriated without having to make significant welding program changes. Lanthanated tungsten electrodes are ideal if you want to optimize your welding capabilities. They work well on AC or DC electrode negative with a pointed end, or they can be balled for use with AC sine wave power sources. Lanthanated tungsten maintains a sharpened point well, which is an advantage for welding steel and stainless steel on DC or AC from square wave power sources. Unlike throated tungsten, these electrodes are suitable for AC welding and, like ceriated electrodes, allow the arc to be started and maintained at lower voltages. Compared with pure tungsten, the addition of 1.5 per cent lanthana increases the maximum current-carrying capacity by approximately 50 per cent for a given electrode size.

Zirconiated (Color Code: Brown)-Zirconiated tungsten electrodes (AWS classification EWZr-1) contain a minimum of 99.10 per cent tungsten and 0.15 to 0.40

percent zirconium. A zirconiated tungsten electrode produces an extremely stable arc and resists tungsten spitting. It is ideal for AC welding because it retains a balled tip and has a high resistance to contamination. Its current-carrying capability is equal to or greater than that of thoriated tungsten. Under no circumstances is zirconiated recommended for DC welding.

Rare Earth (Colour Code: Grey)-Rare-earth tungsten electrodes (AWS classification EWG) contain unspecified additives of rare-earth oxides or hybrid combinations of different oxides, but manufacturers are required to identify each additive and its percentage on the package. Depending on the additives, desired results can include a stable arc in AC and DC processes, greater longevity than thoriated tungsten, the ability to use a smaller-diameter electrode for the same job, use of a higher current for a similar-sized electrode, and less tungsten spitting

Tungsten Preparation — Balled, Pointed, or Truncated-After selecting a type of electrode, the next step is to select an end preparation. The three choices are balled, pointed, and truncated.

Tungsten Diameter	Gas Cup Inside Diameter	Typical Current Range (amps)				
		DC	AC			
		DCEN	70% Penetration		(50/50) Balanced Wave AC	
		Ceriated, Thoriated, Lanthanated	Pure	Ceriated, Thoriated, Lanthanated	Pure	Ceriated, Thoriated, Lanthanated
0.040	#5 (5/16 in.)	15-15	20-60	15-80	10-30	20-60
0.060 (1/16 in.)	#5 (5/16 in.)	70-150	60-100	70-150	30-80	60-120
0.093 (3/32 in.)	#8 (1/2 in.)	150-250	100-160	140-235	0-130	100-180
0.125 (1/8 in.)	#8 (1/2 in.)	250-400	150-200	225-325	15-15	160-250

DCEN = Direct Current Electrode Negative (Straight Polarity)

Figure 2.2(a): The Typical Current Range

Typical current ranges for electrons with argon shielding. A balled tip generally is used on pure tungsten and zirconiated electrodes and is suggested for use with the AC process on sine wave and conventional square wave GTAW machines. To ball the end of the tungsten properly, simply apply the AC amperage recommended for a given electrode diameter (see Figure 1), and a ball will form on the end of the electrode. The diameter of the balled end should not exceed 1.5 times the diameter of the electrode (for example, a 1/8-in. electrode should form a 3/16-in.-diameter end). A larger sphere at the tip of the electrode can reduce arc stability. It also can fall off and contaminate the weld.

Preparing tungsten for DC electrode negative welding and AC with wave shaping power sources. A pointed and/or truncated tip (for pure tungsten, ceriated, lanthanide, and thoriated types) should be used for inverter AC and DC welding processes. To grind the tungsten properly, use a grinding wheel specially designated for tungsten grinding (to prevent contamination) and one that is made of Borazon® or diamond (to resist tungsten's hardness). Note: If you are grinding thoriated tungsten, make sure you control and collect the dust; have an adequate ventilation system at the grinding station; and follow the manufacturer's warnings, instructions, and MSDS.

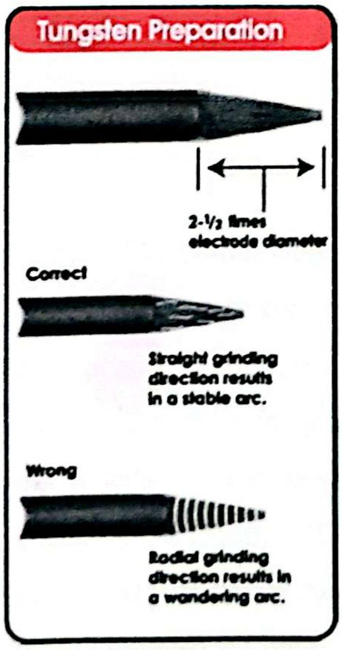


Figure 2.2 (b): The Degree Of Tungsten

Grind the tungsten straight on the wheel versus at a 90-degree angle (see Figure 2) to ensure that the grind marks run the length of the electrode. Doing so reduces the presence of ridges on the tungsten that could create arc wandering or melt into the weld puddle, causing contamination. Generally, you will want to grind the taper on the tungsten to a distance of no more than 2.5 times the electrode diameter (for example, for a 1/8-in. electrode, grind a surface 1/4 to 5/16 in. long). Grinding the tungsten to a taper eases the transition of arc starting and creates a more focused arc for better welding performance.

