5.0 **Module 5**

Capstone Design Project:
Stage 1 + 2 + 3 + 4

(52 hours at school + 28 hours at home)

Introduction

This is the final design project the student does. The student needs to choose the topic for project with care. It is always helpful to make a list of possible topics that you would like to find solutions and then make a choice from this.

The students are discouraged from making choices first based on the media or technology and then trying to fit into this a problem to solve rather than identifying a problem area/issue /concern and then choosing the appropriate media and technology.

The capstone project can be done individually or jointly by a group of 2 students. When the students work as a group, each one should define their area of contribution to the design project.

Aim of this Module

This design project will make use of all the learning from previous modules as well as the use of the different stages of the design thinking process while solving a design problem of their choice. The project duration is 4 months and hence the problem-solving process can be done with a lot of depth and detail.

What will you learn?:

- Design thinking process and methodology for identifying a problem and finding appropriate solutions
- Ability to think critically, understand and analyze relevant information and collate data from both primary and secondary sources
- Confidence in being creative and to come up with alternative innovative ideas
- Prototype the final concept, get feedback and conceive of a business enterprise
- Use best practices of documentation and presentation – visual, written and oral

Stages of the Capstone Project	The capstone project will have the following stages: **5.1 - Stage 1:** Understanding the problem to be solved – Primary and Secondary Research + Analysis of the problem **5.2 - Stage 2:** Ideating, sketching and alternatives + Soft Prototyping **5.3 - Stage 3:** Prototyping and getting feedback **5.4 - Stage 4:** Final Presentation + Documentation Report
Output of the Project	The project will have the following outputs: 1. A presentation (15-20 minutes) explaining the different stages of the Design Process for this Project 2. A project report documentation of the project 3. A concept prototype and a working Demo of the project
Place:	**Place:** Task 5.1, 5.2, 5.3 and 5.4 done at School and at home
Grouping:	**Grouping:** The capstone design project can be done individually or in a group of 2 students
Equipment:	**Equipment:** Sketchbooks for sketching and taking notes. students may use digital devices like computers or tablets to collate information and make presentations (if available, but not necessary)
Design Thinking & Innovation Process involvement:	This task involves the following phases of the DT&I Process: Phase 1. Observe/Empathise/Research (Primary and Secondary Research) Phase 2. Understand/Analyse/Define (Analysis of Findings) Phase 3. Ideate/Alternate/Create (trying creative alternatives) Phase 4. Build/Prototype/Detail (making the prototype and the presentation) Phase 5. Evaluate/Reflect/Implement (feedback from others)
Mapping SDG Goals:	The following SDG goals need to be considered while solving this task. While documenting elements and expressions, do think of gender equality and reduced inequalities and concern for life on our planet.

Task 5:	**Task 5 = 5.1 + 5.2 + 5.3 + 5.4** School Hours: 52, Home hours: 28

Task 5:

Overall Task (Task 5.1 + Task 5.2 + Task 5.3 + Task 5.4):

Task Topic:

Final Capstone Design Project:

Theme:

Identify a problem to solve:

The student needs to identify a problem to solve. This needs to be done with a lot of care as this design project will have duration of 4 months and it is not prudent to change the project halfway.

Along with the identification of the problem to be solved, the following requirements could considered:
a. User Group
b. Subject area
c. Environment or space

The students could look at the different fields and issues covered in the previous grades/modules and make a list of these. Categorize them according to priorities and select a problem to solve. And, depending on the choice of the problem area the project could involve any of these design fields:
a. Communication Design
b. Product Design
c. Animation Design
d. Film Design
e. Digital Design

The Problem to solve:
- the choice of the problem should be decided by the student in discussion with the teacher.
- Since this project has a duration of 4 months, the selected problem can be solved with both depth and breadth
- The design process will include the following: research, understand needs, analyse requirements, ideate alternate solutions, finalise and build prototypes, get feedback, formulate a business plan and make a presentation, where the student/s should be able to justify the solution. The different stages of the design process as well as the final solution need to be documented as a report.

The students can work individually or in groups of 2. If the students are working in groups, then they need to work collaboratively and co-operatively together. They share the workload and are partner team members in solving the different stages of the problem.
They'll need to define their exact roles in solving the problem.

