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KTU STUDY MATERIALS | SYLLABUS | LIVE NOTIFICATIONS | SOLVED QUESTION PAPERS

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Third Semester B.Tech Degree Examination December 2020 (2019 Scheme)

Course Code: EST200

Course Name: DESIGN AND ENGINEERING – SOLUTION

PART A

Question 1) Discuss the importance of design constraints? (3 Marks)

SCHEME) Design Constraints- Minimum three logically correct points (1 mark each)

1.Ans)

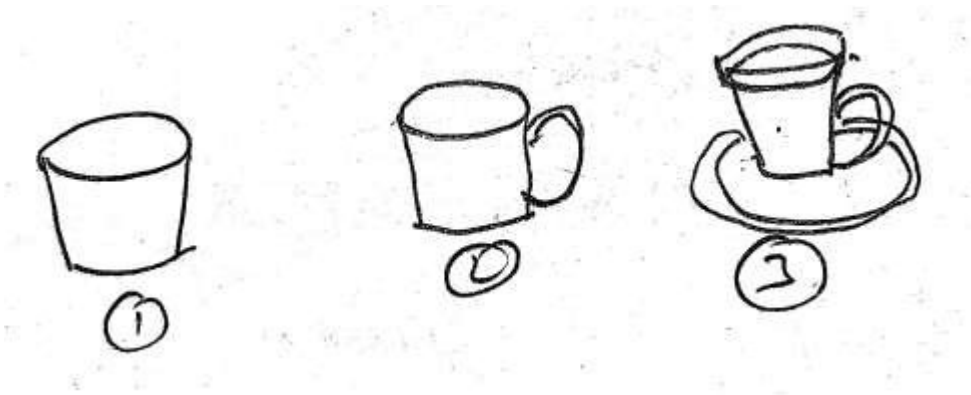
- Constraints are limitations
- Constraints include both imposed limitation and self-imposed as a way to improve design
- Different type of constraints are there
    - Function constraints
    - Safety constraints
    - Quality constraints
    - Time constrains

Question 2) Describe how to select the "best possible design" from the generated design alternatives.? (3 Marks)

SCHEME) Best feasible design selection from design alternatives using an example. Credit may be given to all logically correct examples

2. Ans)

- From the different ideas we may acquire different possible solution
- Investigate the pros and cons of all the possible solutions
- Check which design ideally satisfies the specification, constraints such as time, cost, skills etc.
- Eg :



In the above 3 design we can select design no 3 the reasons are

- Have handle
- Have a cap
- Cheaper material
- More capacity

Question 3) Discuss how to manage the conflicts in a team executing the design thinking process. (3 Marks)

SCHEME) Design thinking process in team environment - Minimum three points, Credit may be given to all logically correct examples

3. Ans)

- In a design thinking process in a team environment all the team member need to be openminded, curious, collaborative and being challenged
- When conflict occur all the member need to be openminded and need to desire their ideas and face to be challenge
- List out the pros and cones of the ideas of each conflict ideas and let the team collaboratively chose the best design for the final design

Question 4) How does the design thinking approach help engineers in creating innovative and efficient designs? (3 Marks)

SCHEME) Explanation using any three stages of design thinking approach. Credit may be given to all logically correct examples

4. Ans)

Design thinking is a iterative process which include 5 stages

1. Empathise
2. Define
3. Ideate
4. Protype
5. Test

Since it is an iterative process, we can improve the design even after the prototype stage.

Ideate stage:

In this stage we can have as many ideas for the problem or need we have. And choose the best from that. Let us take an example of chair

Ideas:

1. chair with cushion

2. chair with cup holder

3. chair with hand rest

Prototype stage:

In this stage we can make the prototype of the idea we have. From the example we can make a chair with the ideas we have.

Test stage:

In this stage we can test the prototype and get the feedback. We can test by ourself or we can give the product to some users and get their feedback.

In above stages if we face any issue or correction with the current design we can go back to the other stages and change it. For example, if the prototype chair has any issues or correction in the test stage then we can go back to the ideate stage and change the design and do the same process again.

Question 5) Clarify the part of mathematics and physics in the design engineering process. (3 Marks)

SCHEME) Importance of mathematical modelling- Minimum three points (Or explanation using a model or suitable equation) Credit may be given to all logically correct examples.

5. Ans)

The mathematics and physics are important in design process

- Mathematical formula will help you to solve the problems in design
- These formulae can predict the behaviour of the device or system that we can design

Mathematical tools like dimension & units can help in the ease of design

For example: a process of moving object the force we need to apply can be predicted using the mathematical formula *(F=ma)*

Question 6) What are factors to be considered in preparing technical reports to communicate a design efficiently? (3 Marks)

SCHEME) Documentation of design process and communication- Minimum three points. Credit may be given to all logically correct examples

6. Ans)

In a technical communication the important points to be considered are

- Know your purpose
- Know your audience
- Organise the contents
- Write/present clearly
- Think visually
- Write ethically

Question 7) Describe the use of value engineering in the design process. (3 Marks)

SCHEME) Explanation with example (Or minimum three points about value of engineering). Credit may be given to all logically correct examples

7. Ans)

The value of engineering is the technique for improving the value of the product, project & process

$$value = \frac{function}{cost}$$

The value of the product increases when the function of the product increases or cost decreases

For example, value of a chair increases when there are more functions like hand rest, writing pad, cup holder etc. without increasing cost

Question 8) How does intelligence in nature inspire engineering designs? (3 Mark)

SCHEME) Bio mimicking design- explanation with examples (Minimum 2 examples) Credit may be given to all logically correct examples

8. Ans)

Biomimicry is the process of borrowing natures blueprint or process in the design

process. Let's take some examples

1. shape of the bullet train in china is borrowed from the shape of beak of king fisher which will give best aerodynamic shape

2. shape of the syringe needle is borrowed from the shape of mosquito needle. The needle shape is best for sucking blood from the vein with minimum pain.

Question 9) How to estimate the cost of a particular design? (3 Marks)

SCHEME) Explanation about Labour, material and overhead cost. Credit may be given to all logically correct examples

9. Ans)

The cost of a particular design can be estimated from

1. Labour cost

2. Material cost

3. Overhead cost

For example, in a design of footwear, the labour cost estimation will give you the man power needed for the production process.

Material cost will give you the production cost and material cost needed for the design

The overhead cost is the miscellaneous cost which will come at the time of manufacturing and distribution process. For example: transportation cost, medical expense, etc

Question 10) How do ethics play a decisive role in engineering design? (3 Marks)

SCHEME) Role of ethics in engineering design- Minimum three points. Credit may be given to all logically correct examples

10. Ans)

To design means to accept responsibility for creating designs: designers are influenced by the society in which they work, and designed products influence society. That is why we must consider ethics and ethical behaviour in our examination of how engineers design things. Ethics means

- the discipline dealing with what is good and bad and with moral duty and obligation
- a set of moral principles or values
- a theory or system of moral values
- the principles of conduct governing an individual or group

These definitions define ethics as a set of guiding principles or a system that people can use to help them behave well

PART B

MODULE 1

Question 11) Design two alternatives of a chair suitable for a five-year-old child, and then to narrow down to the best design based on objectives and constraints. Sketch both the designs. (14 Marks)

SCHEME) Identify Design function, Design constraints – 2 marks each, Figures – 4 marks x 2, justification of choosing the best design -2 marks