When welding with low current on thin material (from 0.005 to 0.040 in.), it is best to grind the tungsten to a point. A pointed tip allows the welding current to transfer in a focused arc and helps prevent thin metals, such as aluminium, from becoming distorted. Using pointed tungsten for higher-current applications is not recommended, because the higher current can blow off the tip of the tungsten and cause weld puddle contamination. For higher-current applications, it is best to grind a truncated tip. To achieve this shape, first grind the tungsten to a taper as explained previously, then grind a 0.010- to 0.030-in. flat land on the end of the tungsten. This flat land helps prevent the tungsten from being transferred across the arc. It also prevents a ball from forming.

2.3 Theory of TIG Welding

TIG welding is the designation TIG comes from USA and is an abbreviation of Tungsten Inert Gas. Tungsten - also called wolfram - is a metal with fusion point of more than 3300oC, which means more than double the fusion point of the metals which are usually welded. Inert Gas is the same thing as inactive gas, which means a type of gas that will not to combine with other elements. In Germany this method is called WIG welding, the W meaning wolfram. TIG welding is the international standardised designation for this welding method. According to DS/EN 24063 this welding process has number 141.

The Principle of TIG Welding-TIG welding is an electric arc welding process in which the fusion energy is produced by an electric arc burning between the work piece and the tungsten electrode. During the welding process the electrode, the arc and the weld pool are protected against the damaging effects of the atmospheric air by an inert shielding gas. By means of a gas nozzle the shielding gas is lead to the welding zone where it replaces the atmospheric air. TIG welding differs from the other arc welding processes by the fact that the electrode is not consumed like the electrodes in other processes such as MIG/MAG and MMA

The TIG Arc-As mentioned before the fusion energy in TIG welding is produced in the arc burning between the tungsten electrode and the work piece. The wire feeding can be done manually or mechanically. In DC TIG welding the tungsten electrode is usually connected to negative polarity and the work piece to positive polarity. According to the theory of electrons the negatively charged electrons and positively charged ions will migrate when the arc is ignited. The electrons will migrate from the negative pole to the positive pole while the ions will travel in the opposite direction. In the arc there will therefore be a collision between the electron and the ions and this collision produces heat energy.

The flow of electrons from the point of the electrode takes place at a very high speed and when it hits the work piece a substantial amount of heat energy is produced. When the flow of ions hits the point of the electrode there is not produced a similar amount of hear energy. The total produced heat energy is distributed by approx. 30% to the point of the electrode that is connected to the negative pole and approx. 70% to the work piece connected to the positive pole.

2.4 Theory of Grinding Wheel

Grinder Wheel is a wheel composed of an abrasive compound and used for various grinding (abrasive cutting) and abrasive machining operations. Such wheels are used in grinding machines. The wheels are generally made from a composite material consisting of coarse-particle aggregate pressed and bonded together by a cementing matrix (called the bond in grinding wheel terminology) to form a solid, circular shape. Various profiles and cross sections are available depending on the intended usage for the wheel.

They may also be made from a solid steel or Aluminium disc with particles bonded to the surface. Today most grinding wheels are artificial composites made with artificial aggregates, but the history of grinding wheels began with natural composite stones, such as those used for millstones. The manufacture of these wheels is a precise and tightly controlled process, due not only to the inherent safety risks of a spinning disc, but also the composition and uniformity required to prevent that disc from exploding due to the high stresses produced on rotation.

Grinding wheels are consumables, although the life span can vary widely depending on the use case, from less than a day to many years. As the wheel cuts, it periodically releases individual grains of abrasive, typically because they grow dull and the increased drag pulls them out of the bond. Fresh grains are exposed in this wear process, which begin the next cycle. The rate of wear in this process is usually very predictable for a given application, and is necessary for good performance. Characteristics of grinder wheels are:

a. There are five characteristics of a cutting wheel: material, grain size, wheel grade, grain spacing, and bond type. They are indicated by codes on the wheel's label
b. The abrasive aggregate is selected according to the hardness of the material being cut.
    i. Aluminium oxide (A) - Aluminium oxide is used for its hardness and strength. It is widely used as an abrasive, including as a much less expensive substitute for industrial diamond
    ii. Silicon carbide (S) - silicon carbide is a popular abrasive in modern lapidary due to the durability and low cost of the material. In manufacturing, it is used for its hardness in abrasive machining processes such as grinding
    iii. Cubic boron nitride (CBN) - widely used as an abrasive. Its usefulness arises from its insolubility in iron, nickel, and related alloys at high temperatures, whereas diamond is soluble in these metals to give carbides.
c. Grinding wheels with diamond or CBN grains are called super abrasives. Grinding wheels with aluminium oxide (corundum), silicon carbide, or ceramic grains are called conventional abrasives.
d. Grain size; from 8 (coarsest) to 1200 (finest), determines the average physical size of the abrasive grains in the wheel. A larger grain will cut freely, allowing

fast cutting but poor surface finish. Ultra-fine grain sizes are for precision finish work.

e. Wheel grade; From A (soft) to Z (hard), determines how tightly the bond holds the abrasive. A to H for softer structure, I to P for moderately hard structure and Q to Z for hard structure. Grade affects almost all considerations of grinding, such as wheel speed, coolant flow, maximum and minimum feed rates, and grinding depth.

f. Grain spacing; Spacing or structure, from 1 (densest) to 16 (least dense). Density is the ratio of bond and abrasive to air space. A less-dense wheel will cut freely, and has a large effect on surface finish. It is also able to take a deeper or wider cut with less coolant, as the chip clearance on the wheel is greater.

g. Wheel bond; how the wheel holds the abrasives; affects finish, coolant, and minimum/maximum wheel speed.

