Programme Structure and Syllabi for Bachelor of Design (B Des) (2023 batch onwards)

Department of Production and Industrial Engineering

Punjab Engineering College (Deemed to be University) Chandigarh, India

Teaching Scheme for B. Des.
(Courses/Credit Distribution-2023)

FIRST YEAR

Semester-I

Course Code	Subject	Credits	L	T	P	Category
OR2302	Orientation and Introduction to Discipline (1 Credit))	2	1	0	0	
BD2301	World of Design	3	2	1	0	DCC
BD2302	Sketching 2D/3D & Rendering	4	2	0	4	DCC
ES2308	Tinkering Studio	3	1	0	4	ESC
HS2351	Communication Skill & Ethics (HSM-I)	3	2	0	2	HSM
ES2309	Materials and Manufacturing	3	2	0	2	ESC
ES2310	Engineering Drawing and CAD	4	2	0	4	ESC
GS2301	Introduction to Environmental Sciences	1	1	0	0	GSC
	Total	**23**				

Semester-II

Course Code	Subject	Credits	L	T	P	Category
BD2303	Design Thinking	3	2	1	0	DCC
BD2304	Creative Visualization Techniques	4	2	0	4	DCC
BD2305	Principles and Elements of Design	3	2	0	2	DCC
BD2306	Introduction to Sustainable Design	3	2	0	2	DCC
BD2307	Design Case Studies	3	2	0	2	DCC
ES2311	Basics of Computer Graphics	3	2	0	2	ESC
BD2308	Design Project-I (Problem Identification and Analysis)	2	0	0	4	Project
GS2302	Universal Human Value	1	1	0	0	GSC
	Total	**22**				

SECOND YEAR

Semester III

Course Code	Subject	Credits	L	T	P	Category
	Mathematics	4	3	1	0	BSC
BD2321	Design Arts and Aesthetics	4	3	0	2	DCC
BD2322	Basics of Interactive Design	4	3	0	2	DCC
BD2323	Physical Ergonomics	4	3	0	2	DCC
BD2324	Programming for Designers	4	3	0	2	DCC
BD2329	Design Project-II (Creative Exploration)	2	0	0	4	Project
	Total	**22**				

Semester IV

Course Code	Subject	Credits	L	T	P	Category
BD2326	Product Design & Development	4	3	1	0	DCC
BD2327	Form and Product Photography	4	2	0	4	DCC
BD2328	Cognitive Ergonomics	4	3	0	2	DCC
BD2361	Form Language	4	2	0	4	DCC
BD2362	Department Elective Course-I	4	2	0	4	DEC
BD2330	Design Project-III (Prototyping and Testing)	2	0	0	4	Project
	Total	**22**				

THIRD YEAR

Semester V

Course Code	Subject	Credits	L	T	P	Category
BD2331	AI in Design	3	2	0	2	DCC
BD2332	Industrial Design	4	3	0	2	DCC
BD2333	Design Forecasting and Trend Research	3	2	1	0	DCC
BD2334	Design, Media and Technology	4	3	0	2	DCC
	Department Elective Course-II	4	3	1	0	DEC
BD2335	Minor Project (Collaborative Design Project)	2	0	0	4	Project
	Total	20				

Semester VI

Course Code	Subject	Credits	L	T	P	Category
BD2336	Internship (Optional) *	12				Internship
	Students opting for course work will do Dept. Electives (8 credits), Project work (4 credits)					
	Total	12				

*Internship Seminar presentations may be held a week before the date of Registration in Semester-I of 4th Year

FOURTH YEAR

Semester VII

Course Code	Subject	Credits	L	T	P	Category
	HSM-II	4				HSM
	Department Elective Course-III	4				DEC
	Department Elective Course-IV	4				DEC
BD2341	Major Project-I	3	0	0	6	Project
	Open Elective Course-I	4				OEC
	Open Elective Course-II	4				OEC
	Total	23				

*Evaluation needs to be carried out in next semester

Semester VIII

Course Code	Subjects	Credits	L	T	P	Category
	HSM-III	4				HSM
	Department Elective Course-V	4				DEC
	Department Elective Course-VI	4				DEC
	Open Elective Course-III	4				OEC
	Proficiency	2				Proficiency
BD2342	Major Project-II	4	0	0	8	Project
	Total	22				

List of Electives

Department Elective-I

- Nature and Form
- Animation Design

Department Elective-II

- Supply Chain management
- Materials and Design
- Material Management
- Operations Research

Department Elective-III

- Product Semantics
- Product Life Cycle Analysis

Department Elective-IV

- Business Process Reengineering
- Entrepreneurship
- Technology Management

Department Elective-V

- Quality & Reliability Engineering
- Value Engineering
- Design Research Methodology

Department Elective-VI

- Universal Design
- Applied Ergonomics
- 3D Modelling and Prototyping
- Quality & Reliability Engineering

DCC	69
DEC	24
BSC	4
GSC	2
ESC	13
Project	13
Internship	12
OEC	12
HSM	11
Proficiency	2
Orientation	2
Total	**164**

Course Name	**:**	**World of Design**
Course Code	**:**	**BD2301**
Credits	**:**	**3**
LTP	**:**	**2-1-0**

Course Objectives:

The main objectives of this course are:	
1.	To introduce various domains of design and understanding of design process.
2.	To develop the ability to identify problems and finding creative solutions.

Total No. of Lectures: 28

Total No. of Tutorials: 14

Sr. No.	Course Contents	No. of Lect.
1.	**Introduction to Design** History & evolution of design, Landmark discoveries & inventions, Design & its relationship with environment (art, craft, culture, society & technology), Various domains in design and design professions.	**04**
2.	**Creative Thinking** Logical Thinking vs. Creative Thinking, Exploring creativity through various mediums, Interpreting creativity through Navrasa.	**05**
3.	**Problem Identification** Methods & Techniques, Observation, Identification and analysis of a problem.	**04**
4.	**Design Process** Understanding the design process, Exposure to various design terminologies, Case studies on Design process, Overview of system design.	**05**
5.	**Introduction to Product Design** Definitions of material, process and product. History and examples of product design. Fundamentals of product development cycle. Concept of end user. Defining user groups. Concept of market. Defining the market gap.	**05**
6.	**Design- Beyond product design** Introduction to Experience Design, Service Design, System Design, etc.	**05**

Course Outcomes:

At the completion of this course, students would be able to:	
1.	To state the importance of design in various domains to students.
2.	To discuss the design process and methodology with students.
3.	To develop the art of creative thinking in students.
4.	Student will be able to analyse the problem from all aspect.
5.	Students will be able to assess the creative solutions of the problem.
6.	Students will be able to propose an optimum design solution.

Bibliography:

Sr. No.	Name of Book/ Authors/Publisher	Year of Publication/ Reprint
1.	Don Norman; Design of Everyday Things.	2014
2.	Don Norman; Emotional Design, Why we love (or hate) Everyday things.	2003
3.	David Raizman; History of Modern Design, Prentice Hall.	2004
4.	William Lidwell, Kritina Holden, Jill Butler; Universal Principles of Design.	2003
5	Edward de bono; Lateral Thinking.	2010

Course Name	**:**	**Sketching 2D/3D & Rendering**
Course Code	**:**	**BD2302**
Credits	**:**	**4**
LTP	**:**	**2-0-4**

Course Objectives:

1.	To observe and represent images, ideas, concepts and improve coordination of eye and hands.
2.	To develop an ability to visualize and articulate the thinking process.

Total No. of Lectures: 28

No. of Lab hours: 28

Sr. No.	Course Contents	No. of Lect.
1	**Basics of free hand drawing and perceptions** Movement of fingers, elbows and arms in sketching and drawing. Basics of drawing tools and media. Exercises for improving manual dexterity in drawing. Improving of observation. Representation of textures. Freehand plotting and layout. Perception of Edges, surfaces, spaces, relationships, light and shadows, whole or gestalt.	5
2	**Basics of Rendering** Shading, filling areas, shading a cube, cylinder and sphere, basics of shadows on cube and cylinder Shading corners, cones, spheres, combined shapes, different materials and vignettes.	5
2	**Nature Drawing** Analysis and appreciation of natural form through visual reference. Capturing of an overall form-character, overall proportions and fine details. Understanding depth, light and shade.	4
3	**Human Figure Study** Over all human form study with actual model, quick sketching to enhance observation. Human body details – understanding of form, relative proportions and details by rendering techniques.	6
4	**Dimensional Solids** Drawing basic solid (cube-cone-sphere) and understanding its hidden dimension and structure in perspective.	4
5	**Perspective Study** Simple one point and two-point perspective of interior and exterior spaces. Complex perspective.	4

Course Outcomes:

At the end of the course, students will be able to:	
1	Understand and draw with correct proportions.
2	Identify the perspectives of depth and volume.
3	Understand and gain the skills of representing 2D space.
4	Analyze and visualize the products in 3D space.
5	Evaluate some criteria for aesthetic decision making abilities in design.
6	Design and understand some basic modules in 2-D and 3-D.

Lab Work

Sr. No.	Lab contents	No. of Hrs
1	Exercise on movement of fingers, elbows and arms in sketching and drawing	4
2	Exercise on improving manual dexterity in drawing.	4
3	Exercise on freehand plotting and layout	4
4	Exercise on shading, filling areas of cylinder, cones etc.	4
5	Exercise on shading and depths in “Nature Drawings”.	4
6	Exercise on shading and depth with respect to “Human figures”.	4
7	Exercise on perspectives of interior and exterior spaces	4

Reference Books

S. No.	Name of Authors/Books/Publishers	Year
1.	Steur, R. & Eissen, K. (2011). Sketching: The Basics. BIS Publishers.	2011
2.	Norling, E. (2008). Perspective Made Easy. BN Publishing	2008
3.	Henry, K. (2012) Drawing for Product Designers. Laurence Kind Publishers	2012

Course Name	**:**	**Tinkering Studio**
Course Code	**:**	**ES2308**
Credits	**:**	**3**
LTP	**:**	**1-0-4**

Course Objectives:

The main objectives of this course are:	
1.	Inculcate the habit of thinking and making in students.
2.	Impart creativity to develop innovative design solutions

Total No. of Lectures: 14

Total No. of Labs Hours: 56

Sr. No.	Course Contents	No. of Hours
1.	**Programming** Basic Programming Concepts in C; Programming with open hardware systems like -Arduino; Raspberry Pi etc., Processing IDE.	**02**
2.	**Electronics** Introduction to electronics and components; Resistors, Capacitors, Inductors, Switches, Diodes, Transistors, Sensors and Actuators. Their Usage and applications. Integration of sensors with Programmable Logic Controllers like Arduino, Raspberry Pi. Internet of Things (IOT).	**02**
3.	**Mechanics and Manufacturing** Introduction to Robotics, Types of Robots, Wood working, Different types of wooden joints, Basics of 3D printing.	**02**
4.	**Control Systems** Open Loop & Closed Loop; Feedback Control Systems, PID Control Systems; Logical controls; On-Off Controls; Physical realization of the controllers: hydraulic, pneumatic and electronic controllers; Using programmable Logic controllers.	**02**
5.	**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.	**03**
6.	**Tinkering Projects** Tinkering with Soft and easily cut and moldable Materials; Thinking innovatively within resources.	**03**

Lab Work:

Sr. No.	Lab contents	No. of Hrs
1.	Practice C programming through Arduino IDE to interface devices such as LCD, keypad with Arduino	**4 ×2 = 8**
2.	Build simple projects using basic Electronics elements such as resistors, capacitors, inductors, Switches, diodes, transistors, sensors and actuators.	**4 ×2 = 8**
3.	Design IoT Based simple systems (e.g. Water Level Monitor, Green House Monitoring System, etc.) using Raspberry Pi.	**4 ×2 = 8**
4.	Make different types of wooden joints in the carpentry shop.	**4 ×2 = 8**
5.	Use of basic mechanics to build hydraulic lift, mini Bug Bot, DIY Grabber and functional Robotic Arm.	**4 ×2 = 8**
6.	Design simple parts/components (e.g. spanner , walking robot, mobile holder, rocket, etc.) in TinkerCad and 3D Print it.	**4 ×2 = 8**
7.	Develop innovative solutions to existing problems in daily life using Design thinking concepts.	**4 ×2 = 8**

Course Outcomes:

At the end of the course, students will be able to:	
1.	State the importance of tinkering to students.
2.	Students will learn basic electrical and electronics devices.basic programming, electronics, mechanics and manufacturing
3.	Analyse the real-time problem using design thinking concepts
4.	Evaluate various feasible solutions for problem to get optimized solution
5.	Apply their knowledge to design systems based on optimized solution
6.	Create IOT technology and 3D printing based simple projects.

Bibliography:

Sr. No	Name of Book/ Authors/Publisher	Year of Publication/Reprint
1.	Sclater, N Chironis, N. P. (2001). Mechanisms and mechanical devices sourcebook (Vol. 3) New York: McGraw-Hill.	2011
	Ratan, S. S. Theory of machines. S Chand.	1999
3.	Edward de Bono, Lateral Thinking, Penguin UK.	2010
4.	Garratt J., Design and Technology, Cambridge University Press.	1996
5.	Don Norman, The Design of Everyday Things, Basic Books.	1988
6.	Martin Gardner, 100 Perceptual puzzles, Barnes & Noble Books Pearson Education.	1995
7..	Yashvant Kanetkar, Let Us C.	1998

Course Name	**:**	**Communication Skills & Ethics**
Course Code	**:**	**HS2351**
Credits	**:**	**3**
L T P	**:**	**2-0-2**

Course Objectives:

The main objectives of this course are:	
1.	The course aims to enhance communication skills and critical thinking skills of the students to further develop their personality so as to be more effective in personal and professional life.
2.	The course further aims to provide basic knowledge in ethics, values, norms and standards.

Total No. of Lectures – 28

Lecture-wise Breakup		**No. of Lectures**
1	**Introduction to Communication Process** Scope, Significance, Types, Levels and Tools of Effective Communication. Verbal, Vocal and Non-Verbal Skills	**(1)**
2	**Critical Thinking Skills** Developing Thinking Skills-Descriptive, Referential, Inferential, Discursive, Analytical, Evaluative, Creative and Lateral Using Texts and Various Media Forms:(Books, Newspaper Articles, Films, Social Visuals)	**(4)**
3	**Speaking Skills** Developing Speaking Skills PACESS-Governed (PACESS-Purpose, Audience, Content, Expression, Structure, Style) for Communication at Various Levels: Interpersonal, Group, Organization and Society	**(3)**
4	**Advanced Technical Writing** Job Application, E-mail, PACESS-Governed Short Essay, Memo, Notice, Agenda, Minutes, IMRD-BasedReport.	**(4)**
5	**Job Preparation** Sensitization to Building Portfolio, Resume, Interview Skills	**(2)**
6	**Introduction to Ethics** Concept, Nature, Scope, Functions and Factors influencing Ethics, Psycho-Social Theories of Moral Development – Kohlberg and Carol Gilligan, Broader Ethical Issues in Society (Research Based)	**(5)**
7	**Ethics and Business** Concept and Objectives of Business Ethics, Factors influencing Business Ethics, 3 C's of Business Ethics, Ethical Dilemmas in Business (Role- Play)	**(3)**

8	**Self-Awareness & Self-Development** Concept of Self Awareness, Self- Esteem, Self-Assessment – SWOT Analysis, Concept of Self-Development, Social Intelligence, Emotional Intelligence, Time and Stress Management, Positive Human Qualities (Empathy, Gratitude, Compassion, Forgiveness and Motivation), Personality Development Models – Johari Window, Myers Briggs Type Indicator Leadership Development	**(6)**

Total No. of Practical Sessions: 14

Practical Session Wise Breakup		**No. of Practical Sessions**
1	**Organizational Communication** Verbal, Vocal and Non-Verbal Communication at Various Levels, Self-Introduction, Speech, JAM	**(2)**
2	**Applying Critical Thinking Skills** Review, Film Review, Social Visuals Reading Comprehension, Book Interpretation and Critical Analysis .	**(4)**
3	**Speaking Techniques at Different Forums** Group Discussions, Making and Presenting Power Point Presentations	**(4)**
4	**Practice on Technical Writing** Job Application, Email, Memo, Notice, Agenda, Minutes, Report, Short Essay	**(3)**
5	**Towards Job Preparation** Sensitization to Building Portfolio, Resume, Interview	**(1)**

Course Outcomes:	
1	The students will gain greater proficiency in English language and its technical aspects for its effective use in personal and professional life.
2	The students will achieve greater refinement of personality through awareness and acquisition of forms and techniques of communication skills.
3	The students will be able to distinguish between right and wrong in both personal and professional life.