11. Ans)

Problem/need

To design a chair for a 5-year-old child

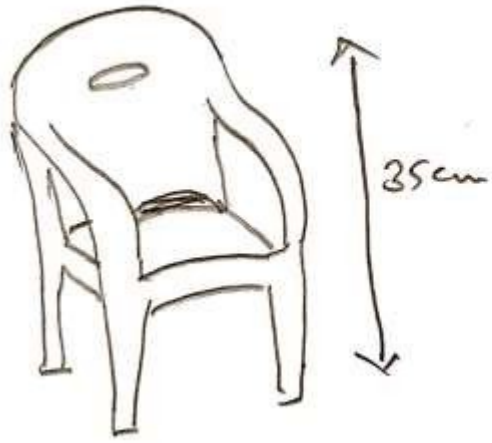
Objectives *(add as many points you can)*

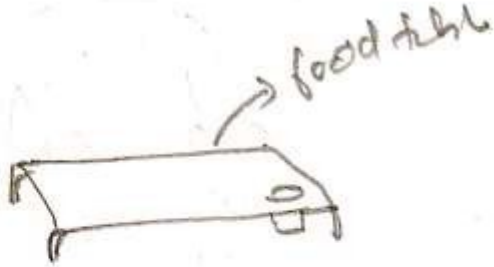
- chair must be safe for children
- easily accessible for 5 year old child
- god material must be used (child safe)
- must be strong
- steady structure
- should be able to have food while sitting

Constraints *(the limitations to the design)*

- Height of the chair must be between 30 to 40 cm
- Budget must be minimum (below 500)
- Material used must be strong and light weight
- Safety must be priority

Design 1 *(draw as many diagram views you can)*





- ✓ Material used – Plastic
- ✓ Height of the chair – 35 cm
- ✓ Hand rest is available
- ✓ Detachable food table comes with the chair
- ✓ Budget is nearly Rs 400
- ✓ Colours available – blue, red, yellow, green

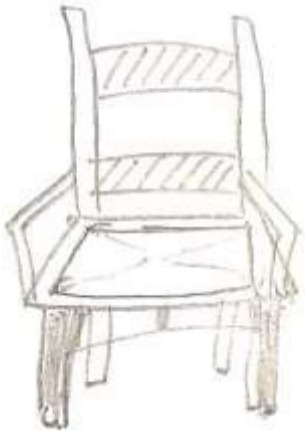
Highlight of the design

The design 1 satisfies most of the objectives. The material used is safe for kids and its light weight. The plastic used material is safe for kids. The height of the chair is between the suggested height mentioned in the objective. There is a detachable food table with this chair, with no extra cost. So it can be used as a study table also. A verity of colours are availbe with this design.

Design 2

- ✓ Material used – wood
- ✓ Height of the chair – 40 cm
- ✓ Hand rest is available
- ✓ Additional food table can be purchased
- ✓ Budget is – 700 rs

- ✓ Colour available – wood colour only



Highlight of the design

In this design the material used is wood. The height of the chair is 40 cm. the wood material colour only available in this design. An addition food table which can be attached on the chair is also available with additional purchase. The chair base is available with cushions for comfort

In the above two designs each design meets most of the objectives/ requirements. By comparing these two designs design 1 have good plastic material used and its light weighted. Which is easy for children's use. Also its available in different colours. The design 2 is on the other hand little bit more expensive and not a good design for children. The weight of the chair is more, compared with the design 1. Also the food table need to be purchased additionally. The design 1 meets more merits to the given objectives, so we can finally choose design 1 as our preferred design.

Tips: when this kind of questions asked for comparing two designs. Design one which meets all the needs and another without meeting the needs but similar design. And always draw figures to explain your ideas.

Question 12) Identify the objectives, functions and constraints for designing a water level indicator. Illustrate the various stages of the design process. Provide suitable sketches. (14 Marks)

SCHEME) Objectives -1mark, functions -2 marks and constraints – 2 marks, explanation of design process - 4 marks, Figure – 5 marks

12. Ans)

A water level indicator is a helpful device which shows the current water level inside the water tank. Users can understand the level of water without looking inside the water tank. There devices will be helpful for bigger tanks and these tanks placed at higher levels

Functions

- ✓ The function of water level indicator is to show the current level of water inside the tank
- ✓ Buzzer the alarm when the water level is below the threshold level
- ✓ The system automatically turns on the motor to pump the water into the tank when the level is low
- ✓ Also, automatically turn off the motor when the water level is full

Objectives

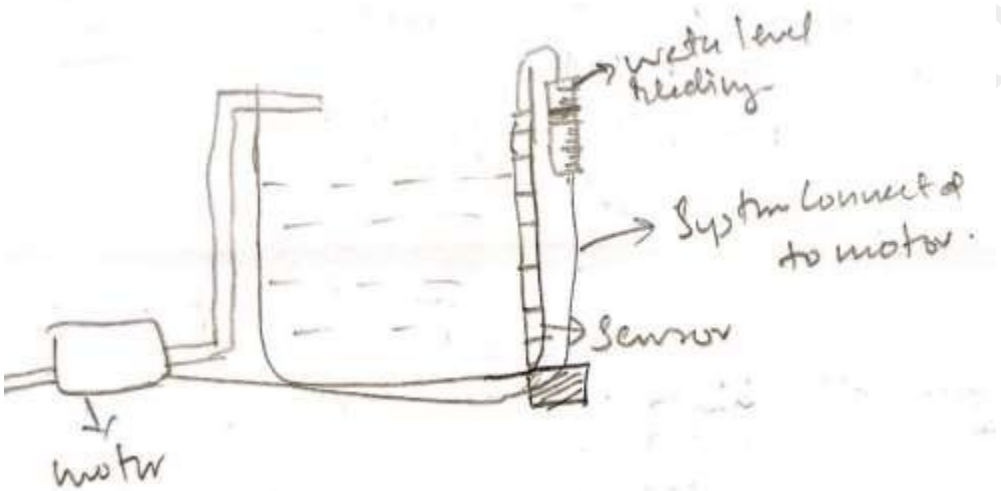
- ✓ The water level indicator must be accurate
- ✓ Easily attachable to any water tank
- ✓ System must be water resistant
- ✓ Automated water filling must be there when the water level is low and should automatically stop the water when tank is full
- ✓ Lao an alarm system must be included

Constraints

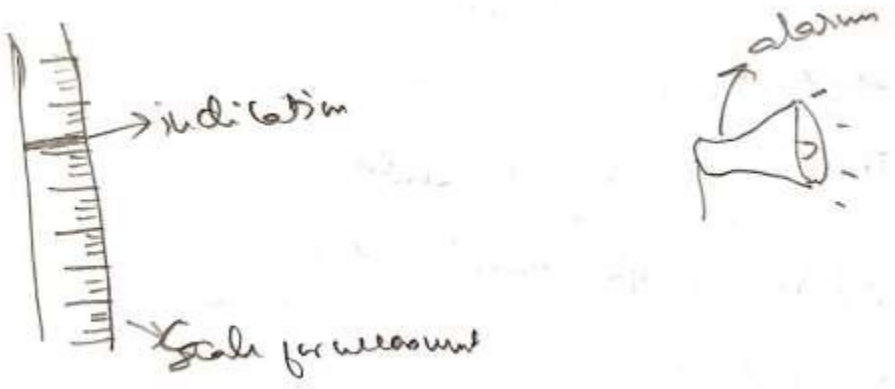
- ✓ System must be portable
- ✓ Water resistant
- ✓ Highly sensitive

- ✓ Long life
- ✓ Readings must be accurate
- ✓ Corrosion resistant

Prototype



The basic working of the water level indicator is to show the current water level inside the water tank. It also consists of an alarm system which will turn on when the water level in below certain level. Also, the system will automatically tun on the water pump motor when the water is low and it turn off when the water is full.