Table 2.4: The Type the Bond Name the, Bond Symbol And The Bond Description Of Wheel

Bond name	**Bond symbol**	**Bond description**
Vitrified	V	Glass-based; made via vitrification of clays and feldspars
Silicate	S	Silicate-based
Rubber	R	Made from natural rubber or synthetic rubber
Plated	P	Made by Electro / Electro less bonding of metal to hold abrasive
Oxy chloride	O	Made from an Oxo halide
Metal	M	Made from various alloys
Shellac	E	Shellac-based
Resinoid	B	Resin-based; made from plants or petroleum distillates

2.5 Summary of Chapter

At the end of this chapter we noted that not all the grinder suitable for grind a tungsten. There are three type of grinder can be used for grind tungsten which is diamond wheel, silicon carbide wheel and aluminium oxide wheel. But for our project we prefer to use silicon carbide because of many reasons we state.

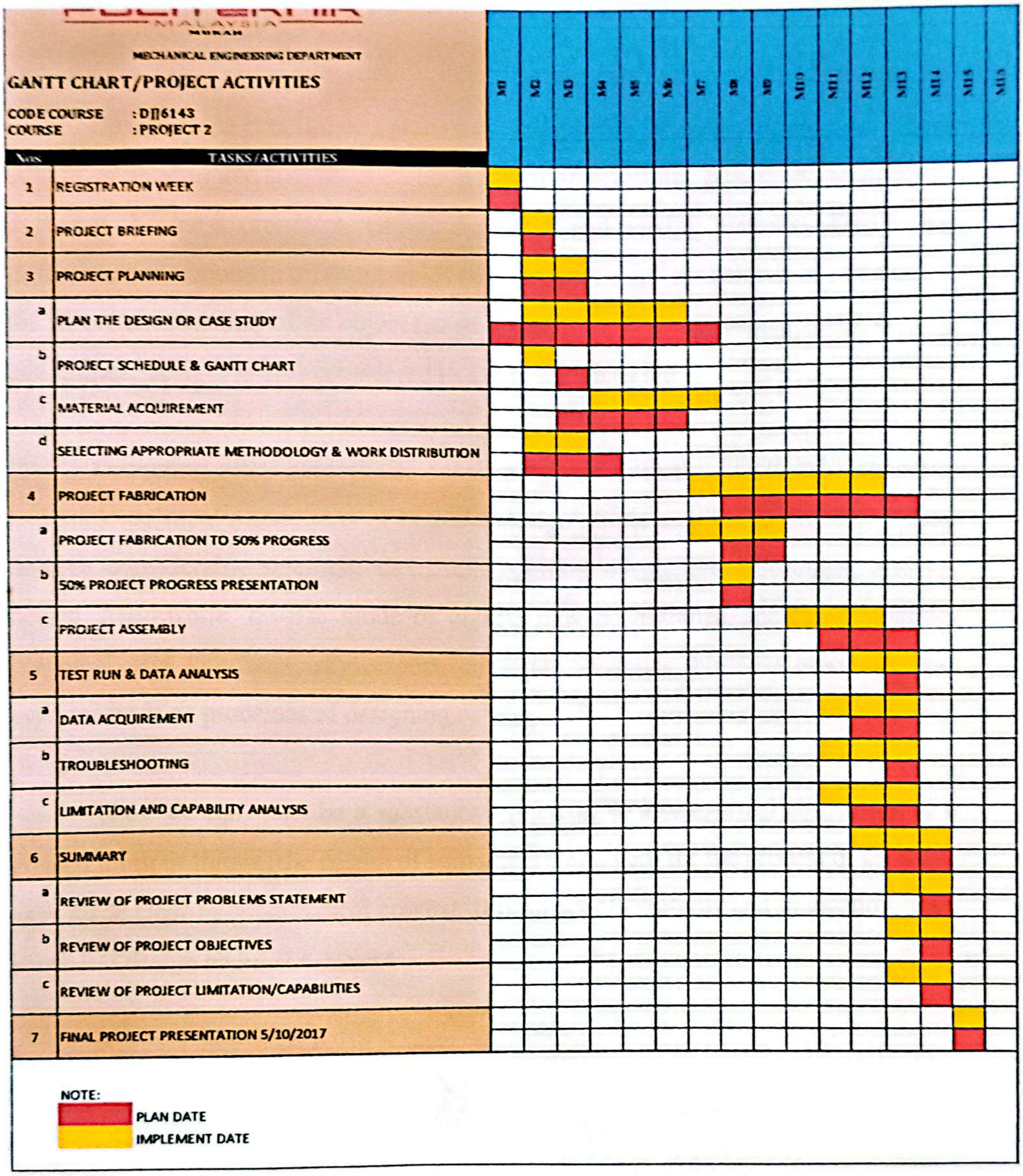
CHAPTER 3
METHODOLOGY

3.1 Introduction

Methodology is systematic theoretical analysis of methods applied to field of study. It comprises the theoretical analysis of the body of methods and principle associated with a branch of knowledge. Typically, it encompasses concepts such as paradigm, theoretical model, phases and quantitative or qualitative techniques. A methodology does not set out to provide solution-it is, therefore, not the same as a method. Instead, a methodology offers the theoretical underpinning for understanding which method, set of method, or best practice can be applied to specific case, for example, to calculate a specific result.

