Dr. A. P. J. Abdul Kalam Technical University, Uttar Pradesh, Lucknow

UNDERGRADUATE COURSE

BACHELOR OF DESIGN

BATCH 2017-2018
PREFACE

Design is a profession of thinkers and visionaries, people who shape human experience of the future by learning from the past and the present. They’re trained by education and practice to spot patterns, trends and gaps in people’s day to day lives and gain insights from them. For these insights to be objective, meaningful and most importantly, actionable enough to evolve into ideas that improve human condition as well as the environment, a multidisciplinary field like design offers itself like a framework of effective problem solving.

This framework adopts practices from many other fields. The scientific method dictates the terms of collection and handling of information in the design practice. Technology drives the functional and engineering prudence of a design solution. Arts and humanities cover the characteristically emotional aspects of it. Hard economics dictates the terms of execution while culture and tradition influence the aesthetic and acceptability parts of a design solution.

With advances in engineering, designers strive to bring every technological breakthrough into the realm of human experience. They try to find new ways to use novel materials and processes to make incremental improvements in the quality of life in general. And now, they also continue to find effective ways to use the existing materials and processes in pursuit of averting further deterioration of the climate.

From the point of view of anthropology, as human behavior evolves and the society changes with it, designers try to gauge this evolution and offer tangible and non-tangible ways help people adapt to the changes induced by it.

Considering these and other aspects of the design profession, the process to train young designers becomes inherently multidisciplinary. It promotes lateral thinking and drives innovation on one hand, while providing tools to further accelerate the structured decision making process to streamline conventional problem solving on the other.

Design students are primed for being a part of the highly skilled talent pool for organizations. They are trained to become entrepreneurs, and they are taught to become scholars for various domains. Hence, an honorable Bachelor’s of Design program must develop a set of skills and instill some virtues in its graduates to be able to contribute to the culture and economy at a level proportionate to their talent and training.

First, an industry standard skill set is an absolute requirement for employability in private or public sector in leading design positions. This skill set includes a certain degree of emotional intelligence to connect and empathize with the end users, analytic skills to distill actionable insights from the market and industry for a timely initiation of a design project, visualization skills to see and present the problems and solutions as they should be, and communication skill to effectively articulate the design process to the stakeholders.

To develop this skill set, the curriculum must include a sufficient workload of skill development courses that includes topics like Representation Techniques, technical drawing and drafting, 3D modeling, model making, materials and process, workshop and manufacturing technologies, technical Studies (Applied Sciences, Mechanics, Electronics, Programming), prototyping, elements of visual design, elements of form, color and composition, ergonomics, research methodologies, design management and system thinking in design. Given the importance of these skills in the profession, the courses covering them constitute the Core of the curriculum.

Second, the qualifications for enrollment in recognized Master’s programs worldwide in Design, Applied Sciences and Humanities are decided by the academic credentials earned by a student during his degree program. The design courses typically exceed the undergraduate and postgraduate norms from the perspective of most of the nationally as
well as globally recognized evaluation systems as the number of topics covered and required contact hours to do so is significantly higher than a typical Technical or Engineering Degree program. However, it is not just the academic transcript that matters in a design degree, it is the quality and potential impact of the design projects and degree projects of the students which culminate in their portfolios and showcase their personal capacity to learn as well as the institution’s capacity to teach and avail resources to visualize and materialize said projects. Students who pursue higher education are aiming to be specialists of a respective sub-domains of design, so their interests in a particular field of design are reflected in the courses they choose to build their theoretical foundation. Subjects offering the starting point for higher education programs form the compulsory and elective foundation part of the curriculum.

Third, the analytic skills are required for design students to be an active part of the Research and Development pool of academia as well as the economy. Courses like Design management and Research methodology offer such skills, hence should be included in the core of the curriculum.

Fourth is the entrepreneurship and management skills that the graduates require for starting their own innovation driven ventures. Since design as a profession transcends the boundaries of multiple domains of expertise, the true potential of some designers is realized when they capitalize upon their skills by offering them to a multitude of domains as entrepreneurs. Hence, they should have a basic level of awareness about starting up a business and its sustainable operation. This awareness also helps them in understanding the needs and limitations of the organizations they work for.

Fifth is the cultural sensibility that helps the designers judge the potential acceptability of their work in society. It is also essential so that solutions adopted from other cultures can be translated into more acceptable local versions.

Sixth, socio-economic sensibility is essential for building social ventures concerned with public affairs. It also helps the design practitioners in being aware of concepts like corporate social responsibility, grass root issues etc. Without being sensitive to customs, traditions and the local ecosystems, designers cannot produce truly inclusive solutions.

Courses like design and ethics, field study parts of the curriculum projects, workshops and short term modules prepared by experts in related fields, and periodic documentation filing assignments help the students develop this aspect of their professional persona.

Seventh, sensibility for environmental concerns encourage designers to contribute for the stabilization of rapidly declining climate quality of the planet. Introduction of basic environmental sciences sensitizes designers towards the potential environmental impact their work may have. Given the impact on future generations, and the repercussions faced current generation due to disregard of natural cycles, this subject becomes crucial and mandatory part of the curriculum.

And eighth, a global perspective that helps the graduates in promoting India’s design heritage in other parts of the world and bringing in the best practices of other economies and cultures into India’s ecosystem. Academic exchanges across the universities and promotion of institutional publications like studies and other body of work of the students and the faculty helps in this regards.

With these considerations in mind, a model curriculum of Bachelor’s degree in Design is offered in this document with an intention to prepare graduates who can successfully render their services to the society, industry and the environment for everyone’s benefit and their personal growth in a profession that is challenging, emotionally and physically taxing yet exciting and fulfilling, philosophical yet pragmatic and emotional yet technology driven.
### Curriculum (2017-18 Batch)

#### SEMESTER I

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**TOTAL CREDITS** 192
DESIGN THINKING – I

ADS101–INTRODUCTION TO DESIGN

Unit 1: Introduction to Design
Definition and understanding of the design process. A brief history of Design, evolution of industrial design as a profession.

Unit 2: Principles of Gestalt
Basic understanding of visual perception. Discussion and demonstration of the way humans make a greater sense out of combination of simple or complex curves and shapes.