The water level indicator system is connected to a circuit which controls the water flow in the pump and the alarm system. The system consist of a water level sensor

system it

connected to the circuit. When the water level is detected below the threshold level then the system will sent a signals to the alarm and the water pump system which is also connected to the circuit of the system. When the water level is above the full threshold level the sensor will detect that the tank is full and the stop signal will sent to the circuit and circuit will stop the water inflow to the tank.

Test Stage

In this stage we can test the prototype we have made. Connect the system to any water tank and check it for some days. Check whether the system is working properly or not. Take feedback on the test period. In the test stage if we face any issues with the system, we can make changes in our design and correct it. After correcting all the errors, we can finalise the design.

Design communication

In this stage we can make a detailed report of the water level indicator. The report will contain the complete explanation and design of the system. It also contains detailed diagrams of water level indicator. Those who are reading this document would have a better understanding of the system.

The relative cost of the water level indicator is in between Rs 700 – 1000. The main parts of the systems are

- Sensor system
- Scaling system
- Circuit to control alarm & motor pump
- Alarm system
- Motor system
- Power supply

MODULE 2

Question 13) Design a water bottle that can be opened with one hand. Illustrate the various stages involved in design thinking. Sketch the final design. (14 Marks)

SCHEME) Explanation of various design thinking stages – 9 marks (Credit may be given to all logically correct statements to explain various stages in design thinking- empathise, define, ideate, prototype and test), Figure – 5 marks

13. Ans)

Here we have to use the design thinking process for the design of water bottle that can be opened with one hand. Design thinking involve 5 stages

1. Empathise
2. Define
3. Ideate
4. Prototype
5. Test

Stage 1: Empathise

This stage is basically understanding the problem. In this stage we have to research our user's need. In this particular problem the water bottle need to be opened with one hand. This design is applicable in many conditions like, for a physically challenged person, for a cyclist while pedalling the cycle, for an athlete while running, or simply a person who need to drink water effortlessly

For this purpose, a person needs to handle the bottle with one hand and open with his/her thumb. The bottle neck needs to be small in order to do that

Stage 2: Define

In this stage we define the problem statement which we need to solve. From the information we collected from the empathise stage, we need to sort out all the details and make problem statement from those data. In this problem the main statements are

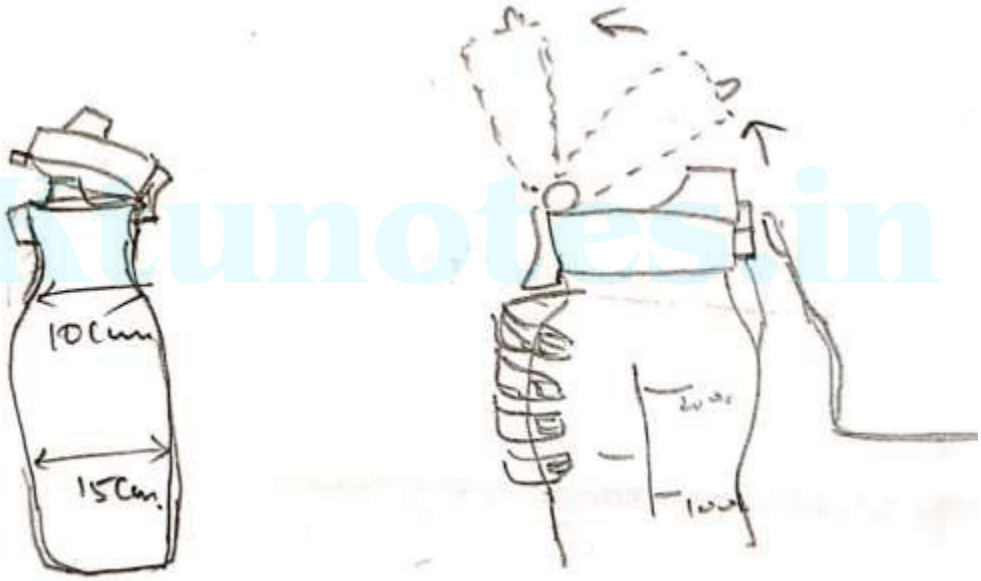
1. water bottle must be opened with one hand.
2. Closure of the bottle should also be done with one hand
3. Person should also able to drink bottle with one hand

Stage 3: Ideate

The problem which we defined from the stage 2 can be resolved in this stage. The ideate stage will bring ideas for the problems. This can be done as a group also

Problem 1

For opening water bottle with one hand the neck of the bottle must be easily holdable by one hand. Also using the thumb, we should be able to open the bottle cap.



Problem 2

If the user is a cyclist or an athlete then the closing also to be done by one hand. In the above design the closing can also be done by one hand because the palm is enough for closing

Problem 3

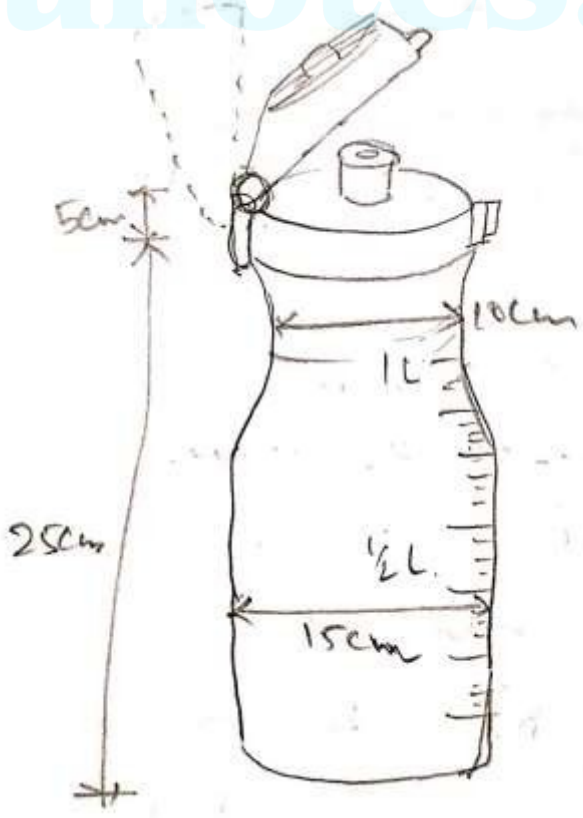
To be able to drink water with one hand the bottle neck should be small to hold it in

one hand. Also, the bottle cap should be tagged to the bottle even after the cap opened. To

avoid spilling of water after the cap open, we can us a small bottle cap that is attached over the head of the bottle like shown in the figure

Stage 4 : Prototype

In this stage we will make a prototype with the ideas we had in the previous sage. The diagram shows the final design of the water bottle prototype. A prototype is a model of the working model of the design we have done. It is mainly use for testing purpose.



Stage 5: Test

In the test stage we will do all possible extreme tests on the prototype. We will provide the prototypes for some customers and sometimes ourself, and use it for some times. Will try with different types of peoples with different hand size. After all the tries and periods we will collect the feedback of the product also comments from the users. From the feedback and comments if some changes or improvement to be done in the design then we will do it. And after the corrections we will finalise the design.

Tips -:

- *Mention 5 stages of design thinking*
- *Make your own ideas for which you know its solution to improve time management*
- *Make it simple, don't think too much*

Question 14) During the Covid-19 pandemic, people have to wear a mask, but wearing a mask is not comfortable. Empathize about this design problem and arrive at a solution using the design thinking process, so that people can select the level of protection provided by masks according to different situations. Illustrate the solution using sketches.

