Shri Vile Parle Kelavani Mandal's

Dwarkadas J. Sanghvi College of Engineering

(Autonomous College Affiliated to the University of Mumbai)

Scheme and Detailed Syllabus (DJS23)

Third Year B. Tech Equivalence in COMPUTER SCIENCE AND ENGINEERING (IoT and Cybersecurity with Block Chain Technology)

(Semester V)

With effect from the Academic Year: 2025-2026

Shri Vile Parle Kelavani Mandal's
DWARKADAS J. SANGHVI COLLEGE OF ENGINEERING
(Autonomous College Affiliated to the University of Mumbai)
NAAC Accredited with "A" Grade (CGPA : 3.18)

Scheme for Third Year Undergraduate Program in Computer Science and Engineering (IoT and Cyber Security with Block Chain Technology) : Semester V (Autonomous) Academic Year (2025-2026)

Sr. No.	Course Code	Course	Teaching Scheme			Continuous Assessment (A)						Semester End Examination (B)						Aggregate (A+B)	Credits
			Theory (hrs.)	Practical (hrs.)	Tutorial (hrs.)	Term Test 1 (TT1) -a	Term Test 2 (TT2) - b	Assg/CP/ GD /Presntation/ Quiz) - c	Total (a+b+c)	Term work	CA Total	Duration	Theory	Oral	Pract	Oral & Pract	SEE Total		
1#	DJS23BCPC501	Embedded System and IoT	3	--	--	15	15	10	40	--	40	2	60	--	--	--	60	100	3
	DJS23BLPC501	Embedded System and IoT Laboratory	--	2	--	--	--	--	--	25	25	2	--	25	--	--	25	50	1
2#	DJS23BCPC502	Applied Cryptography	3	--	--	15	15	10	40	--	40	2	60	--	--	--	60	100	3
	DJS23BLPC502	Applied Cryptography Laboratory	--	2	--	--	--	--	--	25	25	2	--	--	--	25	25	50	1
3	DJS23BCPC503	Introduction to Blockchain Technology	2	--	--	15	15	10	40	--	40	2	60	--	--	--	60	100	2
	DJS23BLPC503	Introduction to Blockchain Technology Laboratory	--	2	--	--	--	--	--	25	25	2	--	25	--	--	25	50	1
4#	DJS23BLPC504	Web application Development Laboratory	--	2	--	--	--	--	--	25	25	2	--	--	--	25	25	50	1
5@	DJS23BCPE511	Distributed Computing	3	--	--	15	15	10	40	--	40	2	60	--	--	--	60	100	3
	DJS23BLPE511	Distributed Computing Laboratory	--	2	--	--	--	--	--	25	25	2	--	25	--	--	25	50	1
	DJS23BCPE512	Computer Vision	3	--	--	15	15	10	40	--	40	2	60	--	--	--	60	100	3
	DJS23BLPE512	Computer Vision Laboratory	--	2	--	--	--	--	--	25	25	2	--	25	--	--	25	50	1
	DJS23BCPE513	Cognitive Computing	3	--	--	15	15	10	40	--	40	2	60	--	--	--	60	100	3
	DJS23BLPE513	Cognitive Computing Laboratory	--	2	--	--	--	--	--	25	25	2	--	25	--	--	25	50	1
6	DJS23BCMD501	Artificial Intelligence	3	--	--	15	15	10	40	--	40	2	60	--	--	--	60	100	3
	DJS23BLMD501	Artificial Intelligence Laboratory	--	2	--	--	--	--	--	25	25	2	--	--	--	25	25	50	1
7	DJS23ITHSX10	Environmental Studies	--	--	1	--	--	--	--	25	25	--	--	--	--	--	--	25	1
8	DJS23IPSCX03	Innovative Product Development III	--	2	--	--	--	--	--	25	25	2	--	--	--	25	25	50	1
		$ Total	14	14	1	75	75	50	200	200	400	24	300	75	0	100	475	875	22

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Scheme for Third Year Equivalence Undergraduate Program in Computer Science and Engineering (IoT and Cyber Security with Block Chain Technology) : Semester V (Autonomous) Academic Year (2025-2026)

