DEVELOPMENT OF MULTIPURPOSE TREE LAMP

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SUPERVISOR'S DECLARATION

I hereby declare that I have checked this project and in my opinion this project is satisfactory in terms of scope and quality for the award of Diploma in Mechanical Engineering

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STUDENT'S DECLARATION

I hereby declare that the work in this report is my own except for quotations and summaries which have been duly acknowledged. The report has not been accepted for any diploma and is not concurrently submitted for award of other diploma.

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ABSTRACT

This report presents about multipurpose tree lamp that usually used for decorating especially at home. This is the device which important in order to provide light, and decoration in our home. Besides that, it also has other function like hook where it used to hold something small and lightweight. The idea of the fabricate for this lamp is based on student's creativity. The selection of suitable materials in the fabricating of this lamp is a loaded material which has ease to form, long life-span and can detain heavy load. Materials are used for the fabrication of the lamp is a round hollow steel.

ABSTRAK

Laporan ini membentangkan tentang lampu pokok pelbagai guna yang selalunya digunakan untuk perhiasan terutamanya di dalam rumah. Lampu merupakan suatu perkakas yang penting untuk menyediakan pengcahayaan, dan perhiasan di dalam rumah. Idea pembentukan lampu ini berdasarkan kreativiti pelajar sendiri. Pemilihan bahan yang sesuai untuk digunakan bagi pembentukkan lampu ini merupakan bahan yang mudah dibentuk, mempunyai jangka hayat yang tahan lama dan boleh menahan beban yang berat. Bahan yang dicadangkan untuk pembentukkan lampu ini merupakan material jenis "*round hollow steel*".

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LIST OF SYMBOLS

e	Strain	
σ	Stress	(N/m^2)
E	Young's Modulus = σ /e	(N/m^2)
y	Distance of surface from neutral surface	(m)
R	Radius of neutral axis	(m)
I	Moment of Inertia	(m^4)
Z	Section modulus = I/y_{max}	(m^3)
M	Moment	(Nm)
W	Total load on beam	(N)
F	Concentrated force on beam	(N)
S	Shear Force on Section	(N)
L	Length of beam	(m)
x	Distance along beam	(m)

LIST OF ABBREVIATIONS

AL	Aluminium
AISI	The American Iron and Steel Institute
ASTM	American Society for Testing and Materials
CAD	Computer Aided Design
MIG	Metal Inert Gas Welding
PPE	Personal Protective Equipment
UHMWPE	Ultra high molecular weight polyethylene
SMAW	Shielded metal arc welding
UMP	Universiti Malaysia Pahang

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

This chapter explained about the project objectives, project background, project scope, and problem statement that been conducted.

1.2 BACKGROUND

Lamp is a very important thing in human life. There are many types of lamp such as study lamp, floor lamp, tree lamp and so on. For the different type of lamps there are have a different shapes, sizes, and functions. For example study lamp have a small size and use by student to study compare to tree lamps it is have large size, shape like a tree and usually use for decorating.

1.3 PROBLEM STATEMENT

(i) Lack of decoration lamps with multifunction.

(ii) The lamp only suitable for certain place

(iii) Lots of previous lamp waste the electricity because cannot control the level of brightness

1.4 OBJECTIVE

The objective of this project is to develop and fabricate the multipurpose tree lamp.

1.5 SCOPE

This project will be limited within the following scopes, which are:

(i) Focused on the design of multipurpose tree lamp.

(ii) Focused on fabricate tree lamp for decorating.

(iii) Focused on indoor use.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

The purpose of this chapter is to provide a review of past research efforts related to multipurpose tree lamp. A review of other relevant research studies is also provided. Substantial literature has been studied on history, types of lamp and material needed.

2.2 TYPE OF LAMP

2.2.1 Table Lamps

Table lamps provide local light that is warm, cozy, and intimate, and also provide focal points throughout a room. Table lamps comprise a base or stand that supports the bulb holder and bulb, and have a cord that delivers power to the source. The bulb is shaded, and the shade itself is what controls the distribution of the light. [1]

Figure 2.1: Table lamp

Source: Lovely lamps (2008)

2.2.2 Floor Lamps

A floor lamp comprises a stand that supports the bulb holder and bulb, which is shaded to distribute light. Like table lamps, floor lamps cast a warm, ambient, cozy glow, and are also good for delivering local light to a couch or chair. The shape and thickness of the shade controls the distribution of light. [1]

Figure 2.2: Floor lamp

Source: Lighting store (2009)

2.2.3 Task Lamps

Task lights, also called work or reading lamps, focus light directly where it is needed. The light is directional and glare-free. Most task lights have jointed, sprung arms that are both stable and flexible. [1]

Figure 2.3: Task lamp

Source: Harrington lights(2006)

2.2.4 Track lighting

Track lighting is a form of spotlighting, in which a track allows a number of different lights to be connected along its length and manipulated for the right effect. The track carries the electrical current, and the lights are plugged in using a special connector. [1]

Figure 2.4: Track lighting

Source: Indoor lighting (2007)

2.2.5 Tree Lamps

Tree lamp usually uses as a decoration lamp. It called as a tree lamp because the shape of lamp more like tree where it has two or more bulbs.

Figure 2.5: Tree lamp

Source: Espritcabane (2007)

2.3 TYPE OF MATERIAL

2.3.1 Wood

Wood is an organic material; in the strict sense it is produced as secondary xylem in the stems of trees (and other woody plants). In a living tree it transfers water and nutrients to the leaves and other growing tissues, and has a support function, enabling woody plants to reach large sizes or to stand up for themselves. However, wood may also refer to other plant materials with comparable properties, and to material engineered from wood, or wood chips or fiber.

People have used wood for millennia for many purposes, primarily as a fuel or as a construction material for making houses, tools, weapons, furniture, packaging, artworks, and paper. Wood can be dated by carbon dating and in some species by dendrochronology to make inferences about when a wooden object was created. The year-to-year variation in tree-ring widths and isotopic abundances gives clues to the prevailing climate at that time. [2]

Figure 2.6: Body lamp make from wood

Source: Home spun lighting (2008)

2.3.2 Plastics

Plastic is the general common term for a wide range of synthetic or semisynthetic organic amorphous solid materials suitable for the manufacture of industrial products. Plastics are typically polymers of high molecular weight, and may contain other substances to improve performance and reduce costs. [3]

Figure 2.7: Body lamp make from plastic

Source: Rustic home lighting (2007)

2.3.3 Glass

Glass generally refers to hard, brittle, transparent material, such as those used for windows, many bottles, or eyewear. Examples of such solid materials include, but are not limited to, soda-lime glass, borosilicate glass, acrylic glass, sugar glass, Muscovy-glass, or aluminium oxynitride. In the technical sense, glass is an inorganic product of fusion which has been cooled through the glass transition to a rigid condition without crystallizing. Many glasses contain silica as their main component and glass former. [4]