SCHEME) Empathize about this design problem (Credit may be given to all logically correct issues in wearing masks) – 4 marks, Explanation of solution - 5 marks, Figure – 5 marks

14. Ans)

In this problem we have to find a design a mask which reduces the discomfort of the people who is wearing it for long time. Design thinking involve 5 stages

1. Empathise
2. Define
3. Ideate
4. Prototype
5. Test

Stage 1: Empathise

In this stage we have to collect issue related data and understand the situation/problem. The highlighted details are given below

- ✓ Wearing mask always make people uncomfortable
- ✓ Breathing issue when wearing for a long time
- ✓ Pain on nose and ears
- ✓ Fogging issue for the people who wear glass
- ✓ Some people have allergies

Stage 2: Define

Even if people have the above issue everyone has to wear the mask for theirs and others protection when going out. So our aim is to reduce the discomfort of wearing make while going out. In this stage we have to define the problem statements from the data we collected from the previous stage. Here we are taking all the points discussed in the empathise stage as our problem statement.

- ✓ Breathing issue
- ✓ Pain in the nose
- ✓ Fogging problem
- ✓ Allergy issues

Stage 3: Ideate

In this stage we have to come up with ideas to solve the above-mentioned problem statements. Let's discuss each one

Breathing issue: for better protection we need to wear double mask these days. So this makes most of the people breathing trouble. In order to solve this issue we need a 4 multi-layered mask so that we can have the same protection with one mask.

We can also change the mask shape in order to make more breathing space between nose and mask. Increasing the breathing space between nose and mask will reduce the breathing problem.

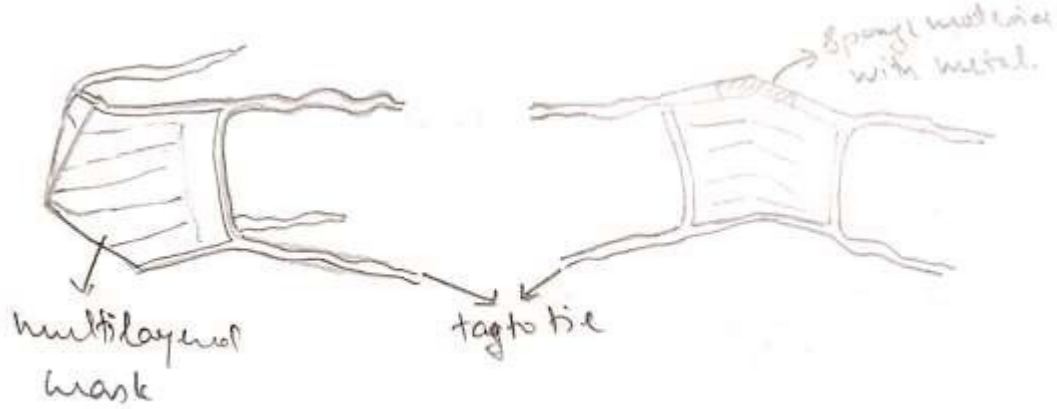
Pain: to reduce the pain on the nose and ears we can introduce mask with sponge on the nose side & corners of the mask and instead of wearing the mas on the ears we can tie the mask in the back of the head. These steps will reduce the pain due to wearing mask for a long time.

Fogging problem: people who's having glasses have to face fogging problem when wearing a mask. This issue can be reduced by using a foldable metal on the mask near nose area. While wearing the mask we can use the flexible metal to keep the mask steady and in correct location. This will stop the air to reach eyes area which creates Fogg.

Allergy issue: this issue can be reduced by using good clothing materials for the making of mask. Reusing of mask can also cause the allergy issue.

Stage 4: Prototype

In this stage we can make some amount of mask based on the design we have. This is mainly for testing purpose. Provide these masks for a group of peoples and tell them to use the mask for some days. The prototype of the mask is shown in the figure



Stage 5: Test

In the final stage we will distribute the prototype masks to a group of people and tell them to use for some days. After few days we will collect feedback of our design from the people. Also we will as for suggestions and comments. Collecting this information we will go through it, if we need some improvements or changes in the design then we will move back to the previous stages and redesign the mask. After the corrections we will finalise the design.

MODULE 3

Question 15) Design a foldable steel table. Draw the detailed 2D drawings of the same with design detailing, scale drawings and dimensions. Use only hand sketches. (14 marks)

SCHEME) Explanation – 6 marks, Figure – 5 marks, design detailing, scale drawings and dimensions – 3 marks. Credit may be given to all logically correct examples

15. Ans)

Problem statement

To draw a detailed 2d drawing of foldable table.

Objective *(Tips: add as many points you can)*

- ✓ Table should be foldable
- ✓ Light weight
- ✓ Adequate height
- ✓ Portable

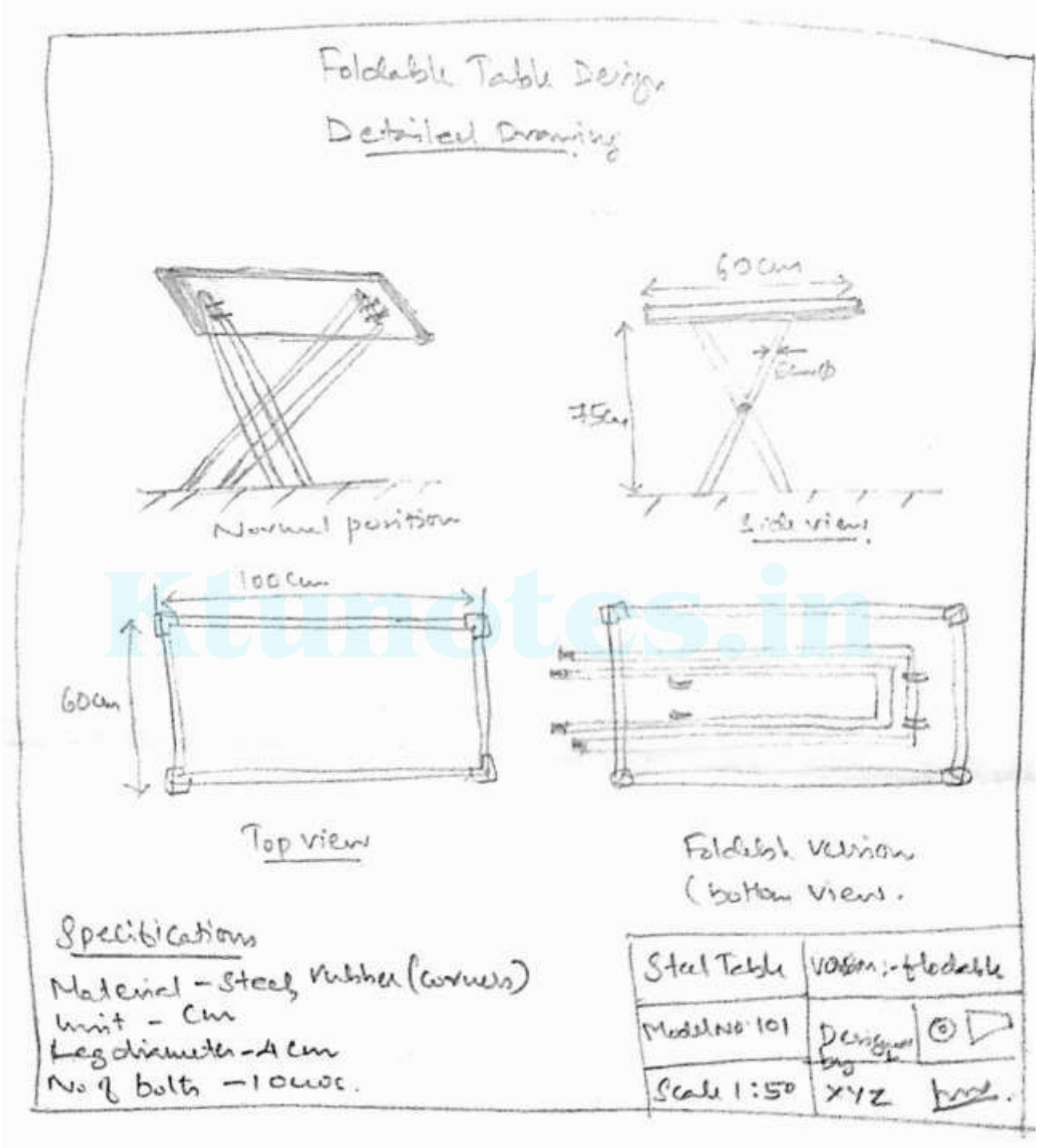
Constraints *(Tips: add as many points you can*

