Syllabus of Design Thinking

B.Tech	1	Semester	1/2	Teaching Scheme				Evaluation Scheme	
Subject Name	**Design Thinking**			**L**	**T**	**P**	**Credits**	**CCE**	**SEE**
Subject Code	**BTGN22101**			**-**	**-**	**2**	**1**	**25**	**25**
Type of course	Engineering Science Course			CCE : Continuous and Comprehensive Evaluation SEE : Semester End Evaluation					
Prerequisite	No prerequisite								
Rationale	This course is open to students from any discipline eager to learn design thinking principles for building brands, products, and services, empowering them with essential strategies for fostering innovation in business and society.								

GROUP	BRANCH
1	Computer Engineering (CO) Information and Technology Engineering (IT) Artificial Intelligence and Data Science Engineering (AIDS)
2	Electrical Engineering (EL) Electronics and Communication Engineering (EC) Instrumentation and Control Engineering (IC)
3	Chemical Engineering (CH) Civil Engineering (CL) Mechanical engineering (MECH)

Syllabus for Group – 1 (CO, IT & AIDS)

B.Tech	1	Semester	1/2	Teaching Scheme				Evaluation Scheme	
Subject Name	**Design Thinking**			**L**	**T**	**P**	**Credits**	**CCE**	**SEE**
Subject Code	**BTGN22101**			-	-	**2**	**1**	**25**	**25**
Type of course	Engineering Science Course			CCE : Continuous and Comprehensive Evaluation SEE : Semester End Evaluation					
Prerequisite	No prerequisite								
Rationale	Design Thinking combines user requirements, finds creative solutions, explores suitable technology alternatives, and results in a new business enterprise or solves existing problems for an organization. This course will help students identify problems in the Computing Domain and IT sector and equip them to find solutions by applying design thinking processes and methods to solve these problems.								

Course Outcomes (COs): At the end of the course, students will be able to		**Marks % Weightage**
CO – 1	Understand the fundamental principles and importance of Design Thinking in fostering innovation, ethics and its relevance in engineering.	20
CO – 2	Apply systematic problem identification, problem framing, articulation, and problem-solving approaches in the context of Design Thinking.	25
CO – 3	Analyze and evaluate different tools and methodologies used in Design Thinking, such as observation, ethnographic research and mind mapping to gain insights into users' needs.	20
CO – 4	Develop and refine product concepts by preparing product development canvases (PDC) that consider product experience, functions, features, and sustainable development of the components.	15
CO – 5	Create a final working prototype for projects with limitations, documenting the Functionality and Features, Viability, Impact, Sustainability, Scalability, Cost and Resource Utilization for the product.	20

Course Contents			
Unit	Content	Tentative Teaching Hours	Tentative Unit % Weightage
1	**Introduction To Design Thinking:** Introduction to Design Thinking for Engineers, Essential Design Thinking Skills, Core Principles of Design Thinking, Foundations of Design Thinking, Building an Effective Design Thinking Team, Discussion of Problems from IT sector.	04	14
2	**Design Thinking Phases:** Stages of Design Thinking, Role of observation in understanding product and process challenges, Preparation of AEIOU and other canvases with defined problem statement, Exploring Design Thinking in Innovation- Understanding the Role of Design Thinking in Product and Process Innovation, Differentiating Engineering Design and Design Thinking, Double Diamond model and its application.	06	20
3	**Design Thinking Techniques:** Understanding, Listening and Empathizing Techniques, Exploring observation methods, Utilizing a structured, open-ended approach for effective communication, Ideation Tools, Brainstorming techniques for idea generation, Applying innovation to foster creativity, Application of SCAMPER Technique to an approved Problem Statement; Prototyping- Creating low-fidelity and high-fidelity prototypes, Testing of Prototype.	06	20
4	**Design Thinking Methods:** Methods and Tools for Design Thinking Practice; Empathize: Ask five why questions, Empathy map, storytelling, critical items diagram, mind map, journey map; Ideate: Brainstorming, 2X2 matrix, Need-Approach-Benefit-Competition (NABC) Methods; Prototype-Exploration map, Minimum Viable Product (MVP), Feasibility Testing, Viability Testing, A/B Testing, Sustainability Testing, Collect Feedback, Iterate and Improve the ideas; PDC canvas verification.	06	20