Suggested Books& E-Material		
S.No.	***Name of Book/ Authors/ Publisher***	***Year of Publication/ Reprint***
1	Technical Communication: Principles and Practices, III Edition, Meenakshi Raman and Sangeeta Sharma, OUP, NewDelhi (with E-Material)	2017

2	English for Writing Research Papers, Adrian Wallwork, Springer, London, New York	2011
3	Business Ethics – Text and Cases", Murthy C.S.V., 1st Edition, Pubs: Himalaya Publishing House.	2014
4	"Issues and Ethics in the Helping Professions", Corey G., Corey M.S. and CallananP., 8th Edition, Pubs: Brooks/Cole, Cengage Learning.	2010

	Reference Books and E-Materials	
1	Business Communication III Edition, RK Madhukar, Vikas Publication House Pvt. Ltd, Noida	2018
2	Body Language, Allan Pease, Sudha Publications Pvt Ltd., New Delhi	2004
3	Techniques of Writing Business Letter, Memos & Reports, Courtland L Bovee, Jaico Publishing House, Mumbai	2005
4	Bridging the Soft Skills Gap, Bruce Tulgan, Wiley, New Delhi	2005
5	A Guide to Gracious Living Etiquette & Life Skills, Jyoti Singh, Mohindra Publishing House	2017
6	TED Talks Videos on Ted.com (Not their Regional versions)	
7	"The Curse of Self: Self-awareness, Egotism and the Quality of Human Life", Leary M.R., 1st Edition, Pubs: Oxford University Press.	2007
8	Business Ethics", Hartman L.P. and Chatterjee A., 3rd Edition, Pubs: Tata McGraw Hill.	2006
9	Positive Human Qualities (web)	https://positivepsychology.com/
10	Theory of Moral Development (web)	https://www.verywellmind.com/kohlbergs-theory-of-moral-development-2795071

Course Name	**:**	**MATERIALS AND MANUFACTURING**
Course Code	**:**	**ES2309**
Credits	**:**	**3**
LTP	**:**	**2-0-2**

Total no. of lectures: 28

Total no of Lab Hrs:28

The main objectives of this course are:	
1.	To understand and classify materials; their principles and applications
2.	To impart basic knowledge on the manufacturing techniques of various materials

Course Contents:

S. No.	Course contents	No. of Lect.
(1)	Types and Classification of Materials: Metals, Alloys, Polymer, Wood, Ceramic materials, Composite materials. Classification of wood and their application, Comparison of properties of Metals, ceramic and polymers, Criteria for selection of materials.	4
(2)	Introduction to composite materials: Definition of composites, Classification of composites; General characteristics of reinforcement- classification, terminology used in fiber science. Manufacturing techniques: Hand lay-up, Filament winding, Pultrusion, Resin transfer molding.	4
(3)	Introduction to polymers and its types, Processing techniques: Compression, Transfer, injection, blow molding, Extrusion, Calendaring, Thermoforming, Rotational molding, Dip coating (gloves, balloons etc.), fiber spinning and manufacturing processes.	4
(4)	Introduction to ceramic materials; Classification of ceramics,; Mechanical behavior of ceramics, Glass ceramics, Preparation and characterization of ceramics powders Applications of ceramics in advanced technologies	4
(5)	Introduction to Manufacturing processes of Metals Types and applications. Primary Manufacturing Processes	4
(6)	Secondary and Tertiary Manufacturing processes: Types and applications.	4
(7)	Case studies and practical examples on: (a) Manufacturing of polymer prototypes using 3D printer. (b) Manufacturing of ceramic based product (c) Manufacturing of small precision parts	4

Course Outcomes:	
1	Students would be able to analyze and choose a material for typical applications.
2	Understand and apply the process and applications of Composites, polymers, ceramics, and metallic alloys.
3	Students will be familiar with various manufacturing techniques to obtain simple/complex shapes.
4	Design/ Create a new product with given material and Injection molding
5	Evaluate and redesign of manufactured parts.
6	Understands the concepts of manufacturing of composites, polymer, ceramic and metallic components
	Material Testing practical

REFERENCE BOOKS:

Sr. No.	Book Detail	Year of Publication
1	Manufacturing Engineering & Technology, Serope Kalpakjian and Steven R. Shmid, Prentice Hall, (Pearson Publications)	2009
2	Advanced Manufacturing Processes, VK Jain, Allied Publishers	2011
3	Introduction to Basic Manufacturing, CS Jawalkar, Narosa Publishers	2016
4	W.D. Kingery, Introduction to Ceramics, 2nd ed., John Wiley & Sons	1999
5	Z. Tadmor, C.G. Gogos, Principles of Polymer Processing, 2nd ed.	2006
6	N. Chawla, K.K. Chawla, Metal Matrix Composites, Springer-Verlag.	1998

S. No.	Lab Content	No. of hours
1	Exposure to foundry tools and exercise on Pattern making	2×2=4
2	Exercise on Mould making and Casting	2×2=4
3	Exposure to Carpentry Shop and Job making with carpentry tools	2×2=4
4	Exercise/practice on Sheet metal operations i.e. Blanking, Punching, piercing, drawing etc.	2×2=4
5	Exercise/practice on Joining operations like welding, brazing and soldering	2×2=4
6	Hand on session on Machining using Lathe, milling, drilling and shaper	2×2=4
7	Exercise on materials characterization on a given job.	2×2=4

Course Name	**:**	**Engineering Drawing and CAD**
Course Code	**:**	**ES2310**
Credits	**:**	**4**
LTP	**:**	**2-0-4**

Course Objectives:

The main objectives of this course are:	
1.	To get exposure about Engineering drawing and modelling.
2.	To provide knowledge of curves, surface, solid, scanning, rendering and animations.

Total no. of lectures: 28

Total no of Lab Hrs:56

S. No	Contents	Hours
1	**Introduction:** Basics of lettering, dimensioning, types of scales and their uses, types of projections, reference planes and quadrants, projection of points keeping it in different quadrants, auxiliary planes	3
2	**Projection of lines:** Projection of Lines and Planes: simple lines, parallel lines, distance between lines, angles between skew lines, oblique plane and its traces, conversion of OP into an AVP or IP, H-parallels and V-parallel, lines lying in oblique planes	4
3	**Plane Projections:** Plane Figures: Projection of plane figures in different positions	3
4	**Projection of Solids:** Types of solids and their projections in initial positions, projections when base is in IP, AVP or OP, projections when axis inclined to HP or VP, development and sections of solids cut by IP or AVP in their different positions.	3
5	**CAD and Modeling:** History of CAD, Product lifecycle, Role of CAD in Industrial Design Modelling. Introduction to modelling tools.	5
6	**AUTOCAD:** Generating Drawings in AUTOCAD: Drawing of buildings and components - front view, top view and sectional views of a typical examples through AUTOCAD. Drawing of different views of given parts.	5
7	Introduction to Nx Softwares, 2D-Sketching, Sketching Entities & Relation, 3D-Sketching, Editing and its Features, Dimensions, Sketch Tools, File handling.	5

Lab Work:

S. No.	Lab Content	No. of hours
1	Projection of Points and Planes	4×2=8
2	Projection of Lines	4×2=8
3	Development of 3–D parts	4×2=8
4	Projection of Sections of Solids.	4×2=8
5	Isometric and Orthographic views	4×2=8
6	Exploring primitive commands of AUTOCAD/ 3-D Software for lines, points planes and objects.	4×2=8
7	Creating drawings of 3-D parts and sections using AUTOCAD	4×2=8

Course Outcome:

At the end of the course, students will be able to:	
1	Understand the basic concepts of graphics and projections.
2	Identify the differences between projection of points and planes.
3	Understand the basics of CAD.
4	Analyze the image through different views.
5	Evaluate differences between the free hand, 2-D, 3-D and CAD drawings.
6	Design basic arts and its projections.

Reference Books:

S. No	Book Title and Author	Publisher/ Year
1	Engineering Drawing, N. D Bhat, Charotar Publishing House.	2014
2	CAD/CAM: Theory and Practice, Zeid, Tata McGraw Hill.	1998
3	An Introduction to Solid Modeling, Martti Mantyla, Computer Science Press.	1988
4	Machine Drawing by R. K. Dhawan	2012
5	Engineering Drawing by P. S. Gill	2013
6	Machine Drawing by P. S. Gill	2013

Course Name		**Introduction to Environmental Sciences**
Course Code		**GS 2301 (Common to all branches)**
Credits		**1**
L T P		**1 0 0**

Course Objectives:

1.	TThis course aims to (i) acquaint the students with the basics of Environmental Science (ii) make them aware of the importance of Environmental Science
2.	

No. of Lectures:14

	Lecture-wise breakup	**No. of Lectures**
	Multi-disciplinary Nature of Environmental Studies; Environmental Problems and their Causes, Concept of Sustainability; Sustainable Development, Sustainable Development Goals (SDG).	2
	Types of Ecosystems - System Dynamics - Understanding Ecosystems, Ecosystem Degradation, Ecosystem Delivery, Habitat Classification.	2
	Natural Resources and Associated Problems, Non Renewable Resources, Renewable Resources, Resource Utilization.	2
	Energy and Environment – Fossil Fuel, Geothermal, Tidal, Nuclear, Solar, Wind, Hydropower and Biomass.	2
	Environmental Pollution – Air Pollution, Water Pollution, Soil Pollution, Marine Pollution, Noise Pollution, Thermal Pollution, Nuclear Hazards ; Global Environmental Issues ; Solutions to Pollution Problems.	2
	Cleaner Production and Life Cycle Analysis - LCA Methodology, Steps and Tools; EIA and Environment Audit.	2
	Environment, Development and Society- Emerging Technologies for Sustainable Development and Environmental Management; Policies and Practices, Legislation; Disaster Management.	2

Course Outcomes (COs):

At the end of the course, the students will be able to:

	Relate the importance of environmental science for sustainable development of society.
	Apply the principles of environmental science and the concept of sustainable development in real life engineering problems.

Test Books		Year of Publication/ Rep
	Name of Book	
	"Environmental Science", Miller G.T. and Spool, Ceonage Learning Publications.	2021
	"Environmental Studies", Banny Joseph, Tata Mcgraw Hill Publication.	2021
	"Text book of Environmental Studies for U.G. Courses", Erach Bharucna, University Press.	2021
	"Environmental Studies – from criteria to cure", R. Raogopalan, Oxford Univ. Press.	2022
	"Principles of Environmental Science – Inquiry and applications", Mary Ann Cunningham, William P. Cunningham, TMH Edition.	2020

Course Name:	**Principles and Elements of Design**
Course Code:	**BD2305**
Credits:	**3**
L T P:	**2 0 2**

Course Objectives:

The main objectives of the courses are:	
1	To impart the knowledge of the fundamental principles of design and their application in different design disciplines such as graphic design, industrial design, and architecture.
2	To equip students with aesthetic and functional aspects of design by understanding the colour psychology, typography and visual hierarchy in design critique.

Total no. of lectures: 28

Total no. of lab hours: 28

Course Outline:

S. No.	Course Content	No. of Lect.
1	**Introduction to Design Principles** Principles of visual design Principles of design, rhythm, balance, unity/harmony, , alignment, hierarchy; emphasis; similarity and contrast; Gestalt laws, Ordering Principles such as Axis, Symmetry, Hierarchy, Datum, Rhythm & Repetition.	5
3	**Primary Elements of Design** Primary elements of design –Point, Line, Plane, Volume. Primary forms, properties of form, transformation of forms - dimensional transformation, subtractive, additive forms, organization of additive forms - Articulation of forms. Space defining elements-horizontal, vertical, openings in space defining elements, Spatial relationship, Spatial organization	5
4	**Colour Psychology** Theory of Perception of colours; Emotion, colours and psychology; Color Psychology – Study of Hues as a determinant of human behavior Psychological effects of colour, Understanding the Grayscale, gradation methods; Composition with grays, black and white. Use of colors in various functional contexts – e.g. Residential interiors, Non Residential interiors. Use of color in special situations – out door/indoor spaces, accessories, art works etc.	5

5	**Typography** Understanding typography and its role in design, Typefaces and font families, Hierarchy and legibility, Basics of Calligraphy and typography, Understanding structure and proportion of types of fonts (Roman Serif and San Serif).	4
6	**Visual Hierarchy** Understanding the importance of visual hierarchy in design, creating emphasis and contrast, Applying hierarchy to different types of design projects, Visual Hierarchy: Visual Focal, Visual Order, Eye Movement, Visual Flow and Continuity, Visual Composition.	5
7	**Design Critique and Review** Analysing and critiquing visual designs using principles of design, Peer review of student design projects, Final project presentations and critiques.	4

Lab work

The main objective of the principles of design lab is to understand the fundamental principles of design.

S. No.	**Lab Content**	**No. of hours**
1	Create compositions using shapes and objects to demonstrate symmetrical, asymmetrical, and radial balance.	4
2	Arrangement of objects of different sizes to create compositions using colours, textures and patterns to observe overall composition and visual impact.	4
3	Combine colours, shapes, and elements to achieve visual harmony for aesthetic appeal of the design.	4
4	Design layouts using different typographic elements (fonts, sizes, spacing) to convey hierarchy, emphasis, and readability.	4
5	Explore the effects of colour combinations (e.g., complementary, analogous, monochromatic) on visual impact.	4
6	Incorporate various textures and patterns into designs to explore their impact on visual interest.	4
7	Create designs that demonstrate Gestalt principles such as proximity, similarity, closure, and continuation and evaluate how these principles influence the viewer's perception and understanding of the design.	4

Course Outcomes:

At the end of the course, students would be able to:	
1	Explain the fundamental principles of design and their application in visual design.
2	Understand the meaning and importance of design with several components of the design useful for the real life systems.
3	Understand the basic principle of the design with the purpose of making any components using ordering principles.
4	Demonstrate an understanding of composition, colour theory, typography, and visual hierarchy.
5	Analyze different kinds of the color combination under the visible spectrum with finding out the physiological impact of the color
6	Analyze and critique visual designs using principles of design.

Bibliography:

Sr. No.	Book Detail	Year of Publication
1.	Alex W. White, The Elements of Graphic Design, Bloomsbury Visual Arts, 2nd edition	2018
2.	William Lidwell, Kritina Holden, and Jill Butler, Universal Principles of Design (Publisher: Rockport Publishers, 3rd edition 2020	2020
3.	Linda Holtzschue, Understanding color, an introduction for designers, Van Nostrand Reinhold, Newyork.	1995
4.	Hanks, A.David. Decorative Designs of Frank Lloyd Wright, Dover Publications, Inc. New York.	2003
5.	Ching, Francis D.K. Architecture Form, space, and Order, 3rd ed. Van Nostrand Reinhold, New York.	2007
6.	Hanks, A.David. Decorative Designs of Frank Lloyd Wright, Dover publications, Inc. New York.	2003
7.	Francis D. K. Ching, ‘Architecture - Form, Space and Order’, Van Nostrand Reinhold Company.	2007

Reference Books

8.	V.S.Pramar, ‘Design Fundamentals in Architecture’, Somaiya Publications, New Delhi.	2007
9.	Leland M.Roth, ‘Understanding Architecture’, Routledge; 3 edition.	2013

Course Name :	**Design Thinking**
Course Code :	**BD2303**
Credits :	**3**
L T P :	**2 1 0**

Course Objectives:

The main objectives of the courses are:	
1.	Understand the principles and practices of Design Thinking.
2.	Apply Design Thinking techniques to solve complex problems.

Total no. of lectures: 42

Course Outline:

S. No.	Lecture wise breakup	No. of Lectures
1	**INTRODUCTION TO DESIGN THINKING** Introduction to Design Thinking, Principles and practices of Design Thinking, Human-centred design process, Design Thinking tools and techniques	5
2	**EMPATHIZE** Understanding user needs, desires, and expectations, conducting user research, Developing personas and user profiles	5
3	**DEFINE** Defining the problem, developing problem statements, Identifying and prioritizing user needs	5
4	**IDEATE** Brainstorming and ideation techniques, Developing and refining ideas, Creating and selecting prototypes.	5
5	**PROTOTYPE** Developing prototypes, Testing and refining prototypes, Communicating design solutions.	6
6	**TEST** Conducting user testing, Gathering and analysing feedback, Iterating and refining solutions	5
7	**APPLYING DESIGN THINKING** Applying Design Thinking to real-world problems, Case studies and examples, Collaborating within a team	6
8	**CONCLUSION** Review of Design Thinking process, Reflection on course experience, Next steps and continued learning	5

Course Outcomes:

At the end of the course, students will be able to:	
1.	Apply the design thinking process to real-world challenges by effectively employing its principles, stages, and techniques.
2.	Develop the skills to evaluate user needs and insights through various research methods and techniques.
3.	Analyse design constraints and consider factors such as technical feasibility, resource availability, and time constraints.
4.	Apply creative problem-solving techniques to generate a wide range of ideas and solutions.
5.	Analyse and evaluate design concepts based on various criteria such as user needs, technical feasibility, market potential, and alignment with project goals.
6.	Evaluate prototypes and iterations through user testing and feedback collection.

Bibliography:

Sr. No.	Book Detail	Year of Publication
1.	Design Thinking: Integrating Innovation, Customer Experience, and Brand Value by Thomas Lockwood and Edgar Papke, Allworth Press	2018
2.	The Design Thinking Playbook: Mindful Digital Transformation of Teams, Products, Services, Businesses and Ecosystems" by Michael Lewrick, Patrick Link, and Larry Leifer, John Wiley & Sons	2018
3.	Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation by Tim Brown, Harper Business	2009

Reference Books

4.	Chapra and Canale, Numerical Methods for Engineers, Tata Mc Graw Hill, 4th edition,	2005
5.	S.S. Rao, Engineering Optimization, New Age, 3rd edition,	2000

Course Name	**:**	**Creative Visualization Technique**
Course Code	**:**	**BD2304**
Credits	**:**	**4**
L T P	**:**	**2-0-4**

Total No. of Lectures: 28
Total No. of Lab Hours: 56

Course Objectives:

The main objectives of this course are:	
1.	To provide a comprehensive understanding of creative visualization techniques and their applications in various fields.
2.	To learn advanced techniques for improving the effectiveness of the design process and generating innovative design ideas.

Course Contents:

Sr. No.	**Course contents**	**No. of Lectures**
1.	**Introduction to Rapid Sketching:** Representing the observed, representing concepts - Sketching for ideation; Lines; Geometric Shapes; introduction to colour and texture	5
2.	**Drawing Techniques:** Grid based drawing, analytical representation; Inside-out sketching; Construction Drawing	5
3.	**Rendering and Sciography:** Studies in light and shadow of 3-dimensional form representations; pencil rendering, Representing reality Mimetic Imagery and Abstraction; Sciography	6
4.	**Representing Imagination:** Memory and Imagination; Object representation; Nature and life Representing nature; Figure drawing gestures and movements	6
5.	**Perspective Projection:** One point, two point and three-point Perspective	6

At the end of the course, students would be able to:	
1	Understand the various applications of creative visualization techniques in various fields such as Engineering art, design.
2	Understand the significance of creative visualization techniques in generating innovative ideas and improving creative thinking skills.
3	Apply advanced creative visualization techniques for improving the overall effectiveness of the design process, such as mind mapping, brainstorming, and sketching.
4	Analyze the effectiveness of different visualization techniques for different design challenges and scenarios.
5	Evaluate the various visualization techniques used for designing various types of design, such as product design, graphic design, and interior design.
6	Find out the most optimal visualization technique for solving design problems and communicating design ideas.

Course Outcomes:

Lab Work

Sr. No.	Lab Content	No. of hours: 56
1	Warm Up Exercises and Rapid Sketching: 1. Line Sketching Exercise: Provided with objects and asked to sketch them using only lines, in a given time limit. 2. Geometric Shapes Exercise: To create various geometric shapes using only lines, with a focus on accuracy and proportion. 3. Colour and Texture Exercise: To create sketches using colours and textures, to explore how they can be used to add depth and dimension to sketches.	**12**
2	Drawing Techniques: 4. Grid-Based Drawing Exercise: Provided with a grid and an image to replicate, and will be asked to use the grid-based approach to create an accurate drawing. 5. Analytical Representation Exercise: Provided with an object and will be asked to break it down into its basic shapes, before sketching it.	**12**
3	Rendering and Sciography: 6. Pencil Rendering Exercise: Provided with an object and will be asked to create a rendering using only pencils, exploring different shading techniques. 7. Sciography Exercise: Provided with an object and will be asked to create a sciography, exploring the effects of light and shadow.	**10**
4	Representing Imagination: 8. Object Representation Exercise: Provided with an object and will be asked to create an imaginary version of it, exploring different styles and techniques. 9. Figure Drawing Exercise: Provided with a model and will be asked to create a series of sketches representing different gestures and movements.	**10**
5	Perspective Projection: 10. One Point Perspective Exercise: Provided with an object and will be asked to create a drawing using one-point perspective. 11. Two Point Perspective Exercise: Provided with an object and will be asked to create a drawing using two-point perspective. 12. Three Point Perspective Exercise: Provided with an object and will be asked to create a drawing using three-point perspective.	**12**

Bibliography:

Sr. No.	Book Detail	Year of Publication
1.	Betty Edwards, New Drawing on the Right Side of the Brain	2002

2.	Dalley Terence ed.,The complete guide to illustration & design, Phaidon, Oxford	1980
3.	T. C. Wang, Pencil Sketching, John Wiley & Sons	1997
4.	Willy Pogany, The Art of Drawing, Madison Books	1996
5.	R. Kasprin ,Design Media – Techniques for watercolour, pen and ink, pastel and coloured markers, John Wiley & Sons	1999

Course Name	**:**	**Introduction to Sustainable Design**
Course Code	**:**	
Credits	**:**	**3**
L T P	**:**	**2-0-2**

Total no. of Lectures: 28

Course Objectives: **Total No. of Lab Hours: 28**

The main objectives of this course are:	
1.	To provide a comprehensive understanding of sustainable design principles and their applications in various industries.
2.	To develop the skills necessary to design products and systems that are environmentally friendly, socially responsible, and economically viable. Also, learn about Lean manufacturing for improving sustainability.

