

Curriculum for M.Des

Integrated Product Design

From The Academic Year 2021

(Approved in Senate 44)



Indian Institute of Information Technology Design and Manufacturing, Kancheepuram

Chennai-600 127

Semester wise Credit Distribution

Category	Semester Wise Credits					
	S1	S2	S3	S4	Total	%
Design Course (DSC)	17	15	6	0	38	42.2
Professional Elective Course (PEC)	0	3	0	6	9	10
Professional Career Development (PCD)	5	5	16	17	43	47.8
Total	22	23	22	23	90	100

Course Title	Foundation for integrated product design	Course No				
Specialization	Integrated Product Design	Structure (LTPC)	0	0	0	0
Offered for	Master of Design (Semester 1)	Status	Core	X	Elective	
Prepared by	Dr Sudhir Varadarajan					
Prerequisite	None	To take effect from	2021 Batch			
Course Objectives	1. Unlearn limiting assumptions, risk avoidance, fear of failure 2. Awaken their senses & rediscover their creative selves 3. Experience the impact of design and technology in everyday objects This course is expected to be conducted as part of the induction process (first two weeks)					
Course Outcomes	At the end the course, the students are expected to: <ul style="list-style-type: none"> unlearn key limiting assumptions demonstrate qualities of immersion in a task be excited by the potential of technology and design in improving lives become comfortable with sketch-thinking and develop skills in design sketching 					
Contents of the course (With approximate break up of hours)	Module-1: Induction: (16 hrs) <ul style="list-style-type: none"> History of the place; the industrial ecosystem; institution Exercises to improve interaction; local visits; Module-2: Learn to observe nature and self (32 hrs) <ul style="list-style-type: none"> Know your context - physical and social; Unlearning activities; Start journaling Observe wholes-parts (trees-leaves); variety of leaves; colors Document in a variety of ways - collage; sketch, paint, photograph, video Module-3: Learn to observe everyday objects (32 hrs) <ul style="list-style-type: none"> Unbundle everyday objects, observe, reorganize Whole-part relations; System physics; Observe interplay of art, design, culture, technology in everyday objects Module 4: Take ownership for your learning <ul style="list-style-type: none"> Understanding learning strategies Self-reflection & purpose for being 					
Texts & References	1. Frank R Wilson (1998), The hand: How it shapes the brain, language and human culture, Vintage Books, NY, ISBN: 9780679740476 2. Keri Smith (2008), How to be an Explorer of the World: Portable Life Museum, Penguin Group, ISBN:9780241953884					

Course Title	Aesthetics, Forms and Sketching	Course No				
Specialization	Integrated Product Design	Structure (LTPC)	1	0	3	3
Offered for	Master of Design (Semester 1)	Status	Core	X	Elective	
Prepared by	Dr Gurunathan					
Prerequisite	None	To take effect from	2021 Batch			
Course Objectives	<ol style="list-style-type: none"> To introduce elements of art and their application in aesthetics and design To provide in-depth understanding of principles of design, concepts of form, 2D/3D geometries, exploration of surface textures in different materials, relationship between form, materials and process. To provide hands-on training in sketching to enable the students to communicate the design ideas and also to stimulate design improvements 					
Course Outcomes	At the end of the course the students will be able to: <ul style="list-style-type: none"> Understand aesthetic principles governing the design Use freehand sketching to communicate the design ideas through realistic product representations 					
Contents of the course (With approximate break up of hours)	<p>Module 1: Art-Design-Aesthetics Interrelation (8 hrs) Role of art in design and idea communication; Aesthetics in design; Drawing tools and materials; Basic sketching; Emotive qualities of line; line weight and style</p> <p>Module 2: 2D and 3D forms (12 hrs) Geometric and organic shapes; Shape modifications; Basics of forms; Constructing complex forms from solids; Freehand representation of shapes and forms using orthographic drawings</p> <p>Module 3: Spatial thinking and visualization (20 hrs) Rendering space in 2D paper – basics of perspective; +/- ve space; white space – composition of objects; Concepts of isometric and perspective drawing and sketching of regular shapes; Scale and proportion; Principles of design in sketching – balance, alignment, emphasis, proportion, movement, pattern, contrast, unity; Freehand generation of complex forms and structures; Product sketching, exploded views and cutaway sections; Quality of light on the forms - Value study and value techniques.</p> <p>Module 4: Surface qualities and color (12 hrs) Representation of surface characteristics and materials through texture; Relating form to materials and processes of manufacture; Color theory and color harmony; Introduction to color psychology and its application in design – case studies.</p> <p><i>Hands-on practice will focus on presentation of design ideas through sketches using conventional tools.</i></p>					
Texts & References	<ol style="list-style-type: none"> J.Itten (1975), Design and Form, John Wiley and Sons, ISBN:9780471289302 Robert H McKin (1980), Experiences in visual thinking, Brooks/Cole, ISBN: 978-0818504112 D’Arcy Thompson (1992), On growth and form, Cambridge University Press, ISBN:9780521066228 Shyamala Gupta (1999), Art, beauty and creativity: Indian and Western Aesthetics, D.K.Printworld , ISBN: 9788124601334 Betty Edwards (2001), The New Drawing on the right side of the brain, Harper Collins, ISBN:9780007116454 Hannah. G. G (2002), Elements of design: Rowena Reed Kostellow and the structure of visual relationships, Princeton Architectural Press, ISBN:9781568983295 M. Macnab (2011), Design by nature: Using universal forms and principles in design, New Riders, ISBN:9780321747761 D. Puhalla (2011), Design elements, form & space: a graphic style manual for understanding structure and design, Rockport Pub, ISBN:9781592537006 K. Eissen, and S. Roselien (2012), Sketching: basics, Stiebner Verlag GmbH, ISBN:9783830714101 					