5	**Case Studies:** Quick-Commerce Applications – Food and Grocery Delivery (eg. Swiggy, Instamart), Ride-sharing (eg. Uber, Ola, Rapido); E-Commerce Applications – Online Shopping (eg. Amazon), Online Publishing (eg. Canva), Online Ticket Booking (eg. BookMyShow); Fintech apps (eg. Google Pay, Razorpay) etc.	08	26

Suggested Specification table with Marks

% Distribution of Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
10	20	30	15	15	10

Legends: R: Remembrance, **U:** Understanding; **A:** Application, **N:** Analyze, **E:** Evaluate **C:** Create and above Levels **(Revised Bloom's Taxonomy)**

Recommended Reference Books

1 Soni, Pavan. Design Your Thinking: The Mindsets, Toolsets and Skill Sets for Creative Problem-solving. Penguin Random House India Private Limited, 2020.

2 Tim Brown, Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation, HarperCollins e-books (2009).

3 Liedtka, Jeanne, Randy Salzman, and Daisy Azer. Design thinking for the greater good: Innovation in the social sector. Columbia University Press, 2019.

4 Lockwood, Thomas. Design thinking: Integrating innovation, customer experience, and brand value. Simon and Schuster, Allworth Press, 2010.

CO-PO-Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO – 1	1	2	2	1	1	1	1	1	2	-	1	1
CO – 2	1	2	1	1	1	1	2	1	2	2	1	-
CO – 3	1	2	2	1	1	2	1	1	2	2	2	-
CO – 4	2	2	2	2	2	2	2	1	2	2	2	1
CO – 5	3	2	3	2	3	2	3	1	2	3	2	2

Open-source software and websites

1. Google Workspace: Docs, Sheets and Slides
2. Google Jamboard
3. Mind-mapping tools: Wisemapping, Freeplane, Semantik

Suggested MOOC Courses

1. B. K. Chakravarthy, Design Technology and Innovation, SWAYAM NPTEL (Online)
2. B. K. Chakravarthy, Innovation by Design, SWAYAM NPTEL (Online)
3. Nina Sabnani, Understanding Design, SWAYAM NPTEL (Online)
4. R. T. Krishnan and V. Dhabolkar, Managing Innovation, SWAYAM NPTEL (Online)

Suggested List of Practical Activities

Note: Activities are to be performed in a team size of 3-4 students. Report is to be prepared based on these activities.

1. Brainstorm and explore various problems in IT field. Select an appropriate problem, draft a Problem Statement and get it approved for performing further activities.
2. Design AEIOU canvas
3. Design Empathy map
4. Design Mind map and Ideation Canvas
5. Prepare PDC canvas
6. Prepare low-fidelity prototype
7. Prepare high-fidelity prototype
8. Testing of Prototype

Syllabus for Group – 2 (EL,EC&IC)

B.Tech	1	Semester	1/2	Teaching Scheme				Evaluation Scheme	
Subject Name	Design Thinking			L	T	P	Credits	CCE	SEE
Subject Code	BTGN22101			-	-	2	1	25	25
Type of course	Engineering Science Course			CCE : Continuous and Comprehensive Evaluation SEE : Semester End Evaluation					
Prerequisite	No prerequisite								
Rationale	This course is open to students from any discipline eager to learn design thinking principles for building brands, products, and services, empowering them with essential strategies for fostering innovation in business and society.								

Course Outcomes (COs): At the end of the course, students will be able to

CO – 1	Identify the core principles of Design Thinking, evaluating their applicability in engineering contexts.
CO – 2	Conduct user research and gather insights.
CO – 3	Frame the problem statement based on research and generate multiple potential solutions.
CO – 4	Build tangible representations of ideas.
CO – 5	Integrate Design Thinking methodologies and apply these techniques to foster innovation and solve real-world problems.