3.2 Project Planning (Flow Diagram)

Project planning is a procedural step in project management, where required documentation is created to ensure successful project completion. Documentation includes all actions required to define, prepare, integrate and coordinate additional plans. The project plan clearly defines how the project is executed, monitored, controlled and closed. Also project planning is part of project management, which relates to the use of schedules such as Gantt charts to plan and subsequently report progress within the project environment. Initially, the project scope is defined and the appropriate methods for completing the project are determined.



Figures 3.2: Gantt Chart

3.3 Project Design

Design is the creation of a plan or convention for the construction of an object, system or measurable human interaction (as in architectural blueprints, engineering drawings, business processes, circuit diagrams, and sewing patterns). Design has different connotations in different fields (see design disciplines below). In some cases, the direct construction of an object (as in pottery, engineering, management, coding, and graphic design) is also considered to use design thinking.

Designing often necessitates considering the aesthetic, functional, economic, and socio-political dimensions of both the design object and design process. It may involve considerable research, thought, modelling, interactive adjustment, and re-design. Meanwhile, diverse kinds of objects may be designed, including clothing, graphical user interfaces, skyscrapers, corporate identities, business processes, and even methods or processes of designing.

Thus "design" may be a substantive referring to a categorical abstraction of a created thing or things (the design of something), or a verb for the process of creation, as is made clear by grammatical context. It is an act of creativity and innovation. This is our last design about our project.

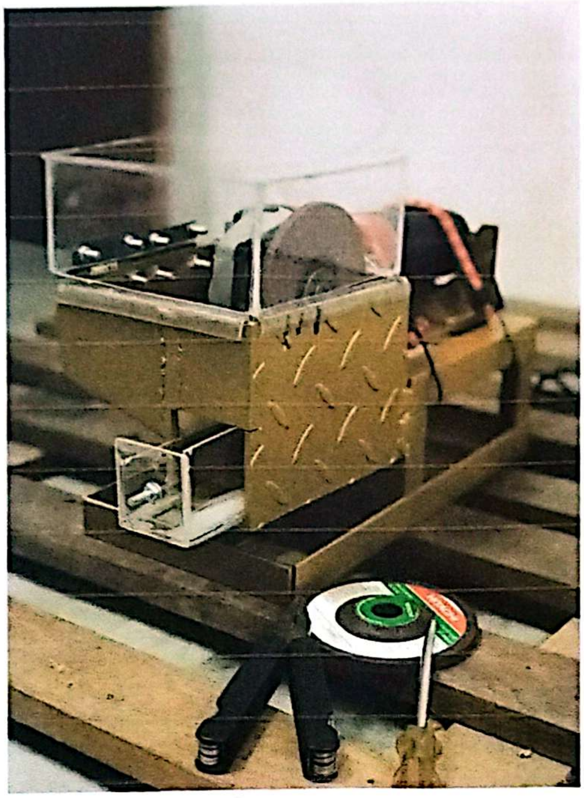


Figure 3.3: The design project

3.3.1 Design Flow Process

A flowchart is a type of diagram that represents an algorithm, workflow or process, showing the steps as boxes of various kinds, and their order by connecting them with arrows. This diagrammatic representation illustrates a solution model to a given problem. Flowcharts are used in analysing, designing, documenting or managing a process or program in various fields.