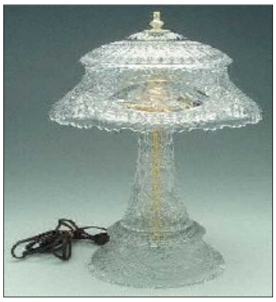


Figure 2.8: Lamp make from glass

Source: Design flute (2008)

2.3.4 Steel

Steel is an alloy consisting mostly of iron, with a carbon content between 0.2% and 2.1% by weight, depending on the grade.Carbon and other elements act as a hardening agent, preventing dislocations in the iron atom crystal lattice from sliding past one another. Varying the amount of alloying elements and form of their presence in the steel (solute elements, precipitated phase) controls qualities such as the hardness, ductility, and tensile strength of the resulting steel. Steel with increased carbon content can be made harder and stronger than iron, but is also more brittle. [5]

Figure 2.9: Lamp make from steel

Source: Indoor lighting (2007)

2.4 WELDING

Welding is a fabrication or sculptural process that joins materials, usually metals or thermoplastics, by causing coalescence. This is often done by melting the work pieces and adding a filler material to form a pool of molten material (the *weld pool*) that cools to become a strong joint, with pressure sometimes used in conjunction with heat, or by itself, to produce the weld. This is in contrast with soldering and brazing, which involve melting a lower-melting-point material between the work pieces to form a bond between them, without melting the work pieces.

Many different energy sources can be used for welding, including a gas flame, an electric arc, a laser, an electron beam, friction, and ultrasound. While often an industrial process, welding can be done in many different environments, including open air, under water and in outer space. Regardless of location, however, welding remains dangerous, and precautions must be taken to avoid burns, electric shock, eye damage, poisonous fumes, and overexposure to ultraviolet light. [6]

Figure 2.10: Welding process

Source: Wikipedia (1995)

2.4.1 Arc Welding

One of the most common types of arc welding is shielded metal arc welding (SMAW), which is also known as manual metal arc welding (MMA) or stick welding. Electric current is used to strike an arc between the base material and consumable electrode rod, which is made of steel and is covered with a flux that protects the weld area from oxidation and contamination by producing CO_2 gas during the welding process. The electrode core itself acts as filler material, making separate filler unnecessary.

The process is versatile and can be performed with relatively inexpensive equipment, making it well suited to shop jobs and field work. An operator can become reasonably proficient with a modest amount of training and can achieve mastery with experience. Weld times are rather slow, since the consumable electrodes must be frequently replaced and because slag, the residue from the flux, must be chipped away after welding. Furthermore, the process is generally limited to welding ferrous materials, though special electrodes have made possible the welding of cast iron, nickel, aluminum, copper, and other metals. Inexperienced operators may find it difficult to make good out-of-position welds with this process. [6]

2.4.2 MIG Welding

MIG (Metal Inert Gas) or as it even is called GMAW (Gas Metal Arc Welding) uses an aluminum alloy wire as a combined electrode and filler material. The filler metal is added continuously and welding without filler-material is therefore not possible. Since all welding parameters are controlled by the welding machine, the process is also called semi-automatic welding.

The MIG-process uses a direct current power source, with the electrode positive (DC, EP). By using a positive electrode, the oxide layer is efficiently removed from the aluminum surface, which is essential for avoiding lack of fusion and oxide inclusions. The metal is transferred from the filler wire to the weld bead by magnetic forces as small droplets, spray transfer. This gives a deep penetration capability of the process and makes it possible to weld in all positions. It is important for the quality of the weld that the spray transfer is obtained. [6]

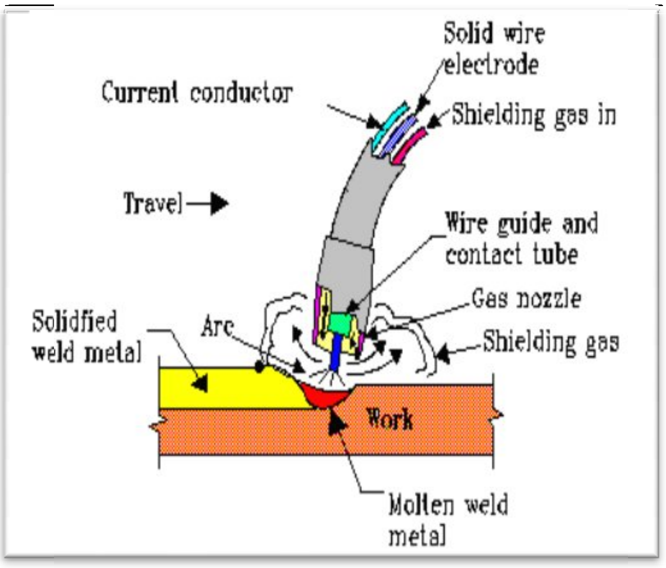


Figure 2.11: Schematic of Metal Inert Gas (MIG) Welding

Source: Wikipedia (1995)

2.5 BENDING PROCESS

Bending is a process by which metal can be deformed by plastically deforming the material and changing its shape. The material is stressed beyond the yield strength but below the ultimate tensile strength. The surface area of the material does not change much. Bending usually refers to deformation about one axis.

Bending is a flexible process by which many different shapes can be produced. Standard die sets are used to produce a wide variety of shapes. The material is placed on the die, and positioned in place with stops and gages. It is held in place with hold-downs. The upper part of the press, the ram with the appropriately shaped punch descends and forms the v-shaped bend.

Bending is done using Press Brakes. Press Brakes normally have a capacity of 20 to 200 tons to accommodate stock from 1m to 4.5m (3 feet to 15 feet). Larger and smaller presses are used for specialized applications. Programmable back gages, and multiple die sets available currently can make for a very economical process. [7]

Figure 2.12: Bending machine

Source: Lab FKM (2008)

2.6 DRILLING

Drilling is easily the most common machining process. One estimate is that 75% of all metal-cutting material removed comes from drilling operations. Drilling involves the creation of holes that are right circular cylinders. This is accomplished most typically by using a twist drill, something most readers will have seen before. The chips must exit through the flutes to the outside of the tool. As can be seen in the figure, the cutting front is embedded within the work piece, making cooling difficult. The cutting area can be flooded, coolant spray mist can be applied, or coolant can be delivered through the drill bit shaft. [8]

2.6.1 Drill Press

A typical manual drill press is shown in the figure below. Compared to other powered metal cutting tools, a drill press is fairly simple, but it has evolved into a versatile necessity for every machine shop. [8]

