EST 200
DESIGN AND ENGINEERING

Hello!

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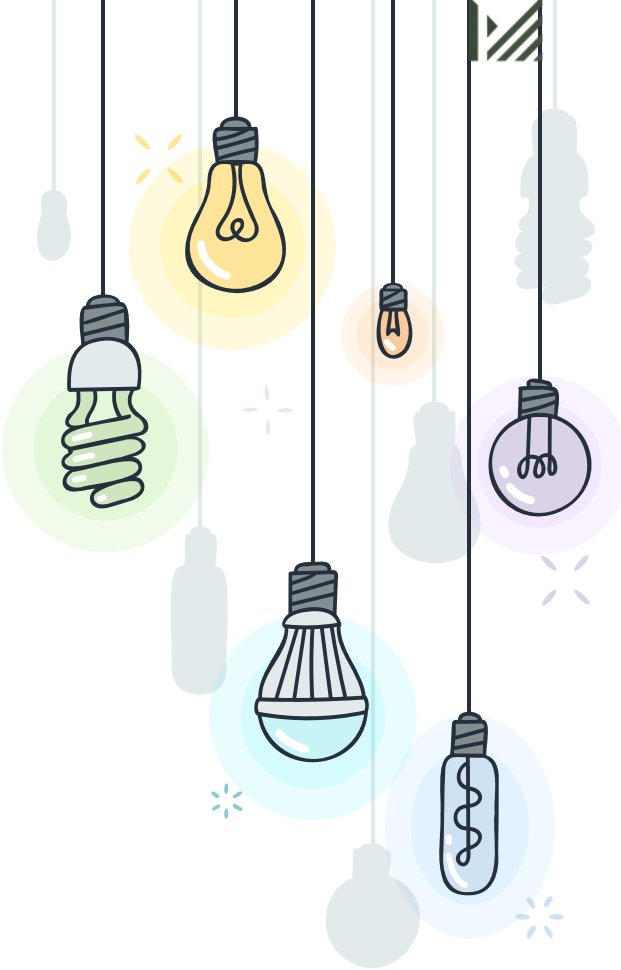
End Semester Examination (ESE) Pattern

University Question Paper Pattern

Question Paper pattern

- **Part A** : 30 marks
- contains 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions.
- **Part B** : 70 marks
- Part B contains 2 case study questions from each module of which student should answer any one. Each question carry 14 marks and can have maximum 2 sub questions.



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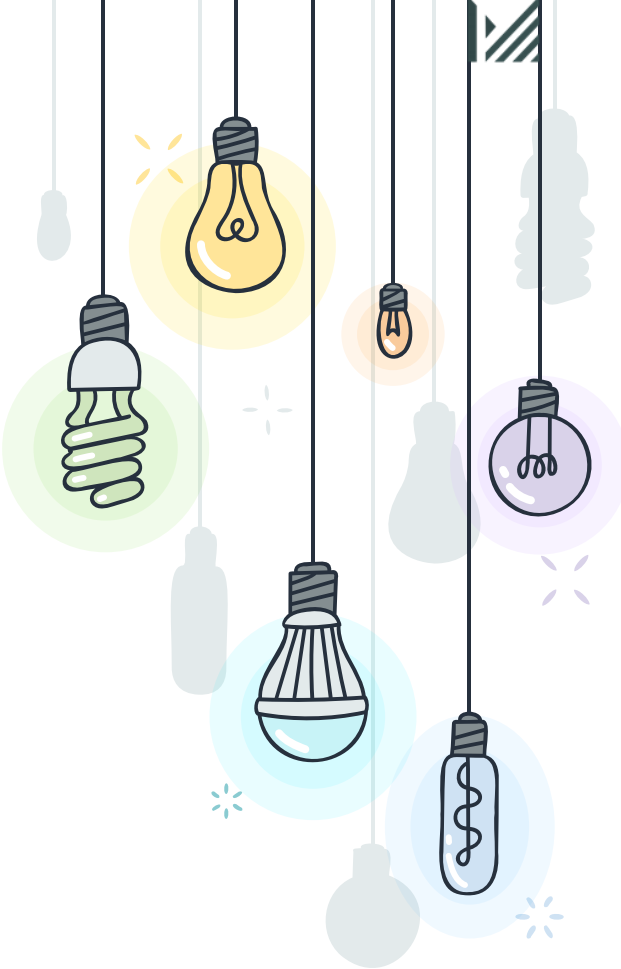
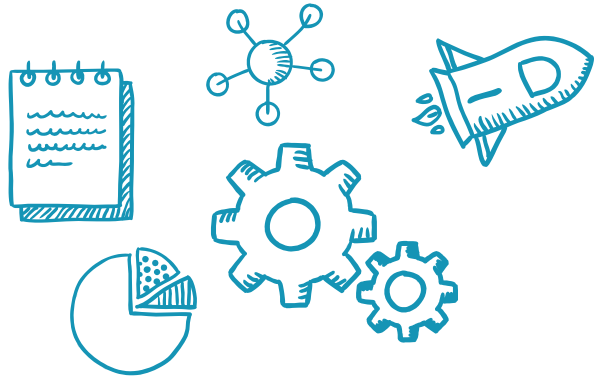
Exam timing

Important

Important

- Normally 3:00 hrs exam due to covid condition 2:15 hrs
- We have 135 minutes
  - 35 mints – Part A
  - 100 mints – Part B