- ✓ Material should be steel
- ✓ Should be foldable and portable
- ✓ Cost should be minimum (under Rs 500)

As per the constraints the materials used must be steel. Since steel is a light weight material it can also aid for the function portability.

In the detailed 2d diagram it is show all the measurements and dimensions of the table. The material used for the product is steel, so it give more durability and less weight. The corners of the tables are smoothened and a rubber material is installed at the corners for safety purpose. There is clamp is placed to hold the leg of the table when it is in standing position. When it is folded the height of the product become 5 cm.

The diameter of the leg is 5 cm and the edges of the legs are covered with rubber bush to get good grip on the floor.



Question 16) Prepare a technical report for a newly designed website for online training of students with neat diagrams for presenting to a client. (14 marks)

SCHEME) Technical report – 9 marks. (Requirement identification- 3marks, logical grouping -3 marks, aesthetic presentation- 3 marks). Credit may be given to all logically correct choices of tabs and scrolls, Figure – 5 marks

16. Ans)

A technical report should contain

- ✓ Title
- ✓ Summary
- ✓ Introduction
- ✓ Design details
- ✓ Result
- ✓ Conclusion

Title

Technical report on Design of

"Online Training Hub"

Designed by: XYZ/ ABC Company

Client : AAA

Tips: Make more attractive

Summary

This report includes the details of design of the online training software "Online training Hub ". This online tool is used for training students anywhere in the world. The website have account for both students and teachers. The teachers can take live class or recorded class to students. Assignments/ quizzes can also be assigned to students. Online exams can also be done through this. The project is mainly done for the client

Introduction

In this covid-19 pandemic time most of the teaching is done in online mode. The important of *"Online training Hub"* is high in this time. Online learning technique has its advantages in many ways. A recorded session of the class can watch by students at any time if they miss some classes. Tracking of the learning process can also be easily done in the online platform. Lets discuss the details of *"Online training Hub"*

Detailed Design

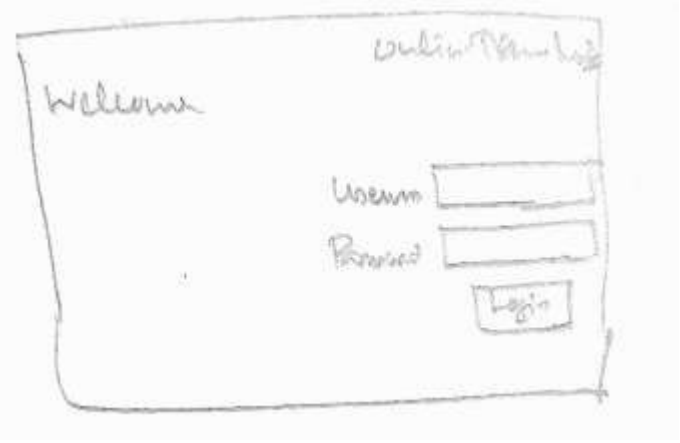
Objectives

- ✓ Should be simple from user perspective
- ✓ Individual account and options for teachers and students
- ✓ Streaming of previous video classes
- ✓ Online test should be able to conduct
- ✓ Results, timetable, assignment etc should be able to track from accounts of individual
- ✓ Attendance system must be there

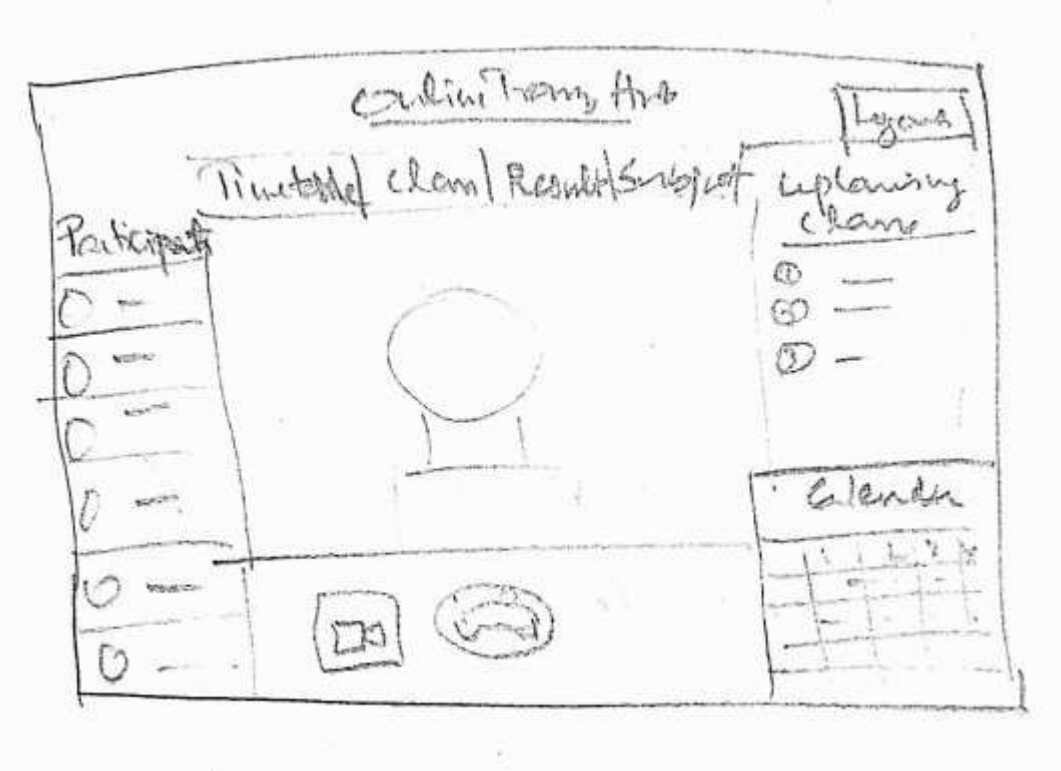
Constraints

- ✓ Data security is important
- ✓ Teacher student interaction must be there
- ✓ Minimal data usage must be there
- ✓ Mobile allocation must be available for the same