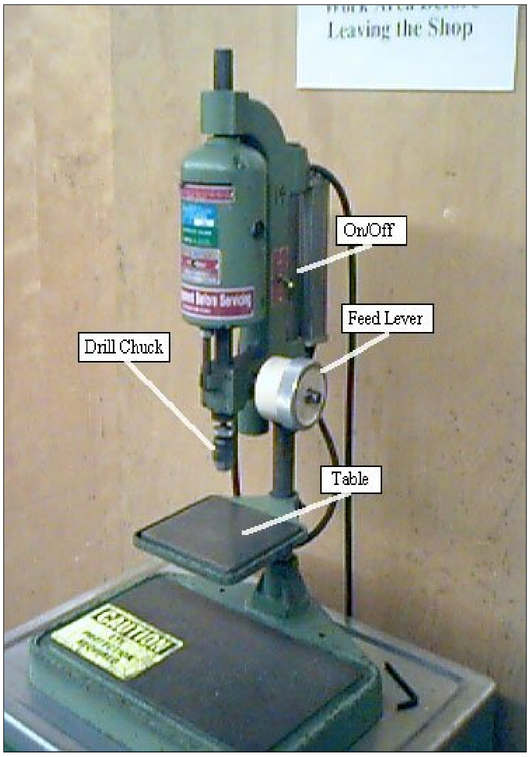


Figure 2.13: Drill Press Machine

Source: Wikipedia (1997)

2.7 GRINDING PROCESS

Grinding is a finishing process used to improve surface finish, abrade hard materials, and tighten the tolerance on flat and cylindrical surfaces by removing a small amount of material. Information in this section is organized according to the subcategory links in the menu bar to the left.

In grinding, an abrasive material rubs against the metal part and removes tiny pieces of material. The abrasive material is typically on the surface of a wheel or belt and abrades material in a way similar to sanding. On a microscopic scale, the chip formation in grinding is the same as that found in other machining processes. The abrasive action of grinding generates excessive heat so that flooding of the cutting area with fluid is necessary. [9]

Figure 2.14: Hand grinder

Sources: Tradevv, Grinder (2005)

CHAPTER 3

METHODOLOGY

3.1 INTRODUCTION

This chapter discusses about all the information and data that required and fabrication process for this project. Firstly, to designing the multipurpose tree lamp skill in drawing and time is required. This kind of data is required to design the concept of tree lamp

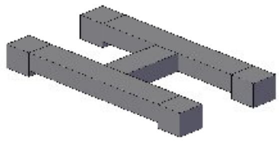
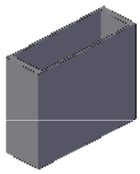
3.2 DESIGN

3.2.1 Concept Generation

Table 3.1: Concept generation

	1	2	3
A (Main part)			

Table3.1: Continued

	1	2	3
B (Base material)	 **Plastic vase**	 **steel**	 **Clay vase**
C (Other functions)	 **Pencil case**	 **hook**	**None**

Concept A (A1 + B3 + C3)

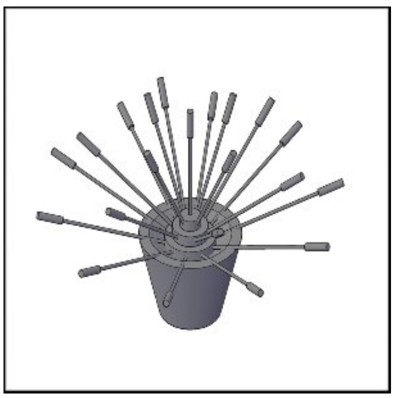


Figure 3.1: Final design for concept A

Concept A is a combination from part A1, B3, and C3 where the base makes from clay vase. It is use for decorating and have shape like paddy. The advantages of this design is simple and use a little material to fabricate. Disadvantage of this design is difficult to fabricate because it have many of lamp and to heavy for the small product.

Concept B (A2 + B2 + C1)

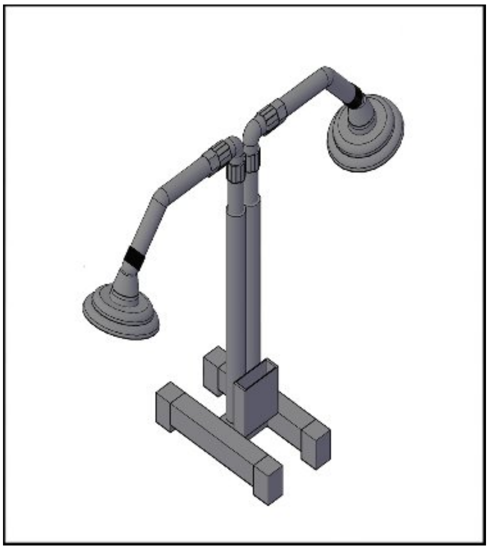


Figure 3.2: Final design for concept B

Concept B is a combination from part A2, B2, and C1. It is use for study and have two lamp. Other criteria is the lamp can be rotate. The advantage of this design is it have more than one function for example pencil box to place stationery and use a little material to fabricate. Disadvantage of this design is difficult to fabricate because it have complicated part.

Concept C (A3 + B1 + C2)

Figure 3.3: Final design for concept C

Concept C is a combination from part A3, B1, and C2 where the base make from plastic vase. It is use for decorating. The other part is hook to hold thing. The advantage of this design is it have more than one function and use a little material to fabricate. Disadvantage of this design is difficult to fabricate because it have complicated part.

Concept D (A3 + B2 + C3)

Figure 3.4: Final design for concept D

Concept D is a combination from part A3, B2, and C3. It is use for decorating. The advantage of this design is it have a hight stability and use a little material to fabricate. Disadvantage of this design is was to heavy, only have one function, and difficult to fabricate.

3.2.2 Pugh Concept

Table 3.2: Concept selection criteria

Selection Criteria	Concepts			
	A	B	C	D (Datum)
Durability	-	-	+	0
Is lightweight	0	+	0	0
functional	-	0	+	0
Can use anywhere	+	0	+	0
Ease of manufacture	-	0	0	0
Cost of manufacture	+	+	0	0
∑+	2	2	3	0
∑0	2	4	3	7
∑-	3	1	0	0
Net Score	-1	1	3	0
Rank	4	2	1	3

Notes:

+ = Better than - = Worse than 0 = Same as

3.2.3 Finalize Concept

Figure 3.5: Concept C

Study of the concept selection table shows that concept C score the highest positive signs. There is no negative sign in concept C. Therefore, concept C is the best concept to be produce.