Course Contents:

Sr. No.	**Course contents**	**No. of Lectures**
1.	**Basics of Sustainable design:** Introduction of sustainability, sustainable design principles. R's approach, Physical, mental, spiritual, cultural, social, ethical and economic issues in designing for sustainability, Planet centric Design, C2C approach	6
2.	**Impact of unsustainable practices on Environment:** Ecological footprints, ecosystem impact, Depletion of Natural Resources, Pollution and Environmental Degradation, Climate Change and Greenhouse Gas Emissions, Biodiversity Loss and Habitat Destruction, Social and Economic Implications	5
3.	**Issues in design with respect to environment:** Issues in Design; Environmental Considerations, Life Cycle Assessment (LCA), Energy Efficiency Material Selection and Resource Efficiency. Water Conservation and Management, Biodiversity and Habitat Preservation in Design.	5
4.	**Sustainable Design & innovation:** Frugal Design, Design for Environment/Eco design, Design for sustainability, Design from Waste, Eco innovation, system-wide product/service strategies	6
5.	**Lean Manufacturing:** About Lean manufacturing and its principles, Tools & Techniques, Understanding through Success stories – Toyota, Nike, Intel etc.	6

Lab Work

Sr. No.	Lab Content	No. of hours: 28
1	Sustainable Design Principles and Approaches: 1. To design a product using sustainable design principles like reduce, reuse and recycle. 2. To evaluate an existing product and suggest improvements to make it more sustainable using the R's approach.	**6**
2	Ecological Footprints and Ecosystem Impact: 3. Calculate their own ecological footprint and discuss ways to reduce it. 4. Conduct a case study on a company's unsustainable practices and discuss its impact on the environment.	**6**
3	Design and Social Concerns: 5. To design a product that addresses a social concern like accessibility, inclusivity or gender equality. 6. To evaluate an existing product and suggest improvements to make it more socially responsible.	**6**
4	Sustainable Design and Innovation: 7. To design a product using frugal design principles to reduce waste and cost. 8. To present case studies of companies that have successfully implemented eco-design or design from waste.	**6**
5	Lean Manufacturing: 9. To optimize a manufacturing process using lean principles like value stream mapping or just-in-time inventory.	**4**

Bibliography:

Sr. No.	Book Detail	Year of Publication
1.	Mendler, S., & Odell, W., The HOK guidebook to sustainable design. John Wiley & Sons. 4.	2000
2.	Williams, D. E., Sustainable design: Ecology, architecture, and planning. John Wiley & Sons.	2007
3.	Walker, S., Sustainable by design: Explorations in theory and practice. Routledge.	2012
4.	Fairs, M., Green design: creative sustainable designs for the twenty-first century. North Atlantic Books.	2009
5.	James P. Womack, Daniel T. Jones, Lean Thinking: Banish Waste and Create Wealth in Your Corporation	1996
6.	Jeffrey K. Liker, David Meier, The Toyota Way Fieldbook, McGraw-Hill Education	2005

Course Name	**:**	**Design Case Study**
Course Code	**:**	**BD2307**
Credits	**:**	**3**
L T P	**:**	**2-0-2**

No. of Lecture hours: 28

Course Objectives: **Total No. of Lab Hours: 28**

The main objectives of this course are:	
1	Ability to develop new Concepts, Ideas successfully and efficiently.
2	Build confidence in the ability to create new Products and Present

Course Contents:

Sr. No.	Course contents	No. of Lectures
1.	**Overview of Design Process and its ecosystem:** Design Relevance: Exposure and analysis, Case studies	6
2.	**Ideation Brainstorming:** Differential Discussion; group methods to generate ideas; solitary methods to generate ideas; Lateral Thinking	5
3.	**Concept Detailing**: User Journey maps, User stories, activity mapping.	5
4.	**Ergonomics Overview Human Factors:** Physical & Cognitive ergonomics; Visual hierarchy & structure of information; Display & Controls composition.	6
5.	**Design Project**: Design and Development of Product as per the brief.	6

Lab Works

Sr. No.	Lab Content	No. of hours: 28
1	Select a specific design oriented project and analyze its relevance.	**4**
2	Generation of ideas for the selected design project using the group as well as solitary methods of brain storming.	**4**
3	Generation of ideas for the selected design project using lateral thinking followed by differential discussion.	**5**
4	Complete detailing of the project design showing the user journey maps as well as activity mapping	**6**
5	Ergonomics evaluation for the completion of the project	**5**
6	Design and development of the project	**4**

Course Outcomes:

At the end of the course, students would be able to:	
1	Understand the basics of sustainable design, including the principles and approaches used for designing sustainable products and systems.
2	Evaluate the impact of unsustainable practices on the environment, including ecological footprints and ecosystem impact.
3	Identify and analyze the various issues in design with respect to the environment and social concerns.
4	Apply sustainable design principles and innovation techniques to design products and systems.
5	Develop an understanding of ergonomics of the design concept.
6	Design products and systems that are sustainable, efficient, and socially responsible.

Bibliography:

Sr. No.	Book Detail	Year of Publication
1.	D.Norman;The Design of Everyday things, London, The MIT Press.	1998
2.	A.Forty; Objects of Desire, Thames & Hudson.	1995
3.	J. de Noblet ed., Industrial Design- Reflections of a century, Thames & Hudson.	1993
4.	Julier, G.;20th Century, Design,Thames & Hudson.	1993
5.	Potter, Norman; What is a Designer: Things, Places, Messages, Princeton Architectural Press.	2002

Course Name	**:**	**Basics of Computer Graphics**
Course Code	**:**	**ES2311**
Credits	**:**	**3**
L T P	**:**	**2-0-2**

Course Objectives:

The main Objectives of this course:	
1	To learn fundamentals of computer graphics algorithms. To learn basics of design, development, and testing of modeling, rendering, and animation solutions to a broad variety of problems found in entertainment, sciences, and engineering.
2	To develop interactive programs that use effectively the graphics functionalities available in contemporary personal computers

Course contents: Total lectures: 28 Hours

Sr. No.	**Course Contents**	**No. of Lectures**
1.	**Introductory Concepts**: Introduction of Coordinate representation and Pixel Graphics output devices: CRT, Raster Scan & Random Scan systems; Color CRT monitors, DVST, flat-panel displays, video controller and raster scan display processor. Graphics Input Devices: Keyboard, Mouse, Track-ball, space ball, Joysticks, data Glove, Light Pen, Digitizer, Image scanners, touch panels, voice systems; Graphics software	**05**
2.	**Graphics Output Primitives**: Point and Lines, Line Drawing Algorithms: Simple, DDA, Bresenham's Line Drawing algorithm, Circle and Ellipse drawing algorithm, Polygon drawing: Representation of polygon; Conventional methods for drawing polygons; Real time Scan Conversion and Run length encoding; Filled area primitives, character generation, Antialiasing	**05**
3.	**2D Viewing**: Viewing pipeline, Window-to-viewport transformation, 2-D Clipping, Chen-Sutherland Line Clipping, Mid-point subdivision algorithm, Liang-Barsky clipping, Cyrus-Beck line clipping; Polygon Clipping: Sutherland-Hodgeman and Weiler-Atherton polygon clipping; Character Clipping	**04**
4.	**2D Transformations**: Scaling, Rotation, Translation, Shearing, Reflection; Homogeneous coordinates, Composite Transformations, Affine transformation; Projections: Perspective, Orthographic, Axonometric, Oblique projections	**03**
5.	**Object Rendering**: Introduction Object-Rendering, Light Modeling Techniques, illumination Model, Shading, Flat Shading, Polygon Mesh Shading, Gaurand Shading Model, Phong Shading, Transparency Effect, Shadows, Texture and Object Representation, Ray Tracing, Ray Casting, Radiosity, Color Models. Introduction to	**06**

	animation, Key-Frame Animation, Construction of an Animation Sequence, Motion Control Methods, Procedural Animation, Key-Frame Animation vs. Procedural Animation, Introduction to Morphing, Three-Dimensional Morphing.	
6.	**Advanced Topics**: Curves and surfaces: Spline representations, Bezier curves and surfaces, B-spline curves and surfaces Visible surface detection methods: Back-face detection, depthbuffer, A-buffer, Z- buffer , scan-line Illumination models and surface rendering: Basic illumination models, Half-toning and dithering techniques, Polygon Rendering, Color models	**05**

List of experiments/practical's (Lab Work hour: 28)

Sr. No.	**Name of Experiments**	**No. of Lectures**
1.	Write a program with menu option to input the line coordinates from the user to generate a line using Bresenham's method and DDA algorithm.	**4**
2.	Develop a program to generate a complete circle based on. a) Bresenham's circle algorithm b) Midpoint Circle Algorithm	**4**
3.	Write a program to implement a stretch band effect. (A user will click on the screen and drag the mouse / arrow keys over the screen coordinates. The line should be updated like rubber-band and on the right-click gets fixed).	**4**
4.	Write program to perform the following 2D on the given input figure a) Rotate through θ b) Reflection c) Scaling d) Translation	**4**
5.	Write a program to demonstrate 2D animation such as clock simulation or rising sun.	**4**
6.	Write a program to implement the bouncing ball inside a defined rectangular window.	**4**
7.	Implement Illumination and shading apply on sphere using two light sources in OpenGL	**4**

Course Outcomes:

By the end of the course, the students will be able to:	
1.	Understand the hardware system architecture for computer graphics
2.	Design and implement model and viewing transformations, the graphics pipeline and an interactive rendering
3.	Identify and analyze the underlying algorithms, mathematical concepts, supporting computer graphics
4.	Know and be able to select and use among models for lighting/shading
5.	Apply the computer graphics concepts in the development of computer games, information visualization, and business applications
6.	Discuss future trends in computer graphics and quickly learn future computer graphics concepts and APIs

Bibliography:

Sr. No.	Name of Book / Authors / Publishers	Year
1	Computer Graphics C Version, D. Hearn And P. Baker, Pearson Education	1997
2	Computer Graphics, Foley and van Dam, Person Education	1996
3	Computer Graphics, R. K. Maurya, John Wiley.	2011
4	Mathematical elements of Computer Graphics, David F. Rogers, J. Alan Adams, Tata McGraw-Hill	1990
5	S. S Pande, Computer Graphics and Product Modeling for CAD/CAM, Narosa Publishing	2011

Mathematics Syllabus

Course Name	**Universal Human Values**
Couse Code	**GS2302**
Credits	**1**
L T P	**1-0-0**

Total Number of Lectures: 14

Lecture wise Breakup	**Number of Lectures**
Course Introduction: Need, Basic Guidelines, Content & Process for Value Education Understanding ethics, morals, and values Ethical theories and their application in engineering and technology	2
Ethical Decision-Making Steps in ethical decision-making Identifying and analysing ethical dilemmas in real-world scenarios	3
Teamwork and Collaboration Characteristics of effective teams Conflict resolution and managing differences collaboration tools and techniques for virtual teams	3
Social Responsibility and Sustainability Role of engineers in promoting social good Environmental ethics and sustainable development Corporate social responsibility and ethical considerations in technology choices	3
Ethical analysis of Technological Innovations Engineering Ethics Balancing short-term gains with long-term consequences	3

Suggested Books:		
	Name of Book/ Authors/ Publisher	*Year of Publication/ Reprint*

	“Engineering Ethics” (Includes Human Values), Govindarajan M, Pearson Education Inc.	**2017**
	“Professional Ethics and Human Values”, Govindarajan M, Learning India Private Limited.	**2020**
	“Professional Ethics and Human Values (JNTU-Kakinada)", B Raghavan, McGraw Hill.	**2021**
	"The Moral Status of Technical Artefacts (Philosophy of Engineering and Technology)", Peter Kroes and Peter-Paul Verbeek	**2020**
	“Ethics and Professionalism in Engineering (Broadview Guides to Business and Professional Ethics)" by Richard H McCuen and Kristin L Gilroy., Pubs: W.W. Norton & Company.	**2020**
	“Engineering Ethics: Challenges and Opportunities" by W Richard Bowen, Cengage Learning	**2019**

Additional Reading-

	Name of Book/ Authors/ Publisher	*Year of Publication/ Reprint*
	A Casebook in Interprofessional Ethics: A Succinct Introduction to Ethics for the Health Professions (SpringerBriefs in Ethics)", Jeffrey P Spike and Rebecca Lunstroth,2 Pearson Education Inc	**2020**
	“Fundamentals of Ethics for Scientists and Engineers", Edmund G Seebauer and Robert L Barry,2020, Pearson Education Inc. .	**2020**

Course Name	**:**	**Design Arts and Aesthetics**
Course Code	**:**	**BD2321**
Credits	**:**	**4**
L T P	**:**	**3 0 2**

Course Objectives :

Students should be able -

- To analyze,appreciate and understand design language and principles of design and aesthetics
- To explorethe past influences and predict future trends
- To apply principles of design to style and enhance everyday products
- To develop Design Thinking for problem solving and conduct user testing

Total No. of Lectures – 42

Lecture wise breakup		**No. of Lectures**
Unit 1	**Introduction to Design and Aesthetics** Introduction to aesthetics, introduction to eminent philosophers, Historical perspective in art and design, Exploring Design Aesthetics through examples from the past	**9**
Unit 2	**Design language and Expression** Prominent art movements and their influence on designed products, Introduction to Design Movements, Expression in design, popular examples	**9**
Unit 3	**Principles of Design and Aesthetics** Exploration of beauty and aesthetics philosophical perspective, Analyzing designs through critique and formal analysis, Contemporary visual and conceptual trends in art and design	**12**
Unit 4	**Aesthetics in Everyday Life** Aesthetics in everyday products, Contribution of aesthetics in arts & design, Contribution of Indian arts and design, Cultural influences on design aesthetics in India, Exploring product brand aesthetics, case studies	**12**

List of Experiments:		**Number of Turns**
1	Analyzing the aesthetic qualities of everyday products	**4**
2	Learning to create a mood board with different images, colours and textures focusing on visual aesthetics	**4**
3	Creating designs based on design movements	**4**
4	Writing and presentation exercise on theories of aesthetics	**4**
5	Using design principles to redesign an everyday product	**5**
6	Develop concept for the final product styling exercise	**7**

Course Outcomes:	
1	Retain the thorough understanding of foundational concepts in design, arts, and aesthetics in addition to various theories and movements
2	Understand how to effectively communicate design choices
3	Apply principles of design and form their own design language
4	Analyzing and problem-solving through product styling exercises
5	Evaluate product styling in different contexts like home, retail, digital etc.

Text Book:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication / Reprint**
1	"Universal Principles of Design," Lidwell, W., Holden, K. and Butler, J., Rockport Publishers.	2010
Reference Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication / Reprint**
1	"Elements of Design", Gail Greet Hannah, Princeton Architectural Press	2002
2	"Design of Everyday Things," Norman, D., Basic Books, 2nd edition	2013
3	"Change by Design," Tim Brown, Harper Business	2012
4	"Concerning the Spiritual in Art," Wassily Kandinsky, Dover Publications Inc. Revised edition	2002

Equivalent MOOCs courses

Sr. No.	Course Links	Offered by
1	Artistic Exploration in Scientific Research and Technology https://nptel.ac.in/courses/109108158	NPTEL
2	Modern and Contemporary Art and Design Specialization https://www.coursera.org/specializations/modern-contemporary-art-design	Coursera
3	Philosophy & History of Design https://archive.nptel.ac.in/courses/107/104/107104078/	NPTEL
4	Visual Elements of User Interface Design https://www.coursera.org/learn/visual-elements-user-interface-design	Coursera

Course Name	**:**	**Basics Of Interactive Design**
Course Code	**:**	**BD2322**
Credits	**:**	**4**
L T P	**:**	**3 0 2**

Course Objectives :

Students should be able -

- To analyze the essentials of interaction design.
- To explore and understand the principle of interactive system design
- To apply principles of interaction design in real-life and product design problems
- To develop goals directed toward interaction design
- To enable and describe different interface design guidelines and their application for creating interactions.

Total No. of Lectures – 42

Lecture wise breakup		**No. of Lectures**
Unit 1	**Introduction** Introduction, Processes of interaction design, Importance of interaction design, Interaction design and the user experience.	**2**
Unit 2	**Conceptualizing Interaction And Cognitive Aspects** The problem space and conceptualizing design, Conceptual models, Interface metaphors, Interaction types, Paradigms for interaction, Cognition and Cognitive frameworks.	**6**
Unit 3	**Social and Emotional Interaction** Introduction; being social, Types of conversations, Telepresence and Co-presence, Emergent social phenomena, Emotions and the user experience, Types of emotional interfaces, Anthropomorphism and zoomorphism, Models of emotion	**10**
Unit 4	**Interfaces, Data Analysis, Interpretation, And Presentation** Interface, Types of Interface, Natural user interfaces, Qualitative and quantitative data analysis, Tools for data analysis, Establishing requirements, Task description, Task analysis.	**8**
Unit 5	**Design, Prototyping and Construction** Introduction, Prototyping and Construction, Conceptual and Physical design, Scenarios and prototypes in design, Support for design.	**8**
Unit 6	**Evaluation** Introduction of Evaluation, Types of Evaluation, Evaluation case studies, Usability testing, Experiments, Field studies, Heuristic Evaluation, Analytics, Predictive models	**8**

Course Outcomes:	
1	Explain the fundamentals of Interaction Design (ID): Definition of ID; Types of Interactions; Goal-Directed Design Principles
2	Explain the Principles of Interface Design, Navigation design and Interaction design.
3	Ability to apply the design process of Human-Centered Interactive systems.
4	Possess knowledge of PACT: A framework for designing interactive systems and demonstrating its application as case study.
5	State Experience design guidelines.
6	Proficient in the use of software tools to Create, Build, and Test the designed prototypes to check its effectiveness.