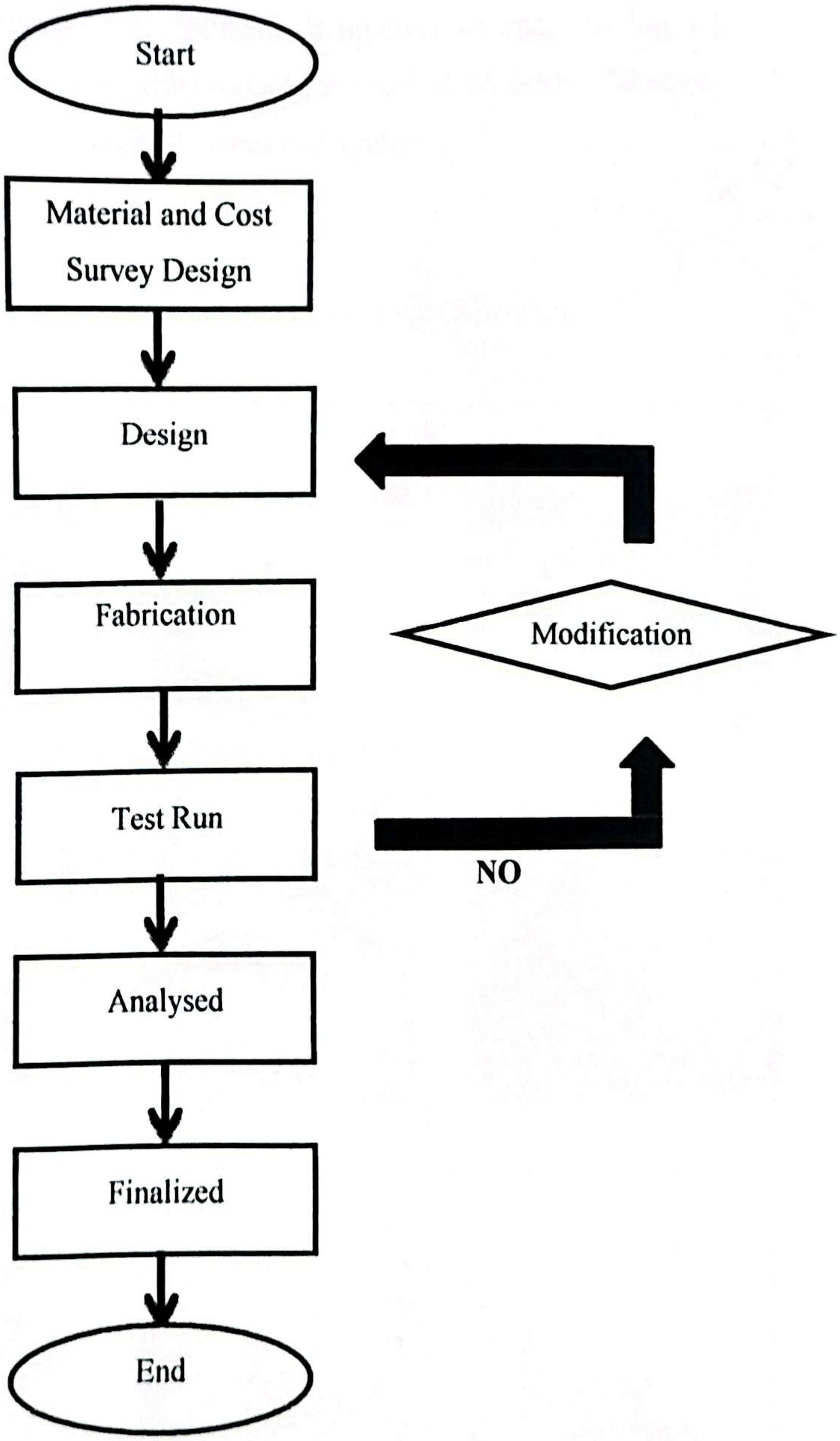
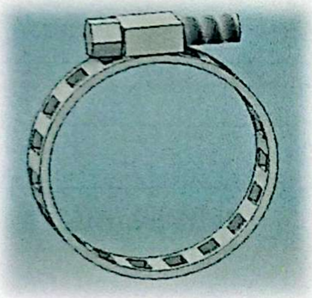
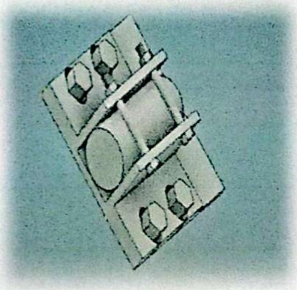
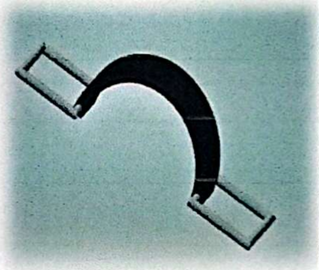
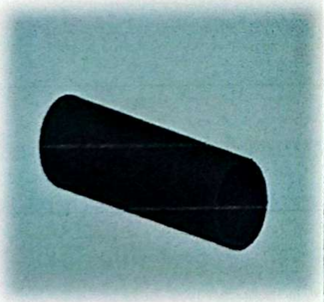
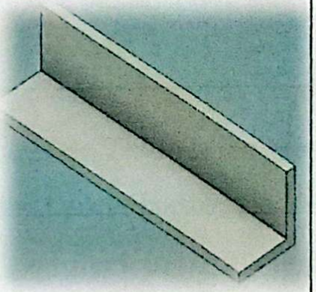
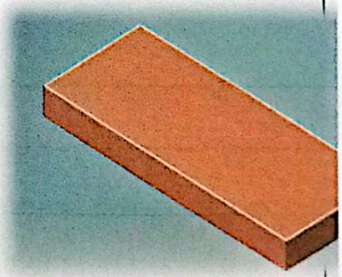
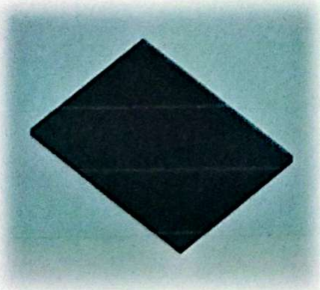
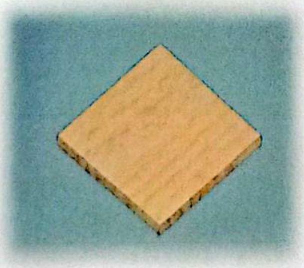
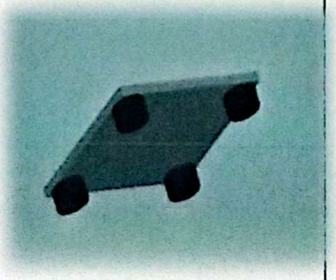
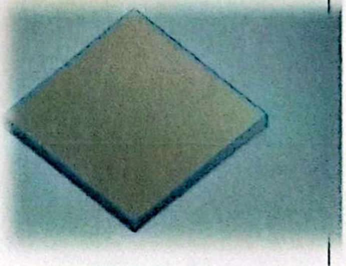