Course Title	Design, Technology and Society	Course No				
Specialization	Integrated Product Design	Structure (LTPC)	2	1	0	3
Offered for	Master of Design (Semester 1)	Status	Core	X	Elective	
Prepared by	Dr Sudhir Varadarajan					
Prerequisite	None	To take effect from	2021 Batch			
Course Objectives	<ol style="list-style-type: none"> To provide an understanding of the social and cultural history of design and technology To develop critical thinking skills and ability to surface unstated needs / hidden meanings 					
Course Outcomes	<p>At the end of the course the students will develop</p> <ul style="list-style-type: none"> An appreciation of historical development of design and technology Use sociological perspectives to understand the context of design & navigate the same Apply ethnographic methods to surface cultural and social aspects for concept development 					
Contents of the course (With approximate break up of hours)	<p>Module-1: History of Design & Technology (9)</p> <ul style="list-style-type: none"> Industrialization, technology and design Design movements - The Bauhaus, Ulm school of design and Indian design What is 'Indian' and how it has been defined over time - artifacts, rituals, myths <p>Module-2: Sociology of Design (12)</p> <ul style="list-style-type: none"> Key sociological perspectives – functionalist, conflict and interactionist Material / temporal / relational dimensions & Actor Network Theory What drives creative design teams - Interactionism and Reflexivity <p>Module-3: Ethnographic observations (21)</p> <ul style="list-style-type: none"> Immersive observation of everyday objects and interactions Gigamapping/rich pictures to capture observations Journaling, synthesizing observations Field visits: Urban/Rural context/needs/problems <p>Evaluation: 70% assignments/activities + 30% End Semester</p>					
Texts & References	<ol style="list-style-type: none"> Gyorgy Kepes ed. (1966), Vision + Value series (The man-made object), George Braziller, ISBN:9781122190879 Papanek, Victor (1985); Design for the Real World: Human Ecology and Social Change, Academy Chicago Publishers; 2nd Revised edition, ISBN:9780897331531 Vance Packard (2007), The hidden persuaders, Ig Publishing, Reissue edition, ISBN:9780978843106 Balaram, S. (2010), Thinking Design, Sage India, ISBN:9788132103141 Trevor Pinch (Editors) (2012), The Social Construction of Technological Systems: New directions in the sociology and history of technology, MIT Press, Anniversary Edition, ISBN:9780262517607 Wendy Gunn, Ton Otto & Rachel Smith (2013), Design Anthropology: Theory and practice, Bloomsbury, ISBN:9781472518231 Adrian Forty (1992), Objects of desire: Design and society since 1750s, Thames & Hudson, ISBN:9780500274125 Bernhard E Burdek (2015), History, theory and practice of product design, second revised edition, ISBN:9783035603965 Bloomsbury (2015), The Bloomsbury encyclopedia of design, Bloomsbury Academic, ISBN:9781472521576 Swapnaa Tamhane and Rashmi VarmSar (2016), The Essence of Indian Design, Phaidon Press, ISBN:978071480502 					

Course Title	Design Research: Theory and Methods	Course No				
Specialization	Integrated Product Design	Structure (LTPC)	2	1	0	3
Offered for	Master of Design (Semester 1)	Status	Core	X	Elective	
Prepared by	Dr Sudhir Varadarajan					
Prerequisite	None	To take effect from	2021 Batch			
Course Objectives	<ol style="list-style-type: none"> To introduce students to a variety of theories and methods used in new concept development To enable students to pick and choose appropriate methods for the context 					
Course Outcomes	<p>At the end of the course, students are expected to</p> <ul style="list-style-type: none"> Apply a set of methods to inquire into a problem situation and define product requirements Reflect on the methodological assumptions and strengths and weaknesses of different methods 					
Contents of the course (With approximate break up of hours)	<p>Module-1: Introduction (6 hrs)</p> <ul style="list-style-type: none"> Product development process Complexity in the fuzzy front-end of new product development Product ontology (form-function-structure-behavior) <p>Module-2: Introduction to design theories and methods of inquiry (6 hrs)</p> <ul style="list-style-type: none"> Developments in design methodology – phenomenology, semiotics, information-aesthetic Qualitative, quantitative, speculative, experiential modes of research <p>Module-3: Methods to capture requirements/surface needs (12 hrs)</p> <ul style="list-style-type: none"> Understanding social, economic (competition, value chains) and technology trends Human/User-centered design theory and methods; Systems theory and methods <p>Module-4: Methods to synthesize findings and writing design briefs (18 hrs)</p> <ul style="list-style-type: none"> Developing a design brief (problem statement) Methods of divergent and convergent thinking to ideate concepts <p>Evaluation: 70% assignments/activities + 30% End Semester</p>					
Texts & References	<ol style="list-style-type: none"> Dan Norman (2010); Living with complexity, MIT Press, ISBN:9780262014861 Brenda Laurel (ed.) (2003), Design research: Methods and perspectives, MIT Press, ISBN:9780262122634 Sanders L & Stappers P J (2013), Convivial Toolbox: Generative research for the front end of design, BIS, ISBN:9789063692841 Peter Downton (2013), Design Research, Elizabeth James Productions, Melbourne Bruce Hanington and Bella Martin (2019), Universal methods of design, Rockport Publishers, Rev edn, ISBN:9781631597497 Edward De Bono (2015), Lateral Thinking: creativity step by step, Harper Perennial, Reissue edition, ISBN:9780060903251 Annie Gentes (2017), The in-discipline of design, Springer, ISBN:9783319659848 Toshiharu Taura (2016), Creative design engineering: An interdisciplinary approach, Elsevier, London, ISBN:9780128042267 					