Text Book:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication / Reprint**
1	Design: Beyond Human–Computer Interaction/ Preece, Rogers and Sharp, Interaction/ John Wiley and Sons.	2003
Reference Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication / Reprint**
1	Measuring the user experience:collecting, analyzing, and presenting usability metrics/Tom Tullis and Bill Albert/Newnes	2003
2	Designing interactive systems: a comprehensive guide to HCI and interaction design/ Benyon David/ Pearson Education.	2010
3	Designing the User Interface: Strategies for Effective Human-Computer Interaction/ Shneiderman/ Addison Wesley	2000

Equivalent MOOCs courses (atleast 2)

Sr. No.	**Course Links**	**Offered by**
1	*:http://www.uie.com/articles/subtle_interaction_design/*	**AskTog**
2	*http://www.asktog.com/basics/firstPrinciples.html*	**AskTog**
3	*http://www.uxmatters.com/mt/archives/2008/10/selling-ux.php*	UXMatters
4	*:http://www.google.com/corporate/tenthings.html*	**Google**

Course Name	**:**	**Physical Ergonomics**
Course Code	**:**	**BD2323**
Credits	**:**	**4**
L T P	**:**	**3 0 2**

Course Objectives :

Students should be able -

To introduce and analyze ergonomics and its significance in design.

- To explore and understand the impact of anatomy, anthropometry, biomechanics, physiology and the physical environment on physical activity.
- To undertake challenges and explain the importance of user-centered design consider how technologies should be designed to support communication and collaboration, and how their design can affect these processes.

Total No. of Lectures – 42

Lecture wise breakup		**No. of Lectures**
Unit 1	**Introduction to Ergonomics** Definitions of Ergonomics and its classification, application and overview, Concept of Man Machine Environment System	10
Unit 2	**Human body & its system** Overview of the Human Body and it's subsystems, Understanding musculoskeletal system and its function in terms of manual activities, Understanding nervous system, human sensory organs and their limitations.	10
Unit 3	**Anthropometry** Understanding and applications of anthropometry; Basic anatomy, measurement system, types; static, dynamic, posture, joint, movement; Study of work posture and its impact on human performance; Physical environment and their impact on human performance	8
Unit 4	**Product Ergonomics** Understanding of product ergonomics; Man, machine and Interaction	8
Unit 5	**Safety** Injury prevention, safety, vibration, shock, fatigue and occupational hazard; Error handling	6

Course Outcomes:	
1	To gain a deep understanding of how people interact with tools, equipment, and workspaces.

2	Learn how to design workstations and tasks to reduce the risk of injuries and promote overall well-being among workers.
3	Design and optimize workspaces to enhance productivity, comfort, and safety. This includes considerations for seating, lighting, layout, and equipment design.
4	Emphasizes the importance of considering the health and well-being of individuals in various settings. Graduates may play a role in promoting a healthier lifestyle and preventing health issues related to poor ergonomics.

Text Book:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication / Reprint**
1	Introduction to Ergonomics/ R. S. Bridger/ Taylor & Francis	2003
2	Ergonomics for beginners, a quick reference guide/ J. Dul, and B. Weerdmeester/ Taylor & Francis	1993
Reference Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication / Reprint**
1	Indian Anthropometric Dimensions For Ergonomic Design Practice/ Dr. Debkumar Chakraborty/ National Institute of Design,	2010
2	An Introduction to Human Factors Engineering/ C. D. Wicknes, S. E. Gordon, and Y. Liu/Longman	1997
3	Design for Ergonomics/ Francesca Tosi/ Springer	2019
4	Human Factors in Product Design: current practice and future trends/ P.W. Jordan and W.S.Green/ Taylor & Francis, London	1999

Equivalent MOOCs courses

Sr. No.	**Course Links**	**Offered by**
1	https://nptel.ac.in/courses/112104222	NPTEL

Course Name	**:**	**Programming for Designers**
Course Code	**:**	**BD2324**
Credits	**:**	**4**
L T P	**:**	**3 0 2**

Course Objectives :

Students will be able -

- To explore the integration of code in design projects using industry-standard tools.
- To apply practical experience in creating interactive and dynamic design elements.
- To evaluate the usability and user experience of interactive designs developed through programming.
- To develop proficiency in HTML, CSS, and JavaScript for web development.
- To enable problem-solving skills through coding challenges and projects.

Total No. of Lectures – 42

Lecture wise breakup		**No. of Lectures**
Unit 1	**Introduction to Programming and Web Development** Overview of programming concepts, Introduction to HTML: Structure and semantics, Introduction to CSS: Styling and layout basics.	**5**
Unit 2	**Intermediate HTML and CSS** HTML5 and advanced structure, CSS3: Advanced styling, transitions, and animations, Responsive web design principles.	**7**
Unit 3	**Introduction to JavaScript** Fundamentals of JavaScript**,** Variables, data types, and operators**,** Control flow: loops and conditionals.	**6**
Unit 4	**Advanced JavaScript** Functions and objects**,** DOM manipulation and events**,** Introduction to jQuery.	**6**
Unit 5	**Integrating Code with Design Tools** Using code in design software (e.g., Adobe XD, Figma), Exporting assets for web development, Designing with code in mind.	**6**
Unit 6	**Interactive Design Projects** Building interactive prototypes, Incorporating user interactions, Project: Interactive design showcase.	**6**
Unit 7	**Final Project** Independent or group project applying learned skills.	**6**

List of Experiments:		Number of Hours
1	Write a simple program to print "Hello, World!" in a design-oriented manner (e.g., using creative fonts, colors, or layouts).	**4**
2	Create a webpage with interactive elements using HTML, CSS, and JavaScript. Implement features such as buttons, sliders, or dynamic content updates.	**4**
3	Use the Processing programming language to create generative art and explore the use of loops, variables, and randomness to generate visually interesting patterns and designs.	**4**
4	Utilize D3.js to create interactive data visualizations and represent design-related data in a visually compelling way, such as showing trends in color preferences or design styles.	**4**
5	Use CSS animations or JavaScript libraries to create animated elements on a webpage and explore how animation can enhance user experience and storytelling in design.	**4**
6	Develop a program that automates the generation of typographic designs and explore ways to dynamically adjust font sizes, styles, and layouts based on user input or design parameters.	**4**
7	Create an interactive artwork or design project using creative coding libraries like Processing or p5.js and experiment with user input to influence the design.	**4**

Course Outcomes:	
1	Outline the connection between programming concepts and their application in solving design-related problems.
2	Apply programming skills to create interactive and visually appealing web designs using HTML, CSS, and JavaScript.
3	Analyze design problems and formulate programming solutions, considering factors such as user experience, aesthetics, and functionality.
4	design and develop visually appealing and user-friendly websites or applications using programming languages and frameworks.
5	Evaluate the usability and user experience of interactive designs developed through programming.

Text Book:

Sr. No.	Name of Book/ Authors/ Publisher	Year of Publication / Reprint
1	"HTML and CSS: Design and Build Websites", Jon Duckett; Wiley.	2011
2	"JavaScript and jQuery: The Missing Manual", David Sawyer McFarland; O'Reilly Media.	2014
3	"Processing: A Programming Handbook for Visual Designers and Artists", Casey Reas and Ben Fry; The MIT Press.	2014
4	"Learning Processing: A Beginner's Guide to Programming Images, Animation, and Interaction", Daniel Shiffman; Morgan Kaufmann.	2008
Reference Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication / Reprint**
1	"JavaScript: The Definitive Guide", David Flanagan; O'Reilly Media (7th Edition).	2020
2	"CSS Secrets: Better Solutions to Everyday Web Design Problems", Lea Verou; O'Reilly Media.	2014
3	"Responsive Web Design with HTML5 and CSS3", Ben Frain; Packt Publishing.	2012

Equivalent MOOCs courses

Sr. No.	Course Links	Offered by
1	https://onlinecourses.nptel.ac.in/noc20_cs54/preview	SWAYAM/ NPTEL

Course Name	**:**	**Product Design and Development**
Course Code	**:**	**BD2326**
Credits	**:**	**4**
L T P	**:**	**3-1-0**

Course Objectives:
● To explore the concept of design in different contexts. ● To analyze the various design phases for product development. ● To develop the model for new product development and assessment of it through different conceptual approaches. ● To apply the concept of system level design for maintainability.

Total Number of Lectures:42

Lecture wise breakup		**No. of Lectures**
Unit 1	**Understanding Design:** Design& its nature, design activities: design exploration, design generation, design evaluation, design communication, design ability: human brain & whole brain thinking, intuition vs. logical thinking, difference between scientist/engineer & a designer, design problems: design brief, ill-defined problems, final design description, four stage design process model	**6**
Unit 2	**Product Development:**What is product development, characteristics of successful product development, who designs & develops products, challenges of product development, phases of product development process **Rapid Prototyping Methods** Liquid based rp methods, solid based RP methods, powder-based methods	**6**
Unit 3	**Product Planning:** Product planning, types of product development projects, product planning process (steps).	**6**
Unit 4	**Concept Development Phase:** Identifying customer needs product specifications: what are specifications, when are specifications established, establishing target specifications. setting the final specifications, the activity of concept generation, a five-step method concept selection & concept testing	**6**
Unit 5	**Constant and Time Dependant Failure Models:** Exponential, weibull, normal and lognormal distributions	**6**
Unit 6	**System Level Design:** Product architecture, industrial design **Detail Design:** Design for manufacturing & robust design, computer aided design: geometric modeling approaches, wireframe & surface modeling, solid modeling, features, parametric &variational design,	**6**

	computer aided engineering analysis, CAD/CAM data exchange, rapid prototyping	
Unit 7	**Design for Maintainability:** Quantifiable measures of maintainability, maintainability management tasks during the product life cycle, life cycle costing, life cycle cost estimation models, spare parts management	**6**

Tutorial Work:		**No. of Turns**
1	Identification of design specifications and aligned them with manufacturing specifications	**3**
2	Product planning as per customer segments	**2**
3	Development of rapid prototyping models	**3**
4	Concept generation and system analysis	**2**
5	Application of modelling approaches	**2**
6	Case studies	**2**

Course Outcomes:	
1	Students are able to know the significance of design.
2	Students will be able to apply the concept of system level design.
3	Students are able to plan strategies and policies for new product development.
4	Students can apply different distributions for product failure analysis.
5	Students will be able to explore the system analysis for detailed design.

Text Books:

S. No.	**Name of Book/Authors/Publishers**	**Year of Publication**
1	Product Design & Development, K.T. Ulrich & S.D. Eppinger,TMH	1992
2	Geometric Modeling, Mortenson, M. E., 3rd Ed., Industrial Press.	2006
3	Product Design and Manufacturing, Chitale, A. K. and Gutpa, R. C., Prentice Hall.	1997
4	Design for X: Concurrent Engineering Imperatives, Huang, G. Q., Chapman and Hall.	1996

Reference Books:

S. No.	Name of Book/Authors/Publishers	Year of Publication
1	Integrated Product Development, Andrearsen, M. M., and Hein, L., Springer.	1987
2	Product Design for Manufacture and Assembly, Boothroyd G., Dewhurst P., and Knight 2nd Ed., Marcel Dekker	2002

Equivalent MOOCs Courses:

S. No.	Couse Links	Offered by
1	https://archive.nptel.ac.in/courses/112/107/112107282/	**NPTEL**
2	https://www.youtube.com/playlist?list=PLp6ek2hDcoNALWidcTcFur34atzXNYHjD	**IIT Delhi**

Course Name	**:**	**Form and Product Photography**
Course Code	**:**	**BD2327**
Credits	**:**	**4**
L T P	**:**	**2 0 4**

Course Objectives :

Students should be able -

- To analyze,appreciate and understand the role of product photography in design
- To understand the camera controls
- To explore elements of product photography
- To apply principles of composing and framing
- To develop a sense of composition and technical expertise in photography

Total No. of Lectures – 28

Lecture wise breakup		**No. of Lectures**
Unit 1	**Overview and fundamentals** Form and meaning, Form and context, Form and aesthetics, Formal analysis	**8**
Unit 2	**Elements of design: Building blocks** Form, Color, and Composition in photography, Light and shadow in photography	**6**
Unit 3	**Setting up the camera** Frame and ratio, Menu and settings, Vantage point ad frame	**6**
Unit 4	**Camera control** Elements of camera, Depth of field, Picture quality and decision making, Photo Editing	**8**

List of Experiments:		**Number of hours**
1	Analyzing products and their composition	**8**
2	Learning framing in terms of lighting and perspective	**8**
3	Creating a setup or product photography	**8**
4	Exercise involving understanding the difference between natural and studio lighting	**8**
5	Using sills like colour correction etc. or post production	**10**
6	Develop skills to plan and execute a photo-shoot	**14**

Course Outcomes:	
1	Demonstrate technical proficiency in handling camera and its accessories
2	Understand how to compose shots
3	Apply principles to improve visual appeal o the products

4	Analyzing that products are represented correctly in terms of their attributes
5	Evaluate the impact on brand value

Text Book:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication / Reprint**
1	"The Photographer's Eye: Composition and Design for Better Digital Photos," Michael Freeman, Focal Press, 2nd ed.	2007
Reference Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication / Reprint**
1	"The Art of Photography: An Approach to Personal Expression," BruceBarnbaum, Rocky Nook; 1st edition	2010
2	"Bryan Peterson's Understanding Composition Field Guide," Bryan Peterson,Amphoto Books; Illustrated edition	2012
3	Freeman Patterson, Photography and the Art of Seeing	2012

Equivalent MOOCs courses

Sr. No.	**Course Links**	**Offered by**
1	**Photography Techniques: Light, Content, and Sharing** https://www.coursera.org/learn/photography-techniques?irgwc=1&utm_medium=partners&utm_source=impact&utm_campaign=315774&utm_content=b2c	Coursera
2	**Camera Control** https://www.coursera.org/learn/camera-control?utm_source=impact&utm_content=b2c&utm_campaign=315774&irgwc=1&utm_medium=partners	Coursera
3	**Principles of Photo Composition and Digital Image Post-Production** https://www.coursera.org/learn/photo-composition/?irgwc=1&utm_medium=partners&utm_source=impact&utm_campaign=315774&utm_content=b2c	Coursera

Course Name	**:**	**Cognitive Ergonomics**
Course Code	**:**	**BD2328**
Credits	**:**	**4**
L T P	**:**	**3 0 2**

Course Objectives :

Students should be able -

- To analyze the implications of psychological research for improving the design and evaluation of computer systems
- To explore solutions for better understanding the behavior of humans as they interact with machines
- To undertake challenges and explain the importance of user-centered design
  consider how technologies should be designed to support communication and collaboration, and how their design can affect these processes.

Total No. of Lectures – 42

Lecture wise breakup		**No. of Lectures**
Unit 1	**Introduction to Cognitive Ergonomics:** Definition and Importance of Cognitive Ergonomics Perception, psychophysical methods, memory and attention, embodied cognition. Human cognitive process and information processing (sensation, perception, attention, cognition, human information processing and execution)	8
Unit 2	**Cognitive Processes and Information Processing:** Sensation and Perception Memory Systems: Sensory, Short-term, Long-term Perception of physical characteristics of objects (colour, form, shape, texture etc.) Cognitive Load and Capacity	8
Unit 3	**Chapter 3: Mental Models and Representation:** Understanding Mental Models Types of Mental Representations Importance in Human-Computer Interaction Designing for Mental Model Alignment	8
Unit 4	**Chapter 4: Interface Design Principles:** Graphic symbols, cognitive tools. Design for the interaction: developing Personas and Scenarios requirement analysis: interviews and questionnaires Probes and card sorting techniques; Case studies. User-Centered Design Approaches	8

Unit 5	**Chapter 5: Usability and User Experience (UX):** Usability Testing Methods Usability, accessibility and acceptability. Designing usable products: affordance, mapping and feedback. Evaluating Cognitive Ergonomics in UX Case Studies and Examples	10

Course Outcomes:	
1	Consider how technologies can affect user experience and how they can encourage changes in behavior
2	Be able to apply major theories in cognitive psychology to practical case studies
3	communicate ideas and research findings by written means
4	Group work.

Text Book:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication / Reprint**
1	Designing Interactive Systems. A Comprehensive guide to HCI, UX and interaction design/ Benyon/ Pearson.	2014
Reference Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication / Reprint**
1	Advances in Cognitive Ergonomics./ Gavriel Salvendy, Waldemar Karwowski / Taylor & Francis	2010
2	Cognitive Ergonomics: Understanding, Learning and Designing Human-computer Interaction (Computers and People Series)/Pierre Falzon/Academic Press Inc	1997
3	Design for Ergonomics/ Francesca Tosi/ Springer	2019

Equivalent MOOCs courses

Sr. No.	**Course Links**	**Offered by**
1	https://onlinecourses.nptel.ac.in/noc24_hs79/preview	NPTEL

Course Name	**:**	**Form Language**
Course Code	**:**	**BD2361**
Credits	**:**	**4**
L T P	**:**	**2 0 4**

Course Objectives :
Students should be able - ● To explore forms with meaning, context, aesthetics and diverse mediums ● To enable to create new forms with theoretical understanding ● To understand relation of forms in different context, culture, and disciplines ● To develop an understanding and critical lens to analyze form

Total No. of Lectures – 28

Lecture wise breakup		**No. of Lectures**
Unit 1	**Contextualizing form in design** Study of forms in existing products from different fields and locations Analyzing and understanding them through principals and elements of design Historical shifts in perspectives on form language in design	**5**
Unit 2	**Form and culture** Understanding form in various design fields through case studies, Cultural influences on design aesthetics, Case studies in design shaped by cultural factors	**5**
Unit 3	**Form functionality** Form and function, Accessibility, usability and aesthetics, Case studies on successful use of form and function in products	**6**
Unit 4	**Form explorations** Through different materials Paper Mache, Metal Wire, Clay, thread, Plaster of Paris, etc.), Abstract form and conceptual form exploration	**6**
Unit 5	**Form and user needs** UX design and form language, Exploring creation of user centered design based on form, Small project on application of form language principles	**6**

List of Experiments:		**Number of Turns**
1	Exercises on exploration of 2D and 3D forms, understanding volumes, scale, shape, sizes, dimensions etc.	**9**
2	Studies on abstract form creation and conceptual form creation	**9**

3	Case studies of form expressing emotions, culture, contexts, nature	**9**
4	Case studies on form from different Design disciplines	**9**
5	User centric design practical's focusing on form and its function based on user needs and aesthetics	**9**
6	Small project on studying form in a given context	**11**

Course Outcomes:	
1	To understand dimensions of form and its transformation
2	To develop ability to manipulate form for demonstration of varied emotions
3	To understand and develop forms with different types of material
4	To be able to analyze any form with formal analyses techniques
5	To evaluate interdisciplinary links between forms in different disciplines
6	Explore the importance of user centric design practices and their application

Text Book:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication / Reprint**
1	"The Form of Design: Deciphering the Language of Mass-Produced Objects," Josiah Kahane, Laurence King Publishing.	2015
Reference Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication / Reprint**
1	"Language of Vision," Gyorgy Kepes, Dover Publications	1995
2	"Ways of Seeing," John Berger, Penguin Books	1972
3	"Design and Form: The Basic Course at the Bauhaus and Later," Johannes Itten, John Wiley & Sons.	1975
4	Albert W Porter, Shape and Form: Design Elements. Davis Publications Inc.,U.S.	1974

Equivalent MOOCs courses

Sr. No.	**Course Links**	**Offered by**
1	**Art & Activity: Interactive Strategies for Engaging with Art**.https://www.coursera.org/learn/art-activity	Coursera
2	**Arts and Culture Strategy** https://www.coursera.org/learn/arts-culture-strategy	Coursera
3	**The Architectural Imagination** https://pll.harvard.edu/course/architectural-imagination?delta=1	Coursera

Course Name	**:**	**AI in design**
Course Code	**:**	**BD2331**
Credits	**:**	**3**
L T P	**:**	**2 0 2**

Course Objectives :
Students will be able - ● To explore the contribution of AI is applied in the field of design. ● To apply AI techniques to enhance the design process. ● To evaluate ethical considerations and societal impact of AI in design. ● To develop a portfolio showcasing AI-powered design projects. ● To enable hands-on experience with AI tools and frameworks.