Sr. No.	Course Code	Course	Teaching Scheme			Continuous Assessment (A)						Semester End Examination (B)						Aggregate (A+B)	Credit
			Theory (hrs.)	Practical (hrs.)	Tutorial (hrs.)	Term Test 1 (TT1) -a	Term Test 2 (TT2) - b	Assg/CP /GD /Presntation/ Quiz) - c	Total (a+b+c)	Term work	CA Total	Duration	Theory	Oral	Pract	Oral & Pract	SEE Total		
1	DJS23OCOE501	Personal Finance Management	3	–		15	15	10	40	–	–	2	60	–	–	–	60	100	3
2	DJS23BTPC505	Theoretical Computer Science	–	–	1	–	–	–	–	25	25	–	–	–	–	–	–	25	1
3	DJS23BLPC506	UI/UX Laboratory		4	–					25	25	2				25		50	2
4	DJS23ILHS501	Design Thinking Laboratory		2						25								25	1
		Total	3	6	1	15	15	10	40	75	50	4	60	–	–	25	60	200	7

Course	Teaching Scheme				Semester End Examination (A)						Continuous Assessment (B)						Aggregate (A+B)	Category
	Theory (hrs.)	Practical (hrs.)	Tutorial (hrs.)	Credits	Duration	Theory	Oral	Pract	Oral & Pract	SEE Total	Term Test 1 (TT1) -a	Term Test 2 (TT2) - b	Assg/CP /GD/Presntation/ Quiz) - c	Total (a+b+c)	Term work	CA Total		
* Grand Total	11	14	2	20	18	240	50	0	75	365	60	60	40	160	200	360	725	Total Credits earned as per Equivalence

- Courses Exempted for Equivalence students
$ - Total of Regular students
* - Total of Equivalence students
@ - Any 1 Programme Elective Course (PEC)

Prepared by Checked by Head of the Department Vice Principal Principal

Program: B.Tech in Computer Science and Engineering(IoT and Cybersecurity with Block chain Technology)	T.Y.B.Tech	Semester : V
Open Elective for Equivalence Program		
Course : Personal Finance Management	Course Code: DJS23OCOE501	

Teaching Scheme (Hours / week)				Evaluation Scheme								
				Continuous Assessment Marks (A)				Semester End Examination Marks (B)			Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Term Test 1	Term Test 2	Assignment	Total	Theory			
				15	15	10	40	60			100
				Term Work				Laboratory Examination			
3	--	--	3	Laboratory Work	Tutorial / Mini project / presentation / Journal/ Practical	Total Termwork		Oral	Practical	Oral & Practical	--
				--	--	--		--	--	--	

Prerequisite:
Nil

Objectives: The objective of the course is
1. To create awareness and educate consumers on access to financial services.
2. To make the students understand the basic concepts, definitions and terms related to direct taxation.
3. To help the students compute the Goods and Service Tax (GST) payable by a supplier after considering the eligible input tax credit.
4. To familiarize the students with microfinance for accelerating the expansion of local microbusinesses.

Outcomes: On completion of the course, learner will be able to:
1. Understand the Indian financial system.
2. Use a framework for financial planning to understand the overall role finances play in his/her personal life.
3. Compute income from salaries, house property, business/profession, capital gains and income from other sources.
4. Compute the amount of CGST, SGST and IGST payable after considering the eligible input tax credit.
5. Understand how Microfinance can help in financial inclusion.