Task 5.1

Task 5.1 = 5.1a + 5.1b + 5.1c + 5.1d + 5.1e + 5.1f
School Hours: 13, and Home hours: 7
- done individually or done collaboratively in groups of 2

5.1 - Stage 1:

Understanding the problem to be solved
- Primary and Secondary Research
+ Analysis of the problem

Task 5.1a

Task 5.1a: Make Selections and Ask Questions
Home Hours: 1, done either individually or in groups of 2

Topic title:

Asking Questions:

1. Select the problem area of your chosen topic
2. Ask the following questions about the above the object
- What? Why? How? Whom? Where? When? etc.
3. Understand the subject well by first **Brainstorming** about it, noting down keywords and then making a **Mindmap** to look at the subject from different points of view and perspectives
Output 5.1a: Summarize this section with a short report and slides (around 3 to 5 pages or slides)

Task 5.1b

Task 5.1b: Secondary Research
School Hours 2, Home Hours: 2, done either individually or in groups of 2

Topic title:

Understanding the Problem Area through Secondary Sources:

Secondary research as the name indicates is collection of information from secondary resources. These could be from books, publications, newspapers, talking to experts and the internet. As someone else has written or spoken about the subject, you need to keep note down the reference details.
1. Understand your chosen product and its components. You could make a mid-map of the product and its connections
2. Compare it with similar products and try to find out its advantages and disadvantages
3. Search for information on media that is accessible to you. Take down notes as points. Mark important aspects
Output 5.1b: Collate the information involving images and short text in form of a report or slides (around 4 to 6 pages or slides)

Design Thinking and Innovation Task-book - Grade 12

Task 5.1c

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Task 5.1c: Primary Research
School Hours: 4, done either individually or in groups of 2

Topic title:

Understanding the Problem Area through Primary Sources:

The Primary research involves the following:
1. Identify all the users - primary and secondary users who interact with the product
2. Converse with the people involved with this activity to get a better understanding (take down notes), try to understand the product use from the user's point of view (empathize with the user)
3. Understand how the object is used (document these)
4. Document through photography or sketching the different aspects of the problem being solved
5. Collate all the information and order it according to priority/importance
6. Identify issues or problem areas that can be solved
Output 8.1c: Make a presentation involving images and short text in form of a report or slides (around 4 to 6 pages or slides)

Task 5.1d

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Task 5.1d: Make (a) Journey/Activity Mapping + Spatial-social Mapping
School Hours 2, Home hours: 2, done either individually or in groups of 2

Topic title:

Analysis of the problem area through Visual Mappings:

Journey/Activity Mapping:
These are visualization of the different activities that happen in your chosen problem area on a time line.
1. Note down all the activities in a given period of time (the time to complete the activity/lifespan)
2. Note down on a timeline the sequence of the activities (you could drawings to represent some of them)
3. Note down the time taken to do the different activities
Output: Time Map of the activities represented on an A3 size sheet

Spatial-social Mappings:
1. Note down all the objects, facilities, and movement that happen in your chosen problem space
2. Plot the activities as a layout on an A3 size sheet
3. Sketch on it the objects that are in this space
4. Show the social interactions that happen in this space.
4. Mark the position of entry and exit points, and the path of movement of the users
Output: Space Map of the objects, facilities, and movement that happen in your chosen problem space represented on an A3 size sheet

Task 5.1e

Task 5.1e: Make Affinity Mapping + Find Connections
School Hours: 4, done either individually or in groups of 2

Topic title:

Analysis of the Problem Area through Classification and Affinities:

Information Sorting/Classification (Affinity Mapping):
1. Summarize information from primary + secondary research as points and write this on separate sticky notes (or on sheets of paper cut to size 5cm x 5cm). These are part of your **observations**
2. Classify the sticky or paper notes related in some way into different categories (some may fit in multiple categories so replicate them)
3. Priorities the sticky notes within the categories according to their importance
Output: Classification of data collected and sorted according to its importance

Find Relational Link Connections:
4. Find connections (links) between the different groups of sticky notes.
5. These could be your **inferences and insights** from your study
6. Begin discussion within your group on the relevance of these inferences and see if they provide or indicate **opportunities for design** intervention to solve some of the problems

Output 5.1e: Make a chart of classifying the information collected according to the following:

Observations	Inferences/Insights	Design Opportunities
1.		
2.		