Total No. of Lectures – 28

Lecture wise breakup		**No. of Lectures**
Unit 1	**Introduction to Artificial Intelligence** Overview of AI concepts and terminology, Historical context and evolution of AI, Types of AI: Narrow vs. General AI.	**3**
Unit 2	**AI Technologies for Design** Machine learning and its applications in design, Natural Language Processing (NLP) and design, Computer Vision and design applications.	**5**
Unit 3	**Hands-On with AI Tools** Introduction to AI tools and platforms (e.g., TensorFlow, OpenAI), Basic programming for AI: Python fundamentals, Exploring AI APIs for design projects.	**4**
Unit 4	**AI-Enhanced Design Thinking** Incorporating AI in the design thinking process, AI-driven ideation and concept generation, Case studies of AI-powered design projects.	**4**
Unit 5	**Design Automation with AI** Automating repetitive design tasks using AI**,** Generative design and AI-assisted creativity**,** Collaborative design with AI tools.	**4**
Unit 6	**Ethical Considerations in AI Design** Understanding bias and fairness in AI**,** Privacy and security considerations**,** Responsible AI design practices.	**3**
Unit 7	**Final AI-Driven Design Project** Independent or group projects applying AI in design.	**5**

List of Experiments:		Number of Turns
1	Implement a basic linear regression model to predict design preferences based on historical data.	**1**
2	Build an image classification model using convolutional neural networks (CNNs) to categorize design elements or styles.	**1**
3	Create a Generative Adversarial Networks (GAN) to generate new design concepts or variations based on an existing dataset.	**2**
4	Develop a model to analyse and generate design descriptions using NLP techniques involving sentiment analysis or summarization.	**2**
5	Build a recommender system that suggests design elements or styles based on user preferences, utilizing collaborative or content-based filtering.	**2**
6	Apply evolutionary algorithms to optimize design parameters, such as color schemes, layouts, or proportions.	**2**
7	Implement an AI model and explore methods to make its decision-making process transparent and interpretable for designers.	**1**
8	Develop an AR application that overlays design elements or modifications onto the real world, allowing users to visualize changes in their environment.	**1**
9	Apply transfer learning techniques to pre-trained models for design-related tasks, such as style transfer or image-to-image translation.	**1**
10	Develop a system that utilizes AI to analyze user interactions and feedback to improve the user experience of a design.	**1**

Course Outcomes:	
1	Outline the fundamental concepts of artificial intelligence relevant to design.
2	Apply AI tools and frameworks to enhance the design process and decision-making.
3	Analyze and interpret the output of AI systems and their impact on design outcomes.
4	Develop innovate solutions by combining AI with traditional design methodologies.
5	Evaluate the performance and reliability of AI models in generating design solutions.

Text Book:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication / Reprint**
1	"Artificial Intelligence: A Modern Approach", Stuart Russell and Peter Norvig; Pearson (4th Edition).	**2021**

2	"Deep Learning", Ian Goodfellow, Yoshua Bengio, and Aaron Courville; MIT Press.	**2016**
3	"Artificial Intelligence: Structures and Strategies for Complex Problem Solving", George F. Luger; Pearson (6th Edition).	**2008**
4	"Designing with the Mind in Mind: Simple Guide to Understanding User Interface Design Guidelines", Jeff Johnson; Morgan Kaufmann (2nd Edition).	**2013**

Reference Books:

Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication / Reprint**
1	"Artificial Intelligence for Humans: Fundamental Algorithms", Jeff Heaton; Heaton Research, Inc.	**2013**
2	"Artificial Intelligence: A New Synthesis", Nils J. Nilsson; Morgan Kaufmann.	**1998**
3	"AI: A Very Short Introduction", Margaret A. Boden; Oxford Press.	**2018**

Equivalent MOOCs courses

Sr. No.	**Course Links**	**Offered by**
1	http://www.digimat.in/nptel/courses/video/106106126/L01.html	**NPTEL**
2	http://www.digimat.in/nptel/courses/video/106102220/L01.html	**NPTEL**

Course Name	**:**	**Industrial Design**
Course Code	**:**	**BD2332**
Credits	**:**	**4**
LTP	**:**	**3-0-2**

Course Objectives:

- Understand about the concepts of field of industrial design
- provides a framework for the development of design methodology
- Create visual features of forms, configurations, patterns, and ornaments involved in the product design .
- Utilize the knowledge student learned to produce various design projects using multidisciplinary approach and the integration of design and engineering.

Total No. of Lectures – 42

Lecture wise breakup		**No. of Lectures**
Unit 1	**Introduction:** Overview of Historical Background of Industrial Design. Furniture of Egyptian Period; Golden Age of Greece; Gothic; Renaissance; Eighteenth Century (Golden Age of Furniture); Colonial America; Nineteenth Century.	5
Unit 2	**Design Theory**: Functional, material, visual requirements; 20/80 Rule; Accessibility; Advance organizer; Aesthetic-usability effect; Alignment; Archetypes; Attractiveness bias.	5
Unit 3	**Design Principles:** Unity and variety; Balance and proportion. Consistency; Comparison; Convergence.	4
Unit 4	**Design Process**: Identifying problem; Collecting data; Hypothesizing; Experimentation; Final solution; Benchmarking. socially and environmentally responsible industrial design practices to develop community-based design projects	6
Unit 5	**Digital Design Methods:** Basics of product design in the CAD environment. 3D modelling methods for solid and surface modelling in CAD software.Process Planning for Rapid Prototyping, STL File Generation Defects in STL Files and Repairing Algorithms, Slicing and Various Slicing Procedures.Study of Parametric design techniques and CNC capabilities in the design development of products, services and systems	12
Unit 6	**User Centered Design Methods**:	6

	Basic of user-centric design methods used to identify, understand, assess and prioritize the factors and perceptions that contribute to more effective product design and human centered design solutions.	
Unit 7	**Smart Product Design:** Introduction to smart product design including the basics of sensor technologies, electronics and programming required to produce working product concept prototypes.	4

Course Outcomes:	
1	Apply knowledge, techniques, skills and modern tools of mathematics, science, engineering, and technology to solve industry problems
2	Design solutions for well-defined industry problems and assist with the engineering design of systems, components, or processes appropriate to the discipline
3	Apply written, oral, and graphical communication in well-defined technical and nontechnical environments
4	Identify and use appropriate technical literature
5	Understand team function effectively as a member of a technical team.

Text Book:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication**
1	Will Lidwell, Kritina Holden, and Jill Butler. Universal Principles of Design, Rockport Publishers	2003
2	John R. Lindbeck, Product Design and Manufacture, Prentice Hall	1995
3	Bruce Hannah. Becoming a Product Designer: A Guide to Careers in Design, Wiley, John & Sons,	2003
Reference Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication**
1	Rapid Prototyping: Principles and Applications in Manufacturing, Chua, C.K., Leong, K.F., John Wiley and Sons Inc	2000
2	Automation, Production Systems, and Computer Integrated Manufacturing, Groover, M P, Prentice-Hall	2007

Total No. of Lab Hours– 28

List of Experiments:	**Number of Hours**

1	Design and fabrication of the additive manufacturing process for a given component using 3D scanning, produce an animation and 3D print.	6
2	Prepare multi-component assembly drawings and explore rendering techniques for product design	6
3	To perform simulation operations for drilling, milling etc. on Master CAM software for given job	4
4	Final Design Project which requires independent study and creative thinking.	10
5	To perform milling/ engraving operation on VMC machine using Master CAM Software	2

Equivalent MOOCs courses

Sr. No.	Course Links	Offered by
1	https://nptel.ac.in/courses/110106062	NPTEL
2	https://archive.nptel.ac.in/courses/112/106/112106134/	NPTEL

Course Name	**:**	**Design Forecasting and Trend Research**
Course Code	**:**	**BD2333**
Credits	**:**	**3**
L T P	**:**	**2 1 0**

Course Objectives:
Students should be able – ● To understand and analyze Forecasting. ● To explore the design trend of research. ● To apply the concept of economic and political trends while designing. ● To develop a product by applying the concept of trend research.

Total No. of Lectures – 42

Lecture wise breakup		**No. of Lectures**
Unit 1	Concept Of Forecasting, Importance and Objectives of Forecasting, Principle of Forecasting.	**8**
Unit 2	Classification Of Forecasting, Qualitative and Quantitative Techniques of Forecasting: Qualitative Techniques, Quantitative Techniques.	**8**
Unit 3	Design majors. Short-term and long-term trends, micro and macro trends. Theories of adoption and diffusion of trends.	**8**
Unit 4	Economic, political, technological, and psychological indicators in trend forecasting.	**8**
Unit 5	Future trends in design using cultural brailing, cross-cultural analysis methods, and ethnographic research.	**8**
Unit 6	Forecasting of Design-Centered Products: Case Studies.	**8**

Course Outcomes:	
1	Students should be able to understand and analyze the Foresting Technique.
2	Students should be able to evaluate Design trends in Forecasting.
3	Students should be able to understand design majors. Short-term and long-term trends, micro and macro trends. Theories of adoption and diffusion of trends.
4	Students should be able to understand and apply while designing about cultural brawling and cross-cultural analysis.
5	Students should be able to apply and design various concepts of forecasting and trend research for designing a product.

Text Book:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication / Reprint**
1	The Trend Forecasters Handbook: Second Edition, Martin Raymond and Sue Evans, Laurence King Publishing.	2016
Reference Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication / Reprint**
1	Trend Forecasting with Intermarket Analysis: Predicting Global Markets with Technical Analysis, Louis B. Mendelsohn, Wiley	2008
2	The Trend Forecaster's Handbook, Martin Raymond, Laurence King Publishing.	2010
3	The Trend Commandments: Turning Cultural Fluency into Marketing Opportunity, Michael R. Solomon, AMACOM.	2011

Equivalent MOOCs courses

Sr. No.	**Course Links**	**Offered by**
1	https://archive.nptel.ac.in/courses/110/107/110107080/	NPTEL
2	https://www.youtube.com/watch?v=DVEbZ__FNRg	NPTEL

Course Name	**:**	**Design, Media and Technology**
Course Code	**:**	**BD2334**
Credits	**:**	**4**
L T P	**:**	**3-0-2**

Course Objectives:
Student will be able- ● To understand the connection between design, media and technology. ● To understand the different modes of communication ● To analyze the connection between media and communication technologies ● To impart the knowledge of potential technologies of communication and their impact on society

Total No. of Lectures – 42

Lecture wise breakup		**No. of Lectures**
Unit 1	Communication and tools of Communication: media, introduction to communication technologies, visual communication, merging of two fields- media and communication	9
Unit 2	Media and changing technologies: visual technologies, audio technologies	9
Unit 3	Potential of technology and its impact on society, digital videos, digital presentation, graphic design for WWW	8
Unit 4	Media artefacts and convergences, junk communications and communication technologies mistakes	8
Unit5	New Applications and ways of working	8

No of lab hours- 28

List of Experiments:		**Number of Turns**
1	An assignment to explore and experiment with the relationship between Design, Media and Technology.	14

Course Outcomes:	
1	Identify various tools of communications in connection with media and technology.
2	Apply the concept of visual and audio communication in the design problems.
3	Experimentally analyze the behavior of media artefacts and junk communication.

4	Understand the application of new media and communication technologies.
5	Identify methods to improve the tools of communications.

Text Book:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication**
1	Jacqueline M. Layng, Terre Layng Rosner, Terre Rosner; Media Design: The Practice of Communication Technologies, Prentice Hall, 2003	2003
Reference Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication**
1	Don Norman:The Design of Everyday Things, Basic Books, 2013	2013

Equivalent MOOCs courses

Sr. No.	**Course Links**	**Offered by**
1	Visual Communication Design for Digital Mediahttps://onlinecourses.nptel.ac.in/noc20_ar15/preview	SWAYAM

Department Elective I

Course Name	**:**	**Nature and Form**
Course Code	**:**	**BD2361**
Credits	**:**	**4**
L T P	**:**	**2 0 4**

Course Objectives :
Students should be able - ● To explore the evolution of natural forms ● To analyze natural and manmade forms with an aesthetical lens ● To apply critical thinking in form analyses ● To develop and design nature inspired form in design

Total No. of Lectures – 28

Lecture wise breakup		**No. of Lectures**
Unit 1	**Understanding Nature & its design** Evolution of form in nature, Pattern & symmetry in nature, Fibonacci series & the golden ratio	**8**
Unit 2	**Form Appreciation** Elements and principles of design in nature, The need and a designer's approach., Form in different design disciplines	**8**
Unit 3	**Form & Metaphor** Understanding metaphors, Use of visual metaphor in product, Metamorphism	**6**
Unit 4	**Nature inspired Design** Understanding Biomimicry through form, features and its application, Case studies	**6**

List of Experiments:		**Number of Turns**
1	Analyzing the details present in nature and photographing and sketching from their perspective	**8**
2	Analyzing patterns, structure, repetition, and symmetry in nature	**8**
3	Case studies of products inspired from nature	**8**
4	Exercise involving taking inspiration from nature & creating mood board	**8**
5	Learning the patterns in nature and to present their artistic concepts	**10**
6	Redesign a product using biomimicry	**14**

Course Outcomes:	
1	Develop observational skills to appreciate nature
2	Understand the patterns and structure of life forms
3	Apply the intricate understanding of nature to various disciplines of design

4	Analyze various domains for application of nature inspired design
5	Evaluate interdisciplinary links between nature, art and design
6	Explore the importance of sustainable design practices and their application for awareness

Text Book:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication / Reprint**
1	"Biomimetics: Nature-Inspired Design and Innovation," Sandy B. Primrose, Wiley-Blackwell	2020
Reference Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication / Reprint**
1	"A Practical Guide to Bio-inspired Design," Helena Hashemi Farzaneh, Udo Lindemann., Springer Vieweg	2019
2	"Design by Nature: Using Universal Forms and Principles in Design," Maggie Macnab,New Riders	2011
3	"Form Follows Nature: A History of Nature as Model for Design in Engineering," Rudolf Finsterwalder,Springer Vienna Architecture	2011
4	"Nature in Design: The Shapes, Colors and Forms that Have Inspired Visual Invention," Alan Powers, Conran	2002
5	"Skin: Surface, Substance, and Design," Ellen Lupton, Jennifer Tobias, Alicia Imperiale, Grace Jeffers and Randi Mates, Princeton Architectural Press	2002

Equivalent MOOCs courses

Sr. No.	**Course Links**	**Offered by**
1	**The Language of Design: Form and Meaning** https://www.coursera.org/learn/design-language	Coursera
2	**Graphic Design Foundations: Ideas, Concepts, and Form** https://www.linkedin.com/learning/graphic-design-foundations-ideas-concepts-and-form	Coursera
3	**Design: Creation of Artifacts in Society** https://www.coursera.org/learn/design	Coursera
4	**Design Form Studies** https://www.udemy.com/course/design-form-studies-master-class-tm/	Udemy

Course Name	**:**	**Animation Design**
Course Code	**:**	**BD2362**
Credits	**:**	**4**
L T P	**:**	**2 0 4**

Course Objectives:

Students should be able to -

- Understand the History of Traditional Animation
- Learn Step-by-step procedures for Traditional Animation
- Know about the principles of animation
- Understand the fundamentals of timing for Animation
- know the various theories of film studies and to relate various technologies and their development

Total No. of Lectures –28

Lecture wise breakup		**No. of Lectures**
Unit 1	**Introduction Animation**: Its definition, early examples of Animation.	**2**
Unit 2	**History of Animation**: Stop Motion Photo Animation, Zoetrope, Thaumatrope, Cel and Paper Animation, early Disney's Cel Animation Processes	**4**
Unit 3	**Types of Animation**: Cel Animation, Stop Motion Animation, Computer Animation, 2-D Animation, 3-D Animation	**4**
Unit 4	**Skills for an Animation Artist**: Visual and creative development of an Artist, importance of observation with minute details, efficiency to draw gestures, and facial expressions, good listening, hard work and patience, creative and innovative	**6**
Unit 5	**Basic Principles of Animation**: Illusion of Life, straight action and pose Timing, Exaggeration, Drama and Psychological Effect, Fade in and Fade out, Squash and Stretch, Anticipation, staging, follow through and overlapping action, Arcs, Solid Drawing, Appeal, slow in and slow out, Secondary Action	**6**
Unit 6	**Various Terms**: Animation Drawings/Cels, Rough Drawings, Cleanups, Color reference drawings, Layout, Model Sheet, Key Drawings and in-betweens, Master Background, Concept Piece, Character drawing, Story Board.	**6**

List of Experiments:		Number of Turns
1	**Adobe Photoshop:** 1. Create your visiting card 2. Create Title for any forthcoming film 3. Digital Matte Paint 4. Convert Black and White to Color 5. Convert Day mode to Night mode 6. Design Image manipulation 7. Smooth skin and remove blemishes & scars 8. Create a 3D pop-out effect 9. Create Textures 10.Timeline Animation	10
2	**Adobe Illustrator:** 1. Advertisement 2. Digital Illustrations 3. Brochure 4. Packet Design(Toothpaste packet, Soap cover, any Food product) 5. Danglers for display 6. Menu cards 7. Calendar Design 8. Tracing image 9. Vehicle Design 10. Festival	10
3	**Adobe Indesign:** 1. Magazine A4 Size 2. Newspaper layout design & advertisements – Fine arts 3. Special Supplement 4. Different categories of Books 5. Info-graphics 6. Caricatures	10
4	**Corel DRAW:** 1. Create a paper ad for advertising of any commercial agency 2. Package Design 3. Corporate ID 4. Exhibition Layout 5. Oblers	10
5	1. Create any Model some objects such as chairs, tables, fruits, utensils 2. Create any Model instruments, tools 3. Create any Model of Cars or Bike, 4. Create any model of the male or female character.	6
6	Techniques of 3D Animation	10

Course Outcomes:	
1	Grasp complete information on early attempts of animation, equipment, development, animation studios, and projects
2	Grasp complete animation film production
3	Grasp and implementation of Animation Principles
4	Understand different types of walks, runs, dialogues, expressions, acting for animation, etc. through mini-project work.
5	Understand the case studies of Classic Animated features and Short Films

Text Book:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication / Reprint**
1	Animation Unleashed, Ellen Bessen, Michael Weise Productions	2008
2	The complete animation course, Chris Patmore, Pub.-Baron's Educational Series. (New York)	2003
3	The Art of 3D Computer Animation and Effects: Isaac Kerlow	2004
Reference Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication / Reprint**
1	The Encyclopedia of Animation Techniques, Richard Taylor	1996
2	Experimental Animation: An Illustrated Anthology, Robert Russet and Cecile Starr Pub.- Van Nostrand Reinhold Compa Pub.	1976
3	Web Design Portfolio 2020 - Adobe Dreamweaver & Photoshop	2020

Equivalent MOOCs courses

Sr. No.	**Course Links**	**Offered by**
1	https://onlinecourses.swayam2.ac.in/cec20_cs08/preview	NPTEL
2	https://www.classcentral.com/course/swayam-animations-13880	SWAYAM

DEPARTMENTAL ELECTIVE -II

Course Name	**:**	**Supply Chain Management**
Course Code	**:**	**BD2363**
Credits	**:**	**4**
L T P	**:**	**3-1-0**

Course Objectives:

- The enable the student's, knowledge of strategic importance of good supply chain design, planning, and operation for industries.
- To explore how good supply chain management can lead to competitive advantages and understand weaknesses that could hurt the performance of industries.
- To analyze the various Drivers in supply chain performance its practical relevance and understanding the knowledge of various distribution networks along with their applications.
- To analyze the various factors governing design of a supply chain network.
- To interpret the various critics behind the supply chain decisions and operation analytics.