Unit 3: Introduction to Product Design

Unit 4: Design Concepts and concerns

Unit 5: Introduction to system thinking
Definition of a system. Understanding the concepts of component, connection, transaction and transformation. Understanding the boundary and boundary conditions. Understanding the concepts of input, activity, response and output. Introduction to Static and dynamic maps.

References
Don Norman, Emotional Design, Why We love (or Hate) Everyday Things, Basic Books, 2003
E. Pilloton, Design Revolution: 100 Products That Empower People, Metropolis Books, 2009
Doblin Jay, 100 Great Product Designs

Course Outcome
Discovery of design as a profession
Awareness about psychology of visual perception
Awareness about historical perspective of aesthetics
Understanding of materials and processes
Ability to define problems
Unit 1: Introduction to Drawing
Introduction to the skills of drawing and sketching, methods and techniques of penciling;

Unit 2: Drawing from still objects
Drawing a still life using different objects of different sizes and shapes,
Exploring Material Properties.

Unit 3: Perspective and Composition
Use of drawing as a means of developing creative thinking, develop and understanding of perspective and composition.

Unit 4: Sketching 1
Different approaches to explore and record daily observations, ideas, imagination and concepts.
Drawing from memory and imagination.

Unit 5: Sketching 2
Representing nature; Figure drawing.

References
Maurrelo Ralphs, The complete air brush, Leon Amiel Publishers Inc. NY, 1980
Schmid & Schmid, Handbook of Graphic Presentation, Roland Press, 1979
Herdeej, Graphic Diagrams, Graphic Press, 1976
Langford Michael, Advance Photograph, Focal Press, 1974
Hedgeco John, The air of colour photography, Michel Beazley, 1981

Course Outcome
Ability to create compelling and detailed line drawings of real or imaginary objects in short time.
Ability to effectively explain an idea through visual language
Ability of create simplified representations.
Ability to generate novel patterns and textures
Basic understanding of composition in graphic design
Unit 1: Point/Dot, Lines and curves

Unit 2: Shapes and Patterns
Characteristics of a shape, concepts of positive and negative space, types of shapes. Developing patterns by repetition of points, dots, rectilinear elements, curvilinear elements, Shapes. Regular and Irregular Patterns. Fractals.

Unit 3: Texture
Understanding of flat surface. Material and process based textures, construction based textures, pigmented textures.

Unit 4: Area, Volume and Form (Primary)
Gradation on Flat Surface, Introduction of highlights and shadows. Primer for elements of form course

Unit 5: Colour (Primary)
Introduction to colors, pigment and light, additive and subtractive models. Shades of Greys. Understanding warm and Cold Greys.

References
Samara Timothy, Design Elements, 2nd Edition: Understanding the rules and knowing when to break them, Rockport Publishers, 2014
Wong W., Principles of Two Dimensional Design, John Wiley & Sons, 1972
White Alex W., The Elements of Graphic Design, Allworth Press, 2011
Itten J., The art of colour: the subjective experience and objective rationale of colour, John Wiley and Sons. 1974
ADS104 – APPLIED SCIENCE FOR DESIGN

Unit 1: Design in natural world
Evolution of species’ & evolution and metamorphosis as design refinement, mechanisms and bio-mechanisms & bio-circulations.

Unit 2: Basic robotics
Genesis of robotics and differentiation, nomenclature of robotic parts, applications of robots, sensors used in various robots. Studio hours involve development of a robotic mechanism in a chosen life form.

Unit 3: Basic Aerodynamics
Bernoulli’s principle, Fluid dynamics conservation laws, static equilibrium and trim.

Unit 4: Basic Pneumatics & Hydraulics
Comparisons of electrical, hydraulic and pneumatic systems, Pascal’s law, hydraulic pumps & air compressors, hydraulic and pneumatic accessories

Unit 5: New Materials
Smart materials, Nano materials, their application and examples of usage.

References
Moshe Shoham; A Textbook of Robotics 1 Basic Concepts, Eshed Robotec 1984
Myke Predko; 123 Robotics Experiments for Evil Genius, 2004
Garratt J.; Design and Technology, Cambridge University Press, 1996
Henry T Brown; 507 Mechanical movements, Brown Coombs & Company
Michael F Ashby, Daniel L Schodek, Paulo J Ferreira; Nano materials, Nano technology & design, Elsevier Ltd, 2009
Jared Diamond; Guns Germs and Steel, W.W. Norton 1997

Course Outcome
Awareness about natural ecosystem.
Ability to assess the working mechanism of basic objects.
ADS105 – TINKERING STUDIO

Unit 1: Linkages and Joints
Introduction of links, mechanisms, inversions, joints etc. (natural and artificial), its applications in various domains.

Unit 2: Cams and Gears
Understanding of the concept of Locus, Introduction of cams and gears, Gear ratios, mechanical advantage, types of gear and cams, and its applications.

Unit 3: Lateral thinking
Lateral thinking by creating puzzle / game board’s designs and working solutions using newer or available technology / DIY kits. Creative thinking by solutions to an existing real world problem.

References
Edward de Bono, Lateral Thinking, Penguin UK, 2010
Martin Gardner; 100 Perceptual puzzles, 1995 Barnes & Noble Books

Course Outcome
Ability to identify working mechanisms that make a product.
Building a creative self.
AME111—ENGINEERING DRAWING

UNIT 1: ENGINEERING DRAWING


UNIT 2: ORTHOGRAPHIC PROJECTIONS

Pictorial view, Terminology, First angle projection and its features, Third angle projections and its features, Symbols, Section lines or hatching, Conversion of pictorial view into orthographic view.

Unit 3: Projection line

Introduction, Orientation of a line, Projections of a line located at different locations, Projections of a line in different angles.

Unit 4: Sectional Views

Introduction, Terminology, Types of section planes, Section by a plane perpendicular to VP, HP and both.

Unit 5: Computer Aided Drafting

Introduction to Software and its tools, computer generated technical drawing and assembly.

References

A.J. Dhananjay, Engineering Drawing, TMH, 2008
M B Shah and B C Rana, Engineering Drawing, 2nd Ed., Pearson Education, 2009

Course Outcome

Ability to create detailed engineering drawings for production
Unit 1:

Unit 2:

Unit 3:
Operational Amplifiers: Op-amp Equivalent Circuit, Practical Op-amp Circuits, DC Offset, Constant Gain Multiplier, Voltage Summing, Voltage Buffer, Controlled Sources, Instrumentation Circuits, Active Filters and Oscillators.