3.3 MATERIAL SELECTION

Table 3.3: Bill of material

No.	Part	Material	Dimension	Quantity
1	Body	Round hollow steel Round hollow steel	Dia-30mm x Length-700mm Dia-25mm x Length-1300mm	-
2	Hook	Steel	Dia-5mm x Length-14000mm	-
3	Base	Plastic vase	-	1
4	Shades	Paper	100mm x 50mm	3

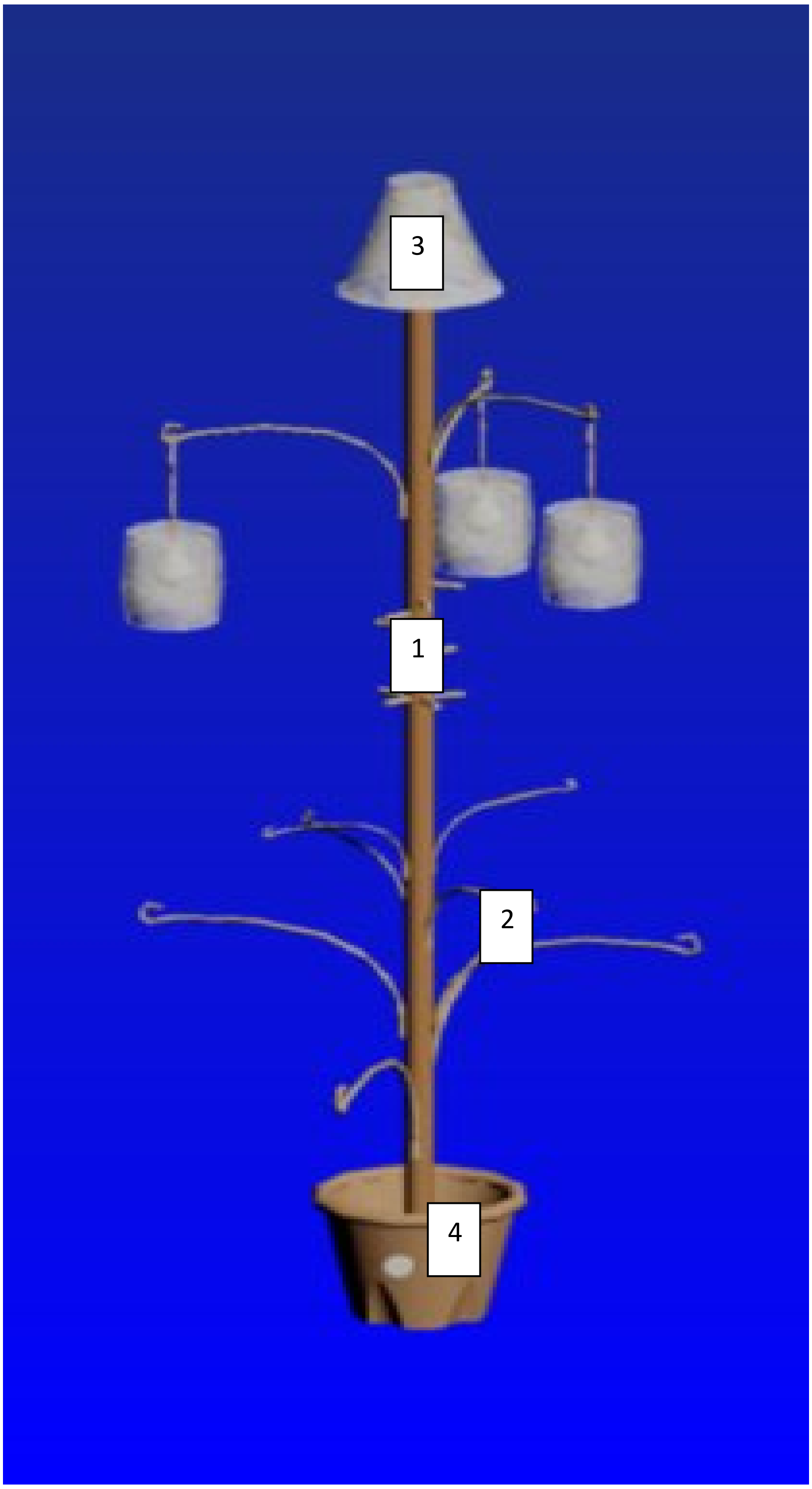


Figure 3.6: Final product

3.4 FABRICATION

After designing phase, comes fabrication process. These processes is about using the material Selection and make the product base on the design and by followed the design dimension. Many methods can be used to fabricate a product, like welding, fastening, cutting, drilling and many more method. Fabrication process is difference from manufacturing process in term of production quantity. Fabrication process is a process to make only one product rather than manufacturing process that focus to large scale production. In the project fabrication process needed to make the base plate, framework of display board and display board. Fabrication process was used at the whole system production. This was include part by part fabrication until assembly to others component.

3.4.1 Fabrication flow

Figure 3.10 shows the fabrication flow chart for this project. This project consists of seven phases, which are:

(i) Phase 1 – Measure the dimension
(ii) Phase 2 – Marking the dimension
(iii) Phase 3 – Cut the material
(iv) Phase 4 – Drilling
(v) Phase 5 – Bend the steel
(vi) Phase 6 – Join the steel
(vii) Phase 7 - Finishing

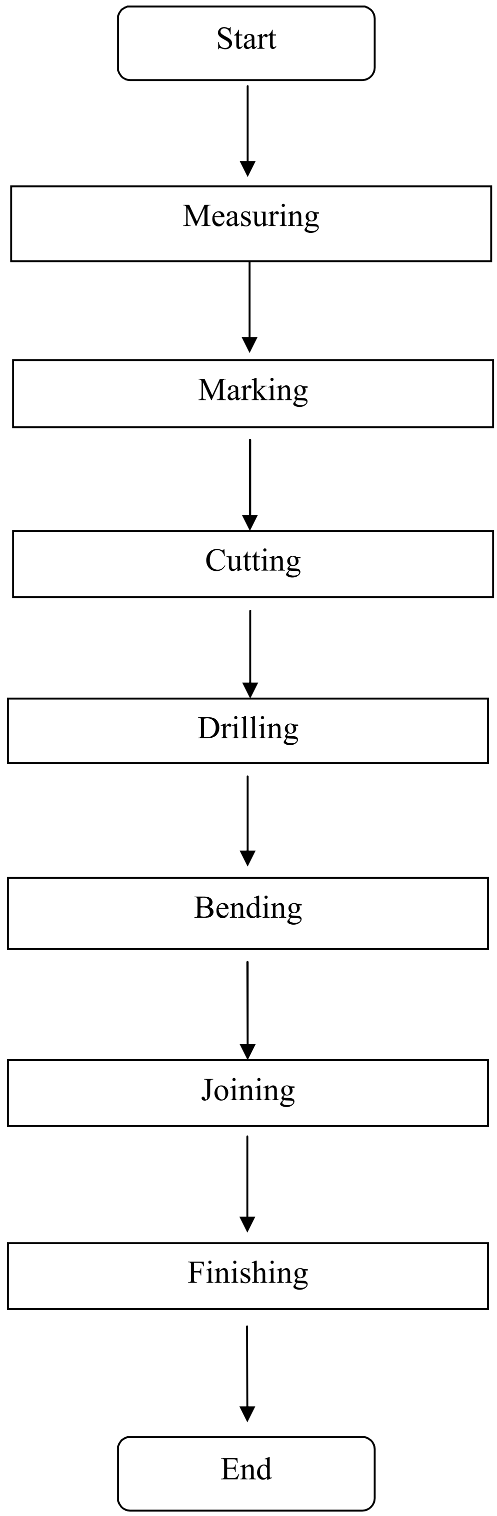


Figure 3.7: Fabrication flow chart

3.4.2 Fabrication Process

In order to make the design come to reality, fabrication process needs to be done first. The fabrication process starts from dimensioning the raw material until it is finish as a desired product. The processes that involved are:

3.4.2.1 Measuring Process

The materials are measured to desire dimensions or location based on design specification. All the measuring process is done measuring tape.