- Based on these findings restate your problem with redefined objectives / goals

Task 5.1f

Task 5.1f: Presentation and Documentation of Stage 1
School Hours: 1, Home hours: 2, done either individually or in groups of 2

Topic title:

Stage 1 Presentation and Documentation:

Output 5.1f: Prepare a presentation (of 6-8 minutes duration) to include all the stages of your project:
a. Title of the System Design Project or Problem Statement
b. Team members
c. Summary/content listing of your presentation
d. Insights from Primary and Secondary Research
e. Analysis through Visual Mappings
f. Analysis through Categorisation and affinities
e. Listing of major design opportunities
f. Restatement of the problem / Design Objectives / Design Goals
g. Reference
h. Credits

Task 5.2 🏫 + 🏠	**Task 5.2 = 5.2a + 5.2b + 5.2c** School Hours: 13, and Home hours: 7 - done individually or done collaboratively in groups of 2 **5.2 - Stage 2:** # Ideating, sketching and alternatives + Soft Prototyping

Task 5.2 🏫 + 🏠	**Task 5.2a: Ideation and Alternate solutions** School hours: 4 and Home hours: 2, done either individually or in groups of 2 **Topic title:** # Ideation on Creative Innovative Design Solution Possibilities - Ideate on possible solutions by sketching these 1. Your group could **brainstorm**, Ideate on possible creative innovative ideas and sketch these out + number or name these ideas 2. Make use of creativity techniques like **SCAMPER** to think of alternatives: Substitute, Combine, Adapt, Modify (magnify /minify), Put to another use , Eliminate, and Reverse 3. **Make visible your ideas** - through sketches, doodles, key-words, diagrams, scenarios, etc. 4. Quick sketches with fuzzy borders help in ideating further **Output 5.2a:** Make a presentation of these ideas in 3 slides (alternate sketches of ideas)

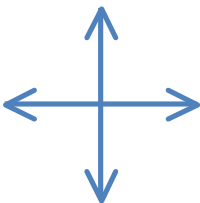| Task 5.2b 🏫 + 🏠	**Task 5.2b: Selection of Ideas** School hours: 3 and Home hours: 1, done either individually or in groups of 2 **Topic title:** # Shortlisting of Ideas 1. Collate all the good ideas together 2. Evaluate these ideas by cross-checking with the redefined objectives or goals An example:

Factors- 1-5 scale	Ease of Use	Aesthetic form	Innovative	Easy to Implement	Total
Concept 1	5	4	3	3	15
Concept 2	3	5	5	5	**18**
Concept 3	2	2	4	5	13

3. Short-list them according to their effectiveness, ease of use, ease of implementation, form, etc.
Output 8.3: Make a presentation of these in 3 slides (alternate sketches + Matrix + short-listed idea)

Task 5.2c

Task 5.2c: Convert Ideas to Concepts
School hours: 4 and Home hours: 2, done either individually or in groups of 2

Topic title:
Ideas to Concepts

1. Consider the top few ideas and convert them into concepts by refining them, detailing them, evaluating them, etc.
2. Make a quick paper or clay mock-up models to visualize the concept
3. The use of the concept can be made into a scenario through sketches
2. Get feedback on your concepts from users

Output 5.2c: Make a presentation of these in 3 slides (selected concepts + feedback)

Task 5.2d

Task 5.2d: Presentation and Documentation of Stage 2
School Hours: 2, Home hours: 2, done either individually or in groups of 2

Topic title:
Stage 2 Presentation and Documentation:

Output 5.2d: Prepare a presentation (of 6-8 minutes duration) to include all the stages of your project:
a. Title of the Design Project or Problem Statement
b. Team members
c. Summary/content listing of your presentation
d. Restatement of the problem / Design Objectives / Design Goals
e. Overview of your ideas
f. Alternate Concepts with sketches
g. Shortlisting of Ideas
h. Ideas to Concepts ((sketches + quick scenarios + concept models)
i. User Feedback
j. Select the final concept
k. Reference
l. Credits