Unit 4:

Unit 5:
Transformers and AC Machines: Ideal Transformer, Circuit Model of Transformer, Determination of Parameters of Circuit Model of Transformer, Voltage Regulation, Efficiency, Three Phase Induction Motor, Three Phase Synchronous Generator, Induced Voltage, Electromagnetic Torque, Equivalent Circuit of Three Phase Induction Motor, Torque Speed Characteristic.
Fractional-kW Motors and DC Machines: Single Phase Induction Motors, Characteristics and Typical Applications, Stepper Motors, Construction Features, Methods of Operations, DC Generator and DC Motor Analysis, Methods of Excitation, Speed Torque Characteristics and Speed control of DC Machines.

References
R.J. Smith and R.C. Dorf, Circuits, Devices and Systems; John Wiley & Sons, 1992
R.L. Boylestad and L. Nashesky, Electronic Devices and Circuit Theory; PHI, 6e, 2001
R.J. Tocci, Digital Systems; PHI, 6e, 2001
ADS 111 – FORM, ORDER AND STRUCTURE

Unit 1: Introduction to the geometry of platonic solids and study of their interrelationship;

Unit 2: Derivation of Archimedean solids through truncation of regular solids;

Unit 3: Boolean solids; Order and structure-interrelationship of 2D and 3D forms;

Unit 4: Construction of solids using paper; Form manipulation; Form transition

Unit 5: Expressive form, combinatory forms and topology of 3D forms

References

W. Wong; Principles of Two Dimensional Design, John Wiley & Sons, 1972
K. Critchlow; Order in Space: A design Source Book, Thames and Hudson, 1969
E. H. Gombrich; The Sense of Order, Phaidon Press, 1994
R. Beech, Origami: the complete guide to the art of paper folding, Lorenz Books, 2001
C. Akner-Koler, Three Dimensional Visual Analysis, Konfffack, Sweden, 1994

Course Outcome

Understanding and appreciation of 3D & natural forms.
Ability to construct & manipulate forms.
ADS 112 – PRINCIPLES OF VISUAL DESIGN

Unit 1:
Study of visual principles – Balance: Formal and informal balance;

Unit 2:
Harmony / Unity; Emphasis / Focus

Unit 3:
Rhythm: different types of rhythm; Pattern; Contrast; Scale and proportion;

Unit 4:
Visual hierarchy; Visual Order and Chaos; Positive – Negative space;

Unit 5:
Tessellation: Regular and Semi-regular tessellation, modular tessellations

References

**ADS113 – VISUALIZATION AND ILLUSTRATIONS**

**Unit 1:**
Introduction to different medium, tools and instruments to create illustrations;

**Unit 2:**
Understanding basic principles of perception including depth and its representation in terms of reflections, rotations, sciography
Inter-relationship of visual forms in terms of size, scale and overall proportion.

**Unit 3:**
Conceptualizing ideas into an illustrative format like sections, cut-away and exploded views
Exploring the area of realistic to experimental illustrations.

**Unit 4:**
Nature drawing - to study form, structure and various shapes;
Representation of 3-dimensional forms;

**Unit 5:**
Introduction to basics of drawing techniques in the digital format;
Transforming works form sketching to digital format, using Google sketchup

**References**

T. C. Wang, Pencil Sketching, John Wiley & Sons, 1997,

**Course Outcome**

Ability to quickly visualize ideas and execute visual design explorations.

Ability to create compelling visuals of ideas before they come to reality for every stakeholder’s proper understanding.
Unit 1:
The von Neumann architecture, machine language, assembly language, high level programming languages, compiler, interpreter, loader, linker, text editors, operating systems, flowchart;

Unit 2:
Basic features of programming (Using C): data types, variables, operators, expressions, statements, control structures, functions; Advanced programming features: arrays and pointers, recursion, records (structures), memory management, files, input/output, standard library functions, programming tools,

Unit 3:
Fundamental operations on data: insert, delete, search, traverse and modify;
Fundamental data structures: arrays, stacks, queues, linked lists; Searching and sorting: linear search, binary search, insertion-sort, bubble-sort, selection-sort, radix-sort, counting-sort; Introduction to object-oriented programming;

References
Programming in ANSI C by E.Balagurusamy, Seventh Edition, McGrawHill,
A Book on C by Ira Pohl, Al Kelly
Programming Laboratory will be set in consonance with the material covered in introduction to computing. This will include assignments in a programming language like C.

References

Programming in ANSI C by E. Balagurusamy, Seventh Edition, McGrawHill,

Course Outcome

Readiness for programming control systems.

Readiness for building and testing software solutions.
AEE102 – BASIC ELECTRONICS LABORATORY

Experiments using diodes and bipolar junction transistor (BJT): design and analysis of half-wave and full-wave rectifiers, clipping circuits and Zener regulators, BJT characteristics and BJT amplifiers; experiments using operational amplifiers (op-amps): summing amplifier, comparator, precision rectifier, a-stable and mono-stable multi-vibrators and oscillators; experiments using logic gates: combinational circuits such as staircase switch, majority detector, equality detector, multiplexer and de-multiplexer; experiments using flip-flops: sequential circuits such as non-overlapping pulse generator, ripple counter, synchronous counter, pulse counter and numerical display.

References

Unit 1: Basic principles of mechanics
Equivalent force system; Equations of equilibrium; free body diagram; Reaction; Static indeterminacy. Difference between trusses, frames and beams, Assumptions followed in the analysis of structures; 2D truss; Method of joints; Method of section; Frame; Simple beam; types of loading and supports; Shear Force and bending Moment diagram in beams; Relation among load, shear force and bending moment. Dry friction; Description and applications of friction in wedges, thrust bearing (disk friction), belt, screw, journal bearing (Axle friction); rolling resistance.

Unit 2: Virtual work and Energy method
Virtual Displacement; Principle of virtual work; Applications of virtual work principle to machines; Mechanical efficiency; Work of a force/couple (springs etc.); Potential energy and equilibrium; stability.

