GUJARAT TECHNOLOGICAL UNIVERSITY (GTU)

Competency-focused Outcome-based Green Curriculum-2021 (COGC-2021)

Semester - V

Course Title: Product Design

(Course Code: 41056304)

Diploma programme in which this course is offered	Semester in which offered
63 – Architecture	Fifth

1. RATIONALE

In today's world, there are many challenges and problems that need to be addressed. In this situation, innovation is what provides the solution that will benefit the maximum number of users. And such innovation is often enabled by design. Product Design focuses on design thinking, creative problem solving and understanding product design factors. Through this course, the learner can take on the role of a design maker of a table-top sized product.

Product design involves the design of an object from concept stage to design development employing graphics and model making. This course places a strong emphasis on the design process, and combines creative ability with technical skills. It is based on project work with an emphasis on learning by doing.

The design thinkers start by observing, interviewing or just plain experiencing a situation. Then, they proceed to improve the situation of the humans by solving problems for them.

The designed product should be eco-friendly materials, aesthetic appeal, functional and user friendly.

2. COMPETENCY

The course content should be taught and curriculum should be implemented with the aim to develop required skills so that the students are able to acquire the following competencies:

- **To demonstrate the process of design of a product and create a viable product by finding solutions to problems by modifying forms and functions**

3. COURSE OUTCOMES (COs)

The practical exercises, the underpinning knowledge and the relevant soft skills associated with the identified competency are to be developed in the learner for the achievement of the following course outcomes in cognitive, psychomotor and affective domains:

a. Introduce the notion of design of a product as it evolved through time
b. Understand creativity & its application
c. Develop the ability to identify problems and finding needs
d. Understand the Design process
e. Create a viable product

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P/2)	Examination Scheme				
				Theory Marks		Practical/Studio Marks		Total Marks
L	T	S	C	CA	ESE	CA	ESE	
0	0	4	2	00	00	25*	25	50

(*): For this practical/studio only course, 25 marks under the practical CA should be done by assessment of process of designing a product with all design parameters. This is designed

*to facilitate attainment of COs holistically. Thus, this course should be considered as an **Applied 'Theory' Course** where the theory portion has to be taught during the practical/studio hours.*

***Legends:** **L**-Lecture; **T** – Tutorial/Teacher Guided Theory Practice; **S** – Studio; **C** – Credit, **CA** - Continuous Assessment; **ESE** - End Semester Examination.*

5. SUGGESTED PRACTICAL/STUDIO EXERCISES

The following practical outcomes (PrOs) are the sub-components of the COs. T*hey are crucial for that particular CO at the 'Precision Level' of Dave's Taxonomy related to 'Psychomotor Domain'.*

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
1	**Introduction to Creative Thinking:** 1. Prepare sketches and models showing the evolution of design any one table-top product (e.g. laptop base, mobile holder, coaster holder etc.) 2. Prepare sketches and models showing how to repurpose an item by selecting any and creating a fresh perspective leading to new uses of the existing item	I	14
2	**Problem Identification:** 1. Identify the product to be designed 2. Enlist the material, use and technology of the existing product 3. Sketch the various stages and reasons of transformation of the desired product with a brief historical back ground	II	14
3	**Design Process:** Prepare schematic sketch designs (10 to 15) and finalize one with material and technology and develop a rough prototype	III	14
4	**Design of the Product:** Prepare all necessary detailed drawings required for developing the product and construct its model	IV	14
	Total Hrs.		**56**

Note

*i. More **Practical/Studio Exercises** can be designed and offered by the respective course teacher to develop the industry relevant skills/outcomes to match the COs. The above table is only a suggestive list.*

ii. Study report, data collection and analysis report must be assigned in a group. Teacher has to discuss about type of data (which and why) before group start their site visits.

*iii. The following are some **sample** 'Process' and 'Product' related skills (more may be added/deleted depending on the course) that occur in the above listed **Practical/Studio Exercises** of this course required which are embedded in the COs and ultimately the competency.*

Sr. No.	Sample Performance Indicators for the PrOs	Weightage in %
Assessment should be done on the basis of demonstration of,		
1	Skills	40
2	Learning Process	20
3	Communication	20
4	Learning Attitude	20
Total		**100**

6. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

These major equipment with broad specifications for the PrOs is a guide to procure them by the administrators to usher in uniformity of practicals in all institutions across the state.

S. No.	Equipment Name with Broad Specifications	PrO. No.
1	Measuring Tape, Laser measure tape, Drawing Sheets, Tracing papers	1-4
2	Drawing Board (A1 size @ 23"X32") with other Other Instruments like Parallel, Set squares (45˚ and 30˚-60˚), Adjustable set square, Triangular scale, Tracing papers, Drawing Sheets	1-4
3	Interactive board with LCD overhead projector	1-4
4	Desktop PCs with latest configuration	1-4

7. AFFECTIVE DOMAIN OUTCOMES

The following ***sample*** Affective Domain Outcomes (ADOs) are embedded in many of the above-mentioned COs and PrOs. More could be added to fulfil the development of this competency.

a) Work as a leader/a team member.
b) Follow ethical practices.
c) Social and Functional Competence of design.
d) Participate in class discussions and present the design effectively, Generate new ideals.
e) Practice environmentally friendly methods and design processes.