Detailed Syllabus:		
Unit	**Description**	**Duration**
1	**Overview of Indian Financial System**: Characteristics, Components and Functions of Financial System. Financial Instruments and Financial Markets, Financial Inclusion. **Introduction to Personal Finance** Personal Financial Planning in Action, Money Management Skills, Taxes in Your Financial Plan, Savings and Payment Services.Consumer Credit: Advantages, Disadvantages, Sources and Costs.	**07**
2	**Personal Financial Management** **Loans:** Home, Car, Education, Personal, Loan against property, and Jewel loan. **Insurance:** Types of Insurance – ULIP and Term; Health and Disability Income Insurance, Life Insurance. **Investment:** Investing Basics and Evaluating Bonds, Investing in Stocks and Investing in Mutual Funds, Planning.	**07**
3	**Income Tax: Income Tax Act Basics**- Introduction to Income Tax Act, 1961 **Heads of Income and Computation of Total Income and Tax Liability**- Heads of Income and Computation of Total Income under various heads, Clubbing Provisions, set off and carry forward of Losses, Deductions, Assessment of Income and tax liability of different persons. **Tax Management, Administrative Procedures and ICDS** - TDS, TCS and Advance Tax Administrative Procedures, ICDS.	**09**
4	**Goods and Services Tax** GST Constitutional framework of Indirect Taxes before GST (Taxation Powers of Union & State Government); Concept of VAT: Meaning, Variants and Methods; Major Defects in the structure of Indirect Taxes prior to GST; Rationale for GST; Structure of GST (SGST, CGST, UTGST & IGST); GST Council, GST Network, State Compensation Mechanism, Registration. **Levy and Collection of GST** Taxable event- "Supply" of Goods and Services; Place of Supply: Within state, Interstate, Import and Export; Time of supply: Valuation for GST- Valuation rules, taxability of reimbursement of expenses; Exemption from GST: Small supplies and Composition Scheme: Classification of Goods and Services	**08**
5	**Introduction to Micro – finance** Micro-Finance: Definitions, Scope & Assumptions, Types of Microfinances, Customers of Micro-finance, Credit Delivery Methodologies, SHG concept, origin, Formation & Operation of Self-Help Groups (SHGs). **Models in Microfinance** - Joint Liability Groups (JLG), SHG Bank Linkage Model and GRAMEEN Model: Achievements & Challenges. **Institutional Mechanism** Current Challenges for Microfinance, Microfinance Institutions (MFIs): Constraints & Governance Issues, Institutional Structure of Microfinance in India: NGO-MFIs, NBFC-MFIs, Co-operatives, Banks, Microfinance Networks and Associations; Demand & Supply of Microfinance Services in India, Impact assessment and social assessments of MFIs	**08**
	Total	**39**

Books Recommended:

Textbooks:

1. Banking and Financial Sector Reforms in India, by Asha Singh, M.S. Gupta, Serials Publication.
2. Indian Banking Sector: Essays and Issues (1st) , by M.S. Gupta & J.B. Singh, Serials Publication.
3. Basics Of Banking & Finance, by K.M. Bhattacharya O.P. Agarwal, Himalaya Publishing House.
4. Agricultural Finance and Management, by S. Subba Reddy, P. Raghu Ram.
5. The Indian Financial System and Development, by Dr.Vasant Desai, Himalaya Publishing House; Fourth Edition.
6. Income Tax Management, Simple Wayof Tax Management, Tax Planning and Tax Saving, By Sanjay Kumar Satapathy.
7. Direct Tax System Income Tax by Dr. R. K. Jain, SBPD Publications.
8. Simplified Approach to GST Goods and Services Tax, By S K Mishra, Educreation Publishing.
9. Introduction To Microfinance, By Todd A Watkins, World Scientific Publishing Company

Evaluation Scheme:

Continuous Assessment (A):

Will consist of following three components:

1. Term Test 1 (based on 40 % syllabus) – 15 marks
2. Term Test 2 (on next 40 % syllabus) – 15 marks
3. Assignment / course project / group discussion / presentation / quiz – 10 marks Total summing up to 40 marks.

Semester End Examination (B):

Theory:

Question paper based on the entire syllabus will comprise of 4 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 60 marks.

Prepared by Checked by Head of the Department Vice Principal Principal

Program: B.Tech in Computer Science and Engineering(IoT and Cybersecurity with Blockchain Technology)										Semester : V
Equivalence course for T.Y. B.tech										
Course : Theoretical Computer Science										Course Code: DJS23BTPC505
Teaching Scheme (Hours / week)				Semester End Examination Marks (A)			Continuous Assessment Marks (B)			Semester End Examination Marks (A)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test +Assignment		Total	
				--			--		--	--
				Laboratory Examination			Term work		Total Term work	
--	--	1	1	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal		----
				--	--	--	--	25	25	

Course Objectives: The Objective of course is

1. Acquire conceptual understanding of fundamentals of grammars and languages.
2. Build concepts of theoretical design of deterministic and non-deterministic finite automata and push down automata.
3. Develop understanding of different types of Turing machines and applications.
4. Understand the concept of Undecidability.