Task 5.3	**Task 5.3 = 5.3a + 5.3b + 5.3c**
	School Hours: 13, and Home hours: 7
	- done individually or done collaboratively in groups of 2

5.3 - Stage 3:
Prototyping, Feedback and Iteration

Task 5.3a

Task 5.3a: Prototypes
School Hours: 2, Home hours: 2, done either individually or in groups of 2

Topic title:

Design Concepts Mock-ups Prototyping
1. Select the best one out of your final concepts and finalise it with details.
2. The final concept prototype could involve any of the following:
- 2D/3D design Sketches
- Mock-ups using paper, scenarios or video
- Physical Prototyping + Visualisation with 2D/3D Models
- Proof of Concept prototypes
3. Detail out the final selected solution: the details could be about its layout, form, colours, material selection, the listing of advantages/disadvantages and how to produce
3. Make a mock-up of your final idea – a scaled version.

Prototype through 'Sketches':
1. Do sketches of your final concept from different points of view /angles and details to explain your idea
2. This can be done using many sheets or on a single A3 size sheet

Prototype through 'Paper Prototype' or 'Clay Prototype':
1. Do sketches on different cards in sequence to explain your idea
2. This can be done using many sheets and shown one after another
3. If it a 3D artifact, scaled model of the final concept can be done using clay

Prototype through 'Scenario Building':
1. Create a sequence of events of actions and reactions by the typical users almost creating a story board on how to use your idea
2. You can write and describe it like a story…. Everyday Ramu goes to school by carrying a heavy load of ….. with the users as characters using the artifact that you have designed
3. The scenario can be put into a sequence of scenes like that of a comic book.
4. Show the scenario in the form of a slide show

Prototype through 'Concept Video':
1. Use programs that allow you to quickly sequence and animate your ideas in action
Or You could have your friends play-enact as users and video shoot them using/demonstrating the artifact
2. Put the scenario together and play it as a video

Task 5.3b

Output 5.3a: Rough Prototype in one or many of the above methods
Task 5.3b: Feedback from users on rough prototypes
School Hours: 2, Home hours: 2, done either individually or in groups of 2

Topic title:

Feedback from Users

1. Show the mock-up to potential users and get feedback
2. Note down all the remarks
3. Incorporate suggestions from the feedback in your design
Output 5.3b: Make a presentation of these in 3 slides incorporating the summary of the feedback from users

Task 5.3c

Task 5.3c: High fidelity prototypes + Proof of Concept
School Hours: 2, Home hours: 2, done either individually or in groups of 2

Topic title:

High-fidelity prototypes

1. Detail out the final selected concept: the details could be about its layout, form, colours, material selection, production method and specifications
2. Different medias would require different ways of making the high fidelity prototypes:
a. Communication Design in 2D – can be printed at a DTP setup
b. Product Design in 3D – Can be 3D printed after making a3D digital model of the final concept
3. Animation and Video – can be made using a video editing software
Output 5.3c: Make a presentation of these prototypes after incorporating the the feedback from users

Topic title:

Proof of Concept (optional)

1. If your solution involved a demonstration of technology, it is suggested to make a proof of the concept showing your idea works
Output: Demonstration through a proof of concept prototype

Task 5.3d

Task 5.3d: Presentation and Documentation of Stage 3
School Hours: 2, Home hours: 2, done either individually or in groups of 2

Topic title:

Stage 3 Presentation and Documentation:

Output 5.3d: Prepare a presentation (of 6-8 minutes duration) to include the stage 3 of your project:
a. Title of the Design Project or Problem Statement
b. Team members
c. Summary/content listing of your presentation
d. Design Concepts Mock-up prototyping
e. Feedback from users
f. High-fidelity Prototyping + Proof of Concept (optional)
k. Reference
l. Credits

Task 5.4	**Task 5.4 = 5.4a + 5.4b + 5.4c** School Hours: 13, and Home hours: 7 - done individually or done collaboratively in groups of 2 **5.4 - Stage 4:** # Final Presentation + Design Project Report