Figure 3.8: Measure the material using measuring tape

3.4.2.2 Marking Process

All measured materials need to be marked to give precise dimension by using steel marker.

Figure 3.9: Marking the material using steel marker

3.4.2.3 Cutting Process

The marked materials were cut into several pieces by using Hand Saw

Figure 3.10: Cutting materials by using hand saw

3.4.2.4 Drilling and Bending

Then, the marked holes were drilled for bolts and nuts placing and also for wiring purpose. Some part needs to be bending into a desire shape using bending machine.

Figure 3.11: Drilling process

3.4.2.5 Joining Process

The material joined by using welding method

Figure 3.12: Welding process

3.4.2.6 Finishing Process

Any rough surface cause by welding spark were grind to give smooth and safe surface using grinding machine and filing by filers and sand paper to give a smooth edge and followed by painting process.

Figure 3.13: Grinding process

CHAPTER 4

RESULTS AND DISCUSSION

4.1 FINAL PRODUCT

The final products in several views are shown in figure 4.1 and figure 4.2 below

Figure 4.1: Product without shades

Figure 4.2: Front view of product

4.2 PRODUCT ADVANTAGE OR FUNCTION

4.2.1 Lighting

The main purpose of the product is use for lighting. Product has four bulbs where each bulb has a maximum power 60 w.

Figure 4.3: Bulbs

4.2.2 Brightness Control

The brightness level of the bulbs can be control where it has a dimmer switch. Dimmer switch also act as switch to on and off the bulbs. Figure 4.4 show the dimmer switch and figure 4.5 show the difference level of bulb brightness.

Figure 4.4: Dimmer switch

Figure 4.5: Difference level of brightness

4.2.3 Adjustable Height and Ability to Rotate

Two difference diameter of round hollow steel which are 30 mm and 25 mm assemble together to make the product can be rotate and can adjust the level of height. Product has four difference level of height.

Figure 4.6: Difference diameter of hollow steel

4.2.3 Hook

The other function of the product is has a hook for hook something small and lightweight such as keys, decoration thing, wish card and other. It has two difference part of hook which are small hook and large hook. Small hook only use for hook thing that have weight below than 0.3 kg and large hook can hook thing that have weight until 0.5 kg.

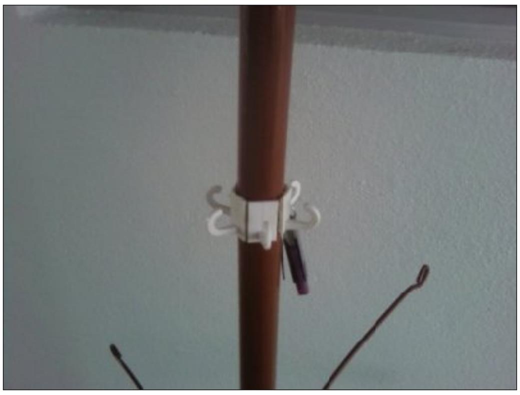


Figure 4.7: Small hook

Figure 4.8: Large hook

4.3 PRODUCT ANALYSIS

4.3.1 Stress Analysis

4.3.1.1 Minimum load (1N)

The stress analyses have been tested to the hook by using COSMOSX simulation. The minimum loads that have been applied are 1 N using uniform distribution. The stress analyses result shows in figure 4.9. The minimum stress is 0.149086 N/m^2 and the maximum stress is 2141.6 N/m^2