Course outcomes: On successful completion of this course, learner will be able to:

1. Build a framework for representing and modeling computational processes.
2. Understand expressions to provide a formal way to describe regular languages.
3. Design Context free grammer, pushdown automata to recognize the language.
4. Develop an understanding of computation through Turing Machine.
5. Acquire fundamental understanding of decidability and undecidability.

Detailed Syllabus:		
Unit	**Description**	**Duration**
1	**Basic Concepts and Finite Automata:** Importance of TCS, Alphabets, Strings, Languages, Closure properties, Finite Automata (FA) and Finite State machine (FSM). Deterministic Finite Automata (DFA) and Nondeterministic Finite Automata (NFA): Definitions, transition diagrams and Language recognizers, Equivalence between NFA with and without ε- transitions, NFA to DFA Conversion, Minimization of DFA, FSM with output: Moore and Mealy machines, Applications and limitations of FA.	9
2	**Regular Expressions and Languages:** Regular Expression (RE), Equivalence of RE and FA, Arden 's Theorem, RE Applications. Regular Language (RL), Closure properties of RLs, Decision properties of RLs, Pumping lemma for RLs.	7
3	**Grammars:** Grammars and Chomsky hierarchy Regular Grammar (RG), Equivalence of Left and Right linear grammar, Equivalence of RG and FA. **Context Free Grammars (CFG)** Definition, Sentential forms, Leftmost and Rightmost derivations, Parse tree, Ambiguity, Simplification and Applications, Normal Forms: Chomsky Normal Forms (CNF) and Greibach Normal Forms (GNF), Context Free language (CFL) - Pumping lemma, Closure properties. **Pushdown Automata(PDA):** Definition, Language of PDA,PDA as generator, decider and acceptor of CFG, Deterministic PDA , Non-Deterministic PDA, Application of PDA.	12
4	**Turing Machine (TM):** Definition, Design of TM as generator, decider and acceptor, Variants of TM: Multitrack, Multitape, Universal TM, Applications, Power and Limitations of TMs.	9
5	**Undecidability:** Decidability and Undecidability, Recursive and Recursively Enumerable Languages, Halting Problem, Rice's Theorem, Post Correspondence Problem.	2
	Total	39

Books Recommended:

Text books:

1. John E. Hopcroft, Rajeev Motwani, Jeffery D. Ullman, "Introduction to Automata Theory, Languages and Computation", 3rd Edition, Pearson Education, 2008.
2. Michael Sipser, "Theory of Computation", 3rd Edition, Cengage learning. 2013.
3. Vivek Kulkarni, "Theory of Computation", Illustrated Edition, Oxford University Press, (12 April 2013) India.

Reference Books:

1. J. C. Martin, "Introduction to Languages and the Theory of Computation", 4th Edition, Tata McGraw Hill Publication, 2013.
2. Kavi Mahesh, "Theory of Computation: A Problem Solving Approach", Kindle Edition, Wiley-India, 2011.

Web resources:

1. Great Ideas in Theoretical Computer Science
2. https://ocw.mit.edu/courses/6-080-great-ideas-in-theoretical-computer-science-spring-2008/pages/lecture-notes/

Online Courses: NPTEL / Swayam

1. Theory of Computation
   https://onlinecourses.nptel.ac.in/noc24_cs71/preview
2. Theory of Computation
   https://onlinecourses.nptel.ac.in/noc24_cs49/preview

Evaluation Scheme:

Continuous Assessment (B):

Tutorial:

i. Term work shall consist of minimum 8 Tutorials.
ii. Performance in each tutorial for 25 marks.

The final certification and acceptance of term work will be subject to satisfactory performance of Tutorial work, and upon fulfilling minimum passing criteria in the term work.

Prepared by Checked by Head of the Department Vice Principal Principal

Program: B.Tech. in CSE(IoT and Cyber Security with Blockchain Technology)											Semester : V
Equivalence course for T.Y. B.tech											
Course : UI/UX Laboratory											Course Code: DJS23BLPC506
Teaching Scheme (Hours / week)				Evaluation Scheme							
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)				Total marks (A+B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test1	Term Test2	Avg.		
				--			--	--	--		--
				Laboratory Examination			Term work				
--	4	--	2	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial /Mini project /presentation / Journal / Assignment	Total Term work		50
				--	--	25	10	15	25		

Prerequisite: Knowledge of Web Programming.