Course Title	Material selection for product designers	Course No				
Specialization	Integrated Product Design	Structure (LTPC)	2	1	0	3
Offered for	Master of Design (Semester 1)	Status	Core	X	Elective	
Prepared by	Dr Raguraman M & Dr Gurunathan C					
Prerequisite	None	To take effect from	2021 Batch			
Course Objectives	<ol style="list-style-type: none"> 1. To introduce a range of materials used in different stages of product devp (concept to prototype) 2. To provide detailed understanding of the behavior of different classes of materials with respect to temperature stability, thermal and electrical conductivity, strength, toughness and chemical resistance 3. To introduce analytical tools and methods for qualified materials selection for product design 					
Course Outcomes	<p>After completion of this course, students are able to:</p> <ul style="list-style-type: none"> • Apply systematic and objective materials selection based on the principles of Ashby model/ Cambridge Engineering Selector (CES) • Define correct conditions and objectives regarding materials selection and analyze and evaluate the role of geometrical aspects in materials selection 					
Contents of the course (With approximate break up of hours)	<p>Module-1: Introduction and overview (18 hrs)</p> <ul style="list-style-type: none"> • Properties of Metals, Ceramics and Polymers • Basics of design calculations and design-oriented materials selection, • Introduction to Material Property Charts <p>Module-2: Material selection process (18 hrs)</p> <ul style="list-style-type: none"> • Rationalizing and Critical Assessment of Material Properties • Selecting materials and shape with multiple constraints and objectives • Materials selection for industrial design <p>Module-3: Advanced materials & environment (6 hrs)</p> <ul style="list-style-type: none"> • Advanced materials design – Composites and Hybrids • Materials and environment <p>Evaluation: 70% assignments/activities + 30% End Semester</p>					
Texts & References	<ol style="list-style-type: none"> 1. Ashby, M.F. (1992), Materials Selection in Mechanical Design, Elsevier, 5th and 4th editions, ISBN:9780081005996 2. Gordon, M. Joseph (2002); Industrial design of plastics products, ISBN:9780471231516 3. Karana, Elvin, Owain Pedgley, and Valentina Rognoli, eds. (2013), Materials Experience: fundamentals of materials and design. Butterworth-Heinemann, ISBN:9780080993591 4. Maleque, Md Abdul, and Mohd Sapuan Salit (2013); Materials selection and design. Springer Singapore, ISBN:9789814560375 					

Course Title	Design Realization Skills Practice	Course No				
Specialization	Integrated Product Design	Structure (LTPC)	0	0	3	2
Offered for	Master of Design (Semester 1)	Status	Core	X	Elective	
Prepared by	Dr Jayachandra Bingi					
Prerequisite	None	To take effect from	2021 Batch			
Course Objectives	To help students develop workshop practice and rapid prototyping skills to realize mockups and concept prototypes					
Course Outcomes	Students will develop skills in workshop practice and rapid prototyping; project management and focusing on delivering outcomes					
Contents of the course (With approximate break up of hours)	<p>Module-1: Exposure to tools/equipment to machine external appearance of simple shapes. (20 hours)</p> <ul style="list-style-type: none"> a. Wood carving b. Plastic welding and cutting c. Engraving d. Sheet metal works e. Wire cutting <p>Module-2: Exposure to rapid prototyping tools – subtractive, additive and electronic (8 hours)</p> <p>Module-3: Practice in realizing simple products in terms of shape, size and functionality etc. (14 hours)</p> <p>Evaluation: Assignments / Activities (70%); End Semester (30%)</p>					
Texts & References	1. Bjarki Hallgrimsson (2012), Prototyping and Modelmaking for Product Design, Lawrence King Publishing, ISBN:9781856698764					