Unit 3: Centre of Gravity and Moment of Inertia
First and second moment of area; Radius of gyration; Parallel axis theorem; Product of inertia, Rotation of axes and principal moment of inertia; Moment of inertia of simple and composite bodies. Mass moment of inertia.

Unit 4: Kinematics and Kinetics
Kinematics of Particles; Rectilinear motion; Curvilinear motion; Use of Cartesian, polar and spherical coordinate system; Relative and constrained motion; Space curvilinear motion; Kinetics of Particles; Force, mass and acceleration; Work and energy; Impulse and momentum; Impact problems; System of particles; Kinematics and Kinetics of Rigid Bodies; Translation; Fixed axis rotational; General plane motion; Coriolis acceleration; Work energy; Power; Potential energy; Impulse-momentum and associated conservation principles; Euler equations of motion and its application.

Unit 5: Practical Mechanics
Exploring mechanical properties of model making materials through experiments; Introduction to DIY culture; Building mechanisms using workable materials; Exploring degrees of freedom, joints and links through experiments. 4 Bar Mechanisms, Grash of Criterion, Crank-Rocker, Double Crank, Double Rocker, and Slider-Crank mechanisms; Bio Mechanics; Introduction to the mechanical aspect of bio-mimicry, skeletal mechanisms of animal limbs, skeletal mechanisms of human limbs, structural characteristics of plants, structural characteristics of exoskeletons; Introduction to Control Systems; introduction to mechanical switches, power trains and experimentation with actuators and motors; Introductions to Arduino and Raspberry Pie;

References

Course outcome
Theoretical understanding of how mechanisms and mechanical forces behave.
Ability to create simplified versions of complex mechanisms.
Ability to rapidly test mechanical solutions.
ADS211—ARCHITECTURAL STUDIES IN DESIGN—I, SPACE AND HABITAT

Unit 1: Space
Concept of Occupation; occupied spaces; unoccupied spaces; Built Spaces; natural Spaces; Landscapes; Arenas; Concept of boundary; Physical Boundaries; Imaginary boundaries; Interior Space; Lighting and illumination, Climatology; Concept of Play; Recreation; Comfort and Safety parameters; Activity Oriented Spaces;

Unit 3: Evolution of Spaces
Visual concepts of Area and Volume, history of built spaces, history of settlements; Concept of Home; Shelters; Dwellings; Settlements; Solitary living; Co Habitation; Cooperative living; Adaption; Structure and Dynamics of Built Spaces; Residential; Commercial and Industrial Spaces; Evolution of agrarian society; prehistoric settlements; Evolution of rituals and customs; Rural Sanitation; Rural connectivity; Migration patterns;

Unit 4: Visual Design in Spaces
History of Aesthetics in architecture; Hedonistic Vs Ascetic design of spaces; Design movements (-isms e.g., Modernism, post modernism, Memphis, art deco)

Unit 5: Utilitarian Spaces
Origin of commerce; commercial spaces; High density habitats; industrialization; post industrialization; Urban Housing; Fundamentals of interior design and exhibitions; Public Spaces, Mobility oriented spaces;

References
Various, A Dictionary of Color Combination (Sanzo Wada’s works), Seigensha Art Publishing, 2011
Charles Correa, A Place in the Shade, Penguin India, 2010
Katherine S. Willis, Net spaces: Space and Place in a Networked World, Routledge, 2017
Meg Boulton, Jane hawkes, Place and Space in the Medieval World, Routledge, 2017

Course outcome
Understanding the concept of space and Place from a designer’s point of view
Ability to differentiate between qualities of built and natural spaces
Understanding human behaviour in isolated and shared spaces
Understanding the need to utilize spaces for gratification
Unit 1: Information
Processing information – Coding & Decoding; Sender, Channel and Receiver; Signs and their meanings in Indian cultures

Unit 2: Communication
Study of relationships between Signifier, Signified and context, Denotation and Connotation; Communicating through gestures, voice, type and visuals; Designing visual messages to send meanings

Unit 3: Introduction to Semiotic Perspective
Goals of Semiotic Analysis; Sign: Concept and Types; Codes: Concepts, Types and Sharing; Process of Signification: Connotation and Denotation

Unit 4: Semiotic Interpretations and Culture
Metaphors; Myths: Concept and Debates; Communication as Text / Discourse; Ideology: Link to Meaning Making

Unit 5: Introduction to Rhetoric Perspective
Origin and Evolution; Functions of Rhetoric; Key Elements of Rhetoric; Introduction to Indian Thoughts on Rhetoric

Unit 6: Rhetoric Presentation and Effects
Rhetorical Schemes and Devices; Elements of Rhetoric Presentation; Analyzing Rhetorical Presentation; Making Rhetorical Presentation

References
Arthaya, Seminar on Visual semantics, IDC, IIT Bombay 1992
ADS213 – MODEL MAKING AND HAND TOOLS

WORKSHOP

Unit 1: Introducing Plastic Polymers
Properties and usage of thermoplastics and thermosetting plastics.

Unit 2: Plastics
Process of selection and applications of plastics for engineering and consumer products.

Design limitations and specific advantages of plastic molding processes. Property change on recycled plastics.

Environmental impact of disposable plastic products, recycling methods of different types of synthetic polymers, biodegradation, UV degradation

Unit 3: Elastomers
Properties, processing and use of natural and synthetic Rubber

Unit 4: Ceramics
Properties, Processing and use of ceramics and glass.

Unit 5: Natural materials
Properties of natural materials like wood, bamboo, cane, leather, cloth, jute and paper and their use at craft and industry. Workshop practice of woodworking and wood carving.