Objectives: The objective of the course is.

1. Explore various user research methods and information architecture and to use them in interaction design, visual design and functional Layout Design.
2. Introduces students to usability testing which is performed on various design.

Outcomes: On completion of the course, learner will be able to:

1. Identify user requirements.
2. Build UI for user Applications.
3. Create Wireframe and Prototype.
4. Generate test report using usability testing.
5. Work effectively as a member of the team.

Detailed Syllabus:		
Unit	Description	Duration
1	Introduction : Introduction to interface design, Understanding and conceptualizing Interface, Understanding user's conceptual cognition., The 5 Main Ingredients of UX: Psychology, Usability, Design, Copywriting & Analysis. Seven factors that influence user experience-useful, usable, findable, credible, desirable, accessible, valuable.	8
2	User Research: UX research, Difference between good and bad UX research, Five steps of UX research, Role of research in the UX design process, Value of UX research, Seven Great, Tried and Tested UX Research Techniques: Card sorting, Expert review, Eye movement tracking, Field studies, Usability testing, Remote Usability Testing, User Personas. Defining the UX, Design Process and Methodology, understanding user requirements and goals, Understanding the Business Requirements/Goals, User research, mental models, wireframes, prototyping, usability testing. Other Research Methods: User Interviews, Observation, Focus group discussion, Survey Competitor analysis, Empathy mapping.	8

3	**Interaction Design:** Ideation Methods – Interaction, Wireframing and Prototyping, Paper Prototyping, Build your own Prototyping, Prototyping Tools For UI/UX Designers, Heuristic (Expert) Evaluation, Designing a Web / Mobile.	10
4	**Visual Design:** Web App UI Elements, Mobile App UI Elements, Grid Systems, Colors Theory and Palette, Understanding Typography – Material UI. **Usability Testing:** Testing Methods - User Testing - A/B Testing - Conducting a Usability Test -Test Results Report.	8
5	**Functional Layout Design:** Z-Pattern, F-Pattern, and Visual Hierarchy, Browsing vs. Searching vs. Discovery, Page Framework, The Fold, Images, & Headlines, The Axis of Interaction Forms, Calls-to-Action, Instructions & Labels, Primary & Secondary Buttons.	10
6	**Research, designing, ideating, & information architecture** Identifying and Writing Problem Statements - Identifying Appropriate Research Methods - Creating Personas - Solution Ideation - Creating User Stories - Creating Scenarios - Flow Diagrams - Flow Mapping - Information Architecture.	8
	Total	52

List of Laboratory Experiments:	
Sr. No.	**Suggested Experiments**
1	Exploring various UI Interaction Patterns
2	Developing an interface with proper UI Style Guides
3	Understand the Grid System and implement the Web App / Mobile App
4	Implement colors Theory and Typography in your own Web App/ Mobile App Through Material UI and other UI Kit.
5	Create the own idea with Empathy Mapping
6	Developing Wireflow diagram for application using open source software
7	Hands on Design Thinking Process for a new product
8	Brainstorming feature for proposed product.
9	Defining the Look and Feel of the new Project
10	Identify a customer problem to solve
11	Conduct end-to-end user research - User research, creating personas, Ideation process (User stories, Scenarios), Flow diagrams, Flow Mapping
12	Sketch, design with popular tool and build a prototype and perform usability testing and identify improvements
13	Presentation on selected mini project topic

Books Recommended: Text books:

1. Joel Marsh, "UX for Beginners", O'Reilly , 2022
2. Jon Yablonski, "Laws of UX using Psychology to Design Better Product Services" O'Reilly 2021
3. Jenifer Tidwell, Charles Brewer, Aynne Valencia, "Designing Interface" 3 rd Edition , O'Reilly 2020
4. Donald Norman, "The Design of Everyday Things: Revised and Expanded Edition", Basic Books, 2013.
5. Rogers Sharp Peerce," Interaction Design: Beyond Human Computer Interaction", 5th Edition, Wiley, 2019.

Reference Books:

1. Jeff Johnson, "Designing with the mind in mind", 2nd Edition, Morgan Kaufmann Publication, 2014.
2. Alan Dix, Janet Finlay, Gregory Abowd, Russel Beale, "Human–Computer Interaction", Pearson, 2009.
3. Brian Fling, "Mobile Design and Development", First Edition , O"Reilly Media Inc., 2009.
4. Wilbert O. Galitz, "The Essential Guide to User Interface Design", Wiley publication, 2002.