Course Contents

Unit	Content	Tentative Teaching Hours	Tentative Unit Weightage
1	**Introduction to Design Thinking for Engineers** Definition of Design Thinking, need for Design Thinking, Objective of Design Thinking, Concepts & Brainstorming, Stages of Design Thinking Process– Being Ingenious & Fixing Problem: Empathize, Define, Ideate, Prototype, Test, Understanding Creative thinking process, Understanding Problem Solving, Testing Creative Problem Solving. Activities: Case studies for new product innovation	06	20%

2	**Approaches and Resources for Understand and Observation phase:** Understand – Interview for empathy, 5W+H questions, Ask 5x why, stakeholder map, Activities: Engage with customers/users **Observation –** Empathy map, Peer Observation, Trend Analysis Activities: Based on AEIOU (Activities, Environments, Interactions, Objects, Users)	06	**20%**
3	**Approaches and Resources for Define and Ideate phase:** **Define –** Story-telling, Context mapping, Define success, Critical items diagram **Ideate –** Brainstorming, 2x2 Matrix, 6-3-5 Method, need- approach-benefit-competition Activities: Develop Potential Solutions, LNM (Learning Need Matrix) canvas, Product Development canvas	08	**25%**
4	**Approaches and Resources for the Prototyping Stage:** Different kinds of prototypes, Exploration map, Prototype to test, Minimum viable product (MVP)	06	**20%**
5	**Approaches and Resources for Test and solution Phase** Feedback capture grid, Solution interview, Structured usability testing, A/B Testing, Create a pitch, Lessons learned, Road map for implementation, Project Report Submission	04	**15%**

Recommended Reference Books

1 The Designing for Growth Field Book: A Step-by-Step Project Guide, JeanneLiedtka, Tim Ogilvie, Columbia Business School publishing, 201p

2 Design Your Thinking: The Mindsets, Toolsets, and Skill Sets for Creative Problem -solving, PavanSoni, Penguin Random House India Private Limited, 2019

3 Design Thinking, Teun den Dekker, Routledge, 2020

4 Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation, Tim Brown, Hypercolins, 2009

CO-PO-Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO – 1	1	-	2	-	-	2	-	2	3	-	2	2
CO – 2	1	-	1	1	1		-	2	3	2	-	-
CO – 3	1	3	1	2	-	-	-	2	3	-	-	-
CO – 4	1	-	-	2	-	-	-		3	-	-	1
CO – 5	-	3	-	1	-	2	-	2	3	2	3	2

List of Open Source/learning website/Other Details if any:

1. https://nptel.ac.in/courses/110106124 (Design Thinking - A Primer, IIT Madras)
2. https://onlinecourses.swayam2.ac.in/aic23_ge17/preview (Design Thinking andInnovation, by Ravi Poovaiah, IIT Bombay)
3. https://onlinecourses.nptel.ac.in/noc20_de01/preview (Understanding Design byProf. Nina Sabnani, IIT Bombay)

Open-source software and website:

1. SessionLab (design workshop planning tool that makes it fast and easy to create theagenda for your design thinking workshop)
2. Sprintbase dedicated design thinking software, smartly guided through the wholeworkflow.
3. InVision is a flexible digital product design platform that straddles the boundarybetween online whiteboard and prototyping tool.
4. Batterii is an open platform for visual thinkers and designers to get on the samepage, structure their thoughts and create more visually

Syllabus for Group – 3 (CH,CL & MECH)

B.Tech.	1	Semester	1/2	Teaching Scheme				Evaluation Scheme	
Subject Name	Design Thinking			**L**	**T**	**P**	**Credits**	**CCE**	**SEE**
Subject Code	BTGN22101			-	-	2	1	25	25
Type of course	Engineering Science Course			CCE : Continuous and Comprehensive Evaluation SEE : Semester End Evaluation					
Prerequisite	No prerequisites								
Rationale	Design Thinking is an iterative, human-centered approach to problem-solving that integrates creativity, critical thinking, and prototyping to develop innovative solutions. This course equips students with systematic tools and methodologies for problem identification, ideation, prototyping, and evaluation. Through hands-on activities, case studies, and real-world applications, students will develop the ability to think creatively, analyse user needs, and create meaningful solutions for engineering and interdisciplinary challenges.								