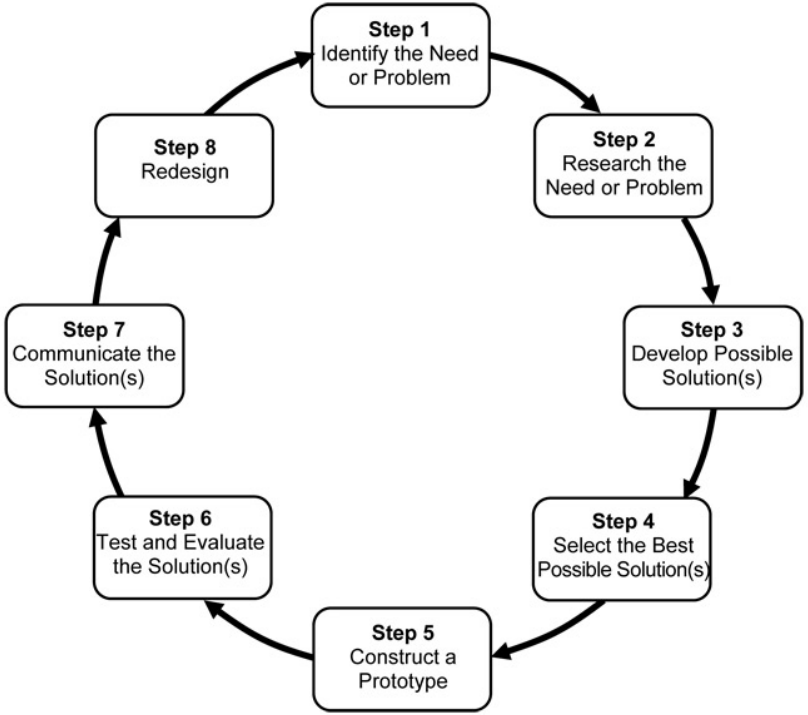


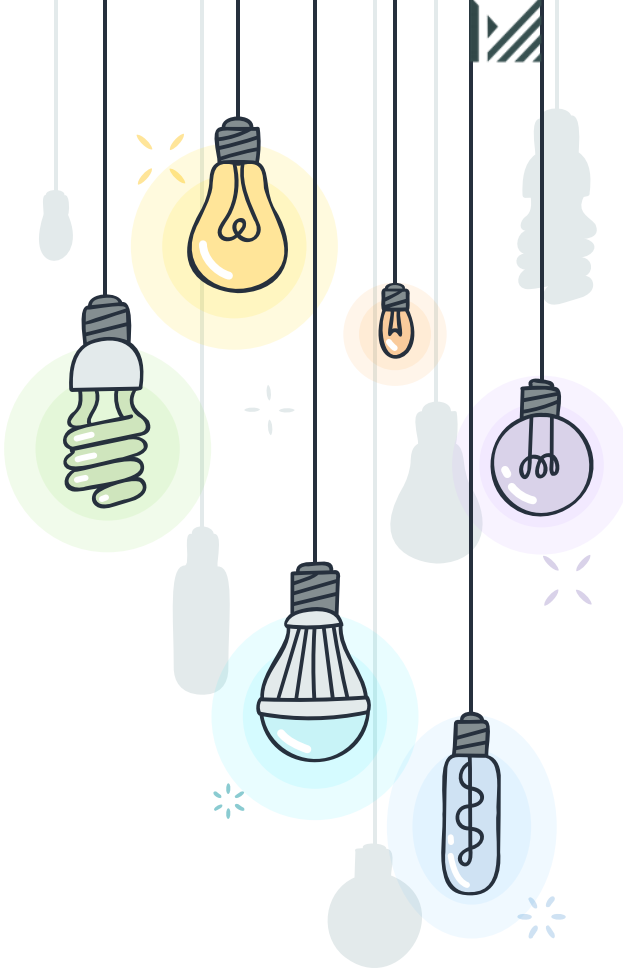


MODULE 1

Design Process: Introduction to Design and Engineering Design, Defining a Design Process-: Detailing Customer Requirements, Setting Design Objectives, Identifying Constraints, Establishing Functions, Generating Design Alternatives and Choosing a Design.

Engineering Design Process





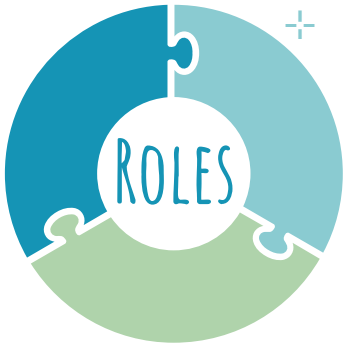
Different stages in a design process

- Analyze the situation
- Write a brief problem statement
- Research the problem through brain storming
- Write a specification – Problem Description
- Work out possible solutions
- Select a preferred solution
- Prepare working drawings and plan ahead
- Construct a prototype
- Test and evaluate the design
- Write a report

What "Roles" are played as the design unfolds?

Client:

a person or group or company that wants a design conceived

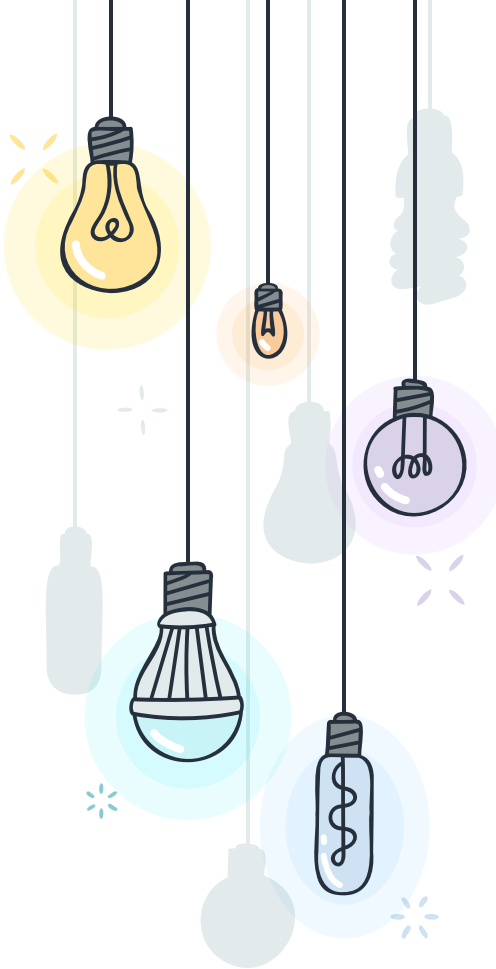


Designer:

whose job is to solve the client's problem in a way that meets the user's needs.

User:

who will employ or operate whatever is being designed.



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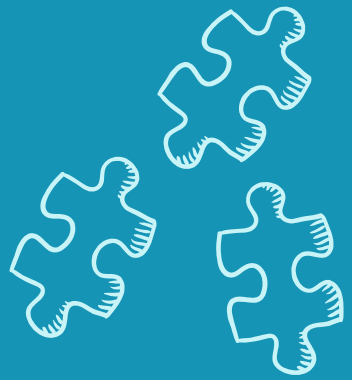
Module 1
Sample Questions

Part A



- Write about the basic design process?
- Describe how to finalize the design objectives?
- Describe how constraints affects the design process?
- Explain how to identify the best possible design from design alternatives?
- What are the main roles in a design process
- What is the Designer's first task and why?