Course Title	Visual Communication Design	Course No				
Specialization	Integrated Product Design	Structure (LTPC)	2	1	0	3
Offered for	Master of Design (Semester 1)	Status	Core	X	Elective	
Prepared by	Dr Raguraman Munusamy					
Prerequisite	None	To take effect from	2021 Batch			
Course Objectives	To introduce students to a practice-based, hands-on approach to visual communication design					
Course Outcomes	<p>On completion of this course, students will be able to:</p> <ul style="list-style-type: none"> Understand differences between visual UX, UI, graphic, and web design and construct an artist's statement Apply the concepts found within elements and principles of design to incorporate theories and concepts when discussing visual communication, Create a brand identity such as business cards, packaging, and advertising, design logos, especially as related to brand identity Use digital tools to design graphical images, understand the difference between different graphics and image file formats. 					
Contents of the course (With approximate break up of hours)	<p>Module 1: Introduction to Visual Communication Design (6 hrs)</p> <ul style="list-style-type: none"> Definition, Graphic design vs art, Design thinking, Visual design tools and Image files Semiotics and design <p>Module 2: Typography and typographic elements (6 hrs)</p> <ul style="list-style-type: none"> Historical evolution, Serif vs sans-serif fonts, Legibility vs readability, Use in ads, signs, movie posters <p>Module 3: Composition, Creativity, Artistry, Aesthetics and the design process (6 hrs)</p> <ul style="list-style-type: none"> Focus, Leading lines, Scale/hierarchy, Contrast, Repetition, White space and Rule of thirds Creativity vs Innovation, Aesthetics and their evolution, Creative/Design Process and flow <p>Module 4: Symbolism and collage (12 hrs)</p> <ul style="list-style-type: none"> Symbols and signs, Psychoanalytical symbols, Metaphor in visual design, Evolution of symbols and metaphor Collage, Photomontage, Assemblage, Digital collage/e-Collage, Influence of movements: Dada, Surrealism, Expressionism <p>Module 5: Visual identity and branding (12 hrs)</p> <ul style="list-style-type: none"> Visual identity, branding, logo design, UI/UX and design for the web, advertising, brochures, print and posters. <p>Evaluation: 70% assignments/activities + 30% End Semester</p>					
Texts & References	<ol style="list-style-type: none"> Umberto Eco (1978), A theory of semiotics, John Wiley & Sons, ISBN:9780253202178 Edward Tufte (1990), Envisioning information, Graphics Pr, ISBN:9780961392116 Carolyn Handa (2004), Visual rhetoric in a digital world: A critical sourcebook, Bedford/St Martin's, ISBN:9780312409753 Lidwen W, Holder K and Butler J (2010), Universal principles of design, Rockport publishers, ISBN:9781592535873 M. Davis and J. Hunt (2017), Visual Communication Design, Bloomsbury Academic, New Edition, ISBN:9781474221573 					

Course Title	Concept Design Project	Course No				
Specialization	Integrated Product Design	Structure (LTPC)	1	0	6	5
Offered for	Master of Design (Semester 1)	Status	Core	X	Elective	
Prepared by	Dr Sudhir Varadarajan					
Prerequisite	None	To take effect from	2021 Batch			
Course Objectives	To encourage the students to identify a domain and problem of interest, and conceptualize and showcase a new product concept using all the theories, methods and tools learnt in the 1 st semester courses					
Course Outcomes	<p>At the end of the course, the student is expected to:</p> <ul style="list-style-type: none"> gain confidence in dealing with the fuzzy front end of product innovation gain practical hands-on experience in doing design research, making design choices conceptualizing and pitching a new product concept to external industry experts 					
Contents of the course (With approximate break up of hours)	<p>The concept design project is expected to be done in a team. The team must experience the process of norming, forming and performing</p> <p>The process followed will be based on the methods learnt in the Design Research course, supplemented by the content and skills learnt in other courses</p> <p>Project management, documentation and presentation skills will be key aspects that will be monitored</p> <p>The activity will be carried out in the design studio, and supported by regular design reviews with peers, faculty, and mentors</p> <p>Evaluation: Evaluation: 70% Continuous assessment + 30% Final Concept Presentation</p>					
Texts & References	<ol style="list-style-type: none"> Dan Cuffaro and Isaac Zaksenberg (2013), The Industrial Design Reference & Specification Book: Everything Industrial Designers Need to Know Every Day, Rockport publishers, ISBN:9781610587891 Bruce Hanington and Bella Martin (2017), The Pocket Universal Methods of Design: 100 Ways to Research Complex Problems, Develop Innovative Ideas and Design Effective Solutions, Rockport publishers, ISBN:9781631593741 Donald A Schon (1984), The reflective practitioner: How professionals think in action, Basic Books, ISBN:9780465068784 					

Course Title	Digital Sketching and Modeling	Course No				
Specialization	Integrated Product Design	Structure (LTFC)	1	0	3	3
Offered for	Master of Design (Semester 2)	Status	Core	X	Elective	
Prepared by	Dr Gurunathan C					
Prerequisite	Studies of Form and Design Sketching	To take effect from	2021 Batch			
Course Objectives	<ol style="list-style-type: none"> To introduce the advanced sketching and modeling concepts needed for product design To provide hands-on training in computer-based sketching and 3D modeling tools. 					
Course Outcomes	Students will be able to demonstrate drawing and modeling skills to communicate the design ideas/concept products using computer-based tools					
Contents of the course (With approximate break up of hours)	<p>Module-1: Digital Product Sketching (21 hrs)</p> <ul style="list-style-type: none"> Introduction to computer-based sketching tools (3 hrs) Digital sketching of planar shapes, curved shapes and objects (6 hrs) Digital sketching of concept products (9 hrs) Colors and material representation using software (3 hrs) <p>Module-2: 3D Modeling (21 hrs)</p> <ul style="list-style-type: none"> Introduction to computer-based modeling tools (6 hrs) Development of 3D forms and objects using software (6 hrs) Photorealistic rendering using software tools (3 hrs) Product animation and concept presentation / AR/VR immersive experience (3 hrs) Artificial intelligence led improvisation in design (generative design) (3 hrs) <p>Evaluation: 70% assignments/activities + 30% End Semester</p>					
Texts & References	<ol style="list-style-type: none"> Caplin. S, Banks. A, Holmes. N (2003); The Complete Guide to Digital Illustration, Watson-Guptill Publications, ISBN:9780823007844 R. Gil (1991); Basic Rendering: Effective Drawing for Designers, Artists and Illustrators, Thames & Hudson, ISBN:9780500276341 S. Robertson and B. Thomas (2012); How to Render: the fundamentals of light, shadow and reflectivity, Design Studio Press, ISBN:9781933492964 					

Course Title	Bio-inspired design	Course No				
Specialization	Integrated Product Design	Structure (LTPC)	2	1	0	3
Offered for	Master of Design (Semester 2)	Status	Core X		Elective	
Prepared by	Dr Jayachandra Bingi					
Prerequisite	Design Research	To take effect from	2021 Batch			
Course Objectives	<ol style="list-style-type: none"> To give the student an exposure of bio-inspired design principles To train the student in applying the bio-inspired methodologies for innovation To introduce different perspectives of bio-inspired design and future scope of this valuable domain 					
Course Outcomes	<p>After completion of this course, the student is expected to:</p> <ul style="list-style-type: none"> Describe methods for creative design Identify mechanical working principles of biological phenomena - explain their construction, motion, and/or processing mechanisms - formalize the essence, derive non-conventional design principles Implement them in innovative devices - summarize the transition process from the biological to the mechanical domain - present their design in drawings and working models. 					
Contents of the course (With approximate break up of hours)	<p>Module 1: Introduction (6 hrs)</p> <ul style="list-style-type: none"> Basic principles, building blocks, material property charts, how the study of nature's designs can help engineers, examples of successful biomimetic designs. Mechanical design – hierarchical construction, bio-composites, structure & properties of bamboo, silks, bones, teeth, shells, antlers and beaks, impact resistance, fracture mitigation, damping, self-healing. <p>Module 2: The Bio-inspired Design Approach (3 hrs)</p> <ul style="list-style-type: none"> Finding the biological information, Dealing with friction, Innovative designing with ACRREx (Abstracting, Categorizing, Reflecting, Reformulating and Extending) method. <p>Module 3: Bio-inspired Design Methodology (6 hrs)</p> <ul style="list-style-type: none"> Problem solving, TRIZ, innovation and efficiency, functions, integration between biology design and innovation, methodology chart. <p>Module 4: Bio-designing Perspectives (27 hrs)</p> <ul style="list-style-type: none"> Materials and surfaces: Muscles and artificial muscles, lotus effect, gecko adhesion, Desert beetle, pitcher plants, bio-fouling, coatings. Silver ant and heat dissipation, insulation of fur and feathers, constructal theory. Sensors: Biological sensors, Bio-inspired sensors Control: Robot controllers, Soft robotics, Bio-inspired Artificial intelligence (Evolutionary & Developmental Systems, Neural Systems, Immune Systems, Behavioral Systems and Collective systems) Bio-optics – structural colors, compound eyes, antireflection, stealth, imaging Navigation – short- and long-range navigation techniques of bees, ants, turtles & migratory birds. Bio-inspired design task <p>Evaluation: 70% assignments/activities + 30% End Semester</p>					
Texts & References	<ol style="list-style-type: none"> Dario Floreano and Claudio Mattiussi (2008), Bio-Inspired Artificial Intelligence, MIT Press, ISBN:9780262062718 Reich Y (1995), A critical review of General Design Theory. Research in Engineering Design, 7 (1) 1-18, https://doi.org/10.1007/BF01681909 Maria G. Trotta (2011), Bio-inspired Design Methodology, Intl Journal of Info Science 1(1), pp 1-11, doi: 10.5923/j.ijis.20110101.01 Yoseph Bar-Cohen (2016), Biomimetics: Nature-Based Innovation, CRC Press, ISBN:9781439834763 Ashok K G, Daniel A McAdams, Robert B. Stone (2013), Biologically inspired designs, Springer London, ISBN:9781447152477 Lakhtakia A, Martin-Palma RJ (eds) (2013), Engineered biomimicry; Elsevier, ISBN:9780124159952 Lawrence Shapiro (2019), Embodied Cognition, Routledge, 2nd Edition, ISBN:9781351719162 					

Course Title	Design for quality and reliability	Course No				
Specialization	Integrated Product Design	Structure (LTPC)	2	1	0	3
Offered for	Master of Design (Semester 2)	Status	Core	X	Elective	
Prepared by	Dr Raguraman Munusamy					
Prerequisite	Probability and Statistics at undergraduate level	To take effect from	2021 Batch			
Course Objectives	The objectives of the course are to help engineering students understand: <ol style="list-style-type: none"> To understand concepts of quality and reliability To evaluate the overall reliability of a system from component reliability. 					
Course Outcomes	On completion of the course, students are able to: <ul style="list-style-type: none"> Model repairable and non-repairable systems and calculate failure/repair rate, reliability, availability Use various probability density distributions significant to reliability calculations Fit a given failure dataset of a product into a Weibull distribution and estimate the reliability 					
Contents of the course (With approximate break up of hours)	<p>Module 1: Concepts of Product Quality and testing (6)</p> <ul style="list-style-type: none"> Quality Function Deployment / House of Quality Software testing for quality Electronic products testing for quality <p>Module 2: Concepts of Reliability (9)</p> <ul style="list-style-type: none"> Basic concepts of repairable and non-repairable systems Reliability, Availability and Maintainability <p>Module 3: Failure data analysis (9)</p> <ul style="list-style-type: none"> Fitting discrete and continuous distributions to failure data sets, Weibull analysis, estimation of important reliability parameters <p>Module 4: Calculation of System Reliability from Component reliabilities (12)</p> <ul style="list-style-type: none"> Markov modeling of repairable and non-repairable systems Reliability Logic Diagrams Fault-tree analysis <p>Module 5: Preventive and Predictive maintenance (6)</p> <ul style="list-style-type: none"> Failure Modes and Effects Analysis <p>Evaluation: 70% assignments/activities + 30% End Semester</p>					
Texts & References	<ol style="list-style-type: none"> B.L. Hansen & P.M. Ghare (1997), Quality Control and Applications, Prentice-Hall, ISBN:9788120307940 Louis Cohen, Joseph P. Ficalora (2009), Quality Function Deployment and Six Sigma, Prentice Hall, 2nd Ed, ISBN:9780133364439 Patrick O'Connor (2012), Practical Reliability Engineering, John Wiley, ISBN:9780470979815 VNA Naikan (2010), Reliability Engineering and Life Testing, PHI Learning, ISBN:9788120335936 Singiresu S Rao (2014), Reliability Engineering, Pearson Education, ISBN:9780136015727 					

Course Title	Interaction design (UX / UI)	Course No				
Specialization	Integrated Product Design	Structure (LTPC)	2	1	0	3
Offered for	Master of Design (Semester 2)	Status	Core	X	Elective	
Prepared by	Dr Raguraman Munusamy					
Prerequisite		To take effect from	2021 Batch			
Course Objectives	<ol style="list-style-type: none"> To introduce students to interaction design for a variety of applications. To provide principles, patterns and processes for interaction design, rapid prototyping, user interface (UI) and user experience (UX) design To develop skills that can be applied to web publishing, mobile app development, game development, entertainment and artistic performances 					
Course Outcomes	<p>Upon successful completion of this course, students are able to:</p> <ul style="list-style-type: none"> Identify basics of both analog and digital interactions Apply disciplined visualization and the design process, implementing design principles Understand the history of interaction design and explore current trends in user experience design 					
Contents of the course (With approximate break up of hours)	<p>Module-1: Introduction and State of the Art (12 hrs)</p> <ul style="list-style-type: none"> Touch Screens vs. real touch and feeling Inspirations from food, fashion, and fitness Interaction paradigms and materials for real “touch” <p>Module-2: Going beyond heads-down interaction (24 hrs)</p> <ul style="list-style-type: none"> Building interfaces that allow users to be adventurous and individual UX as performance Moving towards mindful interaction The bigger picture <p>Evaluation: 70% assignments/activities + 30% End Semester</p>					
Texts & References	<ol style="list-style-type: none"> Don Norman (1988), Design of everyday things, Basic books, ISBN:9780465003945 Donald A Norman (2007), The design of future things, Basic Books, New York, ISBN:9780465002276 Garrett J J (2010), The elements of user experience: User-centered design for the web, New Riders, ISBN:9780321624642 Dan Saffer (2009), Designing for interaction: Creating innovative applications & devices, New Riders, ISBN:9780321643391 Greenberg, S., Carpendale, S., Marquardt, N., & Buxton, B. (2011), Sketching user experiences: The workbook, Morgan Kaufmann, ISBN:9780123819598 Steve Krug (2015), Don't make me think, Revisited, 3rd edition, Pearson Books, ISBN:9789332542860 Simon Robinson, Gary Marsden, Matt Jones (2014), There's Not an App for That – Mobile User Experience Design for Life, Morgan Kaufmann Publishers, ISBN:9780124166912 					

Course Title	Human Factors & Ergonomic Design	Course No				
Specialization	Integrated Product Design	Structure (LTPC)	2	1	0	3
Offered for	Master of Design (Semester 2)	Status	Core	X	Elective	
Prepared by	Dr Raguraman Munusamy					
Prerequisite		To take effect from	2021 Batch			
Course Objectives	<p>The objective of this course is to help students understand</p> <ol style="list-style-type: none"> 1. Different physical, physiological and psychological capabilities and limitations of human beings, 2. Generation of ergonomic specifications 3. Application of ergonomic principles to various products, interfaces and environments for maximizing user satisfaction and minimizing risk involved in the usage of the design 					
Course Outcomes	<p>On completion of the course, students will be able to:</p> <ul style="list-style-type: none"> • Apply the concepts of the human factors and ergonomics in design to complete the several projects in relation to various disciplines 					
Contents of the course (With approximate break up of hours)	<p>Module 1: Introduction and overview (10 hrs)</p> <ul style="list-style-type: none"> • History of human factors, multi-disciplinary engineering, human machine system, characteristics of system, information theory, types of information, selection of display modality, coding of information, compatibility, memory, decision making, attention, text, graphics, symbols, quantitative visual display, representational display, auditory, tactual and olfactory displays. <p>Module 2: Anthropometry (10 hrs)</p> <ul style="list-style-type: none"> • Need for anthropometry, data collection methodology, measuring procedures, tools, statistical analysis of data for percentile calculation, anthropometric measurements, percentile calculation, usage of the anthropometric percentile values, ergonomic guidelines for products, equipment and accessories, anthropometry in applications <p>Module 3: Biomechanics (12 hrs)</p> <ul style="list-style-type: none"> • Biostatics – static equilibrium equations, musculoskeletal system, problems in mechanics of upper extremity and hand, lower extremity and foot, bending, lifting and carrying, • Biodynamics – linear kinematics, angular kinematics, human body kinetics, human body impact and collision, surface electromyogram, electrocardiogram and heart rate measurement <p>Module 4: Virtual ergonomics (10 hrs)</p> <ul style="list-style-type: none"> • Digital Human Modeling (DHM), anthropometric models, models for production design, biomechanical models, anatomical models, cognitive models, • DHM packages – selection strategies, Functionalities, Virtual ergonomics evaluation techniques – Rapid Upper Limb Assessment, field of vision, reach envelopes, accessibility and clearance analysis, discomfort analysis, Applications of DHM <p>Evaluation: 70% assignments/activities + 30% End Semester</p>					
Texts & References	<ol style="list-style-type: none"> 1. M. S. Sanders and Ernest J. McCormick (1992), Human Factors in engineering and Design, McGraw-Hill International Editions, ISBN:9780070549012 2. Duffy V G (2009), "HandBook of Digital Human Modeling: Research for Applied Ergonomics and Human Factor Engineering", Taylor & Francis, ISBN:9780805856460 3. Chandler Allen Phillips (2000), "Human Factor Engineering", John Wiley & Sons, Inc, ISBN:9780471240891 4. D Chakrabarti (1997), "Indian Anthropometric Dimensions for Ergonomic Design Practice", National Institute of Design, Ahmedabad, doi:10.1177/106480469900700210 5. G Salvendy (1997), "Handbook of Human Factors and Ergonomics", John Wiley & Sons, Inc., ISBN:0471116904 					

Course Title	Embodiment Design Project	Course No				
Specialization	Integrated Product Design	Structure (LTPC)	1	0	6	5
Offered for	Master of Design (Semester 2)	Status	Core	X	Elective	
Prepared by	Dr Sudhir Varadarajan					
Prerequisite	None	To take effect from	2021 Batch			
Course Objectives	The objective of this course is to encourage the students to translate their concepts into a minimum viable product (PoC) using all the theories, methods and tools learnt in the 1 st and 2 nd semester courses					
Course Outcomes	Students will develop skills in workshop practice and rapid prototyping; project management and focusing on delivering outcomes					
Contents of the course (With approximate break up of hours)	<p>Module-1: Minimum viable product plan (3 hours)</p> <ul style="list-style-type: none"> ● Markets and Needs ● Business Goals ● Key features <p>Module-2: Core Product Architecture (6 hours)</p> <ul style="list-style-type: none"> ● Storyboarding of the product core ● Framework for mechanical, electronics and computing paradigm <p>Module-3: Design for Manufacture & Assembly (3 hours)</p> <ul style="list-style-type: none"> ● Manufacturing Process: Form ● Assembly constraints: Fit ● HF/Ergonomic considerations ● Interaction design ● Quality and Reliability considerations <p>Module-4: Developing the Proof of Concept (30 hours)</p> <ul style="list-style-type: none"> ● Build ● Assemble ● Iterate ● Validate ● Pitch <p>Evaluation: 70% Continuous assessment + 30% Final Demo</p>					
Texts & References	<ol style="list-style-type: none"> 1. Snyder, C. (2003); Paper prototyping: The fast and easy way to design and refine user interfaces, Morgan Kaufmann, ISBN:9781558608702 2. Bjarki Hallgrímsson (2012), Prototyping and Modelmaking for Product Design, Lawrence King Publishing, ISBN:9781856698764 3. Elaine Chen (2015), Bringing a Hardware Product to Market: Navigating the Wild Ride from Concept to Mass Production, ISBN:9781505380835 4. Sean Michael Ragan (2017), The Total Inventors Manual: Transform Your Idea into a Top-Selling Product, Weldon Owen, ISBN: 9781681881584 5. Jake Knapp, John Zeratsky, Braden Kowitz (2016), How to Solve Big Problems and Test New Ideas in Just Five Days, Transworld Digital, ISBN:9781501121746 					

Course Title	Strategic management of design and innovation	Course No				
Specialization	Integrated Product Design	Structure (LTPC)	2	1	0	3
Offered for	Master of Design (Semester 3); Delivered Online	Status	Core	X	Elective	
Prepared by	Dr Sudhir Varadarajan					
Prerequisite		To take effect from	2021 Batch			
Course Objectives	<ol style="list-style-type: none"> To help designers understand the innovation challenge from entrepreneurial/managerial perspectives To introduce designers to the different paradigms and processes of managing product innovation 					
Course Outcomes	On completion of the course, students will have a familiarity with: <ul style="list-style-type: none"> Innovation processes and structures such as R&D team, the pros and cons of various R&D organizational structures, and challenges of innovation in large and small firms; 					
Contents of the course (With approximate break up of hours)	<p>Module 1: Introduction (9hrs)</p> <ul style="list-style-type: none"> Innovation – multi-disciplinary perspective Innovation as a new management object Processes used to explore innovations along the technology, market and strategy dimensions <p>Module 2: Design activity and Innovation capability (9hrs)</p> <ul style="list-style-type: none"> Design: An activity underlying all innovations Innovative design – an approach for transforming identity of objects <p>Module 3: Design capacities in innovative firms (12hrs)</p> <ul style="list-style-type: none"> Case studies of highly innovative firms <p>Module 4: Innovative design: tools & organizational strategies (12 hrs)</p> <ul style="list-style-type: none"> Strategies to effectively exploit the value of innovation, including innovation platforms that include multiple products, portfolios, standards and business models Processes, structures and strategies for exploring, executing and exploiting innovations that established firms can use to renew their foundations in the face of disruptive innovations <p>Evaluation: 70% assignments/activities + 30% End Semester</p>					
Texts & References	<ol style="list-style-type: none"> Christensen, Clayton M. (2003), The innovator's solution: creating and sustaining successful growth, Harvard Business Press, ISBN:9781578518524 Joe Tidd and John Bessant (2013), Managing Innovation: Integrating Technological, Market and organizational change, Wiley, ISBN:9781118360637 Paul Trott (2011), Innovation Management and New Product Development, Pearson, 5th Edition, ISBN:9780273736561 Ralph D Stacey (2012), The Tools and Techniques of Leadership and Management: Meeting the challenge of complexity. Routledge, London, ISBN:9780415531177 Pascal Le Masson, Benoit Weil and Armand Hatchel (2012), Strategic management of innovation and design, Cambridge University Press Raymond Turner (2016), Design Leadership: Securing the Strategic Value of Design, Routledge, ISBN:9781138247635 Tan, Garry, Chapman, Anne (2017), Design Leadership & Mgmt: A Case Study in Singapore, Springer, ISBN:9789463511551 					

Course Title	Sustainable Product Service Systems	Course No				
Specialization	Integrated Product Design	Structure (LTPC)	2	1	0	3
Offered for	Master of Design (Semester 3) (Delivered Online)	Status	Core X		Elective	
Prepared by	Dr Raguraman Munusamy					
Prerequisite	None	To take effect from	2021 Batch			
Course Objectives	<ol style="list-style-type: none"> To introduce concepts of sustainable design of product-service systems To provide an understanding of methods and tools for sustainable design 					
Course Outcomes	<p>At the end of the course, the students should be able to appreciate</p> <ul style="list-style-type: none"> Product-service systems which are also referred to as servicizing, resource-efficient business models, green business models, or circular business models create designs that are sustainable in terms of environmental burden and resource use, whilst developing product concepts as parts of sustainable whole systems, that provide a service or function to meet essential needs 					
Contents of the course (With approximate break up of hours)	<p>Module 1: Introduction to Product Services systems (6hrs)</p> <ul style="list-style-type: none"> Socio-technical systems Environmental Impact <p>Module 2: Environmentally-responsive design methodologies (18hrs)</p> <ul style="list-style-type: none"> Industrial ecology Dematerialization Design for reuse / modularity Design for recycling Remanufacturing: issues/problems, current and future developments <p>Module 3: Alternative resources (10 hrs)</p> <ul style="list-style-type: none"> Alternative energy Alternative materials Sustainable packaging. <p>Module 4: Life-cycle assessment methods (8hrs)</p> <p>Evaluation: 70% assignments/activities + 30% End Semester</p>					
Texts & References	<ol style="list-style-type: none"> Victor Papanek (1995), The Green Imperative: Ecology and ethics, Thames and Hudson, ISBN:9780500278468 William McDonough and Michael Braungart (2002), Cradle to Cradle, North Point Press, ISBN:9780865475878 Stuart Walker (2006), Sustainable by Design: Explorations in Theory and Practice, Routledge, ISBN:9781844073535 Charter, Tischner (2001), Sustainable Solutions, Green Leaf Publishing, ISBN:9781351282482 Cattanach, Holdreith, Reinke, Sibik (1994), The Handbook of Environmentally Conscious Manufacturing, ISBN:9780786301478 Sim van der Ryn, Stuart Cowan (2013), Ecological Design, Island Press, ISBN:9781559633895 Paul Hawken (2010), The Ecology of Commerce, Collins Business Essentials, ISBN:9780061252792 Natras & Altomare (1999), The Natural Step for Business, New Society Publishers, ISBN:9780865713840 Vance Packard (2011), The waste makers, Ig Publishing, Reprint edition, ISBN:9781935439370 					