Web Recourses:

1. https://www.interaction-design.org/literature.
2. https://www.nngroup.com/articles/
3. https://thehipperelement.com/post/75476711614/ux-crash-course-31-fundamentals
4. https://uiuxtrend.com/user-experience-ux-process/
5. Introduction:
   a. https://uxplanet.org/what-is-ui-vs-ux-design-and-the-difference-d9113f6612de
   b. https://uxplanet.org/a-complete-list-of-ux-deliverables-d62ccf1de434
   c. https://www.toptal.com/designers/ux/10-common-ux-deliverables
   d. https://www.interaction-design.org/literature/article/what-is-design-thinking-and-why- is-it-so-popular
   e. https://thehipperelement.com/post/72080847673/daily-ux-crash-course-3-of-31
6. User research:
   a. https://careerfoundry.com/en/blog/ux-design/how-to-conduct-user- experience-research-like-a-professional/
   b. https://www.interaction-design.org/literature/article/7-great-tried-and-tested-ux- research-techniques
7. Visual Design
   a. https://www.awwwards.com/understanding-web-ui-elements-principles.html
   b. https://blog.tubikstudio.com/mobile-ui-design-15-basic-types-of-screens/
   c. https://appsamurai.com/6-necessary-elements-for-designing-a-perfect-mobile-app- user-interface/
   d. https://www.smashingmagazine.com/2018/02/comprehensive-guide-to-mobile-app- design/
   e. https://www.mockplus.com/blog/post/ui-grid-layout-
   https://careerfoundry.com/en/blog/ui-design/introduction-to-color-theory-and-color- palettes/
8. Interaction Design:
   a. https://www.smashingmagazine.com/2018/03/guide-wireframing-prototyping/
   b. https://medium.theuxblog.com/11-best-prototyping-tools-for-ui-ux-designers- how-to-choose-the-right- one-c5dc69720c47
   c. https://careerfoundry.com/en/blog/ux-design/what-is-a-heuristic-evaluation-in-ux/#:~:text=A%20heuristic%20evaluation%20is%20a,is%20evaluated%20by%20usability%20experts.
   d. https://designforfounders.com/web-app-ux/
   e. https://uxplanet.org/best-practices-in-mobile-app-design-in-2020-7f5026818ade
   f. https://www.toptal.com/designers/ux/mobile-ux-design-best-practices
9. Usability Testing:
   a. https://www.nngroup.com/articles/usability-testing-101/

Online Courses: NPTEL / Swayam:

1. UI By Prof. Saptarshi Kolay | IIT Roorkee https://archive.nptel.ac.in/courses/124/107/124107008/
2. Virtual Lab:
   Creative Design, Prototyping & Experiential Lab : https://cpe-iitg.vlabs.ac.in/

Evaluation Scheme:
Semester End Examination (A):

Laboratory: Oral and practical examinations will be based on the entire syllabus including the Miniproject completed during laboratory sessions

Laboratory: (Term work)

Laboratory work will be based on experiments suggested in experiment list of **DJS23BLPC506** along with Mini project. The distribution of marks for term work shall be as follows:

1. Laboratory work (Performance of Task): 10 Marks
2. Mini project (Write-up, Power Point Presentation): 15 Marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work, and upon fulfilling minimum passing criteria in the term work.

Prepared by Checked by Head of the Department Vice Principal Principal

Program: B.Tech in Computer Science and Engineering(IoT and Cybersecurity with Blockchain Technology)									Semester : V	
Equivalence course for T.Y. B.tech										
Course : Design Thinking Laboratory									Course Code: DJS23ILHS501	
Teaching Scheme (Hours / week)				Semester End Examination Marks (A)			Continuous Assessment Marks (B)			Semester End Examination Marks (A)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test +Assignment		Total	
				--			--		--	--
				Laboratory Examination			Term work		Total Term work	
--	2	--	1	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal		25
				--	--	--	15	10	25	

Pre-requisite:

1. Basic understanding with the development life cycle of products, processes, software, or services.
2. Basic knowledge of iterative frameworks (not mandatory).