Preferences
J. Garratt, Design and Technology, Cambridge University Press, UK, 20004
R. Thompson, Manufacturing processes for design professionals, Thames & Hudson, London 2007

Course Outcome
Understanding of the behaviour and properties of plastic components
Understanding of deformable materials
Finding out biodegradable replacements of polluting materials
UNIT 1: POINTS
Point Cloud data Handling; Fitting curves and surfaces through point Clouds; Interpolation basics

UNIT 2: CURVES
Scanning and tracing Sketches; Curve hierarchy, ISO-Curves; End Tangents; Multi Span Bezier Curves;

UNIT 3: SURFACE CONSTRUCTION
Tolerances; open and closed surfaces; trimmed and untrimmed surfaces;

UNIT 4: FREEFORM SURFACE MODELING
Sculpting with Control vertices; Sculpting with ISO-Curves

UNIT 5: PARAMETRIC SURFACE MODELING
Parent-Child Relationships, Nesting; Feature Arrays; Nesting; Design Variations;

UNIT 6: FUNDAMENTALS OF CLASS A SURFACE MODELING
G0, G1, G2, G3 Continuity, Optical Analysis of Multi-span surfaces, Curvature Analysis

REFERENCES
Christoph M. Hoffmann, Geometric and Solid Modelling: An Introduction
Alejandro Reyes, Beginners Guide to SolidWorks, SDC Publications

Course Outcome
Ability to create Engineering CAD ready Surface models
Ability to conduct design iterations in CAD software
A craft/cottage Industry

Understanding of the current and past scenario of craft and cottage industries of Uttar Pradesh or any other state of India.

Field study of selected craft and cottage industry and pinpoint lacuna in their process/artifacts etc.

Course Outcome

Comprehensive understanding of the history and present state of one cottage industry/craft of Uttar Pradesh or India

Aptitude to conduct thorough field research and collect qualitative and quantitative information which may be useful for other industries and people
Lectures on simplicity; Complex nature of simple products; Single Function Products; Material Property as function; Form as function.

Course Outcome

Ability to create innovative single component single feature solutions
ADS221–DESIGN MANAGEMENT–I, CONSUMER PSYCHOLOGY

Unit 1: Consumer Motivations
Identification of user needs and Driving Factors;
Emotional Design, Sensibility, Social Ethics and Concerns;

Unit 2: Market
Consumer Vs Buyer, Consumer Groups, Buyer Groups, Periodic Trends,
Market Gaps, Market Oriented Innovation;

Unit 3: Business Evolution
Product Planning for the future, Disruptive Innovation;

Unit 4: Product Lifecycle Management
Procurement, Process monitoring, Quality Assurance, Guarantee Statement, Warrantee Statement,
Buybacks, refurbishing;
Component interchangeability, Process Homogenization, Material Homogenization, Feature Standardization;

Unit 5: Intellectual Property
Product differentiation and identity;
Design Rights, Trademarks, and intellectual property, India Design Act;
Global and local frameworks of securing Intellectual Property Rights; indigenous intellectual property;
Indian laws and their enforcement mechanisms. International laws and their enforcement mechanism;

References
Brigitte Borja De Mozota, Design Management: Using Design to Build Brand Value and Corporate Innovation, Allworth Press, 2004
Kenneth B Khan, Product Planning Essentials, M E Sharpe Inc, 2011

Course Outcome
Understating of why people buy things
Ability to offer relevant products which people need
Awareness about Design Rights and their enforcement by law
**ADS222—DESIGN THINKING**

**Unit 1: Intention**
Understanding Empathy; User stories; interpretive research;

**Unit 2: Problem Definition**
Visual representation of problem statements; contextualization and validation of a problem set; Heat maps; polar maps; Data visualization methods;

**Unit 3: Scenario Building**
Mapping solutions; partial solutions; incremental solutions

**Unit 4: Ideation**
Brainstorming; Differential Discussion; group methods to generate ideas; solitary methods to generate ideas; Lateral Thinking

**Unit 5: Concept Detailing**
User Journey maps; User stories; activity mapping; feature matrix

**References**

John Thackara, In the Bubble: Designing in a Complex World, The MIT Press, 2005
Bruce Hanington, Bella Martin, Universal Methods of Design: 100 Ways to Research Complex Problems, Develop Innovative Ideas, and Design Effective Solutions, Rockport Publishers, 2012
Donald A. Norman, Living with Complexity, MIT Press, 2010
Jeffrey Whitten and Lonnie Bentley, Systems Analysis and Design Methods, McGraw-Hill/Irwin, 2005

**Course Outcome**
Ability to comprehend large scale problems.
Ability to come up with radical solutions in relatively short time.
ADS223–SOLID MODELING IN COMPUTER AIDED DESIGN

Unit 1: Solid Modeling basics
Linear Extrusion; Boolean operations;

Unit 2: Parametric Solid modeling
Surface handling; Curvature handling; thickness handling

Unit 3: Assembly
Skeleton modeling; DOF restriction; reference matching; tolerances;

Unit 4: Product integration in CAD
Bottom-Up Modeling; Top-Down Modeling; Fasteners;

Unit 5: Variation
Design explorations

Unit 6: Drafting
Drafting and generating 2D drawings from 3D models
Generation of Bill of materials

References

Christoph M. Hoffmann, Geometric and Solid Modelling: An Introduction
Alejandro Reyes, Beginners Guide to SolidWorks, SDC Publications

Course Outcome

Ability to finalize component level design
Ability to improvise a design before making physical model
Ability to simulate and analyse a solution
Ability to furnish production details
ADS261 – NATURE AND FORM

Form and metaphors

Inspirations from nature, Utility, Evolution

Biomimicry, Biosimilar shapes and volumes, Exoskeletons, Structures

Bionics, Biosimilar components of mechanisms

Applications in product Design

3D modeling

References

Alan Powers, Nature in Design: The Shapes, Colors and Forms that Have Inspired Visual Invention, Conran, 2002

Course Outcome

Ability to take inspiration from nature to solve product design trials
ADS291 –DESIGN PROJECT–II, DISPLAY AND CONTROL DESIGN

Orientation: Cognitive Ergonomics

Unit 1: Morphology
Morphology of Interactive media; Data; Consumer; Input Channels;
Response mechanisms; gratification models; Activity mapping; Stimulus-Response;
Action-Reward;

Unit 2: Narrative
Storytelling and narratives in Interactive media

Unit 3: User Experience
Experience design and interactive media

Unit 4: Information Architecture
Information Structuring, time and space for Interactive Medias

Unit 5: User Interface Design
Design of multi-modal interfaces for text, graphics, animation, video, audio, games, etc.

