KTU NOTES

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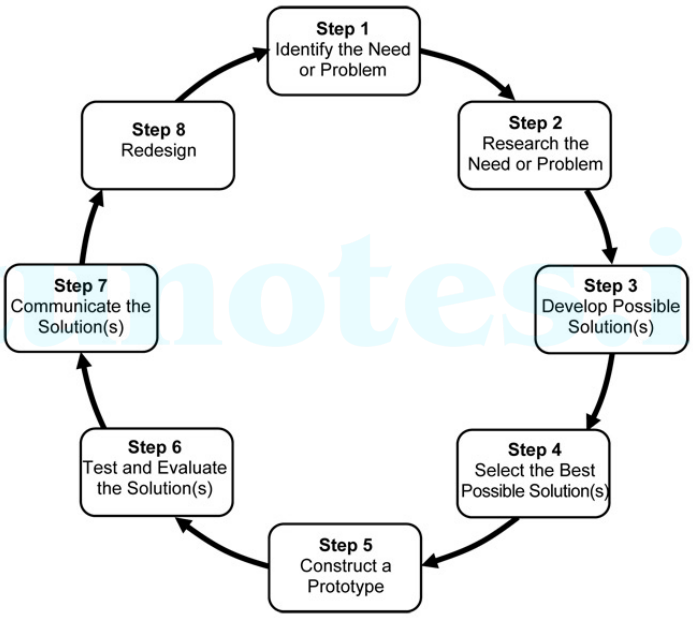
KTU STUDY MATERIALS | SYLLABUS | LIVE NOTIFICATIONS | SOLVED QUESTION PAPERS

Module 1: Design & Engineering

Background

Engineering design is the creative process of identifying needs and then devising a solution to fill those needs. This solution may be a product, a technique, a structure, a project, a method, or many other things depending on the problem. The general procedure for completing a good engineering design can be called the Engineering Method of Creative Problem Solving. Problem solving is the process of determining the best possible action to take in a given situation. The nature of problems that engineers must solve varies between and among the various branches of engineering. Because of the diversity of problems there is no universal list of procedures that will fit every problem. Not every engineer uses the same steps in their design process, but following list, which includes most of the steps of the design method that engineers use.



Q1) Show the designing of a wrist watch going through the various stages of the design process. Use hand sketches to illustrate the processes.

Solution:

Step 1: Identify the need / problem and constraints

Needs/problems

N1) to check the time whenever we want

N2) should be able to carry on wrist all the time

N3) simple and minimum weight

N4) must be wrapped around your wrist all the time

N5) should be able to check current date and day

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N6) Materials used form manufacturing

N7) colour of the product

Constraint

C1) must be small size that can fit in the wrist

C2) time needle must be small but visible

C3) date and day must be included

C4) sweat, water and corrosion resistant

C5) strap must be made of leather

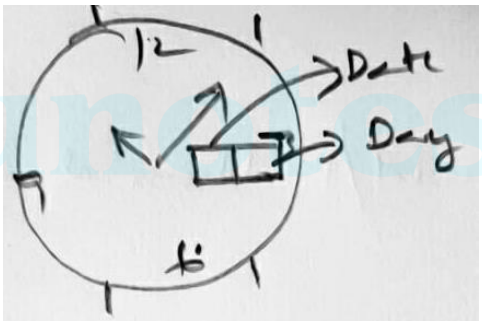
Step 2: Research the need or problem

N1, N2- wrist strap will carry and hold for time

N3 - an analogue or Digital watch is simple and easy. quarts, plastic and low weight Steel material can reduce the weight

N4 - a leather, rubber or plastic strap can be used to wrap around the wrist always

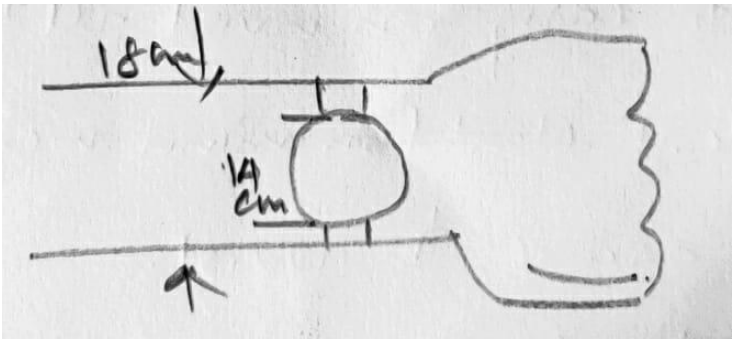
N5 - a date and day section can be included in the watch face