Course Objectives: The Objective of course is

1. To introduce students to the fundamentals, history, and importance of design thinking and its role in solving complex, real-world problems.
2. To develop students' empathy and user-research skills by teaching them how to gather insights, create personas, and map user journeys.
3. To equip students with the skills to define and reframe problem statements effectively, identifying opportunity areas and stakeholder touchpoints.
4. To foster creative ideation, prototyping, and testing skills through hands-on exercises that incorporate strategic innovation and rapid prototyping techniques.

Course Outcomes: On completion of the course, the learner will be able to:

1. Understand and apply the design thinking process to analyze and solve real-world problems.
2. Develop the ability to empathize with users, create user personas, and design empathy and journey maps tailored to specific challenges.
3. Demonstrate proficiency in defining clear and actionable problem statements that uncover areas of opportunity.
4. Generate diverse ideas using ideation techniques, such as brainstorming and SCAMPER, to approach problem-solving creatively and collaboratively.

5. Create and test prototypes, iterating based on feedback and validating solutions through digital platforms and peer review.

Detailed Syllabus:		
Unit	**Syllabus Content**	**Duration**
1	**Introduction to Design Thinking and Strategic Innovation** • Understanding the fundamentals of design thinking. • Exploring the history and evolution of design thinking. • The importance of empathy in the design thinking process. • Conduct market & industry research by observing and contextualizing various macro & micro trends. • Case Study - conduct their research on how Design Thinking helped solve some of the biggest and most critical problems of our time. **Design Thinking for Strategic Innovation:** • Types of innovations, strategic innovation. • Features of strategic innovation. • Design thinking and strategic innovation. • Practices of integrating design thinking in strategic innovation.	8
2	**Empathize Phase** • Techniques for conducting user research and gathering insights. • Creating user personas and empathy maps. • Practicing active listening and observation skills. • To apply various empathizing techniques to the problem statement selected. • Use walk-a-mile immersion and heuristic reviews to first empathize with end users and then to build an empathy map and customer journey map.	4
3	**Define Phase** • Defining problem statements and reframing challenges. • Tools for synthesizing research findings. • Developing a clear and actionable problem statement. • Start building from Persona map and conduct interviews/ Gemba walk to plot user's journeys from start to end. • Define the problem space using the HMW statement. Now highlight areas of opportunities in the journey map and enlist potential channels/touchpoints as well as stakeholders for proposed solution interventions.	4
4	**Ideate Phase** • Generating creative ideas through brainstorming sessions. • Techniques for divergent and convergent thinking. • Prototyping and experimenting with ideas. • Apply suitable ideation technique to quickly generate diverse ideas that could be applied to target problem space – either partially or in full. • Brain Writing – Build on each other's ideas and constructively & creatively develop better ideas using SCAMPER technique.	4
5	**Prototype and Validation** • Introduction to prototyping tools and techniques.	6

	• Rapid prototyping methods. • Testing prototypes with users and gathering feedback. • Refining solutions based on user insights. • Develop user storyboard to layout solution proposition in visual and easily explainable form. Run a quick peer validation. • peer-validated the storyboard. • Build an interactive digital prototype using any digital rapid prototyping platform and seek user validation.	
	Total	**26**

List of Experiments:

- Below is a list of assignments/ activities/ experiments that would be carried out by students as a mini project in groups consisting of 3-4 students.
- Problem statement for these assignments/ activities/ experiments will be provided by facilitator/ instructor/ faculty to the groups/ teams/ batches within each class.
- This list of experiments will help students learn various design thinking methods and practice the corresponding tools available.

Sr. No.	Name of the Experiment
1	To conduct market and industry research and analyze case studies demonstrating the application of design thinking. (Increased understanding of how design thinking has been applied to solve critical problems in various contexts.)
2	To exercise empathizing techniques to understand the needs and pain points of a target audience.
3	Developing empathy maps and customer journey maps based on collected insights.
4	To exercise different tools and techniques (such as affinity diagrams, journey mapping, and user story mapping) for synthesizing research findings.
5	Develop user personas to represent different user archetypes and their needs concerning the problem at hand.
6	To practice the SCAMPER technique, Brainstorming, and brain-writing as a collaborative ideation technique to create multiple creative ideas/ solutions for the problem at hand.
7	Create a mind map to generate a wide range of solutions to a problem at hand.
8	To explore different prototyping tools and platforms, such as Adobe XD, Figma, Sketch, and InVision.
9	To Conduct rapid prototyping sessions to build low-fidelity / High fidelity prototypes based on the ideas generated in the Ideation phase and iterate based on feedback received.
10	Develop a plan for implementing the final solution, considering factors like scalability and feasibility.