Module 1 (Part A) : Sample Questions – 3 Marks

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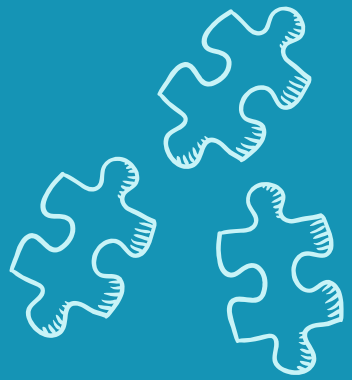
Module 1
Sample Questions

Part B



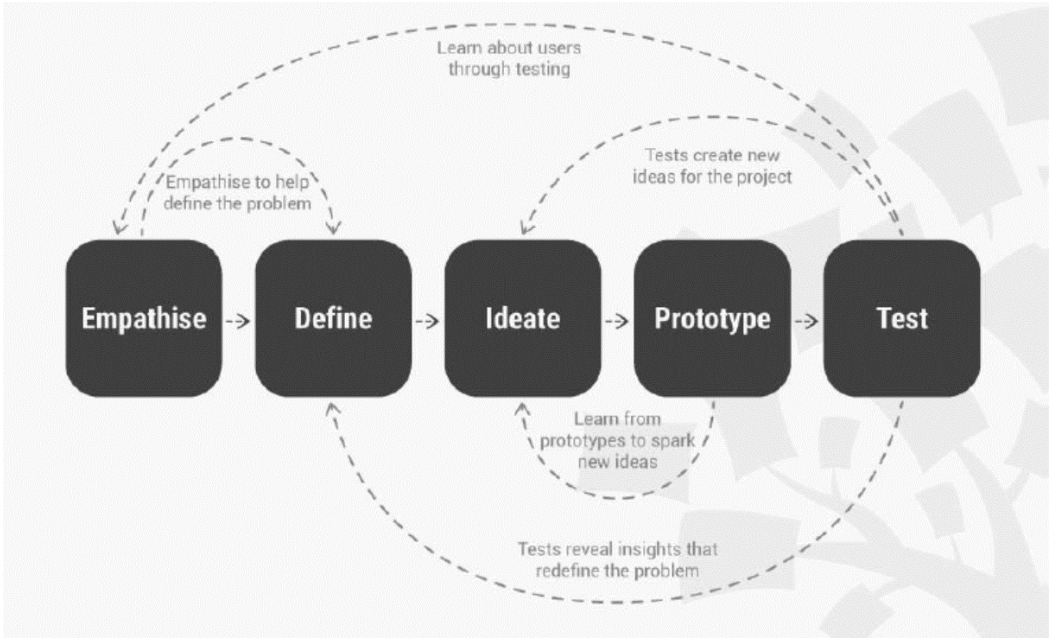
- Q1) Show the **designing of a wrist watch** going through the various stages of the design process. Use hand sketches to illustrate the processes
- Q2) Find the customer requirements for **designing a new car showroom**. Show how the design objectives were finalized considering the design constraints?
- Q3) Show the **designing of an online shopping website** going through the various stages of the design process. Use hand sketches to illustrate the processes.
- Q4) Find the client requirements for **designing a new digital class room**. Show how the design objectives were finalized considering the design constraints?

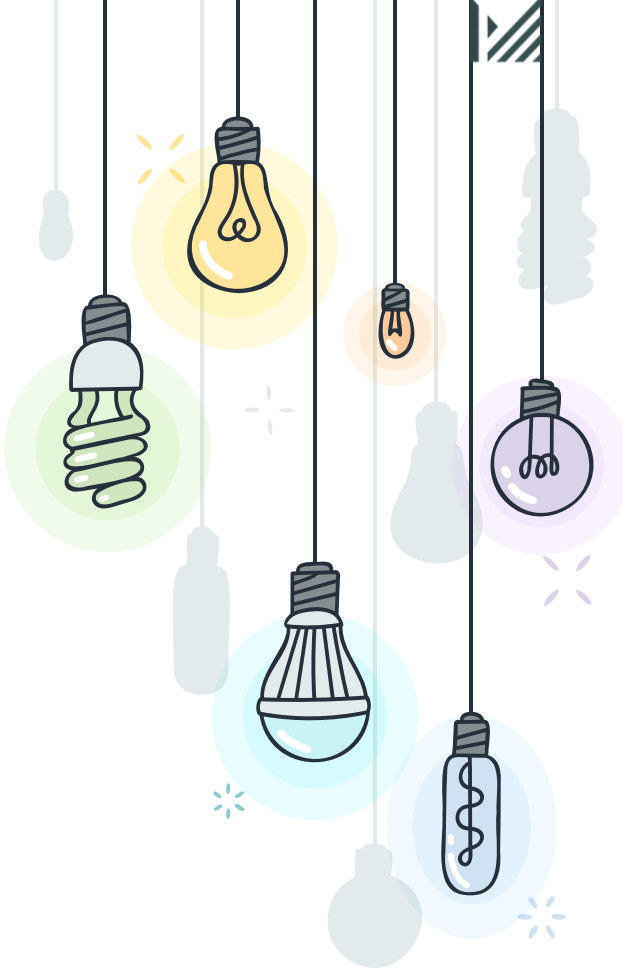
Module 1 (Part B) : Sample Questions – 14 Marks