Total Number of Lectures: 42

Lecture wise breakup		**No. of Lectures**
Unit 1	**Introduction to Supply Chain:** Objectives of supply chain, stages of supply chain, supply chain process cycles, customer order cycle, replenishment cycle, manufacturing cycle, procurement cycle, push/pull view of supply chain processes, importance of supply chain flows, and examples of supply chain**.** **Supply Chain Drivers and Obstacles:** Framework for structuring drivers, role of each driver in supply chain, obstacles to achieve strategic fit.	**6**
Unit 2	**Supply Chain Performance:** supply chain strategies, achieving strategic fit, product life cycle, the minimize local cost view, the minimize functional cost view, the maximize company profit view, the maximize supply chain surplus view. **Sourcing Decisions in Supply Chains** Role of sourcing in supply chains, supplier assessment, design collaboration, sourcing planning and analysis, market sourcing decisions in practice.	**8**
Unit 3	**Managing Economies of Scale in a Supply Chain**: Role of cycle inventory in a supply chain, various costs associated with inventory management, cost trade-off, Inventory Models-Deterministic and Probabilistic, ABC Analysis	**8**

Unit 4	**Network Design** Factors influencing distributioni network design, distribution networks in practice, framework for network design decisions, models for facility location and capacity allocation, making network design decisions in practice. global supply chain networks.	**4**
Unit 5	**Demand Forecasting:** Role of forecasting in supply chain, Forecasting methods-Causal and Time series, Measures of forecast errors.	**6**
Unit 6	**Transportation in a Supply Chain:** Facilities affecting transportation decisions, modes of transportation and their performance characteristics, design options for a transport network, tradeoffs in transportation decision, tailored transportation, routing and scheduling in transportation, making transportation decisions in practice.	**6**
Unit 7	**Coordination in a Supply Chain** Lack of supply chain coordination and the bullwhip effect, effect of lack of coordination on performance, obstacles to coordination, managerial levers to achieve coordination, achieving coordination in practice. information technology and its use in supply chain.	**4**

Tutorial Work:		**No. of Turns**
1	Identification of drivers and issues related to SCM system	**2**
2	Identification of obstacles in system performance measurement	**2**
3	Model development and analysis for demand forecasting	**3**
4	Network design and assessment	**2**
5	Transportation problem solving using mathematical/simulation approach	**3**
6	Case studies	**2**

Course Outcomes:	
1	Students will be able to know the different supply chain cycles used in industry.
2	Students will be able to apply the concept of economic analysis towards overall supply chain profit maximization.
3	Students will be able to develop a framework in order to handle the practical criticality through mathematical algorithms.
4	Students will be able to determine the demand through various forecasting methods.
5	Students will be able to design different transportation and distribution networks with proper coordination among the different stages.

Text Books:		
S. No.	**Name of Book/Authors/Publishers**	**Year of Publication**
1	Marketing logistics: A Supply Chain Approach", Kapoor K K, KansalPurva, Pearson Education Asia.	**2003**
2	Logistics and Supply Chain Management", Christopher Martin, Pearson Education Asia.	**2004**
3	Supply Chain Management, For Global Competitiveness, B S Sahay,Laxmi Publications (P) Ltd	**2006**
Reference Books:		
S. No.	**Name of Book/Authors/Publishers**	**Year of Publication**
1	Designing and Managing the Supply Chain: Concepts, Strategies, and Case Studies, Levi D. S., Kaminsky P. and Levi E. S., McGraw Hill Inc. New York.	**2000**
2	Supply Chain Management – Strategy, Planning and Operation", Sunil Chopra and Peter Meindl, Pearson/PHI, 3rd Edition.	**2007**
3	Logistics Management: An Analytics-Based Approach, Matthew J. Liberatore, Tan Miller, Business Expert Press	**2020**

Equivalent MOOCs Courses:

S. No.	**Couse Links**	**Offered by**
1	https://archive.nptel.ac.in/courses/110/107/110107074/	**NPTEL**
2	https://www.edx.org/learn/supply-chain-design/massachusetts-institute-of-technology-supply-chain-fundamentals?	**GIAN**

Course Name	**:**	**Materials and Design**
Course Code	**:**	**BD2364**
Credits	**:**	**4**
L T P	**:**	**3 1 0**

Course Objectives :

Students should be able -

- To provide students with a comprehensive understanding of the definition and classification of materials, including traditional and new advanced materials.
- To introduce the importance of material selection in the design process and its role in various industries.
- To familiarize students with basic hand tools, cutting, shaping, and joining tools, as well as simple machinery.
- To explore various methods and techniques for material processing, covering cutting, joining, and forming techniques to apply these in practical scenarios.
- To enhance the knowledge in material characterization, testing, and selection, economic considerations, and sustainability factors.

Total No. of Lectures – 28

Lecture wise breakup		**No. of Lectures**
Unit 1	**Introduction to Materials and Design** Definition and Classification of Materials, Traditional Materials, New and Advanced Materials. Importance of Material Selection in Design. Role of Materials in Various Industries. Environmental Considerations in Material Selection	**5**
Unit 2	**Basic Hand Tools and Simple Machinery** Overview of Basic Hand Tools, Cutting Tools, Shaping Tools, Joining Tools. Introduction to Simple Machinery, Types of Simple Machinery. Applications in Material Processing, Safety Measures and Practices in Tool and Machinery Usage.	**6**
Unit 3	**Methods and Techniques for Material Processing** Material Processing Overview, Cutting and Machining Techniques- Turning, Milling, Drilling. Joining Techniques-Welding, Adhesive Bonding. Forming Techniques-Casting, Forging, Extrusion	**6**
Unit 4	**Characterization, Testing, and Selection of Materials** Material Characterization- Physical Properties, Mechanical Properties, Thermal Properties. Material Testing Methods-Non-Destructive Testing, Destructive Testing. Material Selection Criteria- Functional Requirements, Economic Considerations, Sustainability Factors**.**	**6**
Unit 5	**Manufacturing Processes and Applications**	

	Overview of Manufacturing Processes, Metals and Alloys in Manufacturing- Casting and Forging Processes, Machining and Fabrication. Plastics and Ceramics in Manufacturing- Injection Molding, Ceramic Forming Processes. Composite Materials in Manufacturing-Types, Material Processing. Applications of Different Materials in Design. Case Studies and real-world applications and Industry Examples.	**5**

List of Experiments:		**Number of Turns**
1	Material Classification and Properties: To classify and analyze different materials based on their properties.	**3**
2	Hands-on Experience with Basic Hand Tools: To familiarize students with the usage of basic hand tools and emphasize safety measures.	**2**
3	Material Processing Techniques: To explore cutting, joining, and forming techniques in material processing.	**3**
4	Material Characterization and Testing: To characterize and test material properties through experimental methods.	**3**
5	Material Selection Criteria: To evaluate material selection criteria based on functional requirements, economic considerations, and sustainability factors.	**3**

Course Outcomes:	
1	Remember classification of materials, understanding their significance in design and industry applications.
2	Understand the usage of basic hand tools, machinery, and various methods for material processing.
3	Apply cutting, joining, and forming techniques in material processing, and demonstrate safe practices with tools and machinery.
4	Analyze material properties, testing methods, and selection criteria for effective decision-making in design and manufacturing.
5	Evaluate the applications of different materials in design through case studies and real-world examples, demonstrating a holistic understanding of materials and design principles.

Text Book:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication / Reprint**
1	“Materials and Design: The Art and Science of Material Selection in Product Design,” M F. Ashby, K Johnson,Butterworth-Heinemann, Elsevier Publishers.	2011
	“Materials Science and Engineering: A First Course,”V Raghavan, 6th Revised Edition, Prentice Hall India Learning Private Limited.	2015

Reference Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication / Reprint**
1	"Materials Science and Engineering: An Introduction," William D Callister Jr. and David G. Rethwisch, , John Wiley, 8th Edition.	2009

Equivalent MOOCs courses

Sr. No.	**Course Links**	**Offered by**
1	Materials Selection and Design https://archive.nptel.ac.in/courses/112/104/112104122/	NPTEL
2	Smart Materials and Intelligent System Design https://archive.nptel.ac.in/courses/112/104/112104251/	NPTEL

Course Name	**:**	**Materials Management**
Course Code	**:**	**BD2365**
Credits	**:**	**4**
L T P	**:**	**3 1 0**

Course Objectives:

- Gain exposure to integrated materials and purchase management.
- Understand the Inventory management tools and policies.
- Learn the different models of Inventory and understand their costing.
- Exposure to the stores functions and retrieval systems.

Total No. of Lectures – 42

Lecture wise breakup		**No. of Lectures**
Unit 1	**Integrated Approach to Materials Management** Introduction, Materials Productivity and Role of Materials Management Techniques in Improved Materials Productivity. Cost Reduction and Value Improvement, Value Analysis for Right Choice and Rationalization Of Materials.	**4**
Unit 2	**Purchasing Function** Objectives, Purchase Requisitions, Types of Specification, Centralized Versus Decentralized Purchasing, Timing of Purchases. Purchasing Research, Identification of Right Sources of Supplies. Make or Buy Decisions, Vendor Selection, and Vendor Rating. Negotiations, Purchase Price Analysis, and Price Determination. Purchasing Organization, Procedures, Forms, Records and Reports. Purchasing As A Dynamic Profession, Transition To Supply Management, Reverse Auctioning	**8**
Unit 3	**Inventory Management** Inventory Concepts, Reasons for Holding Inventory, Types of Inventories, Inventory Reduction Tactics. Inventory Turnover Ratio. Selective Inventory Management: ABC, VED, And FSN Analysis Etc., Identifying Critical Items with Selective Inventory Management.	**6**
Unit 4	**Operating Policies** Continuous Review System, Periodic Review System, Comparative Advantages and Disadvantages of Continuous and Periodic Review Systems, Hybrid Systems. Inventory Management Across the Organization.	**6**
Unit 5	**Optimizing Inventory**	**6**

	Assumptions For Wilson's Lot Size Model, Inventory Costs, Hidden Costs, Composition of Costs, Estimation of Inventory Related Costs, Lead Time, Stock Out Point, Number Of Time Periods, Calculating Economic Order Quantity (EOQ), Sensitivity Analysis Of EOQ Model.	
Unit 6	**Special Inventory Models** Finite Replenishment Rate Model, Lot Size Models with Planned Backlogging, Generalized Model with Uniform Replenishment Rate, Inventory Model with Lost Sales, Quantity Discount Model, One Period Decisions. Determination of Safety Stock, Service Level and Uncertainty in Demand. Information Systems For Inventory Management.	**6**
Unit 7	**Stores Management** Introduction, Stores Functions, Stores Organization, Stores Systems and Procedures, Stores Accounting and Verification Systems, Stores Address Systems, Stores Location and Layout, Store Equipment. Discussion On Modern Materials Management Techniques Like JIT, SMED, DBR & MRP.	**6**

Course Outcomes:	
1	Remember the functions of inventory control and management.
2	Understand the Purchasing activities and vendor management.
3	Apply different optimization methods in inventory management.
4	Analyze the models in Inventory management.
5	Evaluate the modern principles in-store management.

Text Book:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication / Reprint**
1	Introduction to Materials Management, Arnold and Chapman, Fourth Edition, Pearson Education Asia	2001
Reference Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication / Reprint**
1	Material Management –An Integrated Approach, Gopal Krishnan and Suderashean, Eastern Econoly Edition	1990
2	Production Planning & Inventory Control, Narsimhan, Mcleavey&Billington, Second Edition, Prentice Hall of India	2003
3	Purchasing and Inventory Control, Menon K S, Third Edition, Wheeler Publishing New Delhi	1997

Equivalent MOOCs courses

Sr. No.	Course Links	Offered by
1	https://archive.nptel.ac.in/courses/110/105/110105095/	NPTEL
2	https://www.youtube.com/watch?v=XP_zi6GbU_Q	NPTEL

DEPARTMENTAL ELECTIVE -III

Course Name	**:**	**Operations Research**
Course Code	**:**	**BD2366**
Credits	**:**	**4**
LTP	**:**	**3-1-0**

Course Objectives:

- Understand the methodology of operations research problem solving and formulate linear programming problem
- Analysing different situations in the industrial/ business scenario involving limited resources and finding the optimal solution within constraints
- Deterministic and probabilistic models with emphasis on formulation of problems for scientific and quantitative analysis.
- Interpret and apply the results of an operations research model

Total No. of Lectures – 42

Lecture wise breakup		**No. of Lectures**
Unit 1	**Introduction:** Origin and Development of Operations Research, Scope of Operations Research (OR), General Methodology of OR, OR and Managerial Decision Making, OR Applications In Industrial and Non-Industrial Fields. Classification of Optimization Problems; Optimization Techniques.	3
Unit 2	**Linear Optimization Models** Formulation of Linear Programming Problem, Graphical Solution, Sensitivity Analysis In Graphical Solution, Comparison of Graphical and Simplex Algorithm, Simplex Algorithm, Computational Procedure In Simplex, Big M Method, Two Phase Method, Degeneracy, Duality and Its Concept, Application of LP Model to Product Mix and Production Scheduling Problems.	15
Unit 3	**Transportation Model:** Solution Methods, Balanced and Unbalanced Problems, Vogel's Approximation Method, Degeneracy in Transportation Problems. Assignment Problem, Methods for Solving Assignment Problems. The Traveling Salesman Problem. Numerical On Transportation, Assignment and Traveling Salesman Method. Computer Algorithms For Solution To LP Problems	10
Unit 4	**Dynamic Programming Problems:** Model Formulation, Computational Procedures, Solution In Different Stages.	3
Unit 5	**Game Problems:**	5

	Introduction And Scope Of Game Problems In Business And Industry, Min-Max Criterion And Optimal Strategy, Solution Of Two-Person Zero-Sum Game, Game Problem As A Special Case Of Linear Programming.	
Unit 6	**PERT AND CPM**: Network Representation. Critical Path Computations. Construction of the Time Schedule. Linear Programming Formulation of CPM. PERT Calculations	6
Unit 7	**Queuing Problems**: Queuing systems and concepts, classification of queuing situations; Kendall's notation, solution of queuing problems, single channel, single stage, finite and infinite queues with Poisson arrival and exponential service time, applications to industrial problems.	6

Course Outcomes:	
1	Understand the characteristics of different types of decision-making environments and the appropriate decision making approaches and tools to be used in each type..
2	Convert the industry/ real life problem into a mathematical model.
3	Apply the PERT/CPM for a constraint based problem of service/ manufacturing
4	Understand different queuing/Dynamic programming & Game situations and find the optimal solutions using models for different situations.
5	Understand different queuing situations and find the optimal solutions using models for different situations

Software	
1	Lindo Software for solving LP and IP problems; http://www.lindo.com/ EXCEL add-in Solver for solving LP and IP problems
2	WinQSB v. 2.0: Decision Support Software; Yih-Long Chang, Wiley, 2003

Text Book:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication**
1	"An Introduction to Operations Research", Taha, H.A., 9th Ed., Prentice Hall of India	2011
2	**"Operations Research", P. K. Gupta and D.S. Hira, S. Chand**	2008
Reference Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication**

1	“Principles of Operations Research”, Wagner H M, Second Edition, Prentice Hall of India Private Limited, New Delhi.	2003
2	Panneerselvam R., Operations Research, PHI	2011

Equivalent MOOCs courses

Sr. No.	Course Links	Offered by
1	https://nptel.ac.in/courses/110106062	NPTEL
2	https://archive.nptel.ac.in/courses/112/106/112106134/	NPTEL

Course Name	**:**	**Product Semantic**
Course Code	**:**	**BD2367**
Credits	**:**	**4**
L T P	**:**	**3 1 0**

Course Objectives :

Students should be able -

- To analyze and understand the fundamentals of semantics and their applications
- To explore solutions by gaining an understanding to better design products with the help of product semantics.
- To explore advanced means to communicate ideas to multiple audiences through the application of product semantics, distinguishing between self-perception and how others read design artifacts.
- To undertake challenges through Project-based work that will further challenge students to work individually, as well as collaboratively with external parties.