Project Work
Designing interactive media for public use - installations, Museums and community facilities

References
Noah Wardrip-Fruin (Editor) and Nick Montfort, The New Media Reader, MIT Press, 2003
Robert Klanten, Interactive Installations and Experiences, Die Gestalten Verlag, 2011

Course Outcome
Practical Application of Cognitive and Physical Ergonomics
Understanding Mental models
Understanding how people react with digital devices
ADS311 – CREATIVE NARRATION

Unit 1: Story
Story, narrative and meaning making, metaphors

Unit 2: Objective
Premise and problem statement, Context

Unit 3: Protagonist
Characters and personas, examples of Don Quixote, Karna

Unit 4: Chain of Events
Plot and Scenarios

Unit 5: Dynamics
Relationship between problems, need and conflict, rationalization of need, rationalization of conflict

Unit 6: Closure
Conflict, Action and Resolution

References
Mike Korolenko and Bruce Wolcott, Storytelling and Design: Media Literacy for the Digital Age, Pearson Learning Solutions, 2005
Marie-Laure Ryan (editor), Narrative across Media: The Languages of Storytelling, University of Nebraska Press, 2004
Kristin M. Langellier and Eric E. Peterson, Storytelling In Daily Life: Performing Narrative, Temple University Press, 2004

Course Outcome
Ability to comprehend and draft user stories.
Ability to document user experience in a retainable form.
Unit 1: Artistic Creation
Complete understanding of Perception, Communication, Imagination, Expression, and Creativity for artistic creation.

Unit 2: Art & Design Movements
To understand the thoughts and techniques involved in important art movements - Impressionism, Cubism, Constructivism, Optical Art, Kinetic Art etc. Students are expected to express their ideas through Posters, Murals, Building Art, Collage, Graffiti, 3D-Installations.

Unit 3: Ethnography and Anthropology
Observations/Analysis; Community-Based Ethnographic Research; Activity Theory; Empathy in Design; Value Sensitive Design; Historical development of fieldwork; relations between field methods and dominant theoretical orientations; varieties of fieldwork at present; the implications; Ethnographic research design as a continuous process; the formulation of research problems.

Unit 4: Introductory Sociology & Psychology
Sociology as a Science of Human Society: Introduction: - Basic concepts (Roles, Norms, Values, Groups and Institutions), Social Structure, Culture, Perspectives (Functionalist, Conflict & Interactionist), Psychological Perspectives and Approaches;

References
Amy. E. Aniston, Graphic Design Basics (IInd Edition)
Lydia Darbyshire, Practical Graphic Design Technique
Batya Friedman and Alan Borning, Value Sensitive Design and Information Systems
Julian Murchison, Ethnography Essentials: Designing, Conducting, and Presenting Your Research

Course outcome
Develop visual awareness of the present day environment.
Recognize and relate design forms to historical precedents and possible future developments.
Have a greatly increased general knowledge, including source material which he/she can draw on for future student and development in the field of design
Producing reliable information about human, social life and culture.
Course Outcome

Ability to communicate novel ideas to general stakeholders

Unit 1: Explaining Ideas
Briefs, Detailed Briefs and Concept Notes

Unit 2: Scale of Work
Approximation, Cost Estimation

Unit 3: Discussion
Knowledge Management, Feedbacks, Information loops, Updates

Unit 4: Record Keeping
Activity Documentation and Reporting

Unit 5: Scope of Work
Induction, Work distribution, Task Assignments
Time management, Scheduling

Unit 6: Presentation
Informal and Formal Communication; Top-Down, Bottom-Up, Diagonal and Lateral Communication; Pitch Presentations.

References


Business Press.
Course Outcome
Ability conduct objectivist research
Ability to understand large scale data
Ability to understand collective behaviour

Unit 1: Elements of Research
Data; Variables and constants; Concepts and constructs; Theories and observations;

Unit 2: Logic
Inductive; Deductive;

Unit 3: Sampling
Basic concept; Representativeness; Probability and non-probability sample- concepts; Types of probability and non-probability samples; Practical guidelines for sampling

Unit 4: Quantitative Methods and Statistics
Surveys: importance, types, uses, guidelines for framing questionnaire; Content Analysis- basic concepts, Characteristics and uses; Distribution;

Unit 5: Statistics in media research
Measures of Central tendency; Descriptive statistics, Correlations, Inferential statistics- chi square, t – test

Unit 6: Field Work
Taking up a topic and collecting data from locations; Equivalent to 8 lecture hours;

References
A. Hansen, Mass communication research methods. New Delhi: Los Angeles, 2009
Course Outcome
Understanding of how humans address their need to interact with others as social animals

Unit 1: Connectivity
Communication channels; interpersonal communication; mass communication; Public Information systems; Information Services; Information Consumption patterns; Internet of Things;

Unit 2: Movement
Movement of Goods; Movement of People; Modes of Transportation; Individual Movement; Mass movement; Transportation as service; Transit Systems; Commuter centric Design; Public Vs Individual information systems; Mobile navigation; mental maps; Traffic Management;

Unit 3: Engagement
Public gatherings; Public events; Event management and planning; Crowd Management;

Unit 4: Infrastructure
Resources sharing and management; Delivery systems; Consumption patterns; Occupancy patterns; Remote Area Connectivity; Rural Transportation; Rural Road networks; Urban Connectivity; High Density Transportation; Transit Oriented Development; Public Safety; Accessible Design; Universal Design in Public Transportation; Universal Design in Communication technologies;

Unit 5: Sustainable Transportation
Structure and design flaws of Public Transportation; Alternative Energy resources for transportation; Anatomy of Electric Vehicles;

References
Caspers, Mar, Designing Motion, Automotive Designers 1890 to 1990, Birkhäuser, 2017
Alice Foxley, Distance and Engagement: Walking, Thinking and Making Landscape, Lars Müller, 2001
Kevin Thwaites. Sergio Porta, Urban Sustainability Through Environmental Design: Approaches to Time-People-Place Responsive Urban Spaces, Taylor & Francis, 2007
Herwig, Oli, Universal Design, Solutions for Barrier-free Living, Birkhäuser, 2008
Emphasis on the skill of workshop methods. Hands on techniques to manipulate the basic materials according their understanding. Exposure to the students on some of the software on Product Design and Visual Design. The focus of the course is teaching the students about design intent and how software can be utilized for the maximum benefit of the designer. The student project involves making products out of concepts in virtual environment.