N6 – for watch's inner parts quarts materials and steel can be used, outer body parts can be made out of strong plastic materials. The strap material is leather

N7 – colour choice – Black, blue, orange

C1 - an average wrist size is around 15 to 18 cm so watch face size can be around 13 to 14 cm in diameter



C2- for better visibility with small size we can use bright colour watch face and dark colour needle also we can increase the width of the needle

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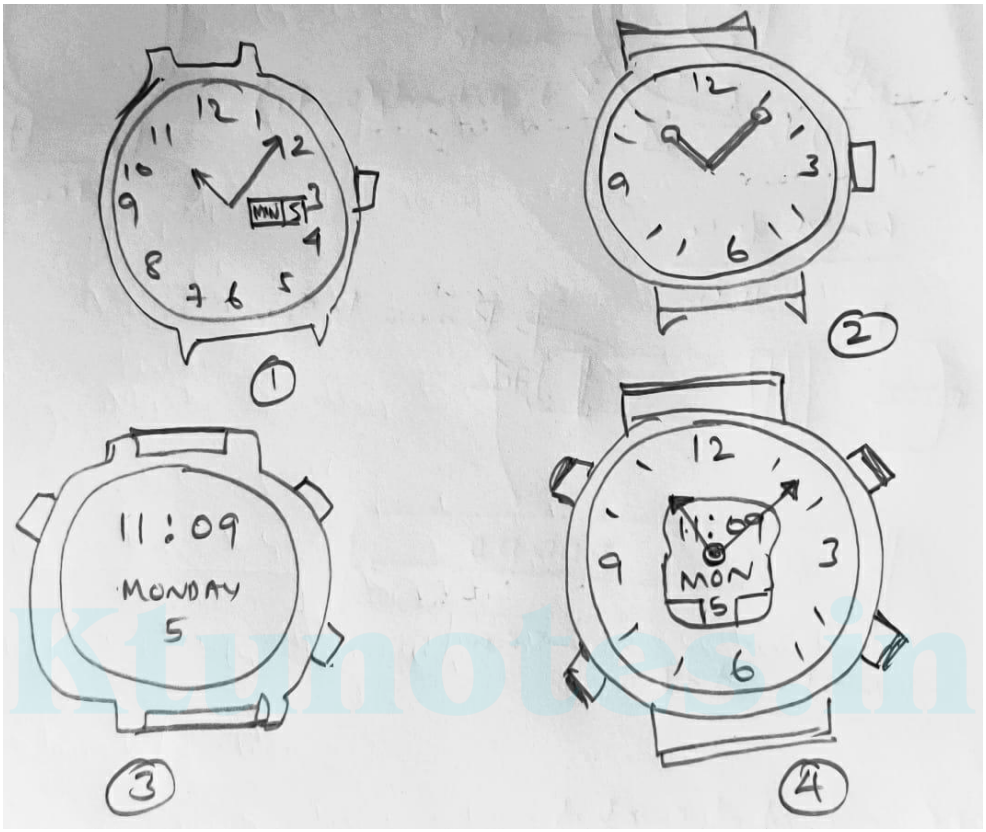
C3- discussed in the N5 section

C4- watch must be completely closed design corrosion free material must be used for example, Plastic or corrosion free steel etc.