Total No. of Lectures – 42

Lecture wise breakup		**No. of Lectures**
Unit 1	**Introduction to Semiotics** Objects,definition,structure,semiosis,Signs and their forms Codes and contextual representation, Sociology, human needs, Rituals religion,and expression.Art and aesthetics as the meaning of expression, Meaning-making, reproduction of image and technology, post-modernism and popular culture, Basics of semiotics, Theories of signs, and Analyzing structure.	10
Unit 2	**Introduction to semantics of the product.** The trajectory of the artificiality and the change of the culture of design and in its speech. Essential concepts on design centered in the person and the meanings of the artifacts: in the use, in the language, its cycle of life, and its ecological framing. Some methodological aspects.	12
Unit 3	**Product design as communication** Aesthetics of design, Product gestalt, Message and communication in product design, semiotics in product design, Semantic functions, Syntax and Pragmatics.	12
Unit 4	**Product semantics theories and their applications** Theories in product semantics, Categorization theory as a framework for product semantics, taxonomy of objects and generative approach in design.	8

Course Outcomes:	
1	Understanding of the fundamentals and their applications in assignments.
2	Active participation in class discussions.
3	Performance in individual assignments.
4	Final submission of classwork and project work.
5	Evaluation through mid-term and end-term examinations

Text Book:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication / Reprint**
1	The semantic turn: A new foundation for design/ Klaus Krippendorff / crc Press	2005
2	Semiotics: the basics/ Chandler, Daniel /Routledge	2007
Reference Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication / Reprint**
1	Design for product understanding: The aesthetics of design from a semiotic approach./ Monö, Rune G., Michael Knight, and Rune Monö/ Liber	1997
2	"Product semantics: A triangulation and four design theories./ Penn Libraries / Klaus Krippendorff,	1989.
3	A. "Categorization... natural language and design." Design Issues 5.2	1989

Equivalent MOOCs courses

Sr. No.	**Course Links**	**Offered by**
1	https://www.mooc-list.com/tags/semantics#google_vignette	MOOC

Course Name	**:**	**Product Life Cycle Analysis**
Course Code	**:**	**BD2368**
Credits	**:**	**4**
L T P	**:**	**3 1 0**

Course Objectives:

Students should be able to -

- Understand the concept of product design and simulation.
- Understand New product development and supporting systems.
- Interpret technology forecasting and product innovation and development in business processes.
- Test, marketing, Sales, and customer support.

Total No. of Lectures – 42

Lecture wise breakup		**No. of Lectures**
Unit 1	**Product Life Cycle Management (PLM) and Product Data and Management (PDM)** Need for PLM, opportunities and benefits of PLM, different views of PLM, components of PLM, phases of PLM, PLM feasibility study. PLM Strategies, strategy elements, its identification, selection and implementation. Product Data Management, and implementation of PDM systems.	**6**
Unit 2	**Product design** Engineering design, organization and decomposition in product design, product design process, methodical evolution in product design, concurrent engineering, design for 'X' and design central development model. Strategies for recovery at end of life, recycling, human factors in product design. Modeling and simulation in product	**6**
Unit 3	**Product development** New Product Development, structuring new product development, building decision support system, Estimating market opportunities for new product, new product financial control, implementing new product development, market entry decision, launching, sales distribution and support, Marketing segmentation positioning and pricing. Concept of redesign of the product.	**6**
Unit 4	**Technology forecasting** Technological change, methods of technology forecasting, relevance trees, morphological methods, flow diagram and combining forecast of technologies Integration of technological product innovation and product development in business	**6**

	processes within enterprises, methods and tools in the innovation process according to the situation,	
Unit 5	**Product building and structures:** Virtual product development tools for components, machines, and manufacturing plants: 3D CAD systems, digital mock-up, model building, model analysis, production (process) planning, and product data technology, Product structures: Variant management, product configuration, material master data, product description data, Data models, Life cycles of individual items, status of items.	**6**
Unit 6	**Outsourcing** Managing Suppliers, Supply Chain Analysis, Product Field Testing, Regulatory Environment, Providing Customer Service and CRM.	**6**
Unit 7	**Safety and Product management** Product Safety, Recalls and Warranties, Managing Product Upgrades, Managing and Responding to Disruption, Life Cycle Cost, P&L Management and ROI	**6**

Course Outcomes:	
1	Remember the basics in technical product management throughout different phases of the product life cycle.
2	Understand and develop, plans for all stages of product management.
3	Apply different tools and methodologies in the supply chains.
4	Analyze product liability issues, product warranties, product recalls and its impacts.
5	Evaluate the product performance and basic financial management tools.

Text Book:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication / Reprint**
1	Product Lifecycle Management: Paradigm for 21st Century Product Realisation, Stark, John, Springer-Verlag	2004
Reference Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication / Reprint**
1	Product Design for the environment-A life cycle approach, FabioGiudice, Guido La Rosa, Taylor & Francis	2006
2	Product Lifecycle Management, Uthayan Elangovan, Taylor & Francis Publications, CRC Press.	2021

3	New product development and product life cycle strategies, Sunil Bajaj, Kaav Publications	2017

Equivalent MOOCs courses

Sr. No.	**Course Links**	**Offered by**
1	https://www.youtube.com/watch?v=qgVs8vskWl0	NPTEL
2	https://nptel.ac.in/courses/105105157	NPTEL

DEPARTMENTAL ELECTIVE -IV

Course Name	**:**	**Business Process Reengineering**
Course Code	**:**	**BD2369**
Credits	**:**	**4**
L T P	**:**	**3-1-0**

Course Objectives
● To explore the concept of business process. ● To analyze the various BPR phases for product processing and development. ● To develop the model for cost reduction and the reducing process cycle time for improving the quality as a whole. ● To apply the concept of IT with BPR stages.

Total Number of Lectures:42

Lecture wise breakup		**No. of Lectures**
Unit 1	Nature, Significance & Fundamentals of business process reengineering BPR, Historical background Fundamentals of BPR Concepts and techniques. Changing business processes: the importance of technology as a driver for organization	**6**
Unit 2	Business vision and process objectives, Processes to be redesigned, measuring existing processes, Relationship between BPR and Information Technology, Role of information technology (IT) and identifying IT levers	**8**
Unit 3	Reasons for implementation of BPR, Different steps to be taken for BPR implementation, BPR phases, Relationship between BPR phases. BPRE & TQM, benchmarking, ISO standards. Implementation of BPRE-business process management, principles, Business models, barriers	**8**
Unit 4	Change and the manager: change and the human resource: the cultural web and the past: the cultural attributes of change Typical BPR activities within phases: Change management, Performance management, and programme management.	**8**
Unit 5	Co-ordination and complementary efforts, IT capabilities and their organizational impacts, Different BPR Methodologies, BPR Model, Performance Measurement of BPR	**6**
Unit 6	Case studies on BPR, The concept of the learning organization and its influence on systems development: restructuring the organization, Discussion on how actually BPR works in the organization.	**6**

Tutorial Work:		No. of Turns
1	Identification of drivers and issues related to BPR	2
2	Development of relationship between BPR and Technology	2
3	Model development and analysis for BPR systems	3
4	Network design and assessment	2
5	Problem solving using mathematical approach	3
6	Case studies	2

Course Outcomes:	
1	Students are able to understand how business processes can be radically improved, dramatically.
2	Students will be able to reducing process cycle time and cost, improving the quality of the process products or outcomes.
3	Students are able to plan strategies and policies for a product development.
4	Students can learn how to help organizations fundamentally rethink the way they do their work in order to dramatically improve customer service and reduction in operational cost.
5	Students will be able to apply the principles and tools of systems analysis and design.

Text Books:

S. No.	Name of Book/Authors/Publishers	Year of Publication
1	Strategic Business Process Transformation through BPR, Warner Winslow, Tata McGraw Hill	1996
2	Business Process Reengineering, R. Radhakrisnan, Prentice Hall of India.	Latest
3	Business Process Re-engineering, Omar El Sawy, Tata McGraw Hill	2010
4	Business Process Re-engineering, R. Srinivasan, Tata McGraw Hill	2011

Reference Books:

S. No.	Name of Book/Authors/Publishers	Year of Publication
1	Business Process Reengineering, Henry J Johansson, H J Johansson, Mo, John Wiley	1994
2	Organisational Transformation through Business Process Reengineering, Vikram Sethi William R. King, Pearson	1998
3	Business Process Reengineering and Change Management, B. R. Dey, Wiley	2004

Equivalent MOOCs Courses:

S. No.	Couse Links	Offered by
1	https://www.shiksha.com/online-courses/business-process-re-engineering	Shiksha
2	https://www.classcentral.com/course/udemy-the-complete-business-process-reengineering-89246	Udemy

Course Name	**:**	**Entrepreneurship**
Course Code	**:**	**BD2370**
Credits	**:**	**4**
L T P	**:**	**3-1-0**

Course Objectives:

Students will be able-

- To instil a comprehensive understanding of entrepreneurship concepts, importance, and diverse types.
- To explore into various entrepreneurial process, scrutinizing its environmental and cultural facets.
- To encourage skills in generating business ideas, crafting business plans, and critically evaluating ideas and organizational choices.
- To equip students with the capability to construct project proposals, plan and monitor entrepreneurial ventures.

Total No. of Lectures– 42

Lecture wise breakup		**Number of Lectures**
Unit 1	**Entrepreneurship Development Introduction** Concept and importance, qualities,nature,types,traits,Goal determination–ProblemsChallengesand solutions. Role of Entrepreneur in Indian economy and developing economies with reference to Self-Employment Development EntrepreneurialCulture.	**10**
Unit 2	**Entrepreneurial Process** Environment, culture and stages in entrepreneurial process, changing dimensions in entrepreneurship – Digital entrepreneurship. Entrepreneur Vs. Intrapreneur, Entrepreneur Vs. Entrepreneurship, Entrepreneur Vs. Manager; Role Of Regulatory Institutions; Role of Development Organizations; Self Employment Oriented Schemes; Various grant schemes.	**14**
Unit 3	**Business Ideation & Business Model Canvas** Meaning and Objectives of A Business Plan, Advantages and cost of preparing a Business Plan, Elements, Critical Assessment Generating business idea–sources of new ideas, methods of generating ideas, opportunity recognition. Choice of the organization: Sole Proprietorship, partnerships, Joint Stock Co., Co- Operatives Family Business–meaning, characteristics, importance, types and models.	**8**
Unit 4	**Entrepreneurship Training & Promotion**	

	Training Preparation and Development Programme. Evaluating entrepreneurial development programs. Developing support system. Feasibility study – market feasibility, technical/operational feasibility, financial feasibility, environmental scanning, competitor and industry analysis. Role of Central Government and State Government in promoting Entrepreneurship-Introduction to various incentives, subsidies and grants.	**5**
Unit 5	**Project Proposal** Need and Objects; Nature of organization, Production Management; Financial Management; Marketing Management; Consumer Management.PlanningandMonitoringentrepreneurship.Entrepreneurs beforeindependence and entrepreneurial growth after independence under planning system.	**5**

Course Outcomes:	
1	Remember fundamental entrepreneurship concepts and acknowledge the crucial role of entrepreneurs in the economy.
2	Understand the entrepreneurial process and distinguishing between its various dimensions.
3	Apply ideation and business planning skills to make informed decisions regarding organizational structures.
4	Analyze entrepreneurship training, programs, and the influence of government incentives on entrepreneurial development.
5	Evaluate project proposals, showcasing an understanding of organizational dynamics, production, financial, and marketing management.

Text Book:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	"Entrepreneurship" by Hisrich Peters, Mc Graw Hills, Tenth Edition	2016
Reference Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	"The Culture of Entrepreneurship" - Brigitte Berger, ICS Pt.	1991
2	"Entrepreneuring:10 Commandments for Building a Growth Company", 3rd Ed. - Steven Brandt	1997
3	"The Entrepreneurial Connection" - Gurmit Narula, Tata McGraw Hill	2001
4	"Fundamental of Entrepreneurship" – H. Nandan, 3rdEd, PHI Learning.	2013

Equivalent MOOCs Courses

S. No.	Course Links	Offered by
1	https://onlinecourses.nptel.ac.in/noc20_mg35/preview	SWAYAM
2	https://archive.nptel.ac.in/courses/127/105/127105007/	NPTEL

Course Name	**:**	**Technology Management**
Course Code	**:**	**BD2371**
Credits	**:**	**4**
L T P	**:**	**3-1-0**

Course Objectives:

Student will be able-

- To describe the evolution in the technology management.
- To contribute along with inputs for facing the changing technology.
- To support the overall business strategy and provide a roadmap for technology-related decisions and investments.
- To assess the current state of technology, identifying gaps and opportunities, and formulating a plan to acquire, develop, deploy, and manage technology resources to create competitive advantage and value for the organization.
- To learn the concept of performance management measures and evaluate the performance of technology resources, assets, and services in alignment with the organization's objectives.

Total No. of Lectures – 42

Lecture wise breakup		**No. of Lectures**
Unit 1	**Technology Management** Issues and applications, concepts of technology; role and importance of technology management, dimensions of technology management, technology management in India.	**5**
Unit 2	**Technology Change:** Nature of technology change, motivation for technology change. invention and innovation, technology life cycle, technology monitoring	**5**
Unit 3	**Technology Forecasting** Objectives and approaches, methodology of technological forecasting, Delphin Technique, growth curves, morphological analysis technological discontinuities, Indian Technology Vision 2020.	**5**
Unit 4	**Management of R & D** Corporate strategy, selection of R & D projects, managing R & D, radical and cyclic innovation processes. technology strategy and innovation	**5**
Unit5	**Technology Absorption and Diffusion** Technology dependence, concepts in technology absorption, constraints in technology absorption. management of technology	**5**

	absorption, technology absorption and adaptation scheme (TAAS), concept of diffusion of technology, perspective on diffusion, developing diffusion strategies	
Unit 6	**Technology Transfer** Models of technology transfer, technology transfer modes, dimensions of technology transfer, dimensions of technology transfer, pricing of technology government policies of technology transfer	**5**
Unit 7	**Role of Intellectual Property Rights** Nature Of IPR, patent, trademark and copy rights legal aspects	**3**
Unit 8	**Managing Process Technology** Continuous Improvement Technology Integration, Product and Process Technology, Techniques of Improvement, Economics If Improvement.	**4**
Unit 9	**Technology as a Competitive Strategy** Competitive analysis, core competitive competencies, technology leadership, adoption of new technology, marketing of new technology. case studies on technology management.	**5**

Course Outcomes:	
1	Remember the fundamental theories and principles of technology management.
2	Understand the importance of technology changes and develop adaptive strategies
3	Apply technology management frameworks to analyze industry trends and challenges.
4	Evaluate the impact of technological advancements on business processes and competitiveness.
5	Develop strategic technology management plans to drive innovation and sustain competitive advantage.

Text Book:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication**
1	"Total Quality Management for Engineers", M Zaire, Wood head publishing Ltd.	2015
2	"Strategic Technology Management", Frederick Betz, McGraw Hill	2009
3	Technology, Innovation, and Educational Change: A Global Perspective", Robert B. Kozma, Lawrence Erlbaum Associates, Inc.	2003
Reference Books:		

Sr. No.	Name of Book/ Authors/ Publisher	Year of Publication
1	"The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail" by Clayton M. Christensen, Harvard Business Review Press	2017
2	"Crossing the Chasm: Marketing and Selling Disruptive Products to Mainstream Customers" by Geoffrey A. Moore, HarperBusiness	1991

Equivalent MOOCs courses

Sr. No.	Course Links	Offered by
1	**NOC:Strategy and Technology: A Practical Primer**https://www.digimat.in/nptel/courses/video/110106157/L55.html	NPTEL

DEPARTMENTAL ELECTIVE -V

Course Name	**:**	**Value Engineering**
Course Code	**:**	**BD2373**
Credits	**:**	**4**
L T P	**:**	**3-1-0**

Course Objectives:

Students will be able-

- To understand the concept of value analysis and value engineering.
- To understand the principles and methodology of value engineering.
- To develop analytical skills to identify value enhancement opportunities.
- To cultivate creativity and problem-solving techniques for innovative solutions.
- To apply value engineering concepts to real-world engineering projects.
- To foster collaboration, ethical decision-making, and continuous improvement in professional practice.

Total No. of Lectures – 42

Lecture wise breakup		**No. of Lectures**
Unit 1	**Concepts and approaches of value analysis and engineering** Concept of value, Maximum value, normal degree of value, importance of value, value oriented work, use of value resources, value work expands market and jobs, approach to prepare the mind for the value analysis techniques	3
Unit 2	**Classification of Functions** Use and aesthetic functions, Identification, clarification and naming functions, quantifying functions, unifying the function and its specifications, analysis of aesthetic functions, classification of functions	3
Unit 3	**Evaluation of Functions** Evaluation of Function, Evaluation of Functions by Comparison, Case Studies on evaluation of a single function, three functions, interactive Functions, Evaluation of all functions by comparison	6
Unit 4	**Problem Setting System** Identify Functions, Separate Functions, Group Functions, Case study on Problem Setting, overlap of problem setting and problem solving.	3
Unit 5	**Problem Solving System**	5

	The Value Analysis Job Plan: Information step, Analysis step, Creativity step, Judgment step, Development planning step, Case study.	
Unit 6	**Setting and Solving Management-Decision-Type Problems** Types of Management problems, Setting the precise problem, Case Study -Should a company build manufacturing facilities for an important purchased assembly.	5
Unit 7	**Using The System** Three Basic Steps, Example of procedure, Basic Step I: identify the function, Basic Step-II: Evaluate the Function, Basic Step-III: cause value alternatives to be developed, interrelation of Basic Steps, Job Plan steps, and results- accelerating techniques	5
Unit 8	**Effect On Other Work in The Business** Accounting, Appearance design, Cost reduction activities, Cost reductions versus value analysis.	5
Unit 9	**Effective Organisation for Value Work** Smallest and smaller business, One man Set Up, Two man Set Up, Three man Set Up, Four or more consultant, structuring the company, Decision Criteria-Performance and time, Decision Criteria-Performance, time, and Cost, Understanding the research and development problem.	2
Unit 10	**Advance techniques** Function Analysis System Technique (FAST), how to use FAST Diagram, FAST diagram cost allocation, case study, quantitative evaluation of ideas. FAST for Product services and other processes, Value optimization, cohesive theory, structure frame work, flow charting, step by step techniques. developing a template for life cycle, cost, customer, FAST to conduct value study	5

Course Outcomes:	
1	Remember key principles and methodologies of value engineering and value analysis, including function analysis and cost-benefit analysis.
2	Understand the underlying concepts and theories that drive value engineering and value analysis processes.
3	Apply value engineering and value analysis techniques to identify opportunities for cost reduction, quality improvement, and performance enhancement in engineering projects.
4	Analyze complex engineering systems and processes to identify areas where value can be optimized through systematic evaluation and comparison of alternatives.
5	To create innovative solutions and recommendations that maximize value while considering constraints and trade-offs within engineering projects.

Text Book:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication**
1	Miles Lawrence D., Techniques of Value Analysis & Engineering, Eleanor Miles Walker,	1990
2	Kaoufman Jerry, Value Analysis's Tear Down- A New Process for Product Development and innovation, Yashihiko Sato Industrial Press	2004
Reference Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication**
1	Mudge Arthur E, Value Engineering - A systematic approach , Part I, J. Pohl Associates,	1989.
2	Bytheway Charles W, FAST Creativity and Innovation: Rapidly Improving Processes, Product Development and Solving Complex Problems, J. Ross Publishing	2007

Equivalent MOOCs courses

Sr. No.	**Course Links**	**Offered by**
1	Product Design using value engineering https://onlinecourses.nptel.ac.in/noc19_me51/preview	NPTEL

Course Name	**:**	**Design Research Methodology**
Course Code	**:**	**BD2374**
Credits	**:**	**4**
L T P	**:**	**3 1 0**

Course Objectives:

- To understand why organizations invest in maintaining their identity.
- To understand knowledge of Branding and Identity design processes.
- Investigate diverse modes of aesthetic experience and their application in the development of compelling brand identities.
- Examine the role of visual experiences, such as photography, moving images, and television, in shaping brand perceptions and consumer engagement.
- Develop into the history of branding, exploring its evolution, key milestones, and the influence of cultural, technological, and economic factors.