The ADOs are best developed through the laboratory/field based exercises. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

i. 'Valuing Level' in 1st year
ii. 'Organization Level' in 2nd year.
iii. 'Characterization Level' in 3rd year.

8. UNDERPINNING THEORY

The major underpinning theory is given below based on the higher level UOs of *Revised Bloom's taxonomy* that are formulated for development of the COs and competency. If required, more such UOs could be included by the course teacher to focus on attainment of COs and competency.

Unit	Unit Outcomes (UOs) (4 to 6 UOs at different levels)	Topics and Sub-topics
Unit –I **Introduction to Creative Thinking**	**1a.** Evolution of Design **1b.** Logical Thinking vs. Creative Thinking **1c.** Exploring Creativity through various mediums	**1.1** Introduction to design thinking of a product **1.2** A brief history of evolution of design of a product **1.3** Product design elements: appearance, functionality and quality **1.4** Logical thinking **1.5** Creative thinking **1.6** Creativity and its applications

Unit	Unit Outcomes (UOs) (4 to 6 UOs at different levels)	Topics and Sub-topics
Unit– II **Problem Identification**	**2a.** Methods and Techniques **2b.** Identification and Analysis	**2.1** Method 1: Define, envision, develop, deliver **2.2** Method 2: Ideation, research, planning and execution, launch **2.3** Brainstorming **2.4** Identifying and defining the product **2.5** Sketching the various stages and reasons of transformation of the desired product with a brief historical back ground
Unit – III Design Process	**3a.** Creating different designs for the defined product **3b.** Prototyping	**3.1** Sketching different designs for the product. **3.2** Shortlisting the best three designs and finalising one of them. **3.3** Creating a rough prototype of the finalised design.
Unit – IV **Design of the Product**	**4a.**Producing a sample of the finalised product **4b.**Sample testing **4c.**Creating the final product after required modifications	**4.1** Preparing all detailed drawings to construct the model of the finalised design **4.2** Modifying the product as required after sample testing **4.3** Creating the final product

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Introduction to Creative Thinking	**Not Applicable**				
II	Problem Identification					
III	Design Process					
IV	Design of the Product					
Total						

Legends: *R=Remember, U=Understand, A=Apply and above (Revised Bloom's taxonomy)*

Note*: This specification table provides general guidelines to assist learners for their learning and to teachers to teach and question paper designers/setters to formulate test items/questions to assess the attainment of the UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may slightly vary from above table.*

10. SUGGESTED LEARNER ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested learner-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course. Learners should perform following activities in group and prepare

reports of about 5 to 7 pages for each activity. They should also collect/record physical evidences for their (learner's) portfolio which may be useful for their placement interviews.

Students should conduct user surveys for the desired product, collect data and samples of different materials used for manufacturing them and analyze them by making a presentation and/or an interactive group discussion. These could be done individually or in a group. For such data collection and other study, students need to go out of the institute to markets, shops, industries or interior sites. Students should go for site visits and prepare a report on it. Such visits should be organized by concerned faculty member/s who should compulsorily accompany the students for this purpose.

The practical/exercises should be properly designed and implemented with an attempt to develop different types of practical skills (Course Outcomes in psychomotor and affective domain) so that learners are able to acquire the competencies (Programme Outcomes).
Note: Here only Course Outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of Programme Outcomes/Course Outcomes in affective domain as given in a common list at the beginning of curriculum document for this programme. Faculty should refer to that common list and should ensure that learners also acquire those Programme Outcomes/Course Outcomes related to affective domain.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a) Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.
b) Guide learner(s) in undertaking micro-projects.
c) ***'L' in section No. 4***means different types of teaching methods that are to be employed by teachers to develop the outcomes.
d) About ***20% of the topics/sub-topics*** which are relatively simpler or descriptive in nature is to be given to the learners for ***self-learning***, but to be assessed using different assessment methods.
e) With respect to ***section No.10***, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.
f) Guide learners on how to address issues on sketching, model making, etc.
g) Use relevant video/animation films to explain various concepts and processes related to basic Architectural design themes for Public Buildings.
h) Use different instructional strategies in classroom teaching.
i) Use the relevant architectural assignments in the given situation.
j) Guide learners on form, functions utility, method of construction, etc. to facilitate them to prepare actual measured drawings.
k) Use the technique of table top discussions along with design jury sessions to teach the relevant content to the learners.
l) Adopt various strategies to enhance each learner's individual creative ability especially with reference to concept and form
m) Expert lectures should be arranged to cover topics of all units thoroughly.