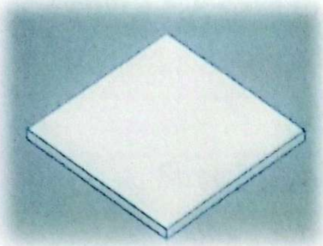
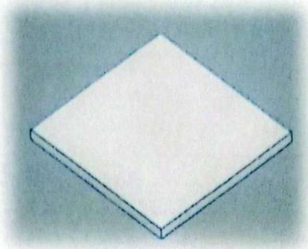
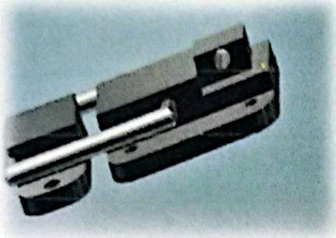
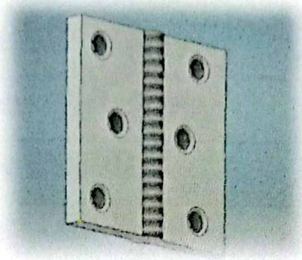
Figure 3.3 1: The flow chart of project

3.3.2 Concept Generation

Conceptual Design is an umbrella term given to all forms of non-aesthetic design management disciplines. It is an early phase of the design process, in which the broad outlines of function and form of s are articulated. It includes the design of interactions, experiences, processes and strategies. It involves an understanding of people's needs - and how to meet them with products, services, & processes. Common artefacts of conceptual design are concept sketches and models.

Table 3.3.2: List of Design and Material by Concept Generation

PART	1	2	3
Grinder holder			
Frame			
Casing			
Base			

Upper casing			
Upper lock			

3.3.3 Design Consideration

a. Cost

The total cost of all of the components needed to implement the design must fall within the department determined budget. There is the possibility of contributions to the project from outside investors if the budget is exceeded, as well as costs that can be avoided by salvaging parts. Being that there are no commercial products of this type, there is no comparable basis for how much this project should cost.

Table 3.3.3: Cost to Produce Tungsten Grinder Machine

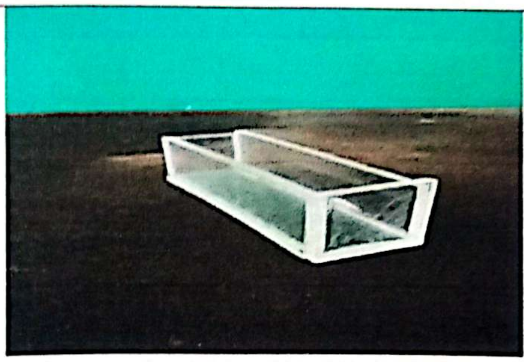
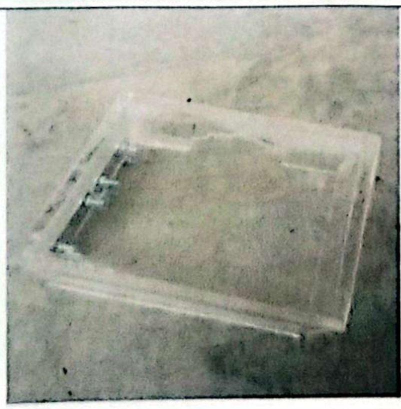
	Type	Cost(RM)
1	Stretch Cords 2S W90CM	2.10
2	Bolts , Screws And Nuts • M8×1.0×25MM High Tensile Bolts • M10×1.25×25MM High Tensile Hex Bolt • PH Machine Screw (Plated) M5×15 • PH Machine (Plated) M5 • M8×1.0 High Tensile Nut • M10×1.25 High Tensile Nut • Hinges 2 Inch Black • Screw Eyes #6 • SS Bolt & Nut M6×14MM 4S • M/S Bolt & Nut BSW ½ Inch × 11 Inch	30.00
3	Angle Iron	30.00
4	Hand Grinder (KEN 97100249042015)	101.89
5	Plate 2×2	80.00
6	Black Hinges 2 inch	2.00
7	Devcon 2 Ton Epoxy-Clear S35	13.50
8	Perspex 2mm	20.00
Amount	RM 279.49	

3.4 Material Selection

Material used is based on the machine size and suitable with machine utilization. In the below is prototype formation of the main parts of machine is as follows:

Table 3.4: Prototype Formation of the Main Parts of Machine

Table 3.4: Prototype Formation of the Main Parts of Machine

Tungsten Grinder Machine	
NAME	MATERIAL
Main Body	
Drawer	
Cover	
Casing	

Hand Grinder	
Product	

Figure 3.4: Prototype Formation of the Main Parts of Machine

3.5 Summary of Chapter

At this chapter, we know that all the process to complete this project is based on the Gantt chart. The design we used is based on the concept generation that we have choose. Then, the process of build the prototype formation we have use many material to achieved the objectives.