Course Outcomes (COs): At the end of the course, students will be able to		**Marks %Weightage**
CO-1	Explain the fundamental principles of Design Thinking.	10
CO-2	Apply systematic problem identification techniques.	20
CO-3	Analyze user perspectives to define key challenges.	10
CO-4	Develop creative solutions and prepare an Ideation Canvas.	10
CO-5	Test prototype and product concepts.	30
CO-6	Evaluate stakeholder feedback and document findings.	20

Course Contents		
Unit	**Content**	**Tentative Teaching Hours**
1.	**Introduction to Design Thinking:** Overview, objective, and significance of Design Thinking. Core principles and socio-economic impact of design thinking. Engineering applications and interdisciplinary relevance. Case studies of successful design thinking applications.	4
2.	**Problem Identification and User Research:** Observational techniques for identifying product and process challenges. AEIOU framework for user research and data collection. Empathizing with users and defining key problem areas. Hands-on exercises: User interviews and observation techniques.	8
3.	**Problem Definition and Ideation:** Defining the Point of View (POV) based on research insights. Ideation techniques: Brainstorming, mind mapping, and SCAMPER method. Preparation of Ideation Canvas to explore possible solutions. Hands-on exercises: Group ideation and concept generation.	6
4.	**Prototyping and Product Development:** Introduction to rapid prototyping techniques (physical and digital). Preparation of Product Development Canvas (PDC). Developing low-fidelity and high-fidelity prototypes. Hands-on activity: Building a prototype for a selected problem.	6
5.	**Testing and Iteration:** Testing the prototype with users and gathering feedback. Analyzing test results and refining the design. Iterative development and design modifications. Hands-on activity: Testing and improving a prototype.	4
6.	**Final Evaluation and Report Writing:** Evaluating stakeholder feedback and integrating changes. Documenting the design process and justifying design decisions. Preparing a final Design Thinking Report with recommendations. Group presentation of final solutions.	2

Suggested Specification Table of Marks as per Revised Bloom's Taxonomy					
%DistributionofMarks					
R Level	**U Level**	**ALevel**	**N Level**	**E Level**	**C Level**
0	10	30	30	20	10

Legends: R: Remembrance, **U:** Understanding; **A:** Application, **N:** Analyze, **E:** Evaluate,**C:** Create and aboveLevels

Recommended Reference Books

1. Design Your Thinking by PavanSoni, Penguin Random House India Private Limited, Gurugram.
2. Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation by Tim Brown, Harper Business, New York.
3. Perspective and use of empathy in design thinking by Gasparini, Andrea, The Eighth International Conference on Advances in Computer-Human Interactions.
4. Design Thinking: Understanding How Designers Think and Work by Nigel Cross, Berg Publishers,Oxford.
5. Defining a Problem Statement –Design Thinking by Priyanka Jeph in QED42

Mapping of Course Outcomes (CO's) with Program Outcomes (PO's)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO-1	2	1	1	1	1	1	-	-	2	-	2	1
CO-2	2	2	3	1	1	1	-	-	2	-	2	1
CO-3	2	3	3	2	2	1	-	-	1	-	2	1
CO-4	2	1	2	1	2	1	-	1	2	2	2	2
CO-5	2	2	3	2	3	2	2	2	3	2	3	3
CO-6	1	-	-	-	1	2	-	1	1	2	2	1

List of Open Source/learning website/Other Details if any

1. B.K. Chakravarthy, Design Technology and Innovation, SWAYAM NPTEL (Online)
2. B.K. Chakravarthy, Innovation by Design, SWAYAM NPTEL (Online)
3. Nina Sabnani, Understanding Design, SWAYAM NPTEL (Online)