12. SUGGESTED DESIGN MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a learner that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based (group of 3 to 5). However, **in the fifth and sixth semesters**, the number of learners in the group should **not exceed three**.

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each learner will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The duration of the micro-project should be about **14-16 (fourteen to sixteen) learner engagement hours** during the course. The learners ought to submit micro-project by the end of the semester to develop the industry-oriented COs.

A suggestive list of micro-projects is given here. This has to match the competency and the CO. Similar micro-projects could be added by the concerned course teacher:

a. Enlist the advantages and disadvantages of any existing product and work out a better solution for the same.
b. Create an imaginary functional product using some new innovative materials.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication with place, year and ISBN
1	The Design of Everyday things	Donald Norman	The MIT Press, 1998 ISBN: 9780262525671
2	Product Design and Development	Karl Ulrich, Steven D. Eppinger	McGraw Hill Education, 1 July 2017 ISBN-13: 978-9352601851
3	Industrial Design-Reflections of a century	Jocelyn de Noblet	Thames & Hudson, 1993. ISBN 10: 2080135392
4	What is a Designer: Things, Places, Messages	Norman Potter	Princeton Architectural Press, 2002 ISBN 10: 0907259162 ISBN 13: 9780907259169
5	Design: History, Theory and Practice of Product Design	Bernhard E. Bürdek	Birkhauser Verlag AG (1 January 2005) ISBN-10 : 3038213810 ISBN-13 : 978-3038213819
6	Ergodesign Methodology for Product Design	Marcelo M. Soares	CRC Press (October 2021) ISBN: 9781032054483
7	Time Saver Standards for Interior Design	Joseph De Chiara Julius Panero Martin Zelnik	McGraw Hill Education; ISBN : 0-07-016299-9 ISBN : 0-07-112589-2
8	Color in Interior Design	John Pile	McGraw-Hill Professional (16 June 1997) ISBN-10 : 0070501653 ISBN-13 : 978-0070501652
9	Inside Outside	Journal/Magazine	Business India Group ISSN: 0970-1761
10	Space Design	Archiworld	ARCHI (1 January 2015) ISBN-10 : 8957701494 ISBN-13 : 978-8957701492

14. SOFTWARE/LEARNING WEBSITES

- https://www.mycoted.com/Main_Page
- http://creatingminds.org/
- Creative teaching: Replacing problems with opportunities (YouTube Video)
- https://www.celt.iastate.edu/instructional-strategies/teaching-format/14-creative-ways-to-engage-students/
- https://www.teachingexpertise.com/classroom-ideas/creative-thinking-activity/
- www.designboom.com

15. PO-COMPETENCY-CO MAPPING

Semester I	Architectural Design Fundamentals (Course Code: 4315001)								
	POs and PSOs								
Competency & Course Outcomes	PO 1 Basic & Discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design/ develop-ment of solutions	PO 4 Engineer-ing Tools, Experimentation &Testing	PO 5 Engineer-ing practices for society, sustain-ability & environ-ment	PO 6 Project Manage-ment	PO 7 Life-long learning	* PSO 1 Planning & Design	#PSO 2 Execu-tion
Competency	To demonstrate the process of design of a product and create a viable product by finding solutions to problems by modifying forms and functions								
a) Introduce the notion of design of a product as it evolved through time	2	1	1	1	1	1	1	-	-
b) Understand creativity and its application	2	1	2	-	1	1	-	-	-
c) Develop the ability to identify problems and finding needs	2	1	2	-	1	1	-	-	-
d) Understand the design process	2	3	1	2	1	1	-	-	-
e) Create a viable product	3	2	3	1	1	2	2	2	3

*Legend: '**3**' for high, '**2**' for medium, '**1**' for low and '**-**' for no correlation of each CO with PO/PSO.*

***PSO 1: Planning & Design:** Prepare architectural designs and all types of drawings with appropriate material specifications and application techniques as per specific project requirements.
#PSO 2: Execution: Suggest appropriate building materials as per the requirement.

16. COURSE CURRICULUM DEVELOPMENT COMMITTEE

GTU Resource Persons

S. No	Name and Designation	Institute	Contact No.	Email
1	Shri Bhaskar J. Iyer, HOD (Arch), Coordinator & Associate Dean	Government Polytechnic for Girls, Ahmedabad	9879474833	bhaskariyer2004 @gmail.com
2	Smt. Swati K, Shah,	Government	9427624105	skshah27@gmail.com

	I/c HoD	Polytechnic for Girls, Ahmedabad		
3	Shri Bhavesh M. Patel, Lect.	Government Polytechnic for Girls, Ahmedabad	9427462830	bhavesh0arch222 @gmail.com
4	Ms. Mrigaya H. Desai, Lect.	Government Polytechnic for Girls, Ahmedabad	8469444555	mrigaya.desai @gmail.com