CHAPTER 4
FINDING AND DATA ANALYSIS

4.1 INTRODUCTION

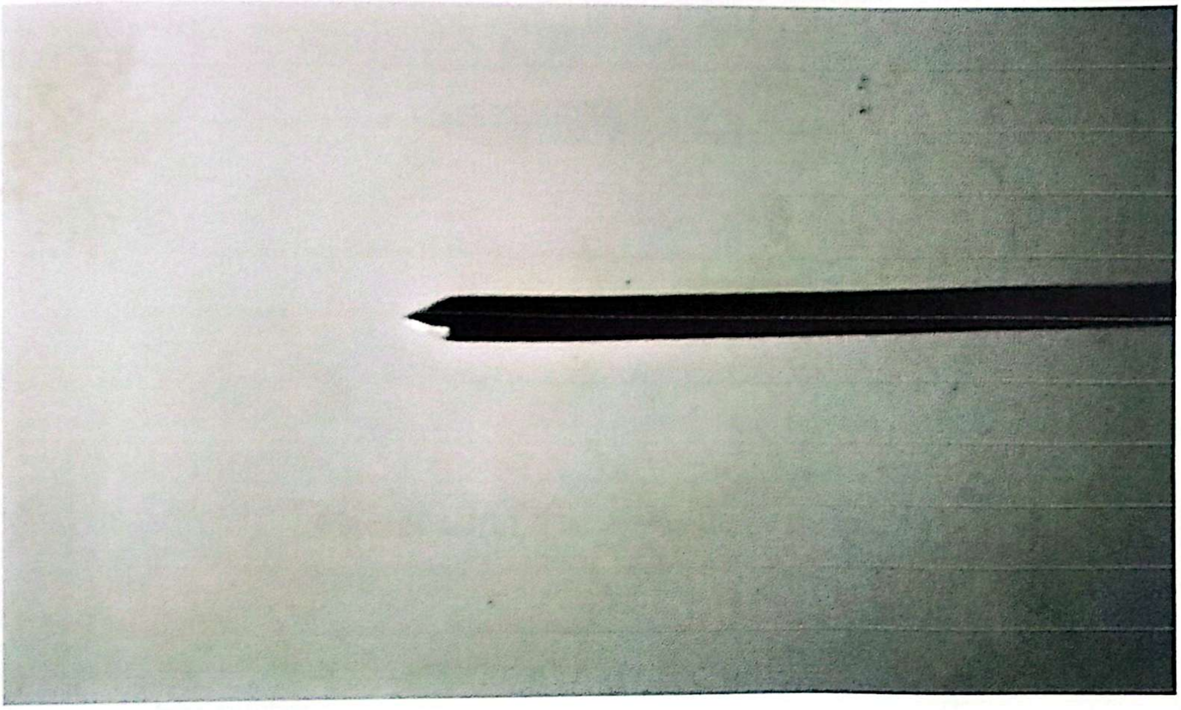
In this chapter will discuss the result obtained form the making of this project. Upon completion of this project findings and analysis should be recorded and analysed in describing manufacturing principles of tungsten grinder machine. There are many techniques in order to finish the project. Every member has been given their own task based on their experienced or skill. This is important so that the project is done on time. Besides that, it is a must for us to have safety while doing any work in workshop. The analysis is conducted to make sure the objective is achieved and the progress of doing the project is based on Gantt Chart that has been made.

4.2 Safety

In this project, safety is important. The design of this machine is emphasizing safety because the available machine is not design with safety.The design of the existing tungsten sharpening machine has a high level of injury since its design has no such features of safety. It can be seen through the process of tungsten sharpening where hands are more likely to get injured because the wheel is not covered by anything.

4.3 Test Run

We do test run to test either we achieved the objectives or not. Our test run is do to get 30 degree and 45 degree for the tungsten electrode. Below is the result for the test run:



Figures 4.3(a): The result for 45 degree

CHAPTER 5
DISCUSSION

5.1 Introduction

Upon successful completion of this project, meetings were held to present and discuss existing problems related to the project has been carried out. It is intended to ensure that the project objectives can be achieved by fully or the ensure the desired objectives are fully achieved and a level that can be implemented. From the project that has been carried out its gives a lot of benefit to the student. A good security features is concerned so that there no problem occurred during test run.

5.2 Identifying Problem

There are some problem occurs during the completion of our project. The problem is as stated below:

a. The thickness of Perspex that used for drawer is not suitable which 5mm is.
b. The material of machine's head cover is hard to weld because of the thickness is not suitable for that welding.
c. The slot of angle of 45 degree is difficult to create
d. The vibration of hand grinder when operation process.

5.3 Problem Solution

a. Change the thickness of Perspex for drawer and we decide to use the thickness of 2mm
b. The material for head cover we have change and use diamond plate also change the welding type which is we use the SMAW rather than TIG.
c. We have change the slot of angle and we decide to use 40 degree
d. The hand grinder is cover by rubber to less the vibration.

5.4 Discussion

We discuss that our project to achieved the objectives and to solve the problem statement which is first about safety. The safety of the machine is important to avoid any accident during process sharpening tungsten or change the wheel. Then is about difficult to get an angle which is 30 degree and 45 degree. So our machine can produce an angle.