MODULE 2

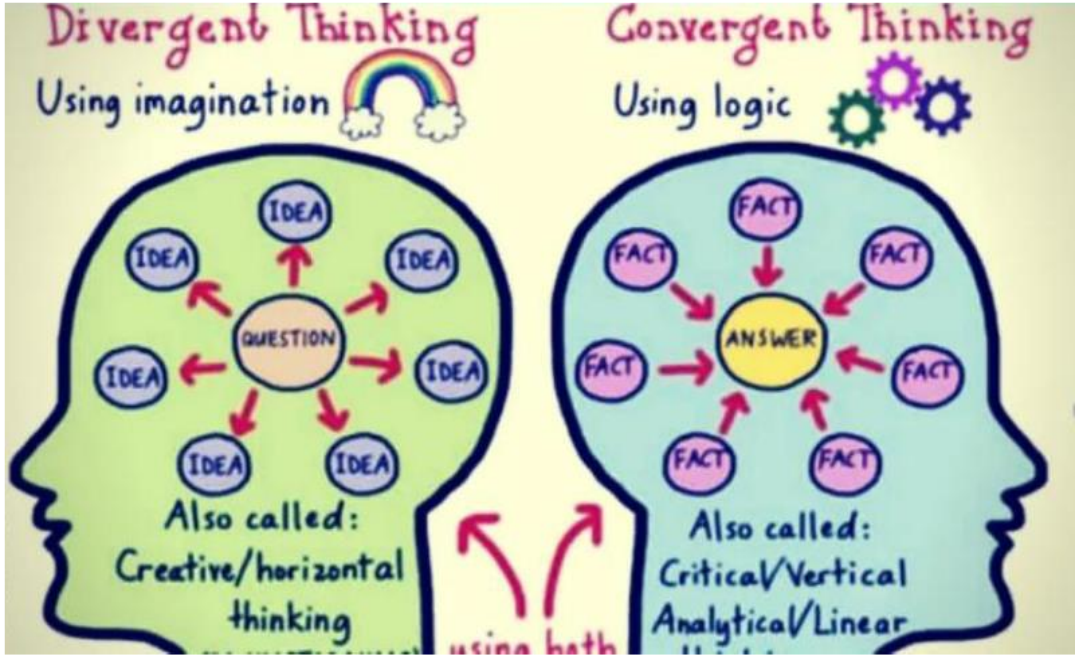
Design Thinking Approach:- Introduction to Design Thinking, Iterative Design Thinking Process Stages: Empathize, Define, Ideate, Prototype and Test. Design Thinking as Divergent-Convergent Questioning. Design Thinking in a Team Environment.

The Five Stages of Design Thinking





Divergent thinking vs Convergent thinking



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Module 2
Sample Questions

Part A

- State the role of divergent-convergent questioning in design thinking
- Discuss how to perform design thinking in a team managing the conflicts.
- Define the term prototype and the importance of it
- What are the different stages of design thinking

Module 2 (Part A) : Sample Questions – 3 Marks

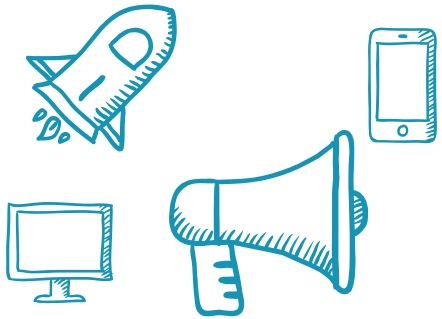
6

Module 2
Sample Questions

Part B

- Q1) Illustrate the design thinking approach **for designing a bag for college students** within a limited budget. Describe each stage of the process and the iterative procedure involved. Use hand sketches to support your arguments.
- Q2) Construct a number of possible designs and then refine them to narrow down to the best **design for a drug trolley used in hospitals**. Show how the divergent-convergent thinking helps in the process. Provide your rationale for each step by using hand sketches only.
- Q3) Describe in detail the design thinking approach for **designing a tiffin box for a 6-year-old child**. Describe each stage of the process and the iterative procedure involved. Use hand sketches to support your arguments.
- Q4) Construct a number of possible designs and then refine them to narrow down to the best **design for an automatic hand sanitizer dispenser**. Show how the divergent-convergent thinking helps in the process. Provide your rationale for each step by using hand sketches only.

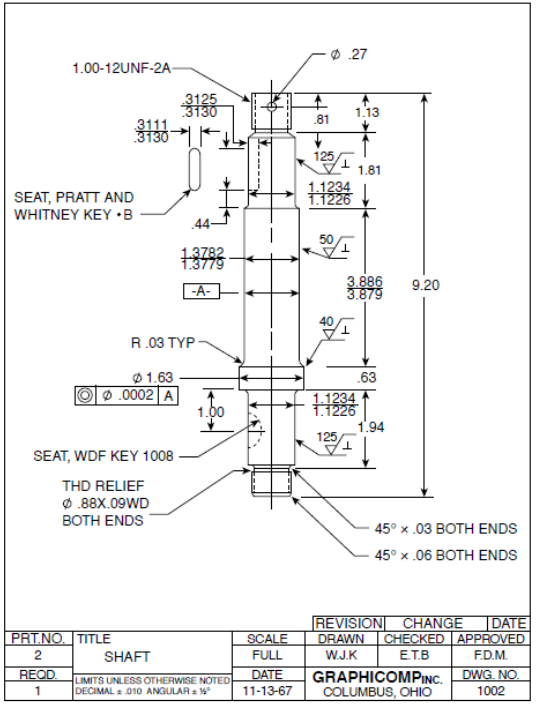
Module 2 (Part B) : Sample Questions – 14 Marks



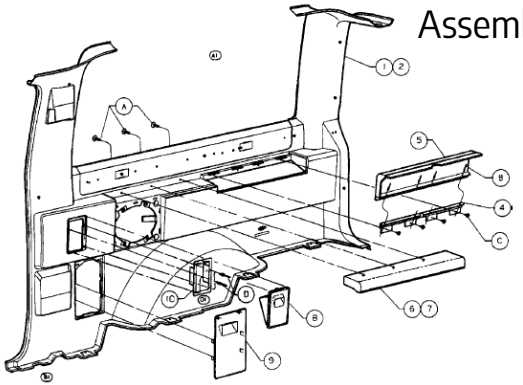
MODULE 3

Design Communication (Languages of Engineering Design):- Communicating Designs Graphically, Communicating Designs Orally and in Writing. Mathematical Modeling In Design, Prototyping and Proofing the Design.