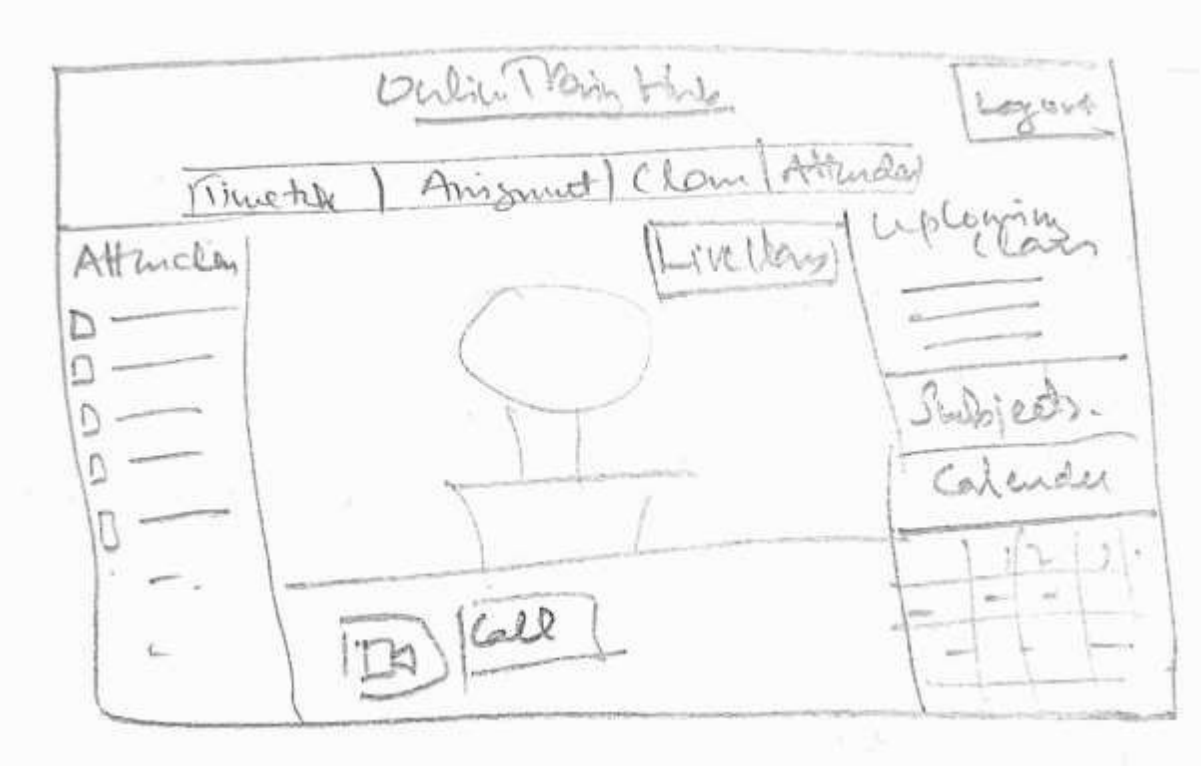
Login page:



Student's account window



Teacher's Account window



Quiz/Assignment window

(Tips: you can add as many features as you can the way you like)

Result & Conclusion

The *"Online training Hub"* can perform as a good online training platform for both students and teachers. All can create and have their own account and keep a track about the academic activities and performance. Also authorities like Principal and HODs can also have their own accounts and keep the status of the academics and get report of the same.

A mobile app based on *"Online training Hub"* is also an easy access to the platform. This can reduce the usage of data used for the students who have low data transaction performance. In summary the platform is simple and user friendly for all the users.

MODULE 4

Question 17) Apply value engineering to a pen, and design a lightweight pen torch. Illustrate the solution using sketches. (14 marks)

SCHEME) Explanation – 9 marks (Requirement identification- 3marks, value addition in cost -3 marks, ergonomic features- 3 marks). Credit may be given to all logically correct choices, Figure – 5 marks

17. Ans)

Value of engineering is the technique for increasing the value of product, project & process. The term defined the ratio of function to the cost.

$$\text{Value} \quad \frac{function}{cost}$$

= Lets discuss the value of engineering to a

pen **Requirement/objective**

- ✓ To design a light weight pen torch
- ✓ Should be able write from one side
- ✓ A working torch in the other side

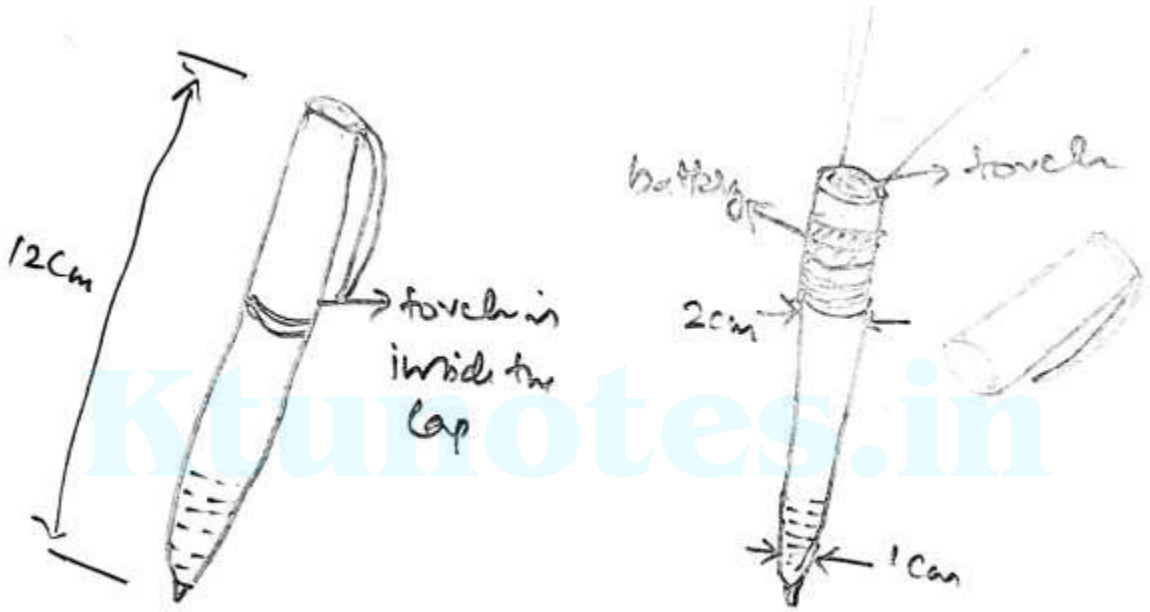
Functions

- ✓ Writing
- ✓ Can be also used as a torch when needed

Normally a pen's basic function is to write, but here we are adding one more function to the pen without increasing the cost of the product. This can increase the value of the product. The value of the product can be increased by either increasing the functions of the product or by reducing the cost of the product.

Ergonomic features of the pen

- ✓ To write with the pen the diameter of the holding side is reduced so that user can hold it easily
- ✓ There is a rubber grip is also placed at the writing side of the pen
- ✓ The torch is placed on the back side of the pen
- ✓ The design is like the pen cap can be removed and torch will be inside
- ✓ The torch cap can be removed to add batteries to the torch
- ✓ To lower the weight of the pen we used light weight plastic material



Question 18) Design waste bins to be kept at bus stops for waste collection enabling source separation. The bin should be theft-resistant and protect the contents of the bin from external weather conditions. Design the bins with ergonomic consideration for waste collection workers. Sketch the design using hand drawings. (14 Marks)

SCHEME) Explanation – 9 marks, (Requirement identification- 3marks, logical grouping -3 marks, ergonomic features- 3 marks). Credit may be given to all logically correct choices, Figure – 5 marks