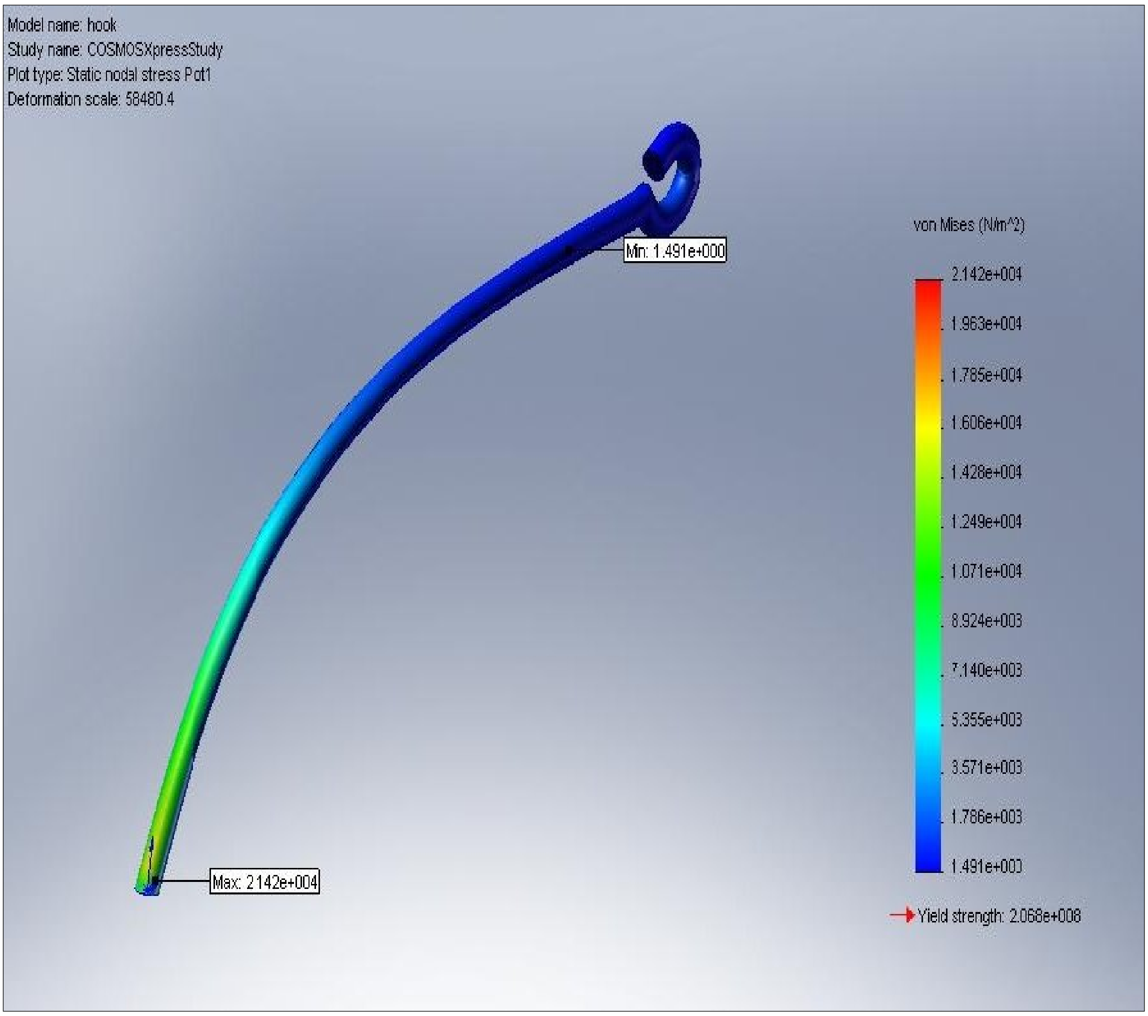


Figure 4.9: Stress analysis result for minimum load 1 N

4.3.1.1 Minimum load (10N)

The stress analyses have been tested to the hook by using COSMOSX simulation. The maximum loads that have been applied are 10 N using uniform distribution. The stress analyses result shows in figure 4.10. The minimum stress is 1.49087 N/m^2 and the maximum stress is 21416 N/m^2

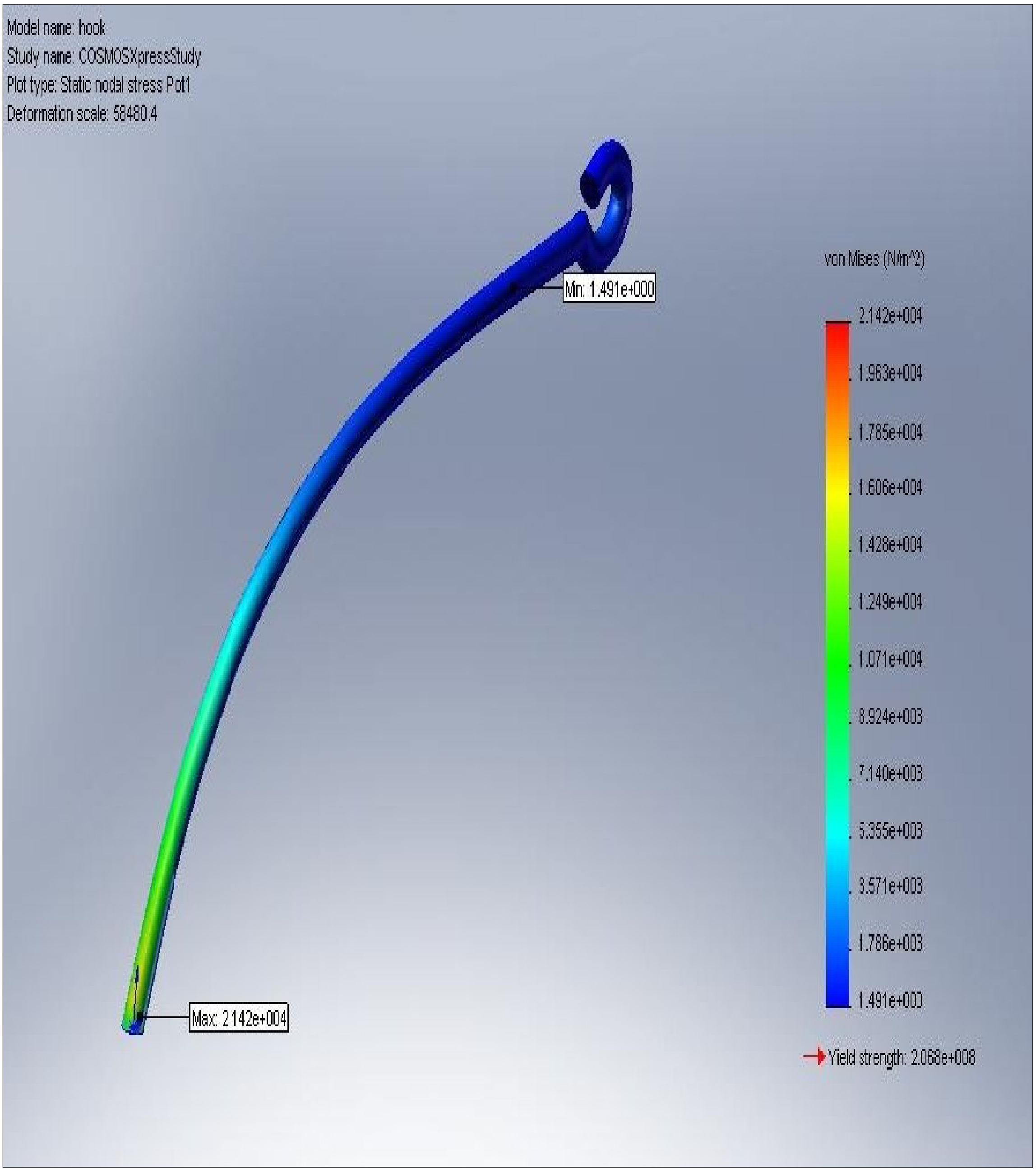


Figure 4.10: Stress analysis result for maximum load 10 N

4.3.2 Displacement Analysis

4.3.2.1 Minimum load (1N)

The displacement analyses have been tested to the hook by using COSMOSX simulation. The minimum loads that have been applied are 1 N using uniform distribution. The displacement analysis result shows in figure 4.11 and table 4.1.