C5- Strap leather can be used commonly available leather for cost reduction

Step 3: Develop possible solutions



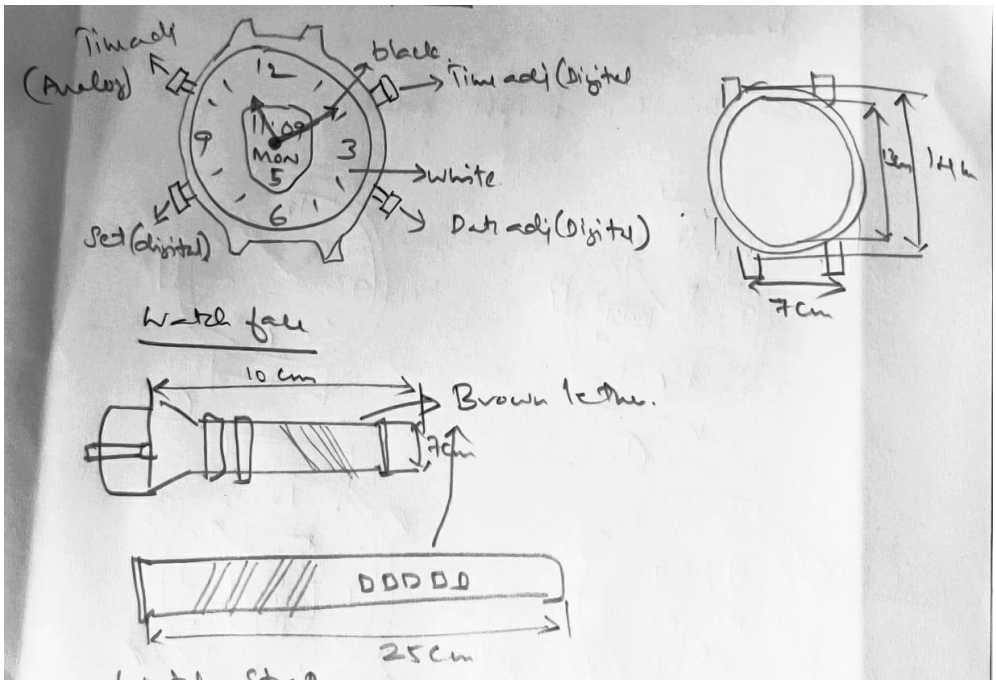
Step 4: Select the best possible solution

From the above solution the best-chosen design is design no 4

Reasons

- Have both analogue and digital clocks can show time
- Even in less battery the digital clock still can work
- Stylish
- More visibility
- Leather strap
- Long lasting materials

Step 5: Prototype/Model



Step 6: Test and evaluation

There are many criteria that engineers use to evaluate the value of a solution or design, which may depend on the nature of the problem. If the solution involves a product, great importance may be placed on safety, cost, reliability, and consumer acceptability. Many designers use prototypes to test the operation of the design. The designer could then identify any weak areas of the design and attempt to improve upon them. No idea should be discarded solely on the basis of one prototype or one test. Many great designs have been discarded prematurely and many working prototypes have failed to give acceptable products. Indirect evaluation can be used as well, to evaluate a design. Scale models can be used to test aircraft design at a fraction of the cost of building a prototype. Computer simulations and mathematical models may not be accurate enough to allow understanding of all the complexities of component interference or turbulence, but they still may be used to approximate the design of the first scale model

Step 7: Communication: preparing reports, plans, and specifications

After selection of the preferred design, it must be communicated to those who must approve it, support it, and translate it into reality. This communication may take the form of an engineering report, or a set of plans and specifications. Plans and specifications are the engineer's means of describing to a manufacturing division or to a contractor sufficient detail about a design so that it can be produced or constructed. Engineering drawings, written and oral communications, and scheduling and planning a design project are very important in implementing a design smoothly and efficiently.

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Q2) Find the customer requirements for designing a new car showroom. Show how the design objectives were finalized considering the design constraints?

Solution:

Step 1: Identify the need / problem and constraints

Need/problem

N1) Design a car showroom withing the provided space and budget

N2) car display space must be there

N3) Reception area needed

N4) need customer waiting room

N5) need service centre

N6) need spare parts sales

N7) need an area for car delivery

N8) need employ office

N9) vehicle loading and unloading

N10) Needed parking space

Constraints

C1) Car display must be in front side

C2) Reception should also in the front side

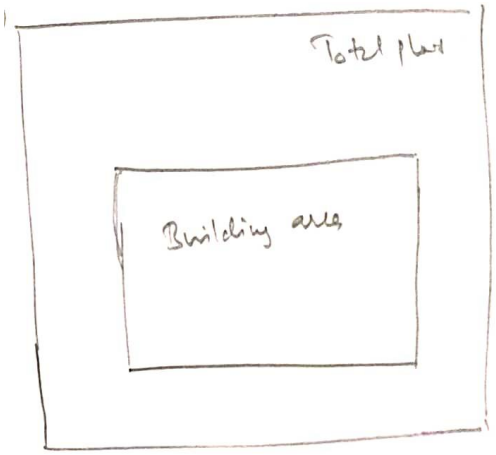
C3) service centre must be at back side

C4) spare sparts sale section must be near service centre and public accessible

C5) Need to park at least 20 cars

Step 2: Research the need or problem & solutions

N1 – Since the parking should needed for minimum 20 cars, which is one of the constraints (C5) the design can be done in 50% of place