References

Sherwin, D.Creative workshop: 80 challenges to sharpen your design skills. How Books.2013
Fullerton, T., Swain, C., & Hoffman, S. Game design workshop: Designing, prototyping, & playtesting games. CRC Press. 2004
Orientation

Unit 1: Theory
Use of HCI methods (Contextual Enquiry, Focus Groups, Interviews, etc.) for understanding the user and his requirement.

Unit 2: Research
Understanding the factors that define user experience.

Unit 3: Design
Design of multi-modal interfaces, expressive interfaces, audio interfaces, tangible interfaces and gestural interfaces.

Design of interactive systems, products for future use, Collaborative products to be used in groups, devices for rural applications and devices for use in public places

References

Donald A. Norman, Invisible Computer: Why Good Products Can Fail, the Personal Computer Is so Complex and Information Appliances Are the Solution, MIT Press, 1998
Brenda Laurel, Computer as Theater, Addison-Wesley Pub Co, 1993
Unit 1: Principles of Visual Design Refresher
Understanding visual culture; Visual Theories; Visual Design; Symbolism, Time, Sound; Point of View

Unit 2: Visual Art
Visual art History; Painting; Architecture and Sculpture; Artistic Styles;

Unit 3: Aesthetic Experience
Modes of Aesthetic Experience; Basics of Aesthetic values; Aesthetics of Thinking and Creativity; Taste and Aesthetes; Aesthetics of Symbols and Language;

Unit 4: Visual Experience
Photography and Moving Images; Historical, Technical and Cultural Perspective; Ethical and Critical Perspective; Motion Pictures; Television and Video; Reality Shows;

Unit 5: Branding and Identity
History of branding; structure of a Brand; Brand language; Logos; Copywriting; Typeface; Brand Placement; Brand Guidelines;
Structure of Identity; Visual Abstraction; Metaphors; Communication; Representativeness; Evolution;

References
Ralf E. Wileman, Visual Communication
David Sless, Learning & Visual Communication
Friedrich O. Huck and Carl L. Fales, The Digital Evolution: Visual Communication in the electronic age
Zia-Ur-Rehman, Visual Communication an Information Theory Approach
Margaret Mark, Carol Pearson, the Hero and the Outlaw: Building Extraordinary Brands through the Power of Archetypes, McGraw Hill, 2001
Unit 1: Regression models
Linear regression, Simple regression, Ordinary least squares, Polynomial regression, General linear model;
Generalized linear model, discrete choice, Logistic regression, Multinomial logit, mixed logit, Probit, Multinomial probit, Ordered logit, Ordered probit, Poisson;
Multilevel model, fixed effects, Random effects, Mixed model;

Unit 2: Nonlinear Regression
Nonlinear regression, Nonparametric, Semiparametric, Robust, Quantile isotonic, Principal components, Least angle, Local, Segmented, Errors-in-variables;

Unit 3: Statistical Extrapolation
Probability Distribution; Linear extrapolation; Polynomial extrapolation; Conic Extrapolation; French Curves;
Least squares, Ordinary least squares, Linear, Partial, Total, Generalized, Weighted, Non-linear, Non-negative, Iteratively reweighted, Ridge regression, Least absolute deviations, Bayesian, and Bayesian multivariate Linear Regression.
Statistical Forecasting; Average, Naive, and seasonal Naive approaches, Drift method;
Qualitative forecasting methods, informed opinion and judgment, Delphi method, market research, and historical life-cycle analogy;
Quantitative Forecasting methods, Time Series methods, last period demand, simple and weighted N-Period moving averages, simple exponential smoothing, poisson process model based forecasting, and multiplicative seasonal indexes; Extreme Value Theory

Interpretive approach: Cool hunting; Dead Reckoning;

Unit 4: Data Visualization
Data Point, Bar, Stack, Pie, Donut, and Dot charts; Histograms;

Unit 5: Graphic Design and Data Visualization
Infographics Design project

References
A. Hansen, Mass communication research methods. New Delhi: Log Angeles, 2009
ADS323–MATERIAL AND PROCESSES IN DESIGN–II, UNCONVENTIONAL MANUFACTURING

Unit 1: Material Deposition Processes
Laser Deposition, Micro-Plasma Powder Deposition, Chemical vapor Deposition, Micro Welding, Powder Casting
Metal 3D Printing, Powder Deposition 3D printing;

Unit 2: Subtractive Processes
Electrochemical machining, Electro-Discharge machining, Ultrasonic Machining, Laser Beam Machining, Water jet machining, Abrasive Jet Machining, Plasma Arc machining

Unit 3: Cutting and Removal
Water jet Cutting, Plasma Cutting, Laser Cutting, Electro-Discharge Wire Cutting; Abrasive Jet Cutting

Unit 4: Additive Extrusion Processes
Extruded Filament 3D printing, Clay 3D printing, Stereo lithography

Unit 5: Special Purpose Manufacturing processes
Rot molding, Layer Compression, Sheet contouring, Friction Welding

Unit 6: Surface Treatment Processes
Laser Etching, Acid/Base Etching, Electro Chemical Etching, Sand Blast Etching, Ultraviolet Etching, Photochemical Machining

Electro Chemical Polishing

References
Unit 1: Sensing
Feedback systems, mathematical modelling of physical systems;

Unit 2: Signals
Laplace transforms, block diagrams, signal flow graphs, state-space models;

Unit 3: Data
Time domain analysis: performance specifications, steady state error, transient response of first and second order systems;

Unit 4: Processing
Stability analysis: Routh-Hurwitz stability criterion, relative stability; proportional integral, PI, PD, and PID controllers;
Lead, lag, and lag-lead compensators;

Unit 5: Analysis
Root-locus method: analysis, design;
Frequency response method: Bode diagrams, Nyquist stability criterion, performance specifications, design; State space methods: analysis, design; Physical realizations of controllers: hydraulic, pneumatic, and electronic controllers.