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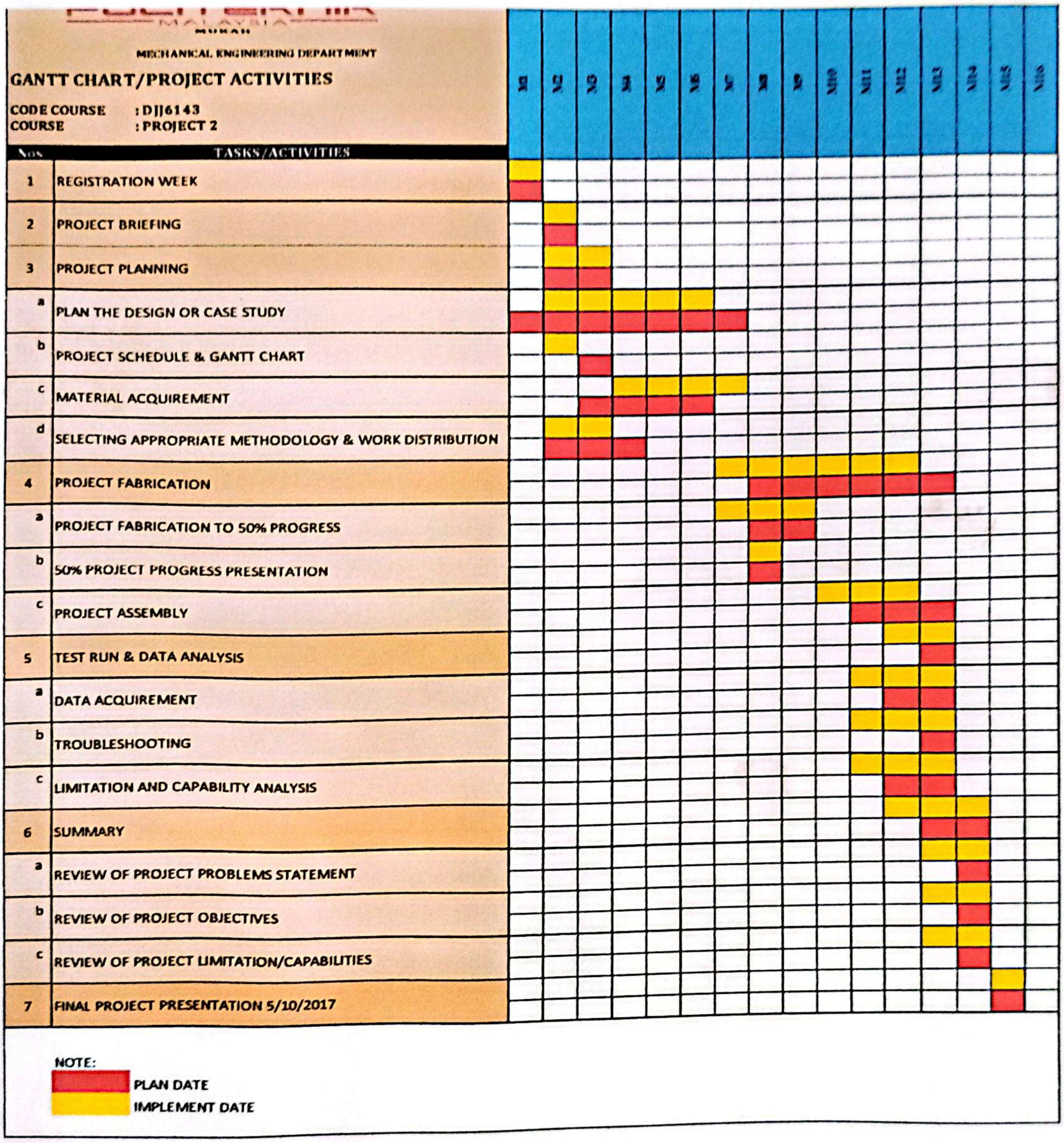
APPENDIX

Project cost

	Type	Cost(RM)
1	Stretch Cords 2S W90CM	2.10
2	Bolts , Screws And Nuts • M8×1.0×25MM High Tensile Bolts • M10×1.25×25MM High Tensile Hex Bolt • PH Machine Screw (Plated) M5×15 • PH Machine (Plated) M5 • M8×1.0 High Tensile Nut • M10×1.25 High Tensile Nut • Hinges 2 Inch Black • Screw Eyes #6 • SS Bolt & Nut M6×14MM 4S • M/S Bolt & Nut BSW ½ Inch × 11 Inch	30.00
3	Angle Iron	30.00
4	Hand Grinder (KEN 97100249042015)	101.89
5	Plate 2×2	80.00
6	Black Hinges 2 inch	2.00
7	Devcon 2 Ton Epoxy-Clear S35	13.50
8	Perspex 2mm	20.00
Amount	RM 279.49	

Gantt Chart


MECHANICAL ENGINEERING DEPARTMENT
GANTT CHART/PROJECT ACTIVITIES
CODE COURSE : DJJ6143
COURSE : PROJECT 2
TASKS/ACTIVITIES
M1
M2
M3
M4
M5
M6
M7
M8
M9
M10
M11
M12
M13
M14
M15
M16
1 REGISTRATION WEEK
2 PROJECT BRIEFING
3 PROJECT PLANNING
a PLAN THE DESIGN OR CASE STUDY
b PROJECT SCHEDULE & GANTT CHART
c MATERIAL ACQUIREMENT
d SELECTING APPROPRIATE METHODOLOGY & WORK DISTRIBUTION
4 PROJECT FABRICATION
a PROJECT FABRICATION TO 50% PROGRESS
b 50% PROJECT PROGRESS PRESENTATION
c PROJECT ASSEMBLY
5 TEST RUN & DATA ANALYSIS
a DATA ACQUIREMENT
b TROUBLESHOOTING
c LIMITATION AND CAPABILITY ANALYSIS
6 SUMMARY
a REVIEW OF PROJECT PROBLEMS STATEMENT
b REVIEW OF PROJECT OBJECTIVES
c REVIEW OF PROJECT LIMITATION/CAPABILITIES
7 FINAL PROJECT PRESENTATION 5/10/2017
NOTE:
PLAN DATE
IMPLEMENT DATE

Project Design and Product