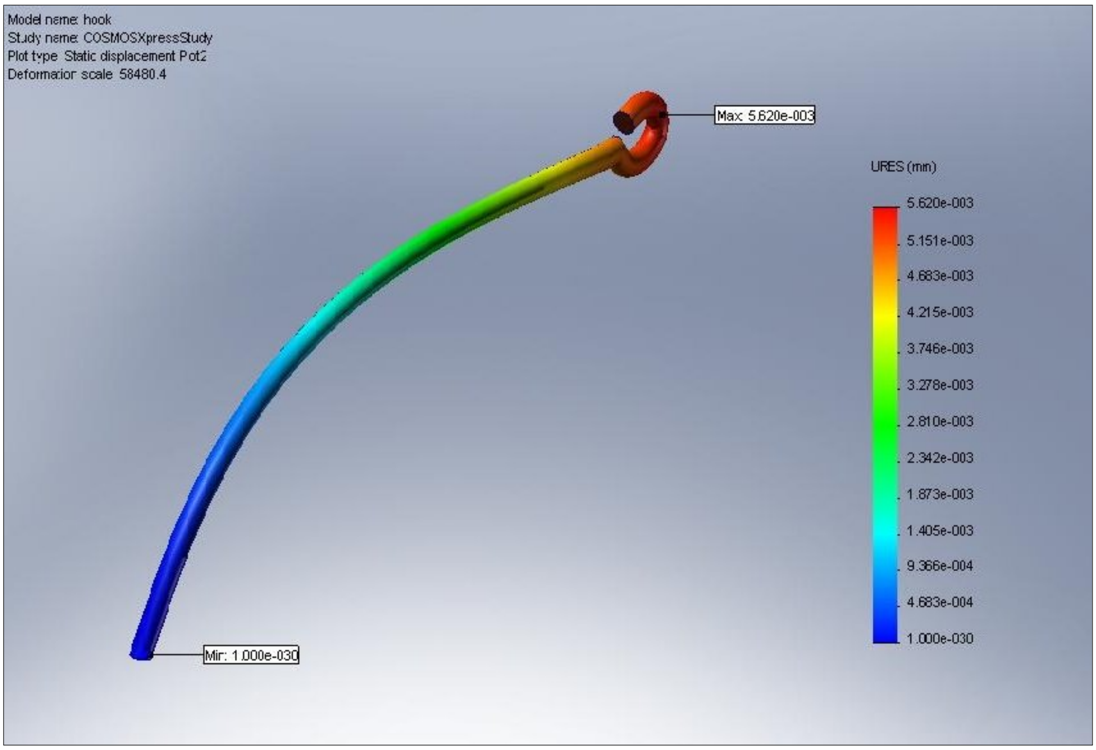


Figure 4.11: Displacement analysis result for minimum load 1N

Table 4.1: Displacement analysis result for minimum load 1N

Name	Type	Min	Max
Plot2	Resultant displacement	0 mm	0.000561974 mm

4.3.2.1 Maximum load (10N)

The displacement analyses have been tested to the hook by using COSMOSX simulation. The maximum loads that have been applied are 10 N using uniform distribution. The displacement analysis result shows in figure 4.12and table 4.2.

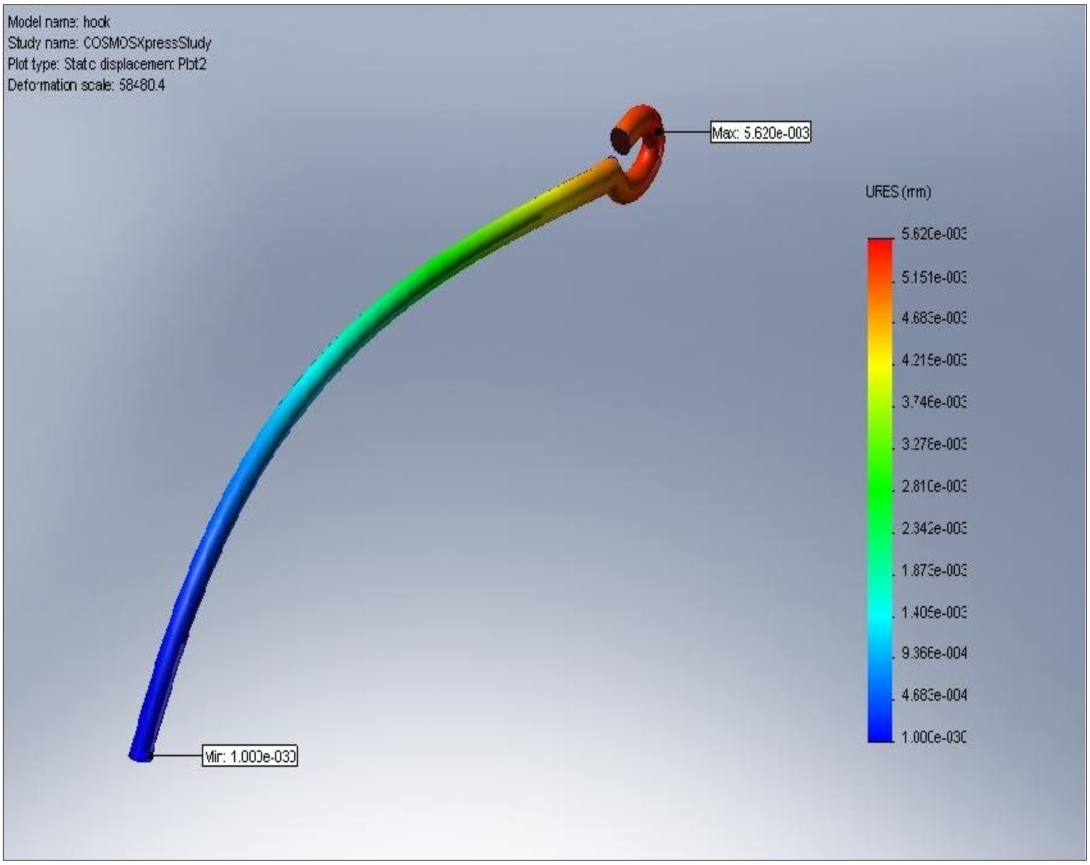


Figure 4.12: Displacement analysis result for maximum load 10N

Table 4.2: Displacement analysis result for maximum load 10N

Name	Type	Min	Max
Plot2	Resultant displacement	0 mm	0.00561974 mm

4.4 DISCUSSION

In this project, several observations have been done with respect to the fabrication of the multipurpose tree lamp. The outcome multipurpose tree lamp was achieve the objective of this project. All the component or part multipurpose tree lamp can function in good condition for example the lamp can provide the light in difference level of brightness and hook can be able to hold thing that weight not more than 1kg.

However, this multipurpose tree lamp was too heavy according to the unsuitable material used in the fabrication process. Round hollow steel was perfect in strengthness, but the weight of this material makes this metal not suitable with the multipurpose tree lamp. Besides that, this material can be corrosion if it surface exposed with oxygen and water. The painting method can be used to prevent this problem.

Figure 4.13: Corrosion on the rod

Besides that, this multipurpose tree lamp also have problem with the stability. The stability increase depends on weight of base. Because of that, the stone and concrete have been added to the vase.

.

Figure 4.14: Stone have been added to increase the weight of base

Finally, the safety achieves using bending method.

CHAPTER 5

CONCLUSION AND RECOMMENDATION

5.1 CONCLUSION

As a conclusion, this project has practice and gives more knowledge about many mechanical properties such as machining and many others material during the fabrication process. Besides that, we also can gain knowledge about the material type, structure and others else. This product also has produces to make an improvement compare to other tree lamps that had been exist in the market. It also is the suitable decoration lamp for family and other places because of the cheaper cost in the production. The final year project is very important because it can make our self more discipline and punctual. Finally, the objectives of this project that to develop and fabricates multipurpose tree lamp has been achieved.

5.2 RECOMMENDATION

The recommendations can improve this product in the future:

(i) All materials should be lightweight and hardy such as plastic. Besides that, plastic also can reduce the cost because it’s inexpensive and more safety.

(ii) To make sure product easy to rotate, bearing should be added. It is because bearing can reduce the friction between two surfaces.

(iii) Electronic component and gear system can be added to make sure the product can automatically rotate.

