

Crusdon

* Conceptual design

Phase 1 — needs assessment [idea for project]

Phase 2 — design specifications

You must have design specifications before you start to do the conceptual design.

Phase 3 — conceptual design

Find the possible options to ~~start~~ satisfy your design specifications.

Procedure for conceptual design.

Step 1: decompose / dissolve / break down the design project into several sub-system or sub-unit according to their functions

Car: power

break

transition time

!

weld splitter

{ power
frame
cutting tool - wedge
safety

Step 2:

develop the options for each sub-system or sub-unit.

do research based on the sub-system or sub-unit

power — electrical

gas

compressor air

frame — steel

aluminum

wood

safety guard

net cover

1

step 3, form --- or alternative options
for the design project one from each sub-system

- ① electrical + steel + net cover
- ② electrical + aluminum + net cover

total options = $3 \times 3 \times 1 = 9$

step 4,

use personal experience or group discussion
to select 3-5 best possible alternative options
for your design.

Capstone Settings Form for this class

* still a course $\swarrow$ practice what you learn in your design project

drawing models + analysis

* not too big
not too small

of components < 10 X

must have at least 5 manufacturing parts
perman. parts

*

*

#1 idea

#2 Feasible analysis

- big or small
- simple or complicated
- skills

#3 Technical evaluation

- base line research
- possible solution

* table of contents

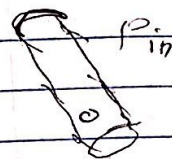
* Design schedule

Part # 00001 ~ 49999 manufacture part

Purchase part # 50000 ~ 79999

assembly # 80000 ~ 99999

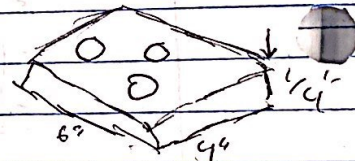
Part #	Description	Material



Component & function type of raw
of the part, raw material

10000, Pin,

raw material is the shape
and material for manufacturing parts
wood, bolt joint, plate



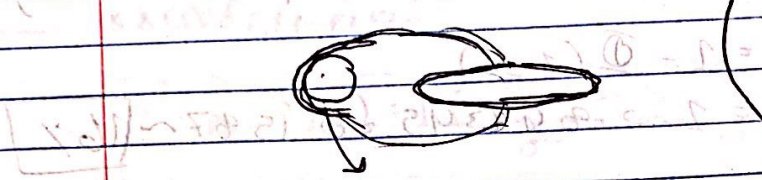
purchase part function, reference

studies, ... all ...

$$f(x) = \frac{1}{\sigma \sqrt{2\pi}} e^{-\frac{(x-\mu)^2}{2\sigma^2}}$$

1.1.1. ...

$$f(x) = \frac{1}{\sigma \sqrt{2\pi}} e^{-\frac{(x-\mu)^2}{2\sigma^2}}$$



... of the ...

Part A

System

$$f(x) = \frac{1}{\sigma \sqrt{2\pi}} e^{-\frac{(x-\mu)^2}{2\sigma^2}}$$

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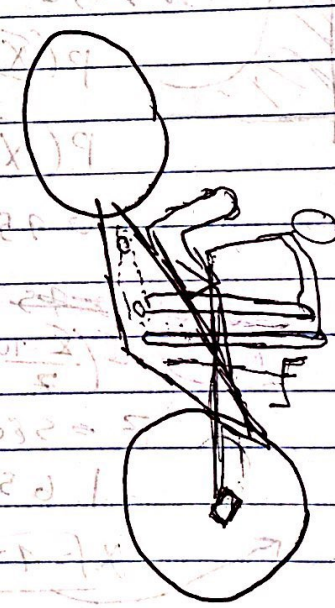
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Capston project

steps

on

SW

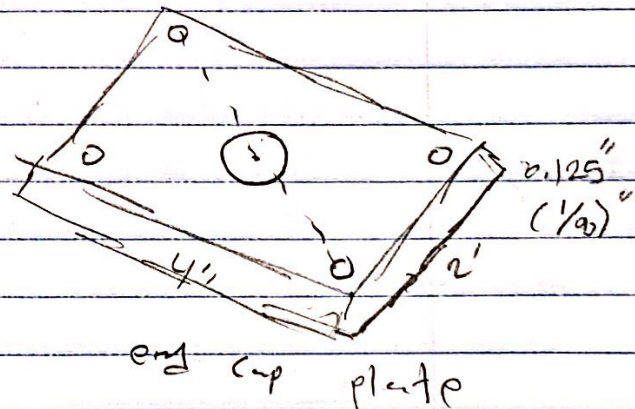
summary info.