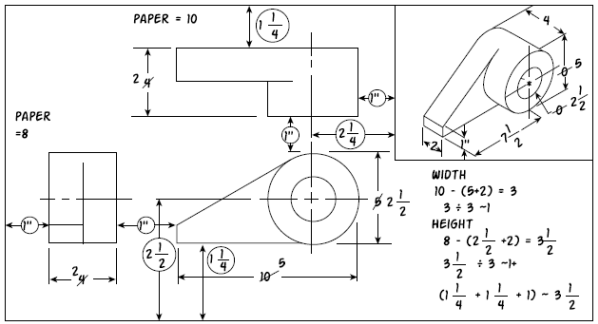
Communicating Designs Graphically



Detail drawings



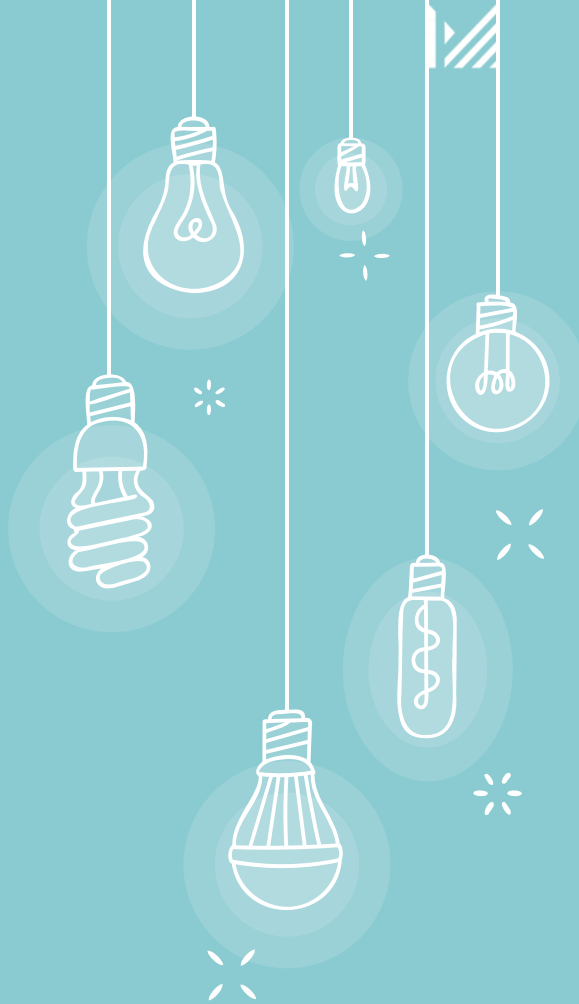
Assembly drawings



Layout drawings

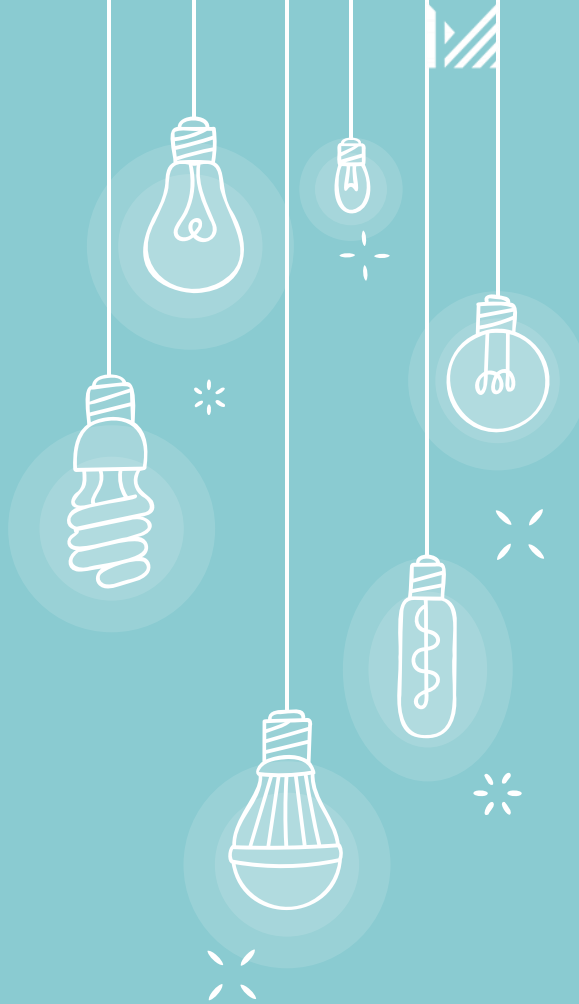
COMMUNICATING DESIGNS ORALLY AND IN WRITING

- **REPORTING** is an essential part of a design project
- We communicate final design results in several ways, including oral presentations, final reports (that may include design drawings and/or fabrication specifications), and prototypes and models.
- The primary purpose of such communication is to inform our client about the design, including explanations of how and why this design was chosen over competing design alternatives.
- It is most important that we convey the results of the design process.



GUIDELINES FOR TECHNICAL COMMUNICATION

- ✓ Know your purpose.
- ✓ Know your audience.
- ✓ Choose and organize the content around your purpose and your audience.
- ✓ Write precisely and clearly.
- ✓ Design your pages well.
- ✓ Think visually.
- ✓ Write ethically!



The Presentation: Outline

- ✓ A title slide
- ✓ A roadmap
- ✓ A problem statement
- ✓ Background material on the problem
- ✓ The key objectives of the client and users
- ✓ The key constraints that the design must meet.
- ✓ Functions that the design must perform
- ✓ Design alternatives
- ✓ Highlights of the evaluation procedure and outcomes
- ✓ The selected design
- ✓ Features of the design
- ✓ Proof-of-concept testing
- ✓ A demonstration of the prototype
- ✓ Conclusion(s)

MATHEMATICAL MODELING IN DESIGN

We will focus on representing the behavior and function of real devices in mathematical terms.
Basic Principles of Mathematical Modelling

- Why do we need a model?
- For what will we use the model?
- What do we want to find with this model?
- What data are we given?
- What can we assume?
- How should we develop this model, that is, what are the appropriate physical principles we need to apply?
- What will our model predict?
- Can we verify the model's predictions (i.e., are our calculations correct?)
- Are the predictions valid (i.e., do our predictions conform to what we observe?)
- Can we improve the model?