Course Objectives:

Students should be able –

- To understand design research.
- To explore the components of design research methodology
- To apply the concept of descriptive study of design research.
- To develop product by prescriptive study and research evaluation and documents**.**

Total No. of Lectures – 42

Lecture wise breakup		**No. of Lectures**
Unit 1	Introduction to design research: What and Why; Current issues with design research and the need for a design research methodology; Major facets of design and design research	**4**
Unit 2	Introduction to DRM - a design research methodology - its main components, and examples to explain the components	**4**
Unit 3	Types of design research, determining the type of research to be persuaded	**6**
Unit 4	Starting design research: Clarification of requirements: Identifying research topics, carrying out a literature search, consolidating the topic into research questions and hypotheses, and developing a research plan	**6**
Unit 5	Types of descriptive study; Processes for carrying out descriptive studies for developing an understanding a facet of design and its influences; Introduction to associated descriptive study real-time and retrospective research methods for data collection such as protocol analysis, questionnaire surveys,	**6**

	interviews, etc; Introduction to quantitative and qualitative data analysis methods	
Unit 6	Types of prescriptive study; Processes for developing design support and associated prescriptive study research methods	**6**
Unit 7	Types of support evaluation; Processes for evaluating design support, and associated Evaluation study research methods	**6**
Unit 8	Types and structures of research documentation; Approaches and guidelines for documenting and reporting research process and outcomes	**6**

Course Outcomes:	
1	Students should be able to understand the concept of design research.
2	Students should be able to analyze and apply various research methodologies.
3	Students should be able to understand and formulate research questions into hypothesis.
4	Students should be able to evaluate design support and evaluation study research methods.
5	Students should be able to analyze research documents from their designed product point of view

Text Book:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication / Reprint**
1	DRM, a Design Research Methodology Lucienne T.M. Blessing, Amaresh Chakrabarti, Springer	2009
Reference Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication / Reprint**
1	Research Design and Methodology, KassuJilcha, intechopen	2009
2	Case Study Research Design and Methods, Robert K Yin,Sage publication	2014

Equivalent MOOCs courses

Sr. No.	**Course Links**	**Offered by**
1	https://archive.nptel.ac.in/courses/107/108/107108011/	NPTEL
2	**https://onlinecourses.nptel.ac.in/noc22_ge08/preview**	NPTEL

DEPARTMENTAL ELECTIVE -VI

Course Name	**:**	**Universal Design**
Course Code	**:**	**BD2375**
Credits	**:**	**4**
L T P	**:**	**3 0 2**

Course Objectives :

Students should be able -

- To analyze and Implement ergonomic principles to optimize human well-being and overall performance.
- To explore, understand, and implement solutions to a human factor problem.
- To understand and apply Understand the impact of human factors in workplace design-environment productivity.
- To develop problem-solving techniques for ergonomically designing human-centered products

Total No. of Lectures – 42

Lecture wise breakup		**No. of Lectures**
Unit 1	**Introduction** What is Universal Design?Its Origin and emergence, Need and its relevance today, Examples of UD	10
Unit 2	**Principles and Goals** Principles of Universal Design, Goals of Universal Design, Understanding above from various design spectrums-Product, building, information, service	12
Unit 3	**Deep Dive** Universal-Inclusive Accessible Design, Universal Design for Learning(UDL), Use of Assistive technologies, Research techniques like-AGNES (Age gain now empathy system simulation suit)	10
Unit 4	**Accessibility Standards and Guidelines** Physical accessibility standards for Barrier free environment, Web accessibility, WAI (Web Accessibility Initiative), World Wide Web Consortium(W3C)	10

List of Experiments:		Number of Turns (28)
1	Conduct surveys, interviews, and focus groups with diverse students to identify challenges in traditional syllabi.	**4**
2	Review existing literature on universal design principles, inclusive education, and accessible course design	**4**
3	Consult with experts in inclusive education, accessibility, and curriculum design to gather insights and recommendations	**4**
4	Develop a prototype of a universally designed syllabus incorporating principles of accessibility and inclusivity.	**4**
5	Distribute the pilot syllabus to a diverse group of students and gather feedback through surveys and focus group discussions	**4**
6	Use feedback received to make necessary adjustments and refinements to the syllabus design.	**4**
7	Implement the finalized universal design syllabus in a real-world educational setting.	**4**

Course Outcomes:	
1	To provide guidance in the design of all products and environments by following examples and applications of Equitable use, Flexibility in use, Simple and intuitive use, Perceptible information, Tolerance for error, Low physical effort, Size and space for approach and use
2	Introduce the concept of Universal Design as a design approach
3	Exposure to accessibility standards and research techniques

Text Book:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication / Reprint**
1	Universal Design–Creating Inclusive Environments/ Edward Steinfeld and JordanaL. Maisel/ WILEY	2012
2	Product design and development/ Eppinger, S., & Ulrich, K./ McGraw-Hill Higher Education.	2015
3	Universal principles of design, revised and updated: 125 ways to enhance usability, influence perception, increase appeal, make better design decisions, and teach through design. / Lidwell, W., Holden, K., & Butler, J./ Universal Rockport Pub.	2010
Reference Books:		

Sr. No.	Name of Book/ Authors/ Publisher	Year of Publication / Reprint
1	William Lidwell, Kritina Holden, Jill Butler; Universal Principles of Design,2003 Bruce Hanington,Bella Martin;	2007
2	Universal Methods of Design,2012	2013
3	James Holmes-Seidle,Barrier-FreeDesign,1996	2015

Equivalent MOOCs courses

Sr. No.	Course Links	Offered by
1	https://onlinecourses.nptel.ac.in/noc21_de01/preview	NPTEL
2	https://onlinecourses.nptel.ac.in/noc23_cs54/preview	NPTEL
3	https://www.coursera.org/lecture/prototyping-design/introduction-to-universal-design-f7hqe	Coursera

Course Name	**:**	**Applied Ergonomics**
Course Code	**:**	**BD2376**
Credits	**:**	**4**
L T P	**:**	**3 0 2**

Course Objectives :

Students should be able -

- To analyze and Implement ergonomic principles to optimize human well-being and overall performance.
- To explore, understand, and implement solutions to a human factor problem.
- To understand and apply Understand the impact of human factors in workplace design-environment productivity.
- To develop problem-solving techniques for ergonomically designing human-centered products

Total No. of Lectures – 42

Lecture wise breakup		**No. of Lectures**
Unit 1	**Introduction** Human-centric Design of service/system, Selection of action in single/multi-task performance. Motor control of the action–co-ordination of action, sequencing, and timing of action-Reaction time.	**3**
Unit 2	**Information Input** Information Input and Processing, Text, Graphics, Symbols and Code, Visual Display of Dynamic Information, Auditory, Tactual and Olfactory Displays, Speech Communications	**7**
Unit 3	**Human Output and Control** Physical Work and Manual Materials Handling Motor Skills, Human Control of systems, Controls and Data Entry devices, Hand tools and devices,	**8**
Unit 4	**Workplace Design** Applied Anthropometry, Work-space design and Seating, Arrangement of Components within a Physical Space, Interpersonal Aspects of Workplace Design	**7**
Unit 5	**Digital Human simulation in Design and virtual environment.** Accident and Incident investigation. Cost Benefit Analysis in Human-system Investments. Methods for evaluation outcomes, Environmental Conditions : Illumination, Climate, Noise, Motion	**6**
Unit 6	**Visual Displays**	**7**

	Information visualization. Human factors in Online communications and social computing. Usability testing– UX and UI perspectives. Website design and evaluation. Human Factors in Ambience Intelligence Environments. Interactivity–Evolution and emerging tools.	
Unit 7	**Applications of Human Factors and Ergonomics** Design for people with functional limitations, Aged and Children. Design for All: Computer-assisted design of user interface. HFE in Manufacturing, Healthcare, Transport, Automation Design, and Aviation.	**4**

List of Experiments:		**Number of Turns (28)**
1	Evaluate office layouts, desk designs, and chair configurations to optimize productivity and well-being.	**4**
2	Assess usability of computer software, control panels, or touchscreens to improve user experience and reduce errors.	**4**
3	Test usability and user satisfaction of products like smartphones or tools through user trials and feedback	**4**
4	Evaluate medical equipment design and healthcare workplace ergonomics to reduce the risk of musculoskeletal disorders.	**4**
5	Assess the effectiveness of ergonomic training programs in promoting healthy work habits and preventing injuries	**4**
6	Study the effects of ergonomic furniture, keyboard and mouse designs, and monitor placement on office workers' well-being.	**4**
7	Investigate lifting techniques, equipment, and workplace layouts to prevent musculoskeletal injuries during manual tasks.	**4**

Course Outcomes:	
1	Ability to consider human factors and limitations in designing consumer /industrial products, workplaces and work environment.
2	Understanding the concepts of applied anthropometry, workplace design and the ergonomics aspects in various environmental conditions.
3	Ability to apply human factors in various environments and considering human factors in human errors & accidents.
4	Ability to perform ergonomic analysis in a virtual environment.
5	Understanding the ergonomic principles in digital interfaces.

Text Book:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication / Reprint**
1	Ergonomics in Design: Methods and Techniques (Human Factors and Ergonomics) 1st Edition/ Marcelo M. Soares, Francisco Rebelo/CRC Press	2016
Reference Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication / Reprint**
1	Human Factors in Engineering and Design/ Mark S Sanders/ McGraw Hill	1993
2	"ERGONOMICS" How to Design for Ease & Efficiency/ G.Karl Kroemer, Henrike Kroemer, Katrin Kroemer-Elbert/ Prentice Hall International Editions	2001
3	Introduction to Ergonomics"/ J.BridgerRS /Taylor and Francis.	2013

Equivalent MOOCs courses

Sr. No.	**Course Links**	**Offered by**
1	*https://onlinecourses.nptel.ac.in/noc22_me32/preview*	**NPTEL**
2	https://alison.com/course/back-safety-revised?show_modal=true	**Google**

Course Name	**:**	**3D Modeling and Prototyping**
Course Code	**:**	**BD2377**
Credits	**:**	**4**
L T P	**:**	**3 0 2**

Course Objectives :
Students should be able - ● To understand the concept of prototyping in the design process. ● To analyze different prototyping techniques for fabrication of working models. ● To understand several conventional and advanced prototyping methods ● To impart the knowledge of CAD modelling and their requirement in prototyping

Total No. of Lectures – 42

Lecture wise breakup		**No. of Lectures**
Unit 1	Modeling and Prototyping Techniques with the materials including timber, plaster, plastics, and metals.	**7**
Unit 2	Casting, Vacuum Forming and Mould Making .	**7**
Unit 3	Introduction to the industrial clay and the techniques used in making clay models	**7**
Unit 4	Clay Modelling is an important step in the 3D design process, and in many professional studios designers are required to make preliminary proposals in clay	**7**
Unit 5	Introduction to 3D CAD using state of art CAD software for product design and development.	**7**
Unit 6	Exercises drawing and 3D modeling, modeling free-form geometries	**7**

List of Experiments:		**Number of Turns**
1	An assignment to explore and experiment with the relationship between Design, Media and Technology.	**14**

Course Outcomes:	
1	Design the basic tooling requirements for conventional prototyping.
2	Apply the prototyping techniques as per the available materials.

3	Select suitable process for manufacturing of porotypes.
4	Understand the different possible ways of CAD modelling and digital sculpting.
5	Identify methods for data exchange in prototyping and reverse engineering.

Text Book:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication / Reprint**
1	Lefteri, Chris, "Making it: Manufacturing Techniques for Product Design", Laurence King., London	2007
Reference Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication / Reprint**
1	Mills, Criss B., Designing with Models: A Studio Guide to Making and Using Architectural Design Models, John Wiley and Sons, New Jersey	2005
2	Shimizu, Y., "Models & Prototypes, Graphic"--sha Pub. Co., Tokyo, Japan.	1991
3	Sutherland, Martha, "Model Making: A Basic Guide", WW Norton and Company, New York USA.	1999

Equivalent MOOCs courses

Sr. No.	**Course Links**	**Offered by**
1	Fundamentals of additive manufacturing technologies https://archive.nptel.ac.in/courses/112/103/112103306/	NPTEL
2	Computer Aided Design and Manufacturing https://nptel.ac.in/courses/112102102	NPTEL

Course Name	**:**	**Product Branding And Identity**
Course Code	**:**	**BD2372**
Credits	**:**	**4**
L T P	**:**	**3-0-2**

Total No. of Lectures – 42

Lecture wise breakup		**No. of Lectures**
Unit 1	**Principles of Visual Design Refresher:** Understanding visual culture; Visual Theories; Visual Design; Symbolism, Time, Sound; Point of View	**08**
Unit 2	**Visual Art :** Visual art History; Sculpture; Artistic Styles	**08**
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.	**08**
Unit 4	**Visual Experience**: Photography and Moving Images; Historical, Technical and Cultural Perspective; Ethical and Critical Perspective; Motion Pictures; Television and Video; Reality Shows.	**08**
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	**10**

No of lab hours- 28

List of Experiments:		Number of Turns
1	Develop a brand logo using graphic design software. Apply the principles of visual design and branding learned in class to create a unique and memorable logo for a hypothetical product.	4
2	Work on translating brand guidelines into practical design elements. Create a set of cohesive visuals, including color schemes, typography, and imagery, following the established brand guidelines.	4
3	Apply your knowledge of branding and identity to design product packaging. Consider factors such as target audience, product positioning, and brandmessaging in the creation of visually appealing and marketable packaging.	6
4	Utilize digital tools to create mockups and prototypes of branded materials. This exercise involves the application of design software to visualize how the brand will appear on various mediums such as packaging, promotional materials, and digital platforms.	6
5	Develop effective presentation skills for communicating and justifying your design choices. Practice presenting your branding concepts to peers, simulating client interactions, and receiving constructive feedback.	8

Course Outcomes:	
1	Grasp the strategic importance of branding in the modern business environment.
2	Analyze and articulate the significance of branding, influencing consumer perceptions and market positioning.
3	Demonstrate proficiency in creating logos, brand guidelines, and cohesive visual elements.
4	Apply knowledge to design and implement impactful branding strategies aligned with organizational goals.
5	Translate theoretical insights into practical design solutions, fostering consumer resonance and organizational success.

Text Book:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication**
1	Paul M., Visual Communication: Images with Messages	2006
2	Ralph E. Wileman, Visual Communication	1993
3	David Sless, Learning & Visual Communication	2020
Reference Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication**

1	Friedrich O. Huck and Carl L. Fales, The Digital Evolution: Visual Communication in the electronic age	1996
2	Margaret Mark, Carol Pearson, the Hero and the Outlaw: Building Extraordinary Brands through the Power of Archetypes, McGraw Hill	2001

Equivalent MOOCs courses

Sr. No.	**Course Links**	**Offered by**
1	https://nptel.ac.in/courses/110104167	NPTEL
2	https://onlinecourses.nptel.ac.in/noc22_mg82/preview	NPTEL

Course Name	**:**	**Quality Control and Reliability Engineering**
Course Code	**:**	**BD2378**
Credits	**:**	**4**
L T P	**:**	**3 0 2**

Course Objectives:
Students should be able – ● To understand and analyze different Quality tools. ● To explore the control chart and process capability for manufacturing processes. ● To apply the concept of system reliability in manufacturing and service industries. ● To develop acceptance sampling plans for producers and consumers.

Total No. of Lectures – 42

Lecture wise breakup		**No. of Lectures**
Unit 1	**Quality -** Introduction to the concepts of Quality, Quality control, quality assurance Introduction to Statistical process control and statistical Quality Control, application of statistics in quality control: Statistical Process Control, Acceptance sampling Concept of variation, cause of variation: Common Cause & Special Cause of variation, Natural control limits of process, stable v/s capable process, Impact of variability in competitive environment	**6**
Unit 2	**Quality Management** Introduction to Quality Management. History of Quality. Basic QM Principles. Total Quality Management (TQM) Introduction to Deming's 14 Points of Quality, International Organization for Standardization. ISO	**5**
Unit 3	**Control Charts for Variables and Attributes** X Bar-R Charts, X Bar-s Charts, Moving Range (MR),Individual Moving Range (IMR) Charts, Exponentially Weighted Moving Average (EWMA) for Attributes - p- Charts, np-Charts, c-Charts, u-Charts	**6**
Unit 4	**Process Capability Analysis, Process capability indices** Cp, Cpk, Cpm Process performance analysis from short pre-production; Pp, Ppk Process capability for attribute data; DPU (defects per unit), DPMO (defects per million opportunity, RTY (Rolled throughput yield)	**5**
Unit5	**Acceptance Sampling Plans**	**6**

	single, double, multiple and sequential – for attributes, minimum inspection per lot, formulation of inspection lots and selection of samples. OC curve. Doge-Romig tables and Deming Kp Rule	
Unit 6	**Introduction to Reliability Engineering** Relationship between reliability, maintainability and availability, Availability – Operational, Inherent and Achieved; MTBF and MTTR	**3**
Unit 7	**Failure distribution, Reliability function** Mean time to failure – Hazard rate function – Bathtub curve – Life Testing and Reliability, Failure Terminated Tests, Time Terminated Tests, Sequential Reliability Testing, Constant failure rate models (Exponential reliability function), Weibull distribution – Normal distribution – Lognormal distribution	**6**
Unit 8	**System reliability** Basics of redundancy – Standby redundancy systems, Use of reliability block diagrams, System with components in series, System with components in parallel, mixed system, k-out-of-n redundancy, Fault tree construction and analysis, Design for reliability: Basic parameters, reliability allocation, Redundancy, Failure analysis	**5**

List of Experiments:		**Number of Turns**
1	Quality tools like Run charts, Pareto diagram, and cause and effect diagrams through statistical software.	**02**
2	Construct X bar and R chart, Construct X bar and S chart through statistical software.	**02**
3	Construct p and np charts through statistical software.	**02**
4	Construct c and u charts through statistical software.	**02**
5	Design a single sampling and double sampling plan through statistical software.	**02**
6	Distribution analysis through statistical software.	**02**
7	Regression and Accelerated life testing with data through statistical software.	**02**

Course Outcome: -

1	Students should be able to understand and analyze the concept of QC tools and Management.

2	Students should be able to Design and apply the various types of variable and attribute control charts.
3	Students should be able to Design and evaluate single and double sampling plan.
4	Students should be able to understand the concepts of failure rate, density, and distribution.
5	Students should be able to Design series, parallel, and mixed systems for a given system's reliability.

Text Book:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication / Reprint**
1	Fundamentals of Quality Control and Improvement, AmitavaMitra, Wiley, and Prentice Hall, