INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE: Department of Design

1. **Subject Code:** IDN-501 **Course Title**: Introduction to Design and Prototyping
2. **Contact Hours:** **L:** 15 **T:** 5 **P:** 10
3. **Examination Duration (Hrs.):** **Theory:** 2 **Practical:** 0
4. **Relative Weightage:** **CWS:** 35 **PRS:** 35 **MTE:** 0 **ETE:** 30 **PRE:** 0
5. **Credits:** 0 **6. Semester:** Foundation Week **7. Subject Area:** PCC
8. **Pre-requisite:** Nil
9. **Objective:** The course is intended to create an overall awareness of the design discipline, designing processes and methods dealing with creation of systems, products, visuals, environments and prototyping methods.

10. **Details of the Course**

S.No.	Contents	Contact hours
1.	Design definitions; Industrial Design chronology; Interrelationship of Design to Engineering, Architecture, Arts and Social Sciences. Design as a creative professional career. Choices, Routes, Courses and Specializations in the field of Design. Brief history of developments in Design and Technology. Scientific and Engineering considerations in Design, Impact of design on society.	3
2.	Aesthetics: Study and exploration of visual elements, Introduction to visual communication.	2
3.	Role of Creativity and Innovation in Design. Case studies of creativity related to design.	1
4.	Interaction Design: Introduction to Human Computer Interaction. Case studies related to introduction design and human computer interaction.	1
5.	Ergonomics: Definition of Ergonomics / Human Factors. Human capabilities and limitations in terms of engineering.	2
6.	Rapid Prototyping: Working Principles and types of Rapid Prototyping machines. Input devices, Contact and non-contact type digitizers such as Co-ordinate measuring machines, Laser and White light scanners.	3
7.	Introduction to Automation: Principles of Computer Numerically Controlled (CNC) machines and programming; Computer Aided Design (CAD); Computer Aided Manufacturing (CAM). Introduction to modelling tools; Product Modeling using CAD software and Rapid Prototyping machine.	3
Total		**15**

Studio Sessions/ Practicals:

1. Identification and analysis of samples of good and bad design for sensitization to Design quality/processes.

2. Chronological studies for analysis of designed objects/systems/environments and their eclectic evolution through technology change.
3. Simple exercises in design creation/recreation through mock ups/montages/paste boards using primary materials such as paper, board, wood etc.
4. Analysis and redesign of a simple utility artifact/ product/ visual communication/ interface or environment.

11. Suggested Books:

S.No.	Name of Authors/Book/Publisher	Year of Publication / Reprint
1.	M. Droste, Bauhaus, Taschen.	2019
2.	P. Sparke, Introduction to Design and Culture in the 20th Century, Routledge.	1986
3.	Norman, Design of Everyday Things, Currency Books, New York.	2013
4.	A. Forty, Objects of Desire, Thames & Hudson.	1998
5.	Taura, Toshiharu, Nagai, Yukari, Concept Generation for Design Creativity - A Systematized Theory and Methodology. Springer, London, pp. 9–20.	2013
6.	Jones, J.C., Design Methods, John Wiley.	1992
7.	Cross, N., Engineering Design Methods, John Wiley.	2021
8.	Pahl, G., and Beitz, W., Engineering Design, Design Council.	2007

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT: Department of Design

1. **Subject Code:** IDN-503 **Course Title**: Design Thinking
2. **Contact Hours:** **L:** 1 **T:** 0 **P:** 4
3. **Examination Duration (Hrs.):** **Theory:** 2 **Practical:** 0
4. **Relative Weightage:** **CWS:** 10-25 **PRS:** 25 **MTE:** 15-25 **ETE:** 0 **PRE:** 30-40
5. **Credits:** 3 **6. Semester:** Autumn **7. Subject Area:** PCC
8. **Pre-requisite:** Nil
9. **Objective:** To develop courage amongst young designers to think and design creatively in order to develop innovative products based on user's need.

10. **Details of the Course**

S.No.	Contents	Contact hours
1.	Design Thinking: Introduction, key concepts, terminologies.	2
2.	Process of Design Thinking: Steps involved and applications.	2
3.	Empathy: Role of empathy, process of empathizing people, user interviews.	2
4.	Define: Methods for identifying challenges and designer's point of view.	2
5.	Ideate: Elements and thinking modes, ideation techniques.	2
6.	Prototype: Types of prototypes, methods and techniques for prototyping.	2
7.	Testing: Feedback from users, getting honest feedback, improving design.	2
Total		**14**

Studio/Project Work:

The practical work will include design studio workshops leading to ideation and brainstorming. The innovative design thinking strategies will be employed to create a habit of inquisitiveness among the students. The process of conducting user interviews leading to identification of needs and recording of the information in standard templates will be undertaken. The user defined needs will be analyzed and product concepts leading to the first form of prototypes will be the major deliverable of the course.

11. **Suggested Books:**

S.No.	Name of Authors/Book/Publisher	Year of Publication / Reprint
1.	Tim Brown, 'Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation' Harper Business	2009
2.	Roger L. Martin, 'The Design of Business: Why Design Thinking is the Next Competitive Advantage' Harvard Business Review Press	2009
3.	Tom Kelley, Jonathan Littman, Tom Peters 'The Art of Innovation: Lessons in Creativity from IDEO, America's Leading Design Firm' Broadway Business	2001

4.	John Christopher Jones, “Design Methods-Seeds of Human Future” John Wiley and Sons.	2008
5.	Thomas T. Woodson, “Introduction to Engineering Design” McGraw-Hill.	2001

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE: Department of Design

1. **Subject Code:** IDN-505 **Course Title**: Elements and Principles of Visual Design
2. **Contact Hours:** **L:** 2 **T:** 1 **P:** 0
3. **Examination Duration (Hrs.):** **Theory:** 2 **Practical:** 0
4. **Relative Weightage:** **CWS:** 20-35 **PRS:** 0 **MTE:** 20-30 **ETE:** 40-50 **PRE:** 0
5. **Credits:** 3 **6. Semester:** Autumn **7. Subject Area:** PCC
8. **Pre-requisite:** Nil
9. **Objective:** To get exposure about basic Design methods and Creativity.
10. **Details of the Course**

S.No.	Contents	Contact hours
1.	Study and exploration of visual elements - point, line, form, shape, texture, colour.	3
2.	Study of visual principles - balance, proportion, mass, unity, harmony, rhythm and variety.	4
3.	Spatial and visual relationship in compositions; Gestalts laws of visual perception; Colour classification - Additive and Subtractive colour theories; Dimensions of colour Hue, Value, Saturation and Chroma and their relationships; Colour dynamics and interaction of colour; Colour and Form relationships; Aesthetic application of colour. Hands-on projects.	7
4.	Studies in form, graphic compositions, grid structure, spatial analysis and organization; Visual expressions in nature. Hands-on projects.	6
5.	Introduction to free hand perspective drawing: Vanishing points, Station Point; One- point perspective drawing and two-point perspective drawing; Worms eye view and Ariel view; Rendering techniques with different media: pen and ink, markers, pastels,thinners and paint on different types of paper including white paper and toned paper. Exercises in free hand object drawing. Gradation exercises using textures, scribbling, stippling and shading techniques. Digital rendering: exposure to image editing software. Hands-on projects.	8
Total		**28**

11. **Suggested Books:**

S.No.	Name of Authors/Book/Publisher	Year of Publication / Reprint
1.	R.W. Gill, Manual of Rendering with Pen and Ink, Thames and Hudson.	1997
2.	J. Bairstow, R. Barber, M. Kenny, Design Modelling - Visualizing Ideas in 2 Dimension and 3 Dimension, Hodder and Stoughton,	2005
3.	W. Wong, Principles of Two-Dimensional Design, John Wiley and Sons,.	1972

4.	J. Itten, The Art of Colour, New York, VNR,.	1973
5.	D.K Francis, Design Drawing, John Wiley and Sons.	2019
6.	J. Bowers, Introduction to Two- Dimensional Design: Understanding Form and Function, John Wiley and Sons.	2008
7.	L. Holtzschue, Understanding Colour: An Introduction for Designer, 2nd Edition, John Wiley and Sons.	2002
8.	H.G Greet and R. Kostellow, Elements of Design and the Structure of Visual Relationships, Architectural Press, New York.	2002

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE: Department of Design

1. **Subject Code:** IDN-507 **Course Title**: Human Factor Design
2. **Contact Hours:** **L:** 1 **T:** 2 **P:** 0
3. **Examination Duration (Hrs.):** **Theory:** 2 **Practical:** 0
4. **Relative Weightage:** **CWS:** 20-35 **PRS:** 0 **MTE:** 20-30 **ETE:** 40-50 **PRE:** 0
5. **Credits:** 3 **6. Semester:** Autumn **7. Subject Area:** PCC
8. **Pre-requisite:** Nil
9. **Objective:** To apply physical and physiological considerations in design. To understandand and use of anthropometric data in design of workspaces.

10. **Details of the Course**

S.No.	Contents	Contact hours
1.	Definition and origin of Ergonomics- Examples of its applications in Design.	2
2.	Data collection techniques in Anthropometry. Types of data from humans at physical, physiological, cognitive and effective levels. Usage of percentile data in design of workspaces. Application of mean, median, mode and percentile in anthropometry.	4
3.	Force, repetitive injury, stress- human physiological potential and limitations.	2
4.	Cognitive load in complex tasks; Applications of cognitive load in design.	4
5.	Control panel design principles. Cognitive perspective in control panel design and graphical user interface design.	2
Total		**14**

11. **Suggested Books:**

S.No.	Name of Authors/Book/Publisher	Year of Publication / Reprint
1.	J Don Norman, “Living with Complexity”, MIT Press.	2010
2.	Wesley Woodson, Peggy Tillman and Barry Tillman, “Human Factors Design Handbook”, McGraw-Hill Professional, 2 Edition.	2016
3.	McCormick, ‘Human Factors in Engineering & Design’, Tata McGraw Hill.	1993
4.	Benjamin Niebel and Andris Freivalds, ‘Methods, Standards & Work design, McGraw-Hill Intl Ed.	2008

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT: Department of Design

1. **Subject Code:** IDN-509 **Course Title**: Materials and Manufacturing
2. **Contact Hours:** **L:** 1 **T:** 1 **P:** 2
3. **Examination Duration (Hrs.):** **Theory:** 2 **Practical:** 0
4. **Relative Weightage:** **CWS:** 10-25 **PRS:** 25 **MTE:** 15-25 **ETE:** 0 **PRE:** 30-40
5. **Credits:** 3 **6. Semester:** Autumn **7. Subject Area:** PCC
8. **Pre-requisite:** Nil
9. **Objective:** To introduce the students to different materials and manufacturing processes used for developing a product.
10. **Details of the Course**

S.No.	Contents	Contact hours
1.	Engineering Materials: Classification, Properties, Selection and Applications.	3
2.	Introduction to Manufacturing: Need, Classifications; Selection of processes, Advantages and Limitations, Applications, Capabilities of Manufacturing Process.	3
3.	Manufacturing Processes: Shaping, deformative, joining, material removal, powder processing, additive processes.	6
4.	Design for Environment: Selection of Eco-friendly materials; Design for environment-friendly manufacturing process.	2
Total		**14**

Practicals:

S.No.	Practicals	Hours
1.	To perform mechanical characterization of metallic/non-metallic materials	04
2.	To analyze the surface characteristics of materials using surface analyzer	02
3.	Study and demonstration of primary forming processes for metallic products (sand/pressure die casting)	04
4.	Study and demonstration of primary forming processes for plastic products (compression/Injection molding)	04
5.	Study and demonstration of deformative processes for metallic products (forging)	02
6.	Study and demonstration of joining processes for metallic products (electric arc welding/gas welding)	04
7.	Study and demonstration of joining processes for plastic products (Ultrasonic / Hot plate welding)	04

11. Suggested Books:

S.No.	Name of Authors/Book/Publisher	Year of Publication / Reprint
1.	Product Design for Manufacture and Assembly, G. Boothroyd, P. Dewhurst, W. Knight, Marcel Dekker, University of Rhode Island Kingston, New York,USA.	2010
2.	Serope Kalpakjian and Steven R. Schmid, 'Manufacturing Engineering and Technology' Pearson Education; Seventh edition	2018
3.	Jr. Callister, William D., David G. Rethwisch, Materials Science and Engineering, John Wiley & Sons Inc; 9th edition	2013
4.	Manufacturing Processes: Casting, Forming and Welding: H. S. Shan, Cambridge University Press.	2017

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE: Department of Design

1. **Subject Code:** IMN-503 **Course Title**: Effective Communication
2. **Contact Hours:** **L:** 1 **T:** 1 **P:** 0
3. **Examination Duration (Hrs.):** **Theory:** 0 **Practical:** 2
4. **Relative Weightage: CWS:** 20-35 **PRS:** 20-30 **MTE:** 0 **ETE:** 0 **PRE:** 40-50
5. **Credits:** 2 **6. Semester:** Autumn **7. Subject Area:** PCC
8. **Pre-requisite:** Nil
9. **Objective:** The course emphasis on effective use of communication for innovation.
10. **Details of the Course**

S.No.	Contents	Contact hours
1.	**Understanding Communication Styles**: Introduction to Communication, Types of communications, Passive Communication, Aggressive Communication, Passive-Aggressive Communication, Assertive Communication	2
2.	**Communicating in Writing**: Using Written Communication, Pros and Cons of Written Communication, Tips for Avoiding Misunderstandings in Written Communication, The Importance of Good Conversational Skills, Active Listening, Be an Engaging Speaker	2
3.	**Communications Technology**: Modern Technologies, Benefits of Communications Technology, Drawbacks of Communications Technology	2
4.	**Cultural Aspects of Communication**: Introduction to culture, Working in a Global Community	2
5.	**Disagreements and Conflicts**: Nature of conflict, Avoiding Conflict, Fostering Healthy Conflict, Conflict Resolution, Negotiation, Compromise, Constructive Criticism: The Critic-Recipient Relationship, Personal Criticism, Offering Criticism, Receiving Criticism	3
6.	**Design related Communication**: Proof of Concept Writing, Drafting Patents and related case studies for best practice	3
Total		**14**

List of suggested Practical:

1. Active listening skill based exercises
2. Exercises on describing design/ innovation
3. Exercises on creating effective atmosphere for conflict resolution
4. Creative Problem solving technique exercises such as Six Thinking hats
5. Brainstorming session based exercises
6. Exercises on negotiation

11. Suggested Books:

S.No.	Name of Authors/Book/Publisher	Year of Publication / Reprint
1.	**Effective Business Communication** by Herta Murphy, Herbert Hildebrandt,Jane Thomas	2017
2.	**Effective Communication** by John Adair	2009
3.	Corporate Communication, **Paul** A. Argenti, Tata Mgraw Hill, 6th Edition	2013
4.	Business Communication: Connecting at Work, Hory Shankar Mukherjee, Oxford University Press,	2013

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT: Department of Design

1. **Subject Code:** IDN-502 **Course Title**: Design Methodology
2. **Contact Hours:** **L:** 2 **T:** 0 **P:** 2
3. **Examination Duration (Hrs.):** **Theory:** 2 **Practical:** 0
4. **Relative Weightage:** **CWS:** 10-25 **PRS:** 25 **MTE:** 15-25 **ETE:** 30-40 **PRE:** 0
5. **Credits:** 3 **6. Semester:** Spring **7. Subject Area:** PCC
8. **Pre-requisite:** Nil
9. **Objective:** To get exposure about basic Design methods and Creativity.
10. **Details of the Course**

S.No.	Contents	Contact hours
1.	Design: Definitions, history and modern practices; Design and the product life cycle.	4
2.	Design and Society: Societal aspects; Impact of Design on Society and vice-versa.	4
3.	Introduction to creativity, creativity methods.	4
4.	Methodology for problem solving in engineering design; Various models, recognition, concept generation.	6
5.	Methodology of Conceptual Design: Definition, analysis, synthesis, communication and presentation. Hands-on projects.	8
6.	Specializations in the field of Design. Design as a creative professional career.	2
Total		**28**

Practical Work:

The practical component involves a hands-on project that involves application of creative skills to become problem solvers by using different design processes and methods. The emphasis of the project is on individually/groups planned design projects that involves design methodologies for problem-solving in design: recognition, definition, analysis, synthesis, communication, and presentation. With wide ranging discussions including social responsibility of designers, application of local materials, various processes and user needs as important design considerations, students learn to correlate technical and functional aspects of a product with real human needs and creating a product for the masses. At the end of the project a comprehensive presentation supported with technical and representational drawings, a prototype and report are the expected deliverables.

11. **Suggested Books:**

S.No.	Name of Authors/Book/Publisher	Year of Publication / Reprint
1.	Norman, Design of Everyday Things, Currency Books, New York	2013
2.	A. Forty, Objects of Desire, Thames & Hudson	1998

3.	Taura, Toshiharu, Nagai, Yukari, Concept Generation for Design Creativity – A Systematized Theory and Methodology. Springer, London, pp. 9–20.	2013
4.	Jones, J.C., Design Methods, John Wiley,	1992
5.	Cross, N., Engineering Design Methods, John Wiley	2008
6.	Pahl, G., and Beitz, W., Engineering Design, Design Council	2007

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE: Department of Design

1. **Subject Code:** IDN-504 **Course Title**: Form Design
2. **Contact Hours:** **L:** 1 **T:** 0 **P:** 4
3. **Examination Duration (Hrs.):** **Theory:** 0 **Practical:** 4
4. **Relative Weightage:** **CWS:** 20-35 **PRS:** 20-30 **MTE:** 0 **ETE:** 0 **PRE:** 40-50
5. **Credits:** 3 **6. Semester:** Spring **7. Subject Area:** PCC
8. **Pre-requisite:** Nil
9. **Objective:** To create sensitivity towards form and aesthetics in products. To develop an understanding of form through knowledge of form based designs.
10. **Details of the Course**

S.No.	Contents	Contact hours
1.	Form and Aesthetics, the need and a designers approach.	2
2.	Elements of Design; Nature inspired design.	2
3.	Form and Detailing Aesthetics; Varied approaches to form design	3
4.	Color theory and Color trends.	3
5.	Product Styling.	4
Total		**14**

Studio/ Practical Work:

The practical work will include introduction to 2-D and 3-D forms. The students will be exposed to exploration of surface textures that can be achieved with different materials, such as metals/ceramics/plastics. The concept of the family of forms will be discussed during the studio work. The students will be learning exploration of forms/shapes in order to develop imagination and insight and will use metaphors to generate new forms. The students will be creating various 3D Forms; cube, tetrahedron, octahedron etc. with different materials which will lead to imaginative generating complex forms and structures. The overall deliverable will be that the students will be able to perform logically the form, material and process relationship during design of products.

11. **Suggested Books:**

S.No.	Name of Authors/Book/Publisher	Year of Publication / Reprint
1.	Gail Greet Hannah- "Elements of Design", Princeton Architectural Press	2002
2.	Peter Fiell, Charlotte- "Design of 20th Century", Taschen America LIc	2012
3.	Allen Hurlburt – "Grid: A Modular System for the Design and Production of Newspapers, Magazines and Books", John Wiley & Sons.	2016

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE: Department of Design

1. **Subject Code:** IDN-506 **Course Title**: Design for Sustainability
2. **Contact Hours:** **L:** 2 **T:** 1 **P:** 0
3. **Examination Duration (Hrs.):** **Theory:** 2 **Practical:** 0
4. **Relative Weightage:** **CWS:** 20-35 **PRS:** 0 **MTE:** 20-30 **ETE:** 40-50 **PRE:** 0
5. **Credits:** 3 **6. Semester:** Spring **7. Subject Area:** PCC
8. **Pre-requisite:** Nil
9. **Objective:** This course will enable the students to think beyond design by understanding the design approaches, methods and tools along with case examples for sustainable development.
10. **Details of the Course**

S.No.	Contents	Contact hours
1.	Basics of sustainability, sustainable development, need and evolution of sustainability within Design.	5
2.	Sustainable Product: Definition, types and examples, transition path and challenges.	3
3.	Product life cycle design: Methods, strategies and software tools; Minimizing resource consumption; Selecting low impact resources and processes; Product lifetime optimization.	7
4.	Extending the lifespan of materials; Facilitating disassembly in system design for eco-efficiency; Environmental complexity and designing activity; Environmentally sustainable design orienting tools; Design criteria and guidelines	8
5.	Sustainable product design: Environmentally, socially and economically led strategies; Environmental impact of products: short-use, electronic, furniture and space related, transportation and mobility.	5
Total		**28**

11. **Suggested Books:**

S.No.	Name of Authors/Book/Publisher	Year of Publication / Reprint
1.	T. Bhamra and V. Lofthouse, “Design for Sustainability: A Practical Approach” Routledge, Taylor and Francis Group, London	2007
2.	J. Penty, “Product Design and Sustainability: Strategies, Tools and Practice, Routledge	2019
3.	C A Vezzoli and E Manzini, “Design for Environmental Sustainability” Springer	2008

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE: Department of Design

1. **Subject Code:** IDN-533 **Course Title**: User Experience Design
2. **Contact Hours:** **L:** 3 **T:** 0 **P:** 0
3. **Examination Duration (Hrs.):** **Theory:** 3 **Practical:** 0
4. **Relative Weightage:** **CWS:** 20-35 **PRS:** 0 **MTE:** 20-30 **ETE:** 40-50 **PRE:** 0
5. **Credits:** 3 **6. Semester:** Both **7. Subject Area:** PEC
8. **Pre-requisite:** Nil
9. **Objective:** To impart knowledge on the user experience and cognition, which are the key factor to achieve user-friendly design.
10. **Details of the Course**

S.No.	Contents	Contact hours
1.	Introduction to User Experience; User behavior pattern	5
2.	Design semantics.	8
3.	Tools and techniques of User Research: Mental model, Persona, scenario, Task flow.	10
4.	User Experience Design Methodology	12
5.	Case studies and best practices	7
Total		**42**

11. **Suggested Books:**

S.No.	Name of Authors/Book/Publisher	Year of Publication / Reprint
1.	Donald Norman – "Design of Everyday Things", Basic Books	2002
2.	Donald Norman – "Emotional Design", Basic Books	2004
3.	Elen Lupton – "Design is Story Telling", Cooper Hewitt Smithsonian Design Museum	2017

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE: Department of Design

1. **Subject Code:** IDN-546 **Course Title**: Product Design
2. **Contact Hours:** **L:** 3 **T:** 0 **P:** 0
3. **Examination Duration (Hrs.):** **Theory:** 3 **Practical:** 0
4. **Relative Weightage:** **CWS:** 20-35 **PRS:** 0 **MTE:** 20-30 **ETE:** 40-50 **PRE:** 0
5. **Credits:** 3 **6. Semester:** Autumn **7. Subject Area:** PEC
8. **Pre-requisite:** Nil
9. **Objective:** To acquaint the students with the practical knowledge regarding conceptualization, design and development of a new product.

10. Details of the Course

S.No.	Contents	Contact hours
1.	**Introduction:** Product life cycle, Product policy of an organization. Selection of a profitable product, Product design process, Product analysis	8
2.	**Functional Analysis:** Value engineering in product design; Advantages, Applications in product design, Problem identification and selection, Analysis of functions, Anatomy of function. Primary versus secondary versus tertiary/unnecessary functions, Functional analysis: Functional Analysis System Technique (FAST), Case studies	9
3.	**Product Design Tools and Guidelines:** Introduction to product design tools, Quality Function Deployment (QFD), Computer Aided Design, Robust design, Design for Excellence (DFX), Design for Manufacturing (DFM), Design for Assembly (DFA), Ergonomics in product design, Design for Manufacturing and Assembly (DFMA) guidelines, Product design for manual assembly	9
4.	**Basic Product Design Guidelines for various Manufacturing Processes:** Design guidelines for metallic and non-metallic products to be manufactured by different processes such as casting, machining, injection molding etc.	8
5.	**Rapid Prototyping:** Rapid prototyping, needs, advantages, working principle of Stereolithography Apparatus (SLA), Laminated Object Manufacturing (LOM) and Selective Laser Sintering (SLS)	8
Total		**42**

11. Suggested Books:

S.No.	Name of Authors/Book/Publisher	Year of Publication / Reprint
1.	Boothroyd G., Dewhurst P., and Knight, "Product Design for Manufacture and Assembly", 2nd Ed., Marcel Dekker.	2002
2.	Mortenson, M. E., "Geometric Modelling", 3rd Ed., Industrial Press	2006
3.	Andreasen, M.M., Kahler, S., Lund, T., and Swift, K., "Design for Assembly", Springer Verlag	1988
4.	Wang, B., "Integrated Product, Process and Enterprise Design", Chapman & Hall, 1997	1997

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE: Department of Design

2. **Subject Code:** IDN-522 **Course Title**: Computer Aided Design

1. **Contact Hours:** **L:** 2 **T:** 0 **P:** 2

2. **Examination Duration (Hrs.):** **Theory:** 2 **Practical:** 0

3. **Relative Weightage:** **CWS:** 10-25 **PRS:** 25 **MTE:** 15-25 **ETE:** 30-40 **PRE:** 0

4. **Credits:** 3 **6. Semester:** Autumn **7. Subject Area:** PEC

8. **Pre-requisite:** Nil

9. **Objective:** To get exposure about basic modelling of curves, surface, solid, scanning, rendering, animation etc.

10. **Details of the Course**

S.No.	Contents	Contact hours
1.	Introduction: History of CAD, Product lifecycle, Role of CAD in Industrial Design Modeling. Introduction to modeling tools	3
2.	Modeling of curves, surfaces and solids, Representation of curve and surfaces Manipulation of CAD models, Parametric Curves, Tangent, Normal, Curvature, Continuity, Bezier curve, B-Spline curves, and surfaces.	6
3.	Wireframe Models, Solid Models, Solid Representations, Regularized Boolean Operators, Constructive Solid Geometry (CSG), Boundary representation.	4
4.	Feature-based modeling, parametric/variational modeling, product data exchange standards; Various CAD data formats	4
5.	Introduction to Computer Aided Industrial Design (CAID); Interfacing for production and tool design	5
6.	Photo rendering and scanning, 3D animation and morphing, studio exercise in virtual products and systems. Hands on project.	6
Total		**28**

11. **Suggested Books:**

S.No.	Name of Authors/Book/Publisher	Year of Publication / Reprint
1.	Zeid I., “CAD/CAM: Theory and Practice”, Tata McGraw Hill	1998
2.	Martti Mantyla, An Introduction to Solid Modelling, Computer Science Press	1988
3.	Les Piegl and Wayne Tiller, The Nurbs Book, Springer-Verlag Heidelberg	1995
4.	R.W. Gill, Manual of Rendering with Pen and Ink, Thames and Hudson	1997

12. List of Practicals:

S.No.	Practicals	Hours
1.	Modelling styling features of a product	4
2.	Curved surface creation using primitive tools	4
3.	Curved Surface Creation using advanced tools such as Surface modelling	4
4.	Assembly Modelling using standard constraints	4
5.	Assembly creation using planes as only constrains	2
6.	To make a fully constrained drawing using sketch command	2
7.	To create a complex 3D structure using primitive 3D structures	2
8.	To create a 3D model using advance tools such as sweep, loft, revolve, pattern	2

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE: Department of Design

1. **Subject Code:** IDN-523 **Course Title**: Rapid Prototyping
2. **Contact Hours:** **L:** 2 **T:** 0 **P:** 2
3. **Examination Duration (Hrs.):** **Theory:** 2 **Practical:** 0
4. **Relative Weightage:** **CWS:** 10-25 **PRS:** 25 **MTE:** 15-25 **ETE:** 30-40 **PRE:** 0
5. **Credits:** 3 **6. Semester:** Autumn **7. Subject Area:** PEC
8. **Pre-requisite:** Nil
9. **Objective:** To introduce students with concepts of Rapid Prototyping and different techniques for developing prototypes.

10. Details of the Course

S.No.	Contents	Contact hours
1.	**Introduction:** Rapid Prototyping (RP), Traditional manufacturing vs RP, history, fundamentals of RP, process physics, RP process chain, Applications of RP.	5
2.	**Liquid based RP methods:** process mechanism, product design guide lines, applications, advantages and limitations of the techniques – Stereolithography (SLA), solid ground curing (SGC), solid creation system (SCS).	6
3.	**Solid based RP methods:** process mechanism, product design guide lines, applications, advantages and limitations of the techniques – fused deposition modeling (FDM), laminated object manufacturing (LOM), and extrusion based fused.	6
4.	**Powder based RP methods:** process mechanism, product design guide lines, applications, advantages and limitations of the techniques – selective laser sintering (SLS), 3D printing (3DP), ballistic particle manufacturing (BPM), shaping, and electron beam melting.	6
5.	**Application of RP:** Selection of RP technologies using decision methods, Additive manufacturing process plan: strategies and post processing, Monitoring and control of defects	5
Total		**28**

11. Suggested Books:

S.No.	Name of Authors/Book/Publisher	Year of Publication / Reprint
1.	I. Gibson, D. W. Rosen, B. Stucker, 'Additive manufacturing technologies: rapid prototyping to direct digital manufacturing', Springer.	2010
2.	A. Gebhardt, 'Understanding additive manufacturing: rapid prototyping, rapid tooling, rapid manufacturing', Hanser Publishers.	2011
3.	J. D. Majumdar and I. Manna, 'Laser-assisted fabrication of materials', Springer Series in Material Science.	2013
4.	L. Lu, J. Fuh and Y.-S. Wong, Laser-induced materials and processes for rapid prototyping, Kluwer Academic Press.	2001

12. List of Practicals:

S.No.	Practicals	Hours
1.	To fabricate a ABS part using the Fused Deposition Modeling process	4
2.	To fabricate a component using Stereolithography Apparatus	4
3.	To fabricate a component using powder-based RP process	4
4.	Study and demonstration of post-curing process for RP parts	4
5.	Group Project	12

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE: Department of Design

1. **Subject Code:** IDN-525 **Course Title**: CAE in Product Design
2. **Contact Hours:** **L:** 3 **T:** 0 **P:** 0
3. **Examination Duration (Hrs.):** **Theory:** 3 **Practical:** 0
4. **Relative Weightage:** **CWS:** 20-35 **PRS:** 0 **MTE:** 20-30 **ETE:** 40-50 **PRE:** 0
5. **Credits:** 3 **6. Semester:** Spring **7. Subject Area:** PEC
8. **Pre-requisite:** Nil
9. **Objective:** To get exposure about basic modeling of curves, surface, solid, scanning, rendering, animation etc.

10. **Details of the Course**

S.No.	Contents	Contact hours
1.	Product development driven by concurrent engineering	4
2.	Role of Computer-Aided Engineering (CAE) in product design	4
3.	Mathematical abstractions of products for functionality verification; lumped mass, finite element, boundary element, and statistical modeling procedures	12
4.	Use of commercial finite element-based packages for design analysis and optimization.	8
Total		**28**

11. **Suggested Books:**

S.No.	Name of Authors/Book/Publisher	Year of Publication / Reprint
1.	Bathe, K.J., Finite Element Procedures, Prentice Hall	1995
2.	Robert Cook, Finite Element Modeling for Stress Analysis, John Wiley & Sons, INC	1995
3.	Banerjee, P.K. and Butterfield R., Boundary Element Methods in Engineering Science, McGraw Hill	1981

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE: Department of Design

1. **Subject Code:** IDN-526 **Course Title**: Reverse Engineering
2. **Contact Hours:** **L:** 2 **T:** 0 **P:** 2
3. **Examination Duration (Hrs.):** **Theory:** 2 **Practical:** 0
4. **Relative Weightage:** **CWS:** 10-25 **PRS:** 25 **MTE:** 15-25 **ETE:** 30-40 **PRE:** 0
5. **Credits:** 3 **6. Semester:** Spring **7. Subject Area:** PEC
8. **Pre-requisite:** Nil
9. **Objective:** To introduce students with the concepts of reverse engineering and enable them to identify the suitable mechanisms and materials for manufacturing of an object.

10. Details of the Course

S.No.	Contents	Contact hours
1.	**Introduction:** scope and tasks of Reverse Engineering (RE), fundamentals and use of RE as a generic process, phases of RE (scanning, point processing, and geometric model development.	7
2.	**Methodologies and techniques:** Object Scanning: types of scanners, destructive methods, coordinate measuring machine, Point data Processing: processing and post-processing of captured data, geometric model development, construction of surface model, solid model, noise reduction, feature identification and model verification	15
3.	**Rapid Prototyping:** fundamentals of RP and different techniques of RP	3
4.	**Legal aspects of RE:** introduction and copyright law	3
Total		**28**

11. Suggested Books:

S.No.	Name of Authors/Book/Publisher	Year of Publication / Reprint
1.	K. A. Ingle, 'Reverse Engineering', McGraw-Hill	1994
2.	T. J. Biggerstaff, 'Design recovery of Maintenance and Reuse', IEEE Corporation	1991
3.	A. Peter, 'Data Reverse Engineering', McGraw-Hill	1996
4.	V. Raja and K. Fernandes, 'Reverse Engineering: An Industrial Perspective', Springer Verlag.	2008

12. List of Practicals:

S.No.	Practicals	Hours
1.	To perform reverse engineering of a component using CMM	4
2.	To perform reverse engineering of a component using 3-D scanner	4
3.	To create indirect rapid tooling for casting process	4
4.	Group Project	12

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE: Department of Design

1. **Subject Code:** IDN-547 **Course Title**: Manufacturing Guidelines for Product Design
2. **Contact Hours:** **L:** 3 **T:** 0 **P:** 0
3. **Examination Duration (Hrs.):** **Theory:** 3 **Practical:** 0
4. **Relative Weightage:** **CWS:** 20-35 **PRS:** 0 **MTE:** 20-30 **ETE:** 40-50 **PRE:** 0
5. **Credits:** 3 **6. Semester:** Autumn **7. Subject Area:** PEC
8. **Pre-requisite:** Nil
9. **Objective:** To instil the concept of design thinking that involves an integrated approach of combining the functions of design and manufacturing (including assembly).

10. **Details of the Course**

S.No.	Contents	Contact hours
1.	**Introduction:** Product Design: Basics, Introduction of Manufacturing Processes, Manufacturing Processes Advantages and Limitations-I, Manufacturing Processes Advantages and Limitations-II, Process Capabilities: Basics	8
2.	**Selection of Materials and Processes:** Engineering Materials, Properties of Materials, Selection of Materials – I, Selection of Materials – II, Applications of Engineering Material, Selection of Processes-I, Selection of Processes-II, Process Capabilities, Design Guidelines for Sand Casting, Design Guidelines for Die Casting Process	8
3.	**Design Guidelines for Primary Processing:** Product Design Guidelines: Compression Molding and Extrusion, Design Guidelines for Extrusion and Injection Molding, Design Guidelines for Sheet Metal Working, Design Guidelines for Machining, Design Guidelines for Powder Metal Processing	9
4.	**Design Guidelines for Secondary Processing:** Assembly Processes: Introduction, Adhesive Joining: Guidelines, Design Guidelines for Mechanical Fasteners, Design Guidelines for Welding, Design Guidelines: Brazing and Soldering, Induction Welding: Plastics, Ultrasonic Welding: Plastics, Vibration and Spin Welding: Plastics, Microwave Joining, Hole Making in Polymer and Polymer Matrix Composites	9
5.	**Concepts of Design:** Robust Design, Design for X, Product Design for Manual Assembly, DFMA Guidelines, Ergonomics in Product Design, Design for Environment, Design for Environment Process, Product Architecture, Rapid Prototyping, Product Design - Manufacturing Perspective	8
Total		**42**

11. Suggested Books:

S.No.	Name of Authors/Book/Publisher	Year of Publication / Reprint
1.	Boothroyd G., Dewhurst P., and Knight W., "Product Design for Manufacture and Assembly", 2nd Edition, Marcel Dekker.	2002
2.	Bralla J. G., "Design for Manufacturability Handbook", 4th edition, McGraw Hill.	1998
3.	Huang G. Q., "Design for X: Concurrent Engineering Imperatives", Chapman & Hall	1996
4.	Kusiak A., "Concurrent Engineering: Automation, Tools, and Techniques", Wiley	1993

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE: Department of Design

1. **Subject Code:** IDN-528 **Course Title**: Product Planning and Marketing
2. **Contact Hours:** **L:** 3 **T:** 0 **P:** 0
3. **Examination Duration (Hrs.):** **Theory:** 3 **Practical:** 0
4. **Relative Weightage:** **CWS:** 20-35 **PRS:** 0 **MTE:** 20-30 **ETE:** 40-50 **PRE:** 0
5. **Credits:** 3 **6. Semester:** Autumn **7. Subject Area:** PEC
8. **Pre-requisite:** Nil
9. **Objective:** To learn and reflect on the marketing process and product planning with reference to brand equity measurement.

10. Details of the Course

S.No.	Contents	Contact hours
1.	Corporate strategy for product planning	3
2.	Introduction to marketing, new strategies, market identification, segmentation and entry, strategies.	4
3.	Consumer response measurement, perceptual mapping, brand equity, strategic product positioning.	7
4.	Estimation of sales potential, product launching and product life cycle	4
5.	Advertising basics, services and processes	5
6.	Fundamentals of consumer behaviour	5
Total		**28**

11. Suggested Books:

S.No.	Name of Authors/Book/Publisher	Year of Publication / Reprint
1.	Philip Kotler and K. L. Keven Lane Keller, Marketing Management, Pearson	2016
2.	C. Merle Crawford, C. Anthony Di Benedetto, New Products Management, McGraw-Hill/Irwin	2006
3.	Luck David J., Rubin Ronald S., Marketing Research, Prentice Hall	1987
4.	Schiffman & Kanuk, Consumer Behavior, Pearson	2000

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE: Department of Design

1. **Subject Code:** IDN-530 **Course Title**: Business and Service Innovation
2. **Contact Hours:** **L:** 3 **T:** 0 **P:** 0
3. **Examination Duration (Hrs.):** **Theory:** 3 **Practical:** 0
4. **Relative Weightage:** **CWS:** 20-35 **PRS:** 0 **MTE:** 20-30 **ETE:** 40-50 **PRE:** 0
5. **Credits:** 3 **6. Semester:** Spring **7. Subject Area:** PEC
8. **Pre-requisite:** Nil
9. **Objective:** To enable students to identify, implement and evaluate innovative service offerings and business models.
10. **Details of the Course**

S.No.	Contents	Contact hours
1.	Service Economy and Service Organizations, Role of services in manufacturing firms, recent trends in manufacturing	4
2.	Developing a service strategy, service positioning and implications for service delivery design, degree of customer contact, divergence, customization; Service blue printing	3
3.	Product, Technology, Process and People-centric Services, Technical View of Services: Techniques for Service Analysis, Work System Method, Service Value Networks	5
4.	Business Models, Components of the business model, Business Model Canvas, Various types of Business Models, Generating New Business Model Ideas, Ideation Process, Visual Thinking, Different Types of Visualization.	8
5.	The value proposition, Elements of intangibles, Value creation through intellectual resources	8
6.	Business Model Design Process Design Attitude five phases (Mobilize, Understand, Design, Implement, and Manage) Prototyping, Prototypes at Different Scales	8
7.	Storytelling, Developing the Story, Making Business Models Tangible, Scenario-Guided Business Model Design	2
8.	Evaluating business models, business model perspective on blue ocean strategy, blending the blue ocean strategy framework with the business model canvas Managing multiple business models, Implementing Business Models in Organizations, Aligning IT with Business	4
Total		**42**

11. Suggested Books:

S.No.	Name of Authors/Book/Publisher	Year of Publication / Reprint
1.	Schultz, M and Doerr, J., "Professional services Marketing", Wiley,	2009
2.	Lovelock, C., and Wirtz, J, "Essentials of Services Marketing", Pearson Education	2008
3.	Alexander Osterwalder and Yves Pigneur, "Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers", Wiley	2010
4.	Adam J. Bock and Gerard George "The Business Model Book: Design, Build and Adapt Business Ideas that Drive Business Growth", Pearson Education Limited	2017
5.	Raphael Amit and Christoph Zott, Business Model Innovation Strategy: Transformational Concepts and Tools for Entrepreneurial Leaders", Wiley	2020

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE: Department of Design

1. **Subject Code:** IDN-531 **Course Title**: Legal Standards/IPR
2. **Contact Hours:** **L:** 3 **T:** 0 **P:** 0
3. **Examination Duration (Hrs.):** **Theory:** 3 **Practical:** 0
4. **Relative Weightage:** **CWS:** 20-35 **PRS:** 0 **MTE:** 20-30 **ETE:** 40-50 **PRE:** 0
5. **Credits:** 3 **6. Semester:** Autumn **7. Subject Area:** PEC
8. **Pre-requisite:** Nil
9. **Objective:** To impart knowledge of the various legal aspects including IPR to protect the designs and innovations.
10. **Details of the Course**

S.No.	Contents	Contact hours
1.	Introduction: Meaning, Relevance, Business Impact, Protection of Intellectual Property Copyrights, Trademarks, Patents, Designs, Utility Models, Trade Secrets and Geographical Indications Bio-diversity and IPR. Competing Rationales for Protection of Intellectual Property Rights	6
2.	Introduction to the leading International Instruments concerning Intellectual Property Rights: The Berne Convention, Universal Copyright Convention, The Paris Convention, Patent Co-operation Treaty, TRIPS, The World Intellectual Property Organization (WIPO) and the UNESCO	6
3.	Concept of Patent- Product / Process Patents & Terminology, Patents- Law and Policy Consideration Elements of Patentability, - Novelty and Non Obviousness (Inventive Steps and Industrial Application, Non- Patentable Subject Matter, Procedure for Filing of Patent Application and types of Applications, Procedure for Opposition, Revocation of Patents, Ownership and Maintenance of Patents, Assignment and licensing of Patents	8
4.	Patent Infringement, Literal Infringement, Contributory Infringement, Defenses to Infringement including Experimental Use, Inequitable Conduct, Patent Misuse, Legal Aspects (Act, Rules, Procedures), Case Study	7
5.	Recent Developments in Patent System, Software and Business Method Patenting in India & other Jurisdiction, Patentable Inventions with Special Reference to Biotechnology Products entailing Creation of New Forms of Life.	7
6.	Key Business Concerns in Commercializing Intellectual Property Rights, Competition and Confidentiality Issues, Antitrust Laws, Assignment of Intellectual Property Rights, Technology Transfer Agreements, Intellectual Property Issues in the Sale of Business, Care & Maintenance of Confidential Information, Legal Auditing of Intellectual Property, Due Diligence of Intellectual Property Rights in a Corporate Transaction	8
Total		**42**

11. Suggested Books:

S.No.	Name of Authors/Book/Publisher	Year of Publication / Reprint
1.	Nithyananda, K V. Intellectual Property Rights: Protection and Management, Cengage Learning India Private Limited.	2019
2.	Neeraj, P., & Khusdeep, D. Intellectual Property Rights, PHI learning Private Limited.	2014
3.	Geoffrey A. Manne, Joshua D. Wright, Competition Policy and Patent Law under uncertainty, regulating innovation, publisher Cambridge University Press	2011
4.	Audrea Stazi, Biotechnological Inventions and patentability of life, the US and European Experience publisher Edward Elgar Publishing Limited	2015
5.	Prasad Karhad, How to patent an Idea in India, from idea to granted patent in quickest time, saving costs and making money with your patented invention, Intellectual Property in India	2018

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE: Department of Design

1. **Subject Code:** IDN-532 **Course Title**: Systems Thinking
2. **Contact Hours:** **L:** 3 **T:** 0 **P:** 0
3. **Examination Duration (Hrs.):** **Theory:** 3 **Practical:** 0
4. **Relative Weightage:** **CWS:** 20-35 **PRS:** 0 **MTE:** 20-30 **ETE:** 40-50 **PRE:** 0
5. **Credits:** 3 **6. Semester:** Autumn **7. Subject Area:** PEC
8. **Pre-requisite:** Nil
9. **Objective:** The objective of this course is to understand system dynamics and its applications in innovative business models.

10. Details of the Course

S.No.	Contents	Contact hours
1.	Introduction to System thinking, System thinking in various disciplines such as Philosophy, the life sciences, social sciences and business.	7
2.	System Dynamics, Applications of system dynamics. The modeling process. The client and the modeler, Steps and overview of modeling process.	7
3.	Structure and behavior of dynamic systems, Fundamental modes of dynamic behavior, S-shaped growth, Overshoot and Collapse, Equilibrium, Randomness and Chaos.	9
4.	Tools for system thinking, Casual loop diagrams. Adam Smith's invisible hand and the feedback structure of the market, policy resistance.	6
5.	Stock flows and accumulation, identifying and mapping stocks and flows, dynamics of stocks and flows.	6
6.	Dynamics of simple structure, dynamics of growth, epidemics, innovation diffusion, and the growth of new product	7
Total		**42**

11. Suggested Books:

S.No.	Name of Authors/Book/Publisher	Year of Publication / Reprint
1.	John D. Sterman, Business Dynamics: System Thinking and Modeling for a complex world, McGraw Hill Education.	2018
2.	Donella Meadows, Thinking in Systems: A Primer, Published by Earthscan.	2015
3.	Michael C. Jackson, Critical System Thinking and the Management of Complexity: Responsible Leadership for a Complex World, Wiley.	2019
4.	David Peter Stroh, Systems Thinking For Social Change, Chelsea Green Publishing Co	2015

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE: Department of Design

1. **Subject Code:** IDN-534 **Course Title**: Interaction Design
2. **Contact Hours:** **L:** 2 **T:** 0 **P:** 2
3. **Examination Duration (Hrs.):** **Theory:** 2 **Practical:** 0
4. **Relative Weightage:** **CWS:** 10-25 **PRS:** 25 **MTE:** 15-25 **ETE:** 30-40 **PRE:** 0
5. **Credits:** 3 **6. Semester:** Spring **7. Subject Area:** PEC
8. **Pre-requisite:** Nil
9. **Objective:** To impart knowledge on the different aspects of Human Computer Interaction Design.
10. **Details of the Course**

S.No.	Contents	Contact hours
1.	Introduction to Human Computer Interaction Design; Brief History of Interaction Design.	6
2.	Interaction Design Methodology; Low fidelity Paper prototype, Wire framing.	8
3.	Information Architecture, GUI, Design Testing.	8
4.	Case studies and best practices	6
Total		**28**

11. **Suggested Books:**

S.No.	Name of Authors/Book/Publisher	Year of Publication / Reprint
1.	Krug, S. – "Don't Make Me Think", Rider publication.	2006
2.	Jakob Nielsen – "Designing Web Usability: The Practice of Simplicity", New Riders Publishing	1999
3.	Lidwell, W., Holden, K. and Butler, J. – "Universal Principles of Design", Rockport Publishers.	2010
4.	Manovich, L. – "The Language of New Media", MIT Press	2001

12. **List of Practicals:**

S.No.	Practicals	Hours
1.	Designing a mobile application/game	10
2.	Designing a website	10
3.	Visual design of UI components	8

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE: Department of Design

1. **Subject Code:** IDN-548 **Course Title**: Inter-Disciplinary Design
2. **Contact Hours:** **L:** 2 **T:** 0 **P:** 2/2
3. **Examination Duration (Hrs.):** **Theory:** 2 **Practical:** 0
4. **Relative Weightage:** **CWS:** 15-30 **PRS:** 20 **MTE:** 15-25 **ETE:** 30-40 **PRE:** 0
5. **Credits:** 3 **6. Semester:** Spring **7. Subject Area:** PEC
8. **Pre-requisite:** Nil
9. **Objective:** To equip students to generate experimental ideas and designs through cross-disciplinary explorations, and to develop creative practices that address emerging and complex challenges; collaborating with stakeholders; imagining futures that can serve as effective interventions; considering issues from multiple perspectives and scales.

10. **Details of the Course**

S.No.	Contents	Contact hours
1.	Bio-Inspired Design: Introduction to Bio Inspired Design; Nature as mentor and source of inspiration; variety of biomimetic methods; systems organisation; hierarchical structures; materials; structure, surface and skin; decomposing objects and deciphering forms; applications	5
2.	Mobility Design: History of transportation and automobile design; basics of mobility design and ergonomics; materials and finishes; vehicle sketching and representation; vehicle styling and packaging; prototyping; future mobility; innovations; applications	5
3.	Culture, Curation and Narrative Design: visual and cultural narratives; social, cultural, historical, technical, and political contexts of design; digital curation and story-telling; design semantics; design-focused museums; design exhibitions; case studies; applications	5
4.	Craft-Design: introduction to craft and skills; material, maker and making; craft-design process; craft-based design for innovation; craft-design collaborations; creative and cultural industries; communities; co-creation; applications	5
5.	Interdisciplinary Design: creative design processes driven by cross-pollination and interdisciplinary exchange amongst the above mentioned paradigms of design; shared knowledge; experimental design; knowledge creation and transfer through interdisciplinary design interventions; case studies; applications	8
Total		**28**

11. Suggested Books:

S.No.	Name of Authors/Book/Publisher	Year of Publication / Reprint
1.	Sandy B. Primrose. Biomimetics: Nature-Inspired Design and Innovation, Wiley-Blackwell; 1st edition	2020
2.	Helena Hashemi Farzaneh, Udo Lindemann. A Practical Guide to Bio-inspired Design, Springer Vieweg	2019
3.	Mike Tovey, Andree Woodcock, Jane Osmond. Designing Mobility and Transport Services, Routledge, 1st edition	2020
4.	Selby Coxon, Robbie Napper, Mark Richardson. Urban Mobility Design, Elsevier, 1st Edition	2018
5.	Rebecca Reubens. Holistic Sustainability Through Craft-Design Collaboration, Routledge, 1st Edition	2020

12. Suggested Exercise:

- Select and study in detail, an organism found in nature. Translate the investigation and understanding in the design of a product/ graphic/ environment.
- Highlight and discuss diverse craft forms and communities through a selected case. Investigate the collaborative and experimental craft-design processes; value addition they bring forth; present the findings; create new prototypes
- Study visual, cultural and oral narratives; investigate and understand the inter-relationships with design; develop storyboards/ project branding and identity/ narrative environments for curation etc.
- Study and investigate varied aspects of mobility design; and develop prototypes
- Cross pollination amongst any two paradigms, listed above, and develop a project focusing on trans-disciplinarity

* Field visits and workshops are recommended to support the diverse practical exercises

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE: Department of Design

1. **Subject Code:** IDN-536 **Course Title**: Service Design
2. **Contact Hours:** **L:** 2 **T:** 1 **P:** 0
3. **Examination Duration (Hrs.):** **Theory:** 2 **Practical:** 0
4. **Relative Weightage:** **CWS:** 20-35 **PRS:** 0 **MTE:** 20-30 **ETE:** 40-50 **PRE:** 0
5. **Credits:** 3 **6. Semester:** Spring **7. Subject Area:** PEC
8. **Pre-requisite:** Nil
9. **Objective:** To impart knowledge on basic concepts and methods of service design.
10. **Details of the Course**

S.No.	Contents	Contact hours
1.	Service Design and implementation of design thinking for enhanced service experience	5
2.	Design research to analyse services	5
3.	Creation and ideation of service design concepts: Creation of new consumer services, with a focus on identifying human needs, transformational services; Development of public amenities and services; Envisioning radically new future services and user experiences driven by technological advancements, environmental and social challenges.	12
4.	Prototyping and testing service design	6
Total		**28**

11. **Suggested Books:**

S.No.	Name of Authors/Book/Publisher	Year of Publication / Reprint
1.	Norman, D. Design of Everyday Things, Basic Books; 2nd edition	2013
2.	Tim Brown, Change by Design, Harper Business.	2012
3.	Schneider, J. and Stickdorn, M. This is Service Design Thinking: basics- tools- cases, Wiley; 1st edition	2012

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE: Department of Design

1. **Subject Code:** IDN-537 **Course Title**: Research into Design
2. **Contact Hours:** **L:** 2 **T:** 1 **P:** 0
3. **Examination Duration (Hrs.):** **Theory:** 2 **Practical:** 0
4. **Relative Weightage:** **CWS:** 20-35 **PRS:** 0 **MTE:** 20-30 **ETE:** 40-50 **PRE:** 0
5. **Credits:** 3 **6. Semester:** Spring **7. Subject Area:** PEC
8. **Pre-requisite:** Nil
9. **Objective:** To impart knowledge about research design, methods and techniques relevant to design.
10. **Details of the Course**

S.No.	Contents	Contact hours
1.	Research in design- its importance and scope, Areas of research and types of research, Research process- identification of problem, formulation of research questions and hypothesis.	4
2.	Need and process of literature review, style of referencing, bibliography, writing literature review.	4
3.	Research Paradigms and Strategies: Various systems of inquiry, Overview of different research strategies.	4
4.	Research methods	4
5.	Experimental and Simulation Research Methods: Their basic assumptions, techniques used and strength and weaknesses. concepts, application of design principles.	4
6.	Tools and Techniques: Used for collecting data (observational studies, surveys, interviews) and analyzing data (quantitative, qualitative, multivariate analysis and software applications) for different research methods.	4
7.	Report writing	4
Total		**28**

11. **Suggested Books:**

S.No.	Name of Authors/Book/Publisher	Year of Publication / Reprint
1.	Hanington, Bruce & Martin, Bella. Universal Methods of Design: 125 Ways to Research Complex Problems, Develop Innovative Ideas, and Design Effective Solutions., Rockport Publishers	2019
2.	Holtzblatt, Karen and Beyer, Hugh. Contextual Design: Design for Life., Morgan Kaufmann; 2nd edition	2016
3.	Koskinen, I., Zimmerman, J. et al. Design Research Through Practice From the Lab, Field, and Showroom., Elsevier	2011
4.	Zeisel, John. Inquiry by Design: Environment / Behavior / Neuroscience in Architecture, Interiors, Landscape, and Planning., W. W. Norton & Company; Revised edition	2006

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE: Department of Design

1. **Subject Code:** IDN-549 **Course Title**: Design for Social Inclusion
2. **Contact Hours:** **L:** 2 **T:** 0 **P:** 2/2
3. **Examination Duration (Hrs.):** **Theory:** 2 **Practical:** 0
4. **Relative Weightage:** **CWS:** 15-30 **PRS:** 20 **MTE:** 15-25 **ETE:** 30-40 **PRE:** 0
5. **Credits:** 3 **6. Semester:** Spring **7. Subject Area:** PEC
8. **Pre-requisite:** Nil
9. **Objective:** To sensitise and inspire design for social inclusion with a human centric approach.
10. **Details of the Course**

S.No.	Contents	Contact hours
1.	Understanding Social inclusion, Concepts of Sustainable Design, Social Sustainability	3
2.	Demographic perspectives of Ageing, Gender, Disabilities in Global South and Global North	3
3.	Understanding Universal Design and Concepts of Inclusion, Universal Design Principles and Case Studies	4
4.	Inclusive Design for Children, Women and Diversity	4
5.	Design for Ageing, Products and Systems for Elderly well-being, Assistive Designs, Lifespan design	3
6.	Design for Disability, Assistive Technologies, Inclusive Products and Systems	4
7.	Inclusive Design for Low Resource context, Design and Social Transformations, Design Futures	4
8.	National and International Policies and Paradigms of Inclusion	3
Total		**28**

11. **Suggested Books:**

S.No.	Name of Authors/Book/Publisher	Year of Publication / Reprint
1.	Ezio Manzini, Design when everybody designs: An Introduction to Design for Social Innovation, The MIT Press	2015
2.	Regine M. Gilbert, Inclusive Design for a Digital World; Design with Accessibility in Mind, Apress	2019
3.	Jonathan Hassell, Inclusive Design for Products, Rethink Press	2019
4.	Elaine Ostroff, Universal Design Handbook, Second Edition, McGraw-Hill Education	2011
5.	Patrick Langdon, Jonathan Lazar, Ann Heyleighen, Hua Dong (Eds.), Designing for Inclusion: Looking towards the future, Springer	2020

12. Suggested Exercise:

- Studies on Products and Systems for Design Inclusion
- Mobility Design and Inclusion for Elderly, Disabled, Women, Children, etc.
- Interface Design for Diverse Population Groups
- Assistive Technology for Low Resource Contexts

Field visits to conduct ethnographic and design studies with live human subjects in diverse contexts.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE: Department of Design

1. **Subject Code:** IDN-541 **Course Title**: Graphic Design
2. **Contact Hours:** **L:** 2 **T:** 0 **P:** 2
3. **Examination Duration (Hrs.):** **Theory:** 2 **Practical:** 0
4. **Relative Weightage:** **CWS:** 10-25 **PRS:** 25 **MTE:** 15-25 **ETE:** 30-40 **PRE:** 0
5. **Credits:** 3 **6. Semester:** Autumn **7. Subject Area:** PEC
8. **Pre-requisite:** Nil
9. **Objective:** To explore visual representation through a range of image-making techniques and to apply the principles of composition to communicate with the help of graphical representation.

10. Details of the Course

S.No.	Contents	Contact hours
1.	Definition and fundamentals of image making, techniques, denotative and connotative meaning	4
2.	Typography, typeface	4
3.	Usage of shape and colour.	4
4.	Icons and symbols	4
5.	Working with colour, colour theories, colour wheel, meaning of colour	4
6.	Visual contrast and balance	4
7.	Composition, image and text	4
Total		**28**

11. Suggested Books:

S.No.	Name of Authors/Book/Publisher	Year of Publication / Reprint
1.	Robert Bringhurst 'The Elements of Typographic Style', Hartley & Marks Inc., U.S.; 2nd edition	2013
2.	Ellen Lupton, Thinking with type: A Critical Guide for Designers, Writers, Editors, & Students second edition, Princeton Architectural Press; 2nd edition	2010
3.	Paul Rand, Paul Rand: A Designer`s Art, Princeton Architectural Press; 1st edition	2016

12. List of Practicals:

S.No.	Practical	Hours
1.	Exploring symmetry, asymmetry, scale, motion and layout	4
2.	Exercises in letterform abstraction, hierarchy of elements	4
3.	Case studies and inferences	4
4.	Group Project	12

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE: Department of Design

1. **Subject Code:** IDN-542 **Course Title**: Product Detailing
2. **Contact Hours:** **L:** 3 **T:** 0 **P:** 0
3. **Examination Duration (Hrs.):** **Theory:** 3 **Practical:** 0
4. **Relative Weightage:** **CWS:** 20-35 **PRS:** 0 **MTE:** 20-30 **ETE:** 40-50 **PRE:** 0
5. **Credits:** 3 **6. Semester:** Autumn **7. Subject Area:** PEC
8. **Pre-requisite:** Nil
9. **Objective:** To get exposure about basic modelling of curves, surface, solid, scanning, rendering, animation etc.
10. **Details of the Course**

S.No.	Contents	Contact hours
1.	Detailing in plastic products while using processes like injection molding, vacuum molding, compression molding, F. R. P. molding.	10
2.	Design detailing for fabricated products in sheet metal, steel tubes and angles, aluminum sheets and extruded sections.	9
3.	Detailing while using fabric materials, foam and other cushions, leather and cloth in combination with materials like wood and metal.	9
Total		**28**

11. **Suggested Books:**

S.No.	Name of Authors/Book/Publisher	Year of Publication / Reprint
1.	Ashby M., Johnson K., 'Materials and Design: The Art and science of Material selection in Product Design', Butterworth-Heinemann	2002
2.	Feirer, J. L., 'Cabinet making and mill work', Bennet, Perria	1977
3.	Beadle, J. D., 'Plastic forming, production engineering series', Macmillan, London	1971
4.	Degarmo E P et al., Materials and processes in Manufacturing 9th ed., John Wiley & sons	2002

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE: Department of Design

1. **Subject Code:** IDN-543 **Course Title**: Contemporary Visual Design
2. **Contact Hours:** **L:** 3 **T:** 0 **P:** 0
3. **Examination Duration (Hrs.):** **Theory:** 3 **Practical:** 0
4. **Relative Weightage:** **CWS:** 20-35 **PRS:** 0 **MTE:** 20-30 **ETE:** 40-50 **PRE:** 0
5. **Credits:** 3 **6. Semester:** Autumn **7. Subject Area:** PEC
8. **Pre-requisite:** Nil
9. **Objective:** To impart knowledge on the historical backdrop and trends of contemporary design languages. To enable the students, interpret various design styles and apply them into design.

10. Details of the Course

S.No.	Contents	Contact hours
1.	Preamble of Contemporary Design during Post Industrial Revolution Characteristics of Modern and Post-modern Visual Design Languages	3
2.	Phases of Modernism in Art and Design: De Stijl, Bauhaus, Art Deco, Avant-garde, etc. Correlations of modern design and art movements.	15
3.	Phases of Post-modernism in Art and Design: Pop movement, Deconstructivism, Historicism, etc. Correlations of post-modern design and art movements.	10
4.	Works of Contemporary Artists, Designers and Architects	7
5.	Case studies: Contemporary Design languages in the paradigm of Digital media, Typography, Furniture Design, Product Design, Architecture and Fine Arts	7
Total		**42**

11. Suggested Books:

S.No.	Name of Authors/Book/Publisher	Year of Publication / Reprint
1.	Fletcher, B. History of Architecture, CBS publisher	2019
2.	Berger, J. Ways of Seeing, Penguin books	2008
3.	Vidiella, A.S. The sourcebook of Contemporary Architecture, Harper Collins	2008
4.	Gombrich, E.H. The Story of Art, Phaidon Press	2006
5.	Gossel, P. Architecture in the 20th century, Vol- 1 & Vol 2, Taschen	2005