Task 5.4a

Task 5.4a: Business Model preparation + Design Patenting (optional)
School Hours: 2, Home hours: 2, done either individually or in groups of 2

Topic title:

Business Model

If your solution has the potential of being implemented as a new venture, then prepare a Business Model for the final solution to be made into an enterprise with a start-up as the beginning.
1. Use the following Business Model template to fill in the details
a. Key Partners of the Enterprise
b. Key activities of the Enterprise
c. Key resources for the Enterprise
d. Value of Product delivered to customer
f. Customer segment
g. Revenue Model of the Enterprise

Output: Make use of these points to make a pitch presentation (where you have to present the business viability of the new product)

Topic title:

Utility and Design Patenting

If your solution is innovative and has the potential of being patented, then prepare a proposal to file a patent.
1. Decide if your innovative concept fits in with the Utility Patent or Design Patent
Utility Patent: these include innovative original improvements to making process, materials, machines, technology and manufacturing methods
Design Patent: this includes innovative original form and shape of the designed concept
2. You'll need to file a patent. More information is available at https://ipindia.gov.in/form-and-fees.htm
Output: Patent application filing – first for provisional and then anon-provisional patent

Task 5.4b

Task 5.4a: Final Capstone Design Project Presentation
School Hours: 2, Home hours: 2, done either individually or in groups of 2

Topic title:

Final Presentation

Prepare a presentation (of 15-20 minutes duration) to include all the stages of your project:

a. Title of the Design Project or Problem Statement

b. Team members

c. Summary/content listing of your presentation

d. Insights from Primary and Secondary Research

e. Major design opportunities

f. Restatement of the problem / Design Objectives / Design Goals

g. Alternate Concepts (sketches + quick scenarios + concept models)

h. Final Concept and its unique features

i. Process, Form or Interface development and detailing

j. Mock-up Prototype/High Fidelity Prototype

j. Proof of Concept Prototype (optional)

k. User feedback on final solution

l. Future steps and suggestions

m. Full References (Learn how to do references)

n. Acknowledgments – to all who have helped

Output 5.4a: A presentation (15-20 minutes, roughly 30 to 40 slides) explaining the Project outcome along with Process + the Business Model for your enterprise (optional)

Task 5.4c

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Task 5.4a: Final Capstone Design Project Report
School Hours: 2, Home hours: 2, done either individually or in groups of 2

Topic title:

Final Design Project Documentation Report

Prepare a report (around 30 to 40 pages) to include all the different stages of your project. The project report will have text for explanations supported by visuals/images.

The project report needs to include the following:

a. Title of the Design Project or Problem Statement

b. Team members

c. Summary/content listing of the report

d. Undertaking that the work is done by you and your team

e. Insights from Primary and Secondary Research

f. Major design opportunities

g. Restatement of the problem / Design Objectives / Design Goals

h. Alternate Concepts (sketches + quick scenarios + concept models)

i. Final Concept and its unique features

j. Process, Form or Interface development and detailing

k. Mock-up Prototype/High Fidelity Prototype

l. Proof of Concept Prototype (optional)

m. User feedback on final solution

n. Future steps and suggestions

o. Full References (Learn how to do references)

p. Acknowledgments – to all who have helped

Output 5.4a: A report (around 30 to 40 pages) explaining the Project outcome along with the steps of the Design Process + the Business Model for your enterprise

Reflection:

Questions to ponder:
- What are the most interesting methods of the Capstone design project that you found useful and interesting in solving the problems?
- Can you apply what you learnt by redesigning products and artifacts around your home and neighbourhood to make them better?
- Will you collaborate and make use of the Design Thinking Process with others – like your friends and cousins to solve problems?

