

OPEN DESIGN SCHOOL



B.E. Semester IV: Design Engineering – 1B

Academic Guidelines

In Design Engineering, in every branch, students are required to take up problems of design in a small group (4-5 students) and to solve them by following a systematic process.

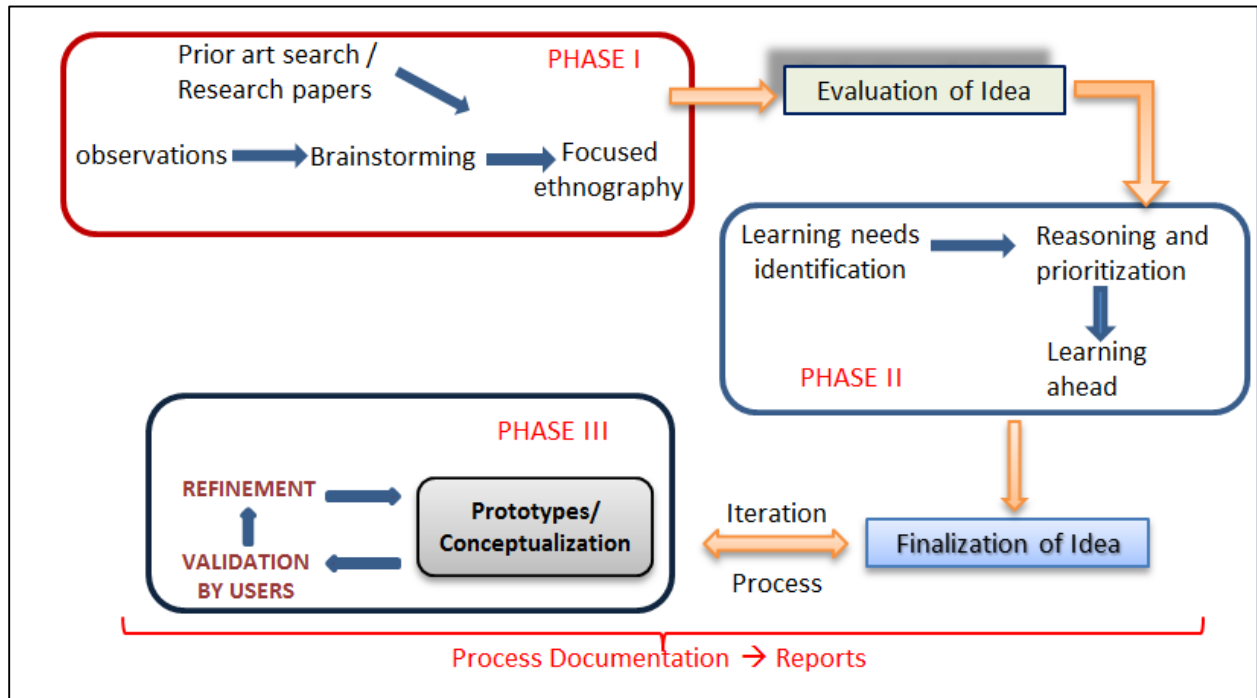
During the 3rd semester, the students have used the following:

1. *“The Help Manual” for 3rd semester Design Thinking for Engineering, which was made available at the web-site of GTU Innovation Council. It is being made available along with the Guidelines again.*
2. *Stanford Manual available at <http://dschool.stanford.edu/wp-content/uploads/2013/10/METHODCARDS-v3-slim.pdf>*

Note: In the 3rd semester, the students may have worked upon general topic/domain. In the 4th semester the students need to work on branch-specific design projects. They are required to relate all stages/phases of Design Engineering with the knowledge, they are obtaining by studying the subjects in their branch. But every student is supposed to study and use every thing, required to solve the design project, which they have selected.

During the 4th semester, the students are to follow the work flow, shown below:

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Phase 1: Evaluation of Idea

Activity 01 – Observation

The 4th semester students will continue with the Product Development (PD) Canvas (on page 22 of the Help Manual, which they have used during the 3rd Semester. However the students must strengthen the ‘observation’ component, by using AEIOU framework. This will help students to verify their concepts and help in clarifying the insights that they need for implementing their idea.

NOTE: AEIOU is a frequently used framework for guiding and structuring observational research. The framework creates a taxonomy of observations under the themes of

- **A**ctivities,
- **E**nvironments,
- **I**nteractions,
- **O**bjects and
- **U**users.