18. Ans)

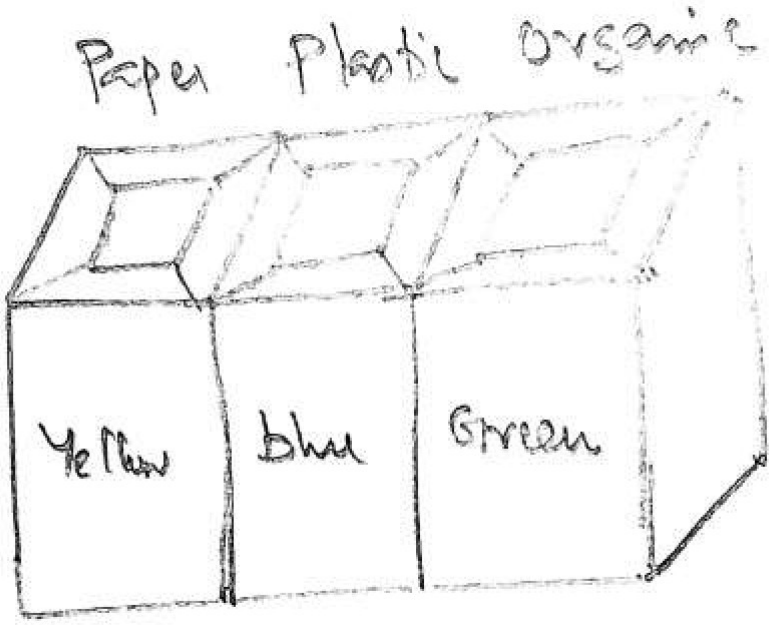
Here our objective is to design a wate bin at bus stop. The design must be ergonomic & stable. Let's discuss the design

Objective/requirement

- ✓ To design a wate bins to be kept in the bus stop for waste collection.
- ✓ Source separation must be there (separate sections for separate waste)
- ✓ Must be theft resistant
- ✓ Protection from extreme weather condition
- ✓ Ergonomic consideration for waste collection workers

Design for source separation

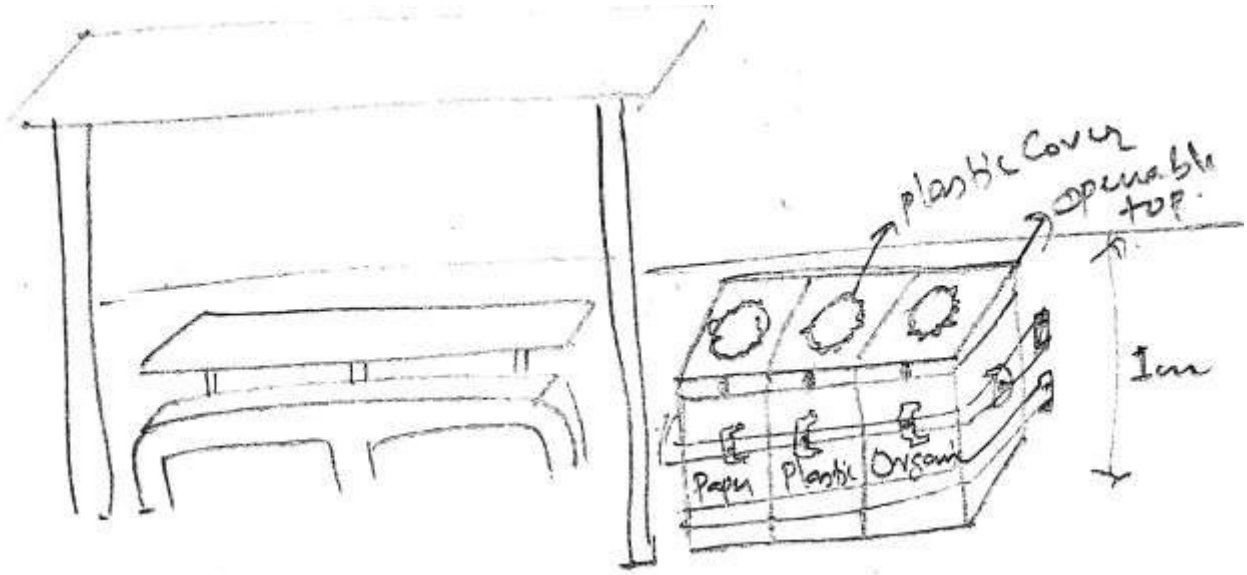
For separation of the wastes, it is better to separate it from the time of the dumbing itself. So lets put separate opening for common separate waste. The common wastes can be separated in to three paper waste, plastic waste, organic waste. To distinguish the waste bin we can put separate colour for each bins. The common colour for these wastes are yellow, blue and green. The basic design of the waste bin is shown in the figure



- ✓ to protect the waste bin form thieves, we can make a permanent waste bin which is placed near the bus stop.
- ✓ The waste bin can be fixed to a location or wall with the help of a steel bars around it , as shown in the figure
- ✓ To protect waste bin from extreme weather conditions we can either place the waste bin under the bus stop roof or place a plastic sheet above the waste bin.

Ergonomic features of the bin

- ✓ To make the collection of waste easy by the waste collectors, the height of the waste bin can be given as 1 meter
- ✓ For easy retrieval of the waste a door is given at the top and side of the waste bin.
- ✓ Also can place a plastic bag inside the bin so that collectors can easily take the trash out.
- ✓ The bin fixed bars can be opened and lock by the collectors for easy bin management
- ✓ Different colures are given for the bin for better bifurcation of the garbage.



Tips:

- *you can add as many features you can*
- *Add more figures*
- *In ergonomic consideration mention design to make the product easier*

MODULE 5

Question 19) Design a fan which automatically reduces speed or stops when the temperature reduces during the night for energy conservation. Use hand sketches to support your design. (14 marks)

SCHEME) Explanation – 9 marks (Requirement identification- 3marks, logical solution -3 marks, feasible circuitry- 3 marks). Credit may be given to all logically correct choices, Figure – 5 marks

19. Ans)

Here we have to design a fan that can reduce its speed or stop automatically when the temperature is low in order to save energy. Let's discuss the design

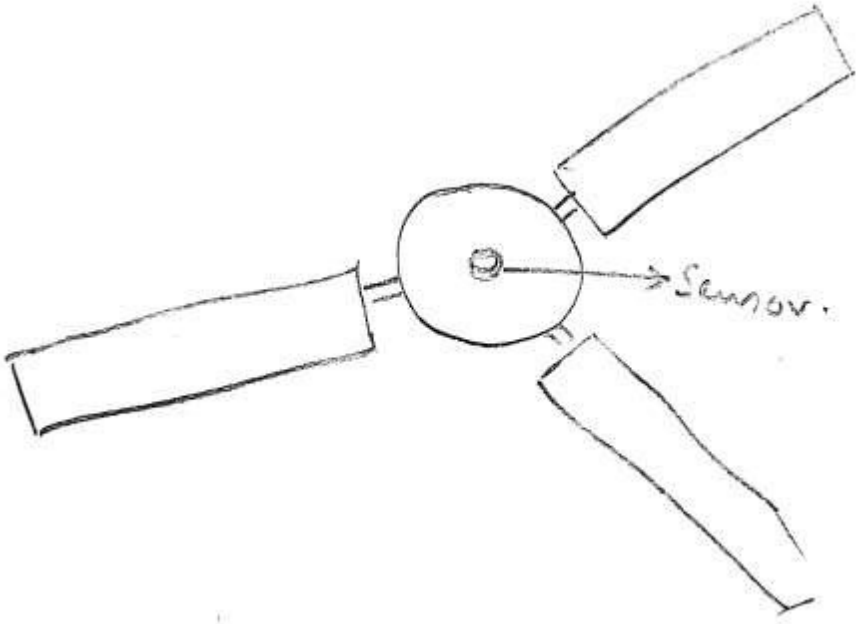
Requirement/Objective

- To design a fan that reduce speed when temperature is low
- Fan should automatically stop when temperature is below certain level

Solution steps

To design a fan that automatically controls its speed need a sensor system that can sense the temperature inside the room. Lets take the threshold temperature as 22 ^{0}C. below thqat temperature the fan should automatically stop.