REFERENCES

1) http://www.allupandon.co.uk/lighting/information/types_of_light, dated on August 7th, 2009

2) http://en.wikipedia.org/wiki/Wood, dated on August 7th, 2009

3) http://en.wikipedia.org/wiki/Plastic, dated on August 7th, 2009

4) http://en.wikipedia.org/wiki/Glass, dated on August 7th, 2009

5) http://en.wikipedia.org/wiki/Steel, dated on August 7th, 2009

6) http://en.wikipedia.org/wiki/Welding, dated on Oct 15th, 2009

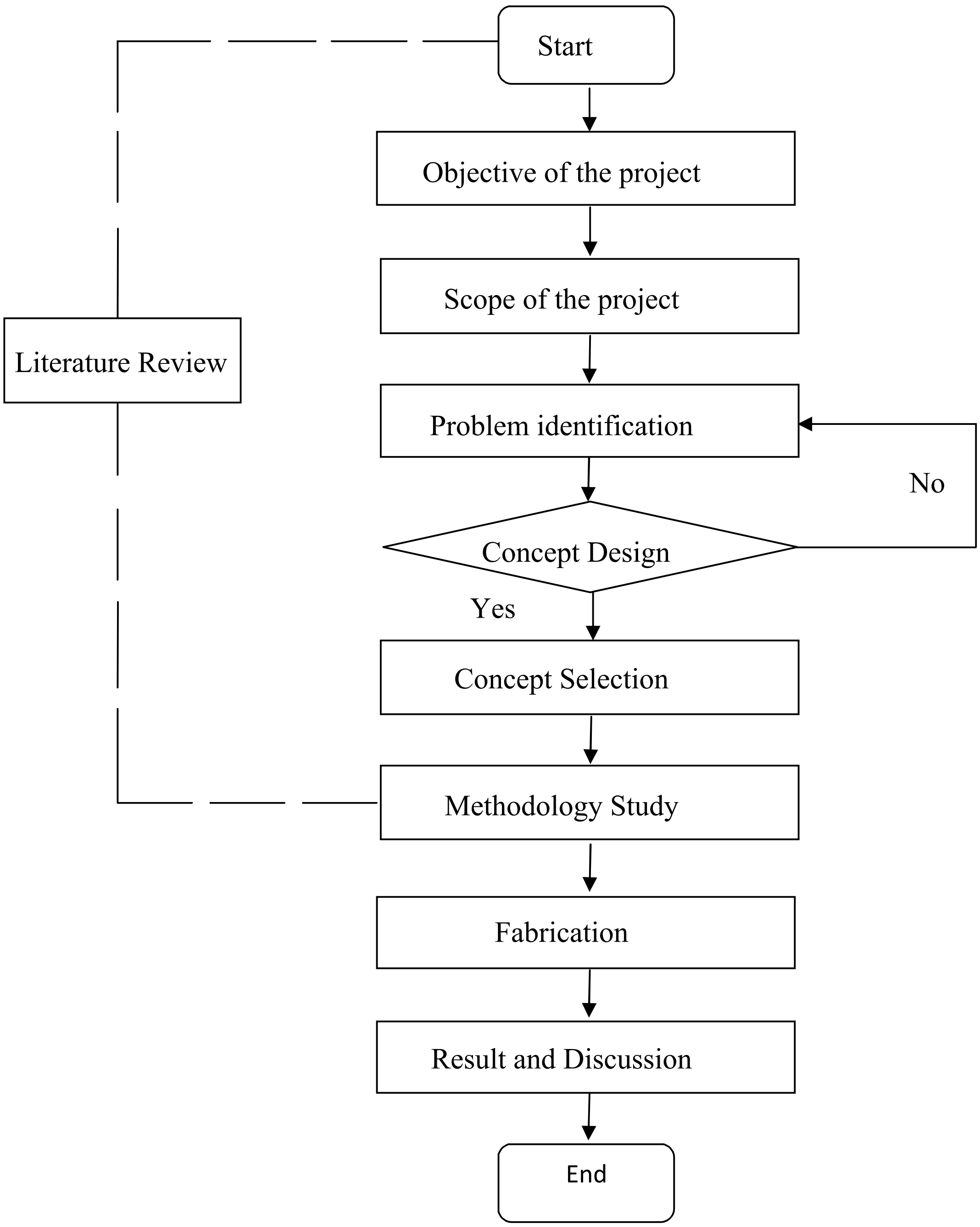
7) http://www.efunda.com/processes/metal_processing/bending.cfm, dated on Oct 15th, 2009

8) http://www.efunda.com/processes/machining/drill.cfm?search_string=drilling, dated on 15th, 2009

9) http://www.efunda.com/processes/machining/grind.cfm, dated on Oct 15th, 2008

APPENDIX

PROJECT FLOW



PROJECT SCHEDULE

ID	TASK	WEEK													
		1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Title selection, scope and objective														
2	Literature review														
3	Identify problem														
4	Design concept														
5	Selection concept														
6	Collecting data and information														
7	Preparing mid presentation														
8	Mid presentation														
9	Fabrication														
10	Verification														
11	Preparing final presentation														
12	Making report														
13	Final presentation														
14	Correction and submit final report														

TYPICAL YIELD STRENGTH

Material	Yield strength (MPa)	Ultimate strength (MPa)	Density (g/cm³)
Structural steel ASTM A36 steel	250	400	7.8
Steel, API 5L X65 (Fikret Mert Veral)	448	531	7.8
Steel, high strength alloy ASTM A514	690	760	7.8
Steel, prestressing strands	1650	1860	7.8
Steel Wire			7.8
Steel (AISI 1060 0.6% carbon) Piano wire	2200-2482 MPa		7.8
Stainless steel AISI 302 - Cold-rolled	520	860	
Cast iron 4.5% C, ASTM A-48	276	200	
Titanium alloy (6% Al, 4% V)	830	900	4.51
Aluminium alloy 2014-T6	400	455	2.7
Copper 99.9% Cu	70	220	8.92
Cupronickel 10% Ni, 1.6% Fe, 1% Mn, balance Cu	130	350	8.94
Brass	approx. 200+	550	5.3
Tungsten		1510	19.25
Glass		50 (in compression)	2.53
E-Glass	N/A	3450	2.57
S-Glass	N/A	4710	2.48
Basalt fiber	N/A	4840	2.7

Marble	N/A	15	
Concrete	N/A	3	
Carbon Fiber	N/A	5650	1.75
Spider silk	1150	1200	
Silkworm silk	500		
Aramid (Kevlar or Twaron)	3620		1.44
UHMWPE	23	46	0.97
UHMWPE fibers (Dyneema or Spectra)		2300-3500	0.97
Vectran		2850-3340	
Pine Wood (parallel to grain)		40	
Bone (limb)	104-121	130	
Nylon, type 6/6	45	75	
Rubber	-	15	
Boron	N/A	3100	2.46
Silicon, monocrystalline (m-Si)	N/A	7000	2.33
Silicon carbide (SiC)	N/A	3440	
Sapphire (Al_2O_3)	N/A	1900	3.9-4.1
Carbon nanotube (see note above)	N/A	62000	1.34