Assessment:
Stage 1 – Task 5.1:
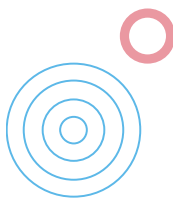
Assessment Criteria (Task 5.1) - Assess yourself:
Stage 1 - Task 5.1: Understanding the problem to be solved – Primary and Secondary Research + Analysis of the problem
- The student asked questions and the Mind-map of the chosen topic was done very well. (Group or individual task)

☐ *Beginning*   ☐ *Developing*   ☐ *Promising*   ☐ *Proficient*   ☐ *Excellent*

- The presentation of the Summary points of the Primary Research was very done well. (Group or individual task)

☐ *Beginning*   ☐ *Developing*   ☐ *Promising*   ☐ *Proficient*   ☐ *Excellent*

- The presentation of the Summary points of the Secondary Research documentation was very done well. (Group or individual task)

☐ *Beginning*   ☐ *Developing*   ☐ *Promising*   ☐ *Proficient*   ☐ *Excellent*

- Analysis of the design problem was done very well with proper categorisation and assigning priorities. (Group or individual task)

☐ *Beginning*   ☐ *Developing*   ☐ *Promising*   ☐ *Proficient*   ☐ *Excellent*

- The collation/summary of the different stages of this module was presented very well. (Group or individual task)

☐ *Beginning*   ☐ *Developing*   ☐ *Promising*   ☐ *Proficient*   ☐ *Excellent*

Self Assessment:
Stage 2 – Task 5.2:
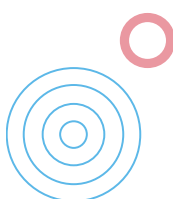
Assessment Criteria (Task 5.2) – Assess yourself:
Stage 2 – Task 5.2: Ideating, sketching and alternatives + Soft Prototyping
- Is able to identify an appropriate problem and develop a detailed design brief which has all the relevant parameters of the problem. (Group or individual task)

☐ *Beginning*   ☐ *Developing*   ☐ *Promising*   ☐ *Proficient*   ☐ *Excellent*

- Detailed and well-presented sketch of the possible creative ideas for solution to the problem. (Group or individual task)

☐ ☐ ☐ ☐ ☐

Beginning   *Promising*   *Excellent*

- The Temporal and Spatial Mappings were done well. (Group or individual task)
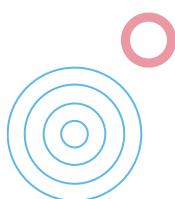
☐ ☐ ☐ ☐ ☐

Beginning   *Promising*   *Excellent*

- The selection of the final idea was very done well. (Group or individual task)

☐ ☐ ☐ ☐ ☐

Beginning   *Developing*   *Promising*   *Proficient*   *Excellent*

- The presentation of the stage 2 of the project was done well. (Group or individual task

☐ ☐ ☐ ☐ ☐

Beginning   *Promising*   *Excellent*

Self Assessment: Stage 3 – Task 5.3:

Assessment Criteria (Task 5.3) – Assess yourself:
Stage 3 – Task 5.3: Prototyping, Feedback and Iteration
- Completes a detailed and creative mock-up prototype of the concept. (Group or individual task)

☐ ☐ ☐ ☐ ☐

Beginning   *Developing*   *Promising*   *Proficient*   *Excellent*

- Gets Feedback from the users on the final concepts. (Group or individual task)

☐ ☐ ☐ ☐ ☐

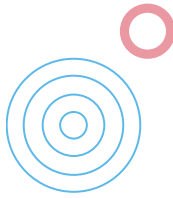*Beginning*   *Promising*   *Excellent*

- High Fidelity prototype was done well. (Group or individual task)

☐ ☐ ☐ ☐ ☐

Beginning   *Promising*   *Excellent*

- The presentation of this project was done well. (Group or Individual task)

☐ ☐ ☐ ☐ ☐

Beginning   *Promising*   *Excellent*

Self Assessment:
Stage 4 – Task 5.4:

Assessment Criteria (Task 5.4) – Assess yourself:
Stage 4 – Task 5.4: Design Project presentation + Project Report
- The collation/summary of the different stages of this module was presented very well. (Group or individual task)

☐ *Beginning* ☐ *Developing* ☐ *Promising* ☐ *Proficient* ☐ *Excellent*

- The report on the different stages of this module was documented very well. (Group or individual task)

☐ *Beginning* ☐ ☐ *Promising* ☐ ☐ *Excellent*

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Other References:

Other suggested References:
1. Design Thinking Process - explained with an example:
https://www.youtube.com/watch?v=uRtAzzitBmA

2. Design Thinking Framework - a short video:
https://www.youtube.com/watch?v=LhQWrHQwYTk