It is commonly used for coding observational data. Organisational frameworks help researchers and designers to capture key details in observation, and AEIOU is a very easy mnemonic device to remember what to look for and write down. The structure is also a helpful framework for using observational material in design and innovation workshops. You may refer to:

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<http://help.ethnohub.com/guide/aeiou-framework>

<http://www.doctordisruption.com/design/design-methods-8-aeiou/>

http://www.drawingideasbook.com/images/AEIOU_worksheets.pdf

For the problem of design, that a student takes up, he/ she would prepare the PD Canvas. They should strengthen the observation component by using the AEIOU Framework and maintaining the Observation Record Pages (*Format as given in Appendices 1 to 5 at the end of this document*) through field work. This process will ensure that for their proposed product/system/process/application, they would develop clearer concepts and insights. A round of brainstorming among students and Faculty Guide shall enhance the quality of their work. The result of Observation Record Pages may include notes, photographs, video, sketches etc. The results of observations shall be clubbed with other thoughts, developed with the PD Canvas to bring out all the real factors in the concept. At this stage, one may find that one has to modify the Canvases, prepared earlier in 3rd semester on the basis of Observation.

After carrying out the observation exercise, students are required to verify the important aspects, using the context of five principles, namely:

- i. Technological,
- ii. Aesthetic,
- iii. Ergonomics,
- iv. Environment, and
- v. Cost.

For the design problem, each of their components, functions and features of the proposed solution will be checked using the above five principles. This verification may lead to modification and sharpening of their concept.

Activity 02 - Prior art search

Each student will search for the research and development work, done by others in the field, related to their design project. Every student should find at least 2 references through a study of journals, patent databases, literature of similar products and any other resource, which can provide information related to their product/ idea/ concept. The students are expected to read thoroughly these references and make a summary of the work described in the references in their own words. *This exercise will ensure, to some extent, the novelty of the idea, as well as enable students to understand ongoing works in the field, relevant to their work.*

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Phase 2: Pre-Design

Activity 03 - Learning Need Matrix (LNM)

Every group of students, with the guidance of their Faculty Guide, are required to identify at this stage, the need for generic learning, which may be required while they develop their idea. The learning requirements will depend upon and may be specific for the concept/ idea for their solution. This will help students to do the research in a timely manner so that they are able to obtain the specific learning/ understanding, they would require for designing the product.

With understanding of the basic subjects or topics, related to their branch/ project , (after having discussions with and the guidance of their Faculty Guide) they will be able to identify *tools/ use of software/ applicable standards/ material / design specifications/ theories/ principles/ methods/ experiments* needed by their design project.

After identifying the specific learning, that will be required to develop their idea/ product/ concept, the students may distribute learning requirements among the members of the group and each member may have to learn a minimum of one component of LNM, in consultation with the Faculty Guide. Then they should discuss, whatever each member of the group has learnt, so that the whole of the group is prepared to jointly work on the project properly. **The Group needs to make LNM and include it in their report. It should include:**

- 1. Theories/ Methods/ Application Process Involved/ Mathematical Requirement**
- 2. Applicable Standards and Design Specifications/ Principles & Experiments**
- 3. Software/ Tools/ Simulation Methods/ Skills required**
- 4. Components Materials' & strengths criteria (Exploration- varieties/testing requirements)**

It should also include briefly what has been learnt by each member of the Group, in the words of that member and all the references used by the member.

Basic instructions for LNM (Please see Appendix 6):

- a) The requirements of the core discipline should be identified. At the same time the group has to work out the learning needs of the inter-disciplinary domains. The learning ***responsibilities shall be distributed*** among the group members. Also all learnings requirements to be brought on a mutually fixed ***timeline*** with a vision that the Group will be preparing a working model/ engineered product as per the components of the PD Canvas. *(In actual practice, the working model may or may not be prepared, depending upon the time and the facilities, available to the students. But the entire work is with the clear intention of making an engineered product.)*
- b) Students (along with their Faculty Guides) shall identify practical limitations, due to non-coverage in the syllabus, the knowledge, they would require to develop their product and

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focus on the same so that development (manufacturing level detailing) of their project, as desired, may be completed.

- c) Students must learn **at-least one** (additional matrix component which is not in the syllabus of the branch) –during Sem. 4. It may be a topic of Theory/ mechanism/ principle/ simulation/ software module. The students, with the help of the Faculty Guide, will need to prioritize the learning needs and the level of understanding required.
- d) The students may prepare a comprehensive LNM for the learning needs of all the components for implementing their idea/ concept. Also, they may prepare one LNM showing assigned learnings to each individual.

Phase 3 –Proof of Concept

Activity 04 – Dirty Mock-ups/ Fast-prototype/ Schematic plan

The students shall be preparing the first draft of prototype/ schematic plan on the product/ concept they wish to develop. It shall show the details on anticipated working patterns/ mechanisms. Here, the students need to show the basic design calculations/ mathematical aspects in the process report, involved in the product development, based on which the first draft of the prototype/ schematic plan has been prepared. The students shall be expressing their concept/ idea in a clear and understandable form through description, figures, calculations, drawings and model. They may also use animations, pictures or video-clips to explain the idea.

Upon preparation of the fast-prototype/ schematic plan on the product/ concept they wish to develop, it needs to be verified by involving some actual users. The students may take their idea/ product plan/ proto-type to the user and discuss their own conceptual thoughts and verify whether the user's expectations are along the anticipated lines. This inter-action may require the inclusion of any missing or overlooked function and/or feature. Based on such discussions, students will further perform refinement in their design of the product..