11	Conduct usability testing to gather feedback on prototypes. Use A/B testing to compare different versions of a solution and determine which performs better.

***Note** – A minimum of five experiments from the above-suggested list or any other assignment based on the syllabus will be included, which would help the learner to apply the concept. The mini-project is mandatory.*

Books Recommended

***Text books**:*

1. I. Mootee, "Design Thinking for Strategic Innovation: What They Can't Teach You at Business or Design School", Wiley, 2013.
2. M. Lewrick, P. Link, and L. Leifer, "The Design Thinking Playbook: Mindful Digital Transformation of Teams, Products, Services, Businesses and Ecosystems", Wiley, 2018.
3. T. Lockwood, "Design Thinking: Integrating Innovation, Customer Experience, and Brand Value", Allworth Press, 2010.
4. K. T. Ulrich and S. D. Eppinger, "Product Design and Development", McGraw-Hill Hill Education, 6th Edition, 2016.
5. C. J. Meadows and C. Parikh, "The Design Thinking Workbook: Essential Skills for Creativity and Business Growth", Emerald Publishing, 2022.

***Reference books**:*

1. T. Kelley and D. Kelley, "Creative Confidence: Unleashing the Creative Potential Within Us All", HarperCollins Publisher, 2013.
2. T. Brown, "Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation", HarperCollins, 2013.
3. J. Knapp, J. Zeratsky, and B. Kowitz, "Sprint: How to Solve Big Problems and Test New Ideas in Just Five Days", Simon & Schuster, 2016.
4. Chakrabarti, "Engineering Design Synthesis: Understanding, Approaches and Tools", Springer, 2002.
5. K. Otto, and K. Wood, "Product Design", Prentice Hall, 2000.

Web Resources:

1. **Design and Innovation:**
   https://openstax.org/books/entrepreneurship/pages/4-suggested-resources
2. **Overview of Design Thinking:**
   https://www.interaction-design.org/literature/topics/design-thinking
   10 Models for Design Thinking. In 2004, business consultants Hasso… | by Libby Hoffman | Medium
   https://www.tcgen.com/design-thinking/#What_is_Design_Thinking_and_How_Does_it_Relate_to_Product_Development
3. **Understand, observe and define the problem:**

a. https://www.nngroup.com/articles/empathy-mapping/
b. https://uxdesign.cc/the-purpose-of-a-journey-map-and-how-can-it-galvanize-action-9a628b7ae6e

4. **Ideation and prototyping:**

a. https://www.interaction-design.org/literature/topics/prototyping

b. https://www.uxmatters.com/mt/archives/2019/01/prototyping-user-experience.php

5. Testing and implementation:

a. https://www.nngroup.com/articles/usability-testing-101/

b. https://www.interaction-design.org/literature/article/test-your-prototypes-how-to-gather-feedback-and-maximise-learning

6. Design thinking in various sectors:

a. https://www.tutorialspoint.com/design_thinking/design_thinking_quick_guide.htm

Online Courses : **NPTEL/ SWAYAM Courses**

1. Creative Engineering Design (https://nptel.ac.in/courses/107108010)
2. Understanding Creativity and Creative Writing (https://nptel.ac.in/courses/109101017)
3. Understanding Design Thinking & People Centred Design (https://nptel.ac.in/courses/109104109)
4. Design Thinking - A Primer (https://nptel.ac.in/courses/110106124)
5. Product Engineering and Design Thinking (https://nptel.ac.in/courses/112105316)

Evaluation Scheme:

Continuous Assessment(B):

Laboratory: (Term work)

Term Work shall consist of at least 5 practical's based on the above list.

The distribution of marks for term work shall be as follows:

1. Laboratory work (Performance of Experiments, Write-up): 15Marks
2. Mini Project (Report and Presentation): 10 Marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

Prepared by | Checked by | Head of the Department | Vice Principal | Principal