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Module 3
Sample Questions

Part A

- Q1) Show how engineering sketches and drawings convey designs.
- Q2) What are the importance of CAD models
- Q3) Draw an example of assembly drawing
- Q4) What are the guidelines for technical communication
- Q5) Write a brief about technical presentation
- Q6) Explain the role of mathematics and physics in design engineering process.
- Q7) Discuss about some mathematical tools for design modelling
- Q8) What is the difference between prototypes and models

Module 3 (Part A) : Sample Questions – 3 Marks

8

Module 3
Sample Questions

Part B

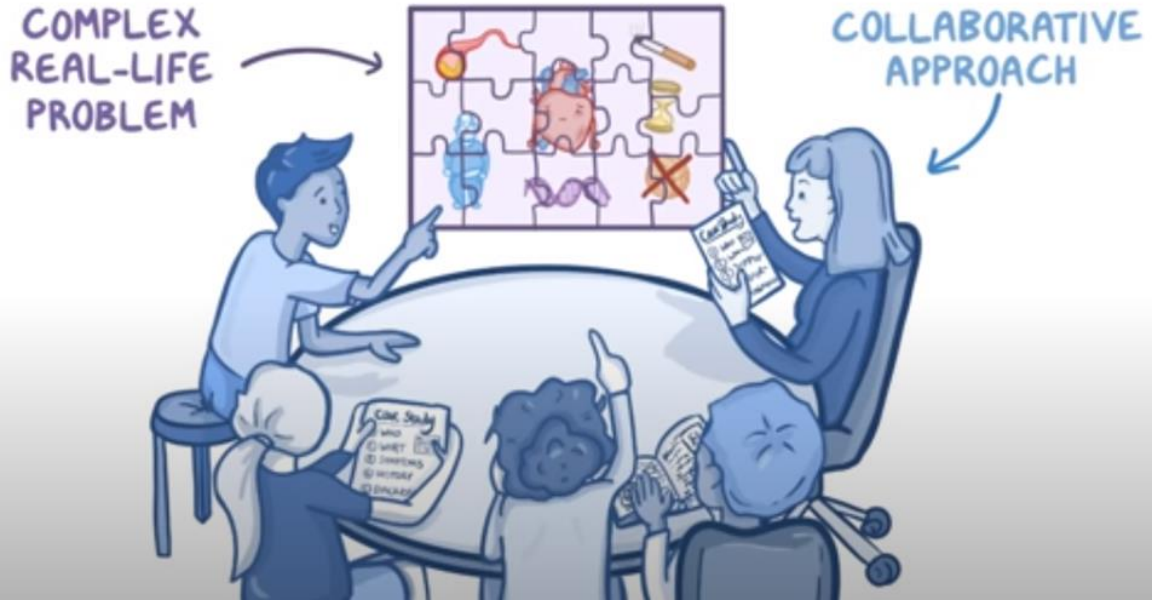
- Q1) Graphically communicate the **design of a thermo flask used to keep hot coffee**. Draw the detailed 2D drawings of the same with design detailing, material selection, scale drawings, dimensions, tolerances, etc. Use only hand sketches.
- Q2) Describe the **role of mathematical modelling in design engineering**. Show how mathematics and physics play a role in designing a lifting mechanism to raise 100 kg of weight to a floor at a height of 10 meters in a construction site.
- Q3) Graphically communicate the **design of wheel chair for physically handicap persons**. Draw the detailed 2D drawings of the same with design detailing, material selection, scale drawings, dimensions, tolerances, etc. Use only hand sketches.
- Q4) Applying mathematical model communicate **design of a 1000-liter water tank at 20-meter height**

Module 3 (Part B) : Sample Questions – 14 Marks

MODULE 4

Design Engineering Concepts:-Project-based Learning and Problem-based Learning in Design. Modular Design and Life Cycle Design Approaches. Application of Biomimicry, Aesthetics and Ergonomics in Design. Value Engineering, Concurrent Engineering, and Reverse Engineering in Design.

Problem-based Learning and Project-based Learning in Design



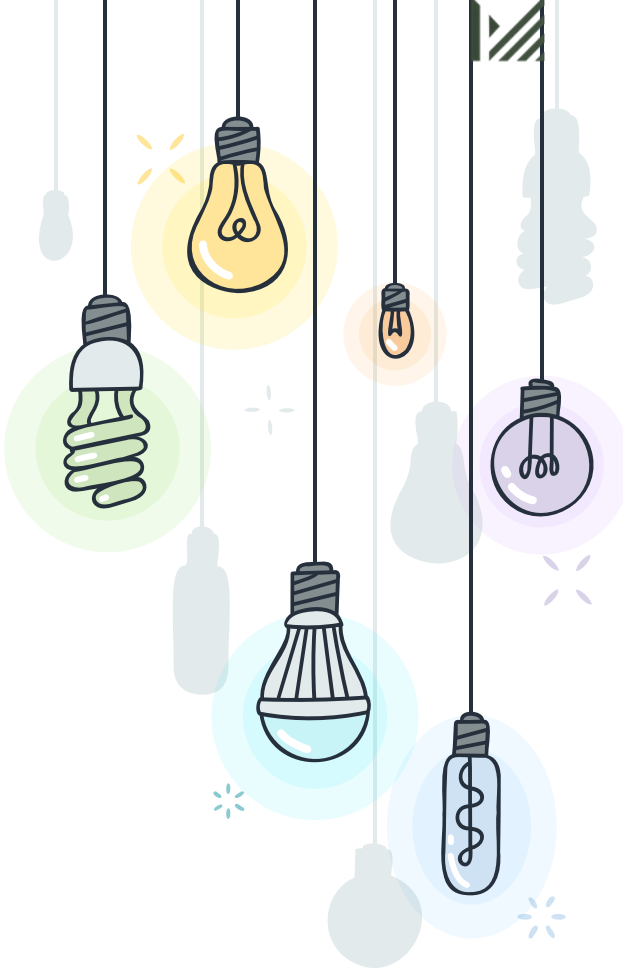
Difference between problem based and project based learning

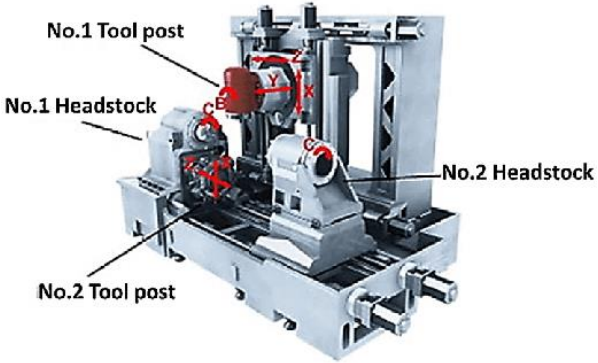
Project based learning

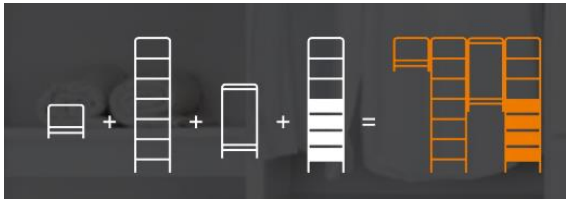
- goals are set and quite structured
- often multidisciplinary and longer
- follows general steps
- involves authentic tasks that solve real-world problems