Submissions of students by the end of 4th semester shall be:

- A. Report
 - a. Introduction to concept/ idea based on PD Canvas
 - b. Observation Record sheets (AEIOU Framework)
 - c. Summary of findings of Prior Art Search on their purpose/project theme (2 summary papers per student)
 - d. Modifications made in the Canvases after observation exercise

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- e. Pre-design calculation which decides size / shape / material requirement / manufacturing process / design specifications/applicable standards for the first prototype
 - f. Summary on validation process and refinement in the first-prototype
- B. Learnings Need Matrix (LNM): *Please see Phase 2 on Pre-Design.*
- a. Summary on learning needs by students in the 4th Semester
 - b. Allocation of preparing learning material among the members of the group
- C. Fast-prototype model / Conceptual Plan-Layout for process related branches

Observation record page type 1

AEIOU framework:		Group id:	Date:	Sheet No:
Activities		Project Name :		
General impressions / Observations		Sketch/photo- Summary of activities		
Elements, features and special notes				

(Paper size – A3)

Observation record page type 2

AElOU framework:		Group id:	Date:	Sheet No:
Environment		Project Name :		
General impressions / Observations Style, materials & atmosphere)		Floor plan		
Elements, features and special notes		Scene		

(Paper size – A3)

Observation record page type 3

AEIOU framework:		Group id:	Date:	Sheet No:
Interactions		Project Name :		
General impressions / Observations (Who is interacting with whom, what?)		Scene of interection (How it is being done)		
Elements, features and special notes				

(Paper size – A3)

Observation record page type 4

AEIOU framework:		Group id:	Date:	Sheet No:
Objects		Project Name :		
General impressions / Observations (What components are involved?)		Inventory of key objects		
Elements, features and special notes (How objects are relating to the activities?)				

(Paper size – A3)

Observation record page type 5

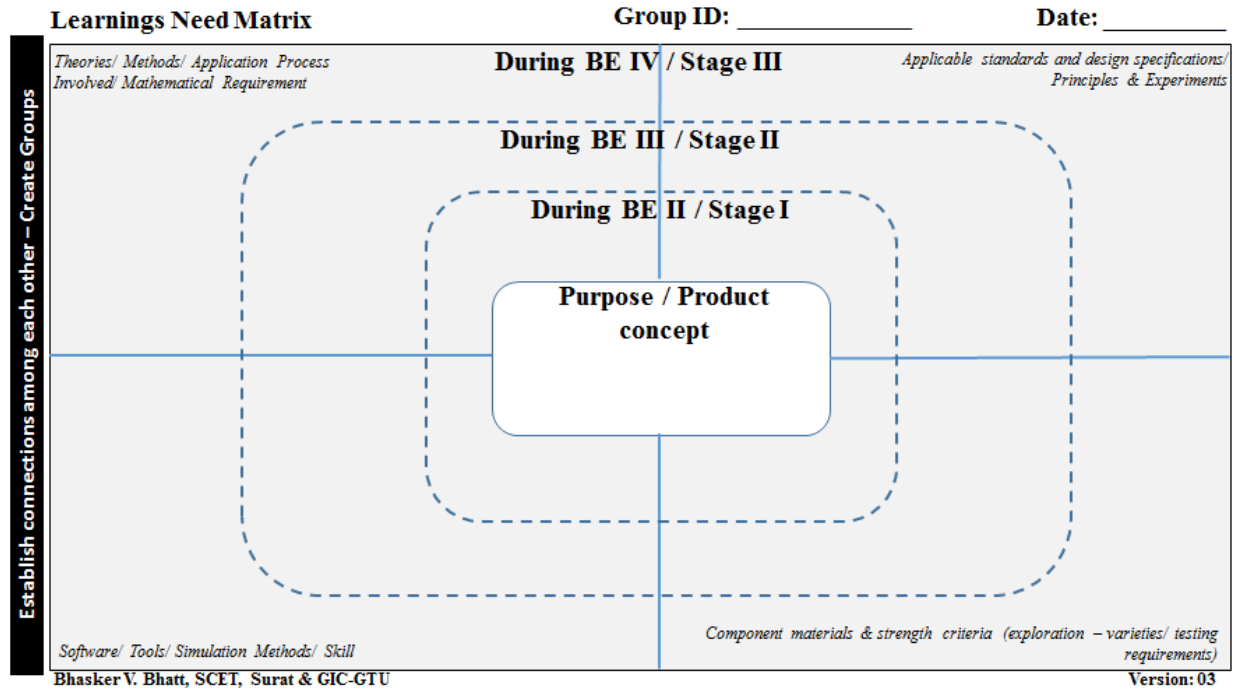
AEIOU framework:		Group id:	Date:	Sheet No:
Users		Project Name :		
General impressions / Observations (Who is present roles & responsibilities?)		Scene of users in context		
Elements, features and special notes (List of identified people involved)				

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Appendix-6



(Paper size – A2)