References
K Ogata, Modern Control Engineering, 4th Ed., Pearson Education Asia, 2002
M Gopal, Modern Control System Theory, 2nd Ed., New Age International, 1993
Orientation

Product Integration; Forward Integration; Backward integration;
Top – Down Design Approach; Bottom-Up Design Approach;
Reverse Engineering; Proof Of concept;

Course Outcome

Ability to break down complex product ideas into smallest components
Ability to build functional prototypes
DS411—PROFESSIONAL PRACTICE IN DESIGN

Unit 1: Entrepreneurship
Social Entrepreneurship, Business Entrepreneurship, Trading Entrepreneurship, Corporate Entrepreneurship, and Agricultural Entrepreneurship;

Unit 2: Business Foundation
Timmons Model of Entrepreneurship, Investment Models, Startup Business Models, Business Plans, Pitch presentations, Small Business models;

Unit 3: Legal aspects of business
Contracts and Agreements, Conflict Resolution, Arbitration;

Unit 4: Running a Design Business
Set up of an independent design business, Hiring processes, Project Scheduling and work delegation, Cost Estimation;

Unit 5: Intellectual Property
Registration process of Intellectual property Rights, Design Registration, and Brand/Trademark Registration;

Unit 6: Accounting
Billing, salaries and taxation;

References

Course Outcome
Understanding of how modern businesses start and run.
Ability to supervise and manage live design projects
Basic skillset of a design business owner
ADS412 – FORM IN FOUR DIMENSIONS

Unit 1: Projection and Transition
Movement of Light around a Form, Movement in time and space.
Movement of Space around a Form
Kinematic Structures, Mechanisms, spontaneous, automatic and reactive dynamic forms

Unit 2: Transformation
Fluid Forms, Semi Fluid Forms, Semi Solid Forms

Unit 4: Evolution
Feature based evolution; Content based evolution; Environment Based Evolution

Unit 5: Union and Separation
Merger, Conformity, Subtraction, Division

Unit 6: Decay
Concept of Decay, Examples from nature, examples of manmade objects

References
Lung-Wen Tsai, Mechanism Design: Enumeration of Kinematic Structures According to Function, CRC Press, 2001
Sibel Deren Guler, Madeline Gannon, Kate Sicchio, Crafting Wearables: Blending Technology with Fashion, 2016

Course Outcome
Understanding of evolution of shapes and forms with time
ADSM413–MATERIALS AND PROCESSES–III,
PRODUCTION PLANNING

Unit 1: Fundamentals of Mass Production
Introduction, Production Planning and Control, Value analysis and value engineering

Unit 2: Structure of Mass Production
Plant location and layout, Equipment selection, Maintenance planning

Job, batch, and flow production methods

Group technology, Work study, Time and motion study, Incentive schemes, Work/job evaluation, Inventory control,

Unit 3: Manufacturing planning
MRP, MRP-II, JIT, CIM, Quality control, Statistical process control, Acceptance sampling, Total quality management, Taguchi’s Quality engineering.

Forecasting, Scheduling and loading, Line balancing, Break-even analysis.

Unit 4: Operations
Introduction to operations research, linear programming, Graphical method, Simplex method, Dual problem, dual simplex method, Concept of unit worth of resource, sensitivity analysis, Transportation problems, Assignment problems

Network models: CPM and PERT, Queuing theory

Unit 5: Alternatives of Mass production
Studio hours to be committed to explore 3D printing and additive manufacturing

References
S. L. Narasimhan, D. W. McLeavey, and P. J. Billington, Production, Planning and Inventory Control, Prentice Hall, 1997
At a sponsor business

Students in this semester would avail opportunity to work with design firm under the guidance of practice professional for 6-8 weeks.

Course Outcome

Work Experience under the guidance of practice professionals
Location and Industry/Craft

Understanding of the history and present state of one cottage and craft industry of UP. To understand the conventional processes, materials and prepare a product catalog, Design Insights and proposals for survival and advancement of the subject industry/craft

Course Outcome

Comprehensive understanding of the history and present state of one cottage industry/craft of Uttar Pradesh or India

Design inputs for the benefit of the targeted craft/cottage industry

Aptitude to conduct thorough field research and collect qualitative and quantitative information which may be useful for other industries and people
ADS481 – DESIGN PROJECT – V, SYSTEM THINKING IN DESIGN

Unit 1: System Thinking

Lectures on Design Thinking and System Thinking from Design perspective. The Fifth Discipline approach. Scenario Maps and Metaphors

Unit 2: Problem Solving

Design of system level solutions so that design can be thought of modularly as suited for different combinations and applications.

Unit 3: Complex Systems

Understanding, strategizing, conceptualizing and designing for complex systems.

Unit 4: System Design

Designing complex artefacts. Design solutions that are suitable for transportation, education, publishing, retailing, etc.

References

John Thackara, In the Bubble: Designing in a Complex World, The MIT Press, 2005
Bruce Hanington, Bella Martin, Universal Methods of Design: 100 Ways to Research Complex Problems, Develop Innovative Ideas, and Design Effective Solutions, Rockport Publishers, 2012
Donald A. Norman, Living with Complexity, MIT Press, 2010
Jeffrey Whitten and Lonnie Bentley, Systems Analysis and Design Methods, McGraw-Hill/Irwin, 2005

Course Outcome

Ability of comprehend large scale problems
Skillset to work in the collaborative dynamic of a design team
Development of systemic approach to solve ill-defined problem
Social/environmental awareness
Sponsored/Self Sponsored full time Project

Students in this semester would take sponsored /self-sponsored fulltime project (technically complex project). The students can do design degree project in house but it would be advisable for them to go to industry/design firm and do the design degree project.
ELECTIVES

**ELECTIVE I**
- ADS331a Sustainable Design
- ADS331b Furniture & Interior Design
- ADS331c Frugal Innovation

**ELECTIVE II**
- ADS332a Design of Medical Equipment
- ADS332b Mobility and Vehicle Design
- ADS332c Aerospace Design

**ELECTIVE III**
- ADS341a Videography and Film Making
- ADS341b Graphics and Animation
- ADS341c Typography

**ELECTIVE IV**
- ADS342a Interaction Design
- ADS342b Universal Design
- ADS342c Toy and Games Design

**ELECTIVE V**
- ADS431a Photography and Image Processing
- ADS431b FEM and Optimization Tools
- ADS431c Mechatronics

**Course Outcome**
To make students specialized in particular domains
### Evaluation Scheme

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### SEMESTER VIII

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