Problem based learning

- often share the outcomes and jointly set the learning goals and outcomes
- more likely to be a single subject and shorter
- provides specific steps
- uses scenarios and cases that are perhaps less related to real life



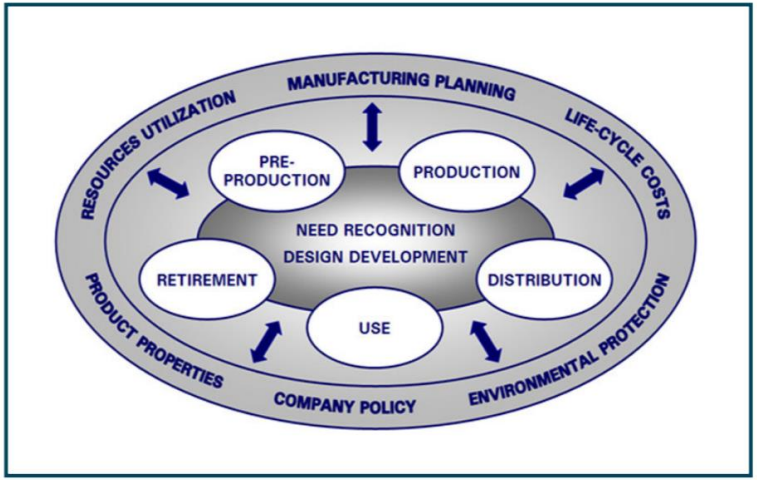


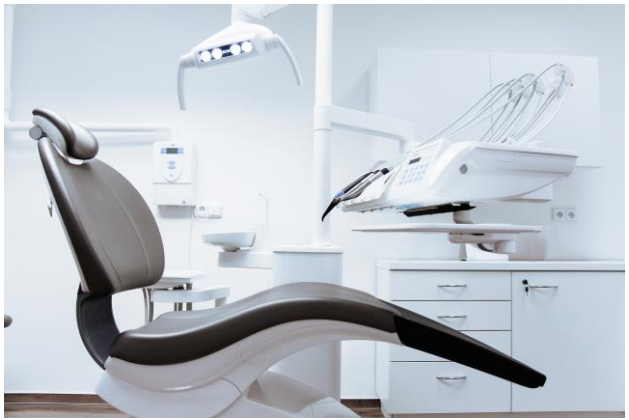


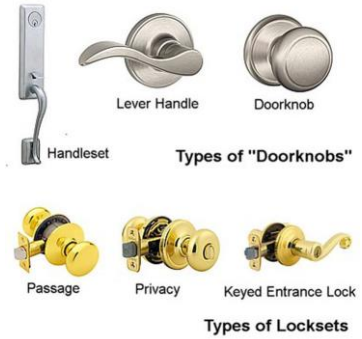
Modular Design

Life Cycle Design

- Development
- Production
- Distribution
- Use
- Maintenance
- Disposal
- Recovery



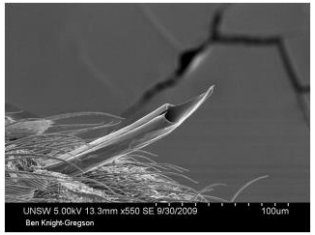


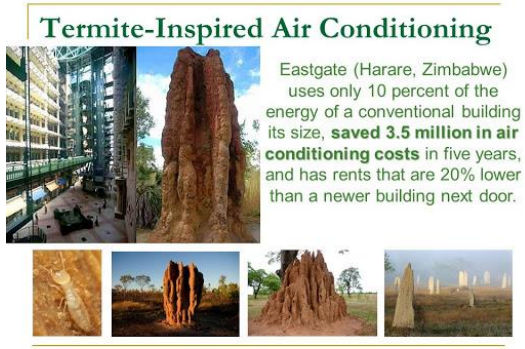


Ergonomics in design

AESTHETICS IN DESIGN

Bio-mimicry in design





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Module 4
Sample Questions

Part A

- Q1) Distinguish between project-based learning and problem-based learning in design engineering.
- Q2) Describe how concepts like value engineering , concurrent engineering and reverse engineering influence engineering designs?
- Q3) Explain the importance of modular design
- Q4) Explain the term Bio-mimicry
- Q5) What is the role of life cycle design in engineering?
- Q6) Describe concept of concurrent engineering and reverse engineering.
- Q7) What are the factors affecting ergonomic design
- Q8) Discuss the term value of engineering

Module 4 (Part A) : Sample Questions – 3 Marks

10

Module 4
Sample Questions

Part B

- Q1) Show the development of **a nature inspired design for a solar powered bus waiting shed** beside a highway. Relate between natural and man-made designs. Use hand sketches to support your arguments.
- Q2) Show the **design of a simple sofa** and then depict how the design changes when considering 1) aesthetics and 2) ergonomics into consideration. Give hand sketches and explanations to justify the changes in designs.
- Q3) Show the development of a nature inspired **design for house for four people**. Relate between natural and man-made designs. Use hand sketches to support your arguments.
- Q4) Show the **design of a chair** and then depict how the design changes when considering 1) aesthetics and 2) ergonomics into consideration. Give hand sketches and explanations to justify the changes in designs.