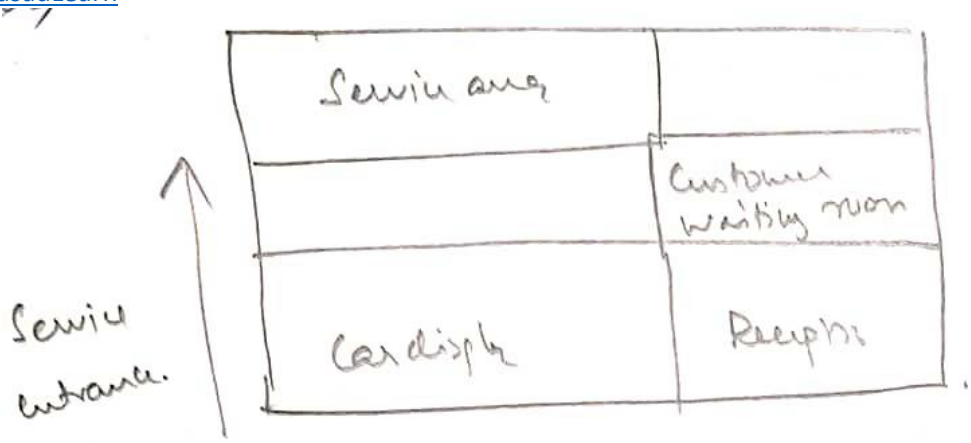


N2 – car display can be place on front side since it is one of the constraints(C1)

N3 – Reception area also should be in front from the constraint (C2)

N4 – customer waiting room can be placed near reception Also can be equipped with TV, sofa, AC and bathroom

N5 – service centre can be placed back side of the building and entrance of the service station can be given from the left side of the building

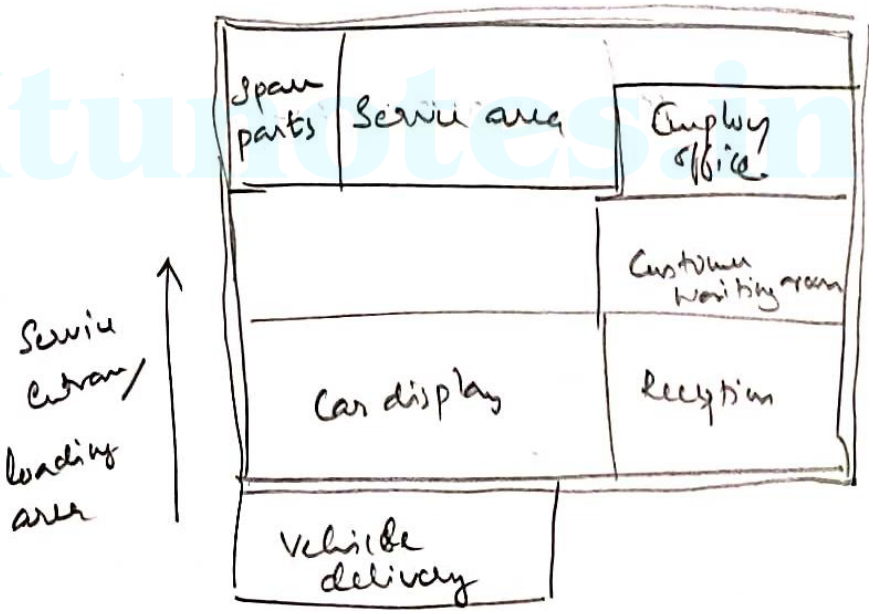


N6 – spare parts sales can be placed near service area for public accessibility too. (Which is C4)