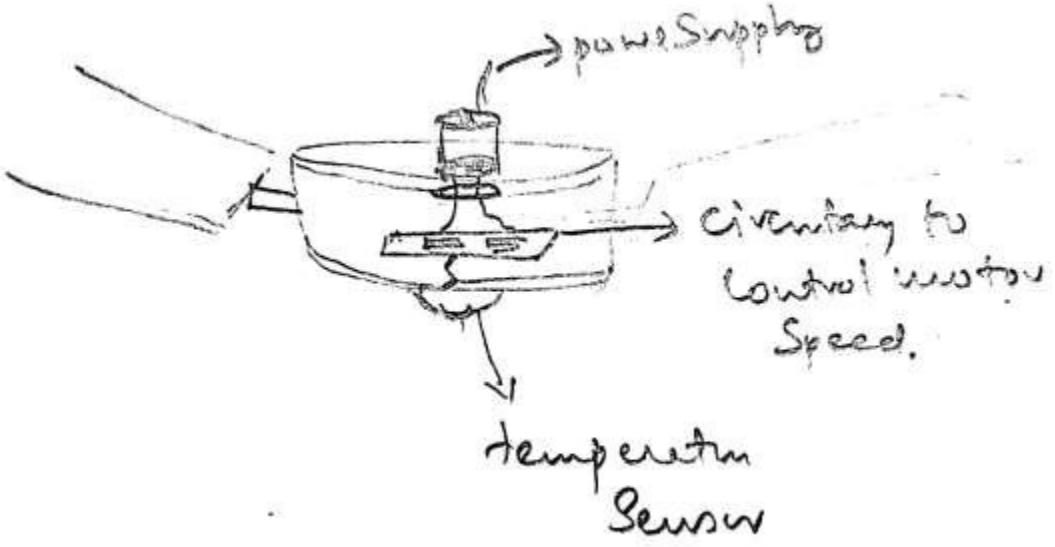
The sensor can be placed on the fan itself. The sensor must be exposed to the room then only it can detect the room temperature. Lets place it in the middle of the fan face, and the circuitry can be placed inside the fan.



We can set some temperature threshold for the sensory circuit.

Temperature reading	Speed of the fan
Above 27^0C	Speed 5
26^0C	Speed 4
25^0C	Speed 3
24^0C	Speed 2
23^0C	Speed 1
22^0C	OFF

The circuit for the fan can be set up like shown in the figure



The fan can also be controlled by the mobile app, because of the Bluetooth connectivity in the fan. The temperature settings can be controlled or set by the mobile application providing with the fan. The basic structure of the mobile application is shown in the figure

Question 20) Describe how to estimate the cost of a pen and list the various parts. Show how the economics will influence the engineering designs. Use hand sketches to support your arguments.(14 marks)

SCHEME) Identification of parts and its cost – 6 marks, Choice of economical design by choosing different ideas – 3 marks, Credit may be given to all logically correct choices, Figure
– 5 marks

20. Ans)

Objective

- ✓ To estimate the cost of the pen & show how the economics will influence the engineering design

For the estimation of cost we need to consider three types of cost

1. Labour cost
2. Material cost
3. Overhead cost

Let us consider a company is manufacturing 50000 pens for a month. In order to estimate the cost of the product manufacturing and distribution let us identify each costs.

The different parts of the pen consist of

- ✓ Body of the pen
- ✓ Point ball of the pen
- ✓ Ink
- ✓ Ink reservoir
- ✓ Cap of the

pen Materials needs

- ✓ Steel
- ✓ Plastics
- ✓ Ink

- ✓ Colours

Steps of manufacturing

1. Making of ink
2. Body and other parts Moulding
3. Ink filling
4. Assembly of parts

From the above information we can estimate the cost of the product

1. Labour cost estimation

Let us assume the labour cost for each dept as below

Labour section	No of Labour	Salary/month	Total cost
Ink making	2	5000	10000
Moulding	4	10000	40000
Ink filling	4	5000	20000
Final assembly	4	5000	20000
		Total	90000

2. Material cost estimation

Item	Quantity	Rate/kg	Total
Metal	2 kg	70	140

Plastic	10kg	40	400
Ink material	2 kg	30	60
		Total	600

3. overhead cost estimation

Building rent	10000/month
Current bill	20000/month
Water bill	10000/month
Miscellaneous expenses	10000/month
Total	50000/month

From the above estimations the total expense are

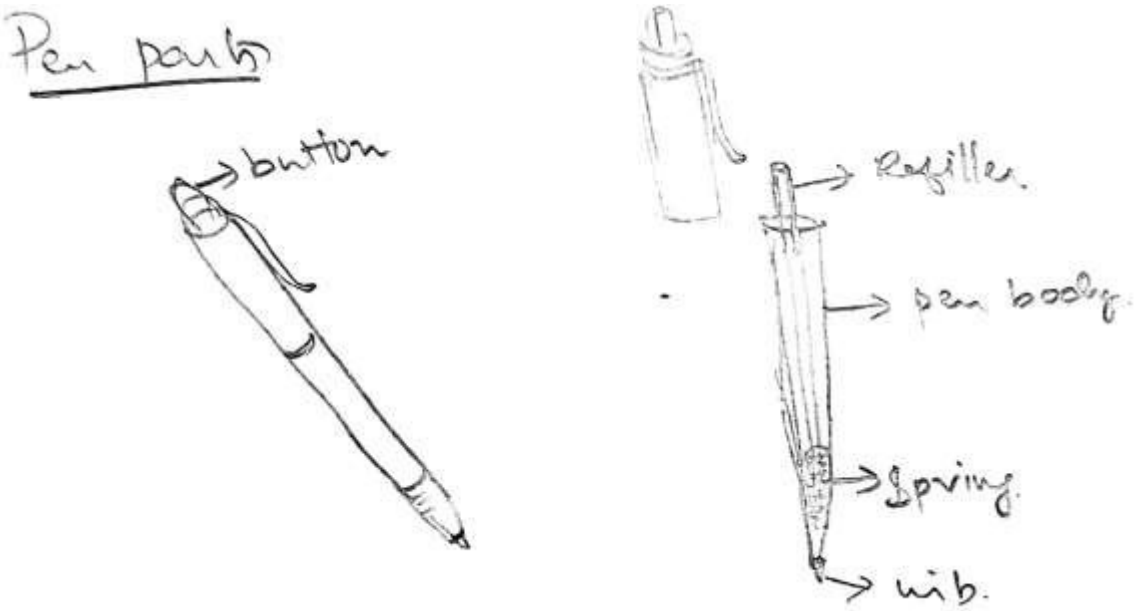
90000+600+50000 = 140600

We are estimated 50000 pens per month so if we take average 140600/50000 = 2.81

So from the perdition we can estimate the cost around Rs 3 per pen

Effect of economy in manufacturing

In order to understand the effect of economy in design, lets discuss each parts and its materials. The main pars of the material is shown in figure



For the manufacturing of the pen nib we can use different materials but here we used the copper for reducing the higher cost. This will give the same performance as other materials and with less cost

Similarly, we can choose other materials too with good performance and less expense. Plastic materials are used as body material. if we make the pen's inside body as the ink carrier without ink spilling technique we can reduce the materials for refill.

Also reducing the size of the pen can reduce the expense.

By choosing the best product for manufacture as well as choosing experienced labours we can increase the design and productivity output. In this way we can reduce the product cost and increase the value of the product. Her we are able to sell the product Rs 3 per piece.

Tips: include as many points you can based on the expense of product