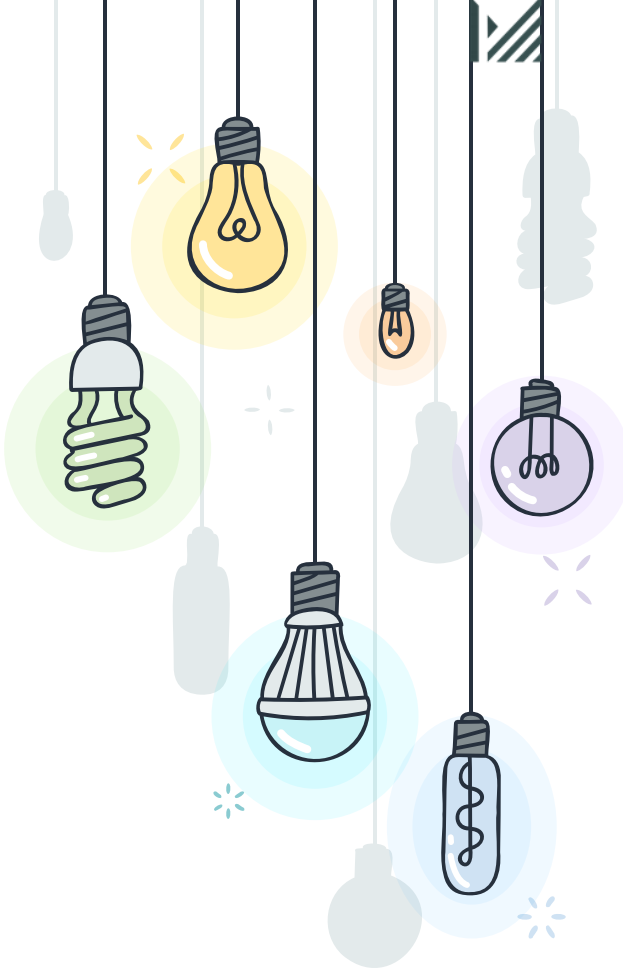
Module 4 (Part B) : Sample Questions – 14 Marks

MODULE 5

Expediency, Economics and Environment in Design Engineering:-Design for Production, Use, and Sustainability. Engineering Economics in Design. Design Rights. Ethics in Design

Economics in Design Engineering

- COST ESTIMATION: HOW MUCH DOES THIS PARTICULAR DESIGN COST?
  The simplest, conceptually, is to estimate labor, materials, and overhead costs.
  - Labor : costs include payments to the employees who build the designed device, as well as to support personnel who perform necessary but often invisible tasks such as taking and filling orders, packaging, and shipping the device.
  - Materials include those items and inputs directly used in building the device, along with intermediate materials and inventories that are consumed in the manufacturing process.
  - The costs incurred by a manufacturer that cannot be directly assigned to a single product are termed overhead.



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Module 5
Sample Questions

Part A

- Q1) Show how designs are varied based on the aspects of production methods, life span, reliability and environment?
- Q2) Explain how economics influence the engineering designs?
- Q3) Explain the term design for manufacturing (DFM)
- Q4) What are the factors to be considered when we design for use
- Q5) Discuss about environmental life-cycle assessment
- Q6) What is design rights?
- Q7) Explain the importance of ethics in engineering design

Module 5 (Part A) : Sample Questions – 3 Marks

12

Module 5
Sample Questions

Part B

- Q1) Examine the changes in the **design of a foot wear** with constraints of 1) production methods, 2) life span requirement, 3) reliability issues and 4) environmental factors. Use hand sketches and give proper rationalization for the changes in design.
- Q2) Describe the how to **estimate the cost of a particular design** using ANY of the following:

  1) a website, 2) the layout of a plant, 3) the elevation of a building, 4) an electrical or electronic system or device and 5) a car. Show how economics will influence the engineering designs. Use hand sketches to support your arguments.

- Q3) Space is the major problem faced by the modern world. As an Engineer you should **identify a solution for the parking space for a new building.** Design a system by considering the following constraints:

  1) Minimum space must be included, 2) Easy parking and easy retrieval, 3) The design must be suitable for all types of vehicles, 5) Special area for service vehicles, 6) Area for emergency vehicle

  You can use the mechanisms like lifts, moving platforms or any supportive arrangements. Sketch the solution and explain briefly

Module 5 (Part B) : Sample Questions – 14 Marks

Image

An image can convey more

Time management:

convey more in minimum time

Highlight important points

Use underlines or quotes to get attention

Train yourself

Design more

Tips

Useful links

Download material and watch video here:

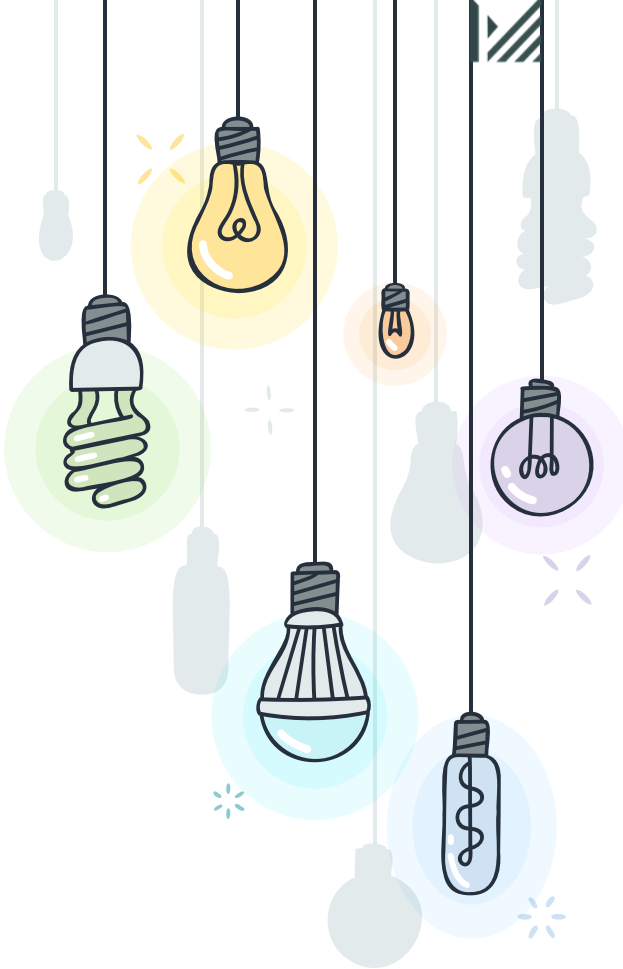
- https://bit.ly/iammanuprasad_DE

Design & Eng. Video playlist

- https://bit.ly/design_engg_playlist

Other subjects

- https://bit.ly/iammanuprasad_teachingstuff



Thanks!

Any questions?

You can find me at:

- manuprasad@awhengg.org