Property name	Type	Value
1 part no	text	01001
2 Description	text	End CAP, plate
3 Material	text	
4 -		
5 -		

then save it

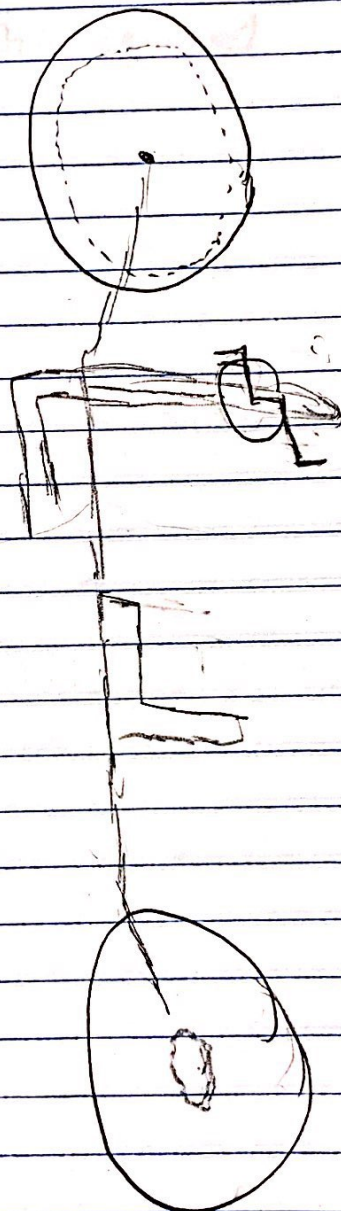
as

01001 part number



2.1 construction of C/S

7/5/20



Capston

* Decision matrix

- for big company 10~15 different design option,

- for small company 3~5 design option

For this class, you need to analyze 3 different option A, B, C -

- choose the best one for production

> Decision matrix can be used to determine the best option

step 1: Rank - order of the design goals (design specification)

	price	safety	performance	total
Price	/	0	0.5	0.5
safety	1	/	1	2
performance	0.5	0	/	0.5

rank - order

price

safety

performance

step 2: The weighting factor for each design goal. 0 ~ 100

critical	75 ~ 100
important	35 ~ 75
optional	0 ~ 35

Safety - 95

Price - 75

performance - 20

Step 3: Rating factor of the design goal.

This is the value for each option on the performance of each design goal

10 → excellent, 8 = good
6 → satisfactory, 4 = median
2 = unacceptable, 0 = failure

A	B	C
Price	\$200	\$95
\$105		

design goal: price < 120

	2	2	10	rating factor
safety	2.5			
2.6	5		2.4	
10	6		2	

A	B	C	
Performance	12 min		
55	58	1.3 min	
10	8	4	ranking factor

step 4: Create the decision matrix

weighting factor

design option	design goal	price	Performance	weighting factor	
	speed 45	75			
A	10x45	8x75	10x70	2175	Maximum
B	6x45	2x75	8x70	1260	
C	2x45	10x75	4x70	1220	

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Three variables that can affect a bicycle can stop are:

1. Friction between tire and ground
2. height above ground of rider + vehicle center of gravity
3. friction between brake pads and whatever surface they are contacting.
4. mechanical advantage of the levers and actuators in the brake system.

When braking, there is
• one kinetic friction $\rightarrow$ force applied between the pad and the disc
• one static friction $\rightarrow$ applies to the tyre/road interface

The kind of force that applies on brakes is:
Kinetic energy

Kinetic energy of the bicycle $= \frac{1}{2} M_b V^2 + \frac{1}{2} M_w \omega^2 \cdot 3$

• $\frac{1}{2} M_b$: half of the mass of bike including wheels

• V^2 : square of bike's velocity

• $3 \times$ kinetic energy in the rotating wheels

cus
we have
3 wheels

Assuming all of the mass of the wheels is located on the outer edge

• M_w : kinetic energy of a wheel due to rotation is half of bike's mass

• r^2 : square of its radius

• ω^2 : angular velocity

of the wheel

Since, The velocity of an object rolling on wheels is $= r \times \omega \rightarrow$ its angular velocity
we can substitute and get:

Kinetic energy of the bike $= V^2 (M_w + \frac{1}{2} M_b)$

we stop the bike by turning its kinetic energy into friction.

> the brakes apply a force to the disk. The force of this friction is $= (f) (N)$. f : total downward force that pads put on the disk
 μ : coefficient of friction

Cupston

* Final presentation on 4/8/19

* Poster templates on BB Due 4/8/19

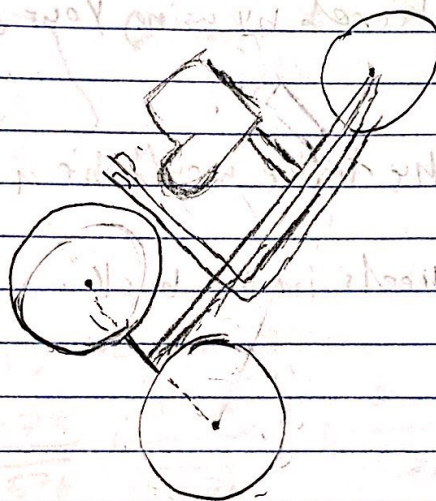
* Final ^{report} submission and Engineering Notebooks
on 4/17/19 be 3-2:15
Certificate exam is on 4/17/19 morning

* Each one submit ^{at least} 20 page for Eng. notebook

* Conceptual design for our project are:

Sub-systems:

- braking
- steering
- Pedalling
- gears/shifting
- overall design layout
- Pulley



* Design Specifications

- Under 7ft

- Less than 50 lbs

- Top speed (15-25 mph)

- Nonrestrictive range of motion steering

- Functioning Brakes

- Legs cannot be used

There are three basic options

Welding ~ \$150 - \$300 - will be operated

Equipment: (not your funds).

Bike wheels = \$100

Brakes: \$20 - 100

Gears and pedals = \$200 to store the bike at a

Supplies:

(1) Bike frame material = \$150

the steering \$30 - 100

General reserves = \$100

Total estimate = \$950

↖ Budget

opt. 3