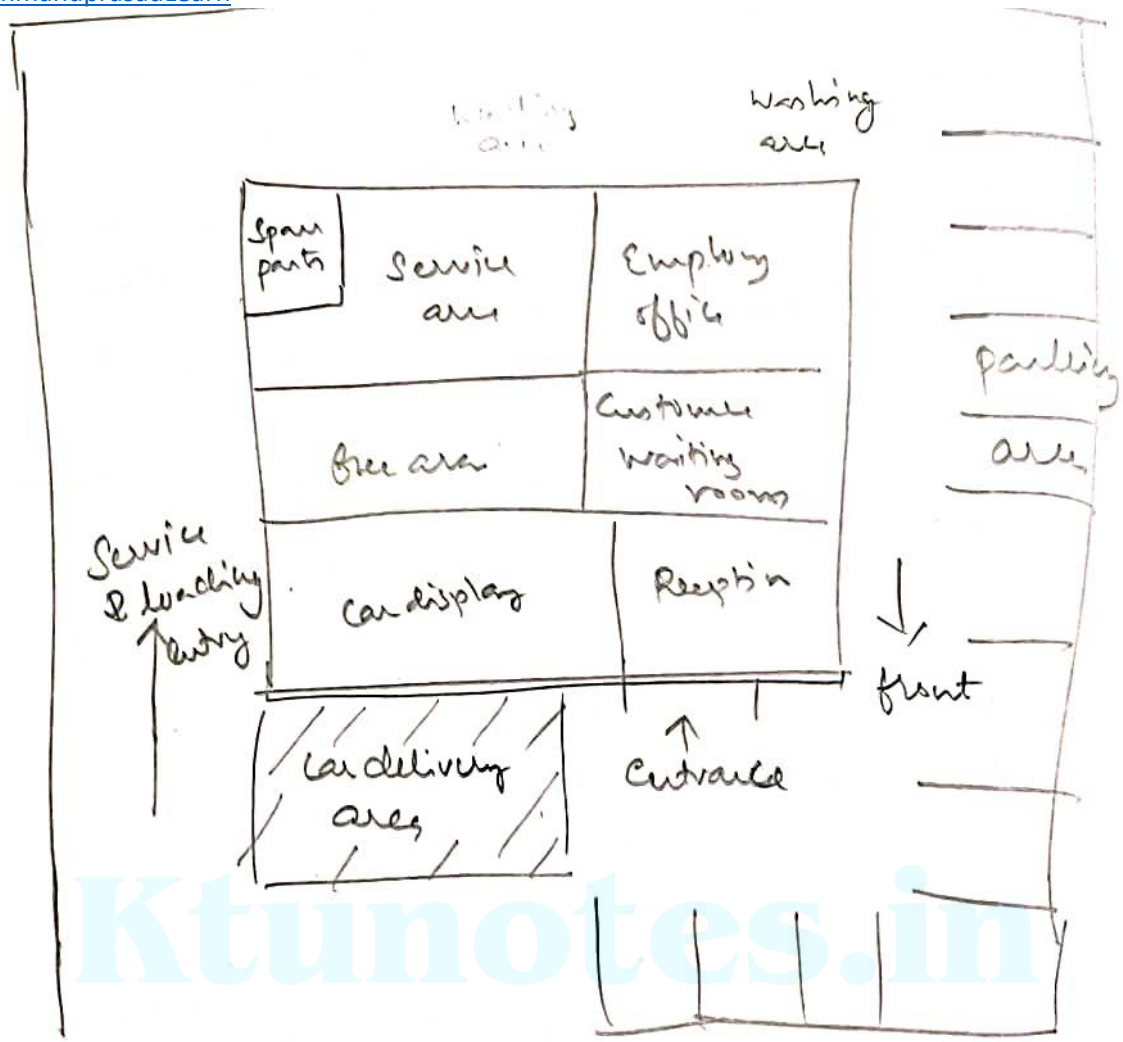
N7 – Car delivery can be place in front of the car display in building

N8 – employ office can be given behind the customer waiting room area

N9 – vehicle loading and unloading area can be placed at same area as service entrance area



N10 – Parking space can be given at right side of the building



Step 3: Model design

Indirect evaluation can be used as well, to evaluate a design. Scale models can be used to test the design at a fraction of the cost of building a prototype. Computer simulations and mathematical models may not be accurate enough to allow understanding of all the complexities of component interference or turbulence, but they still may be used to approximate the design of the first scale model for testing.

Step 4: Communication: preparing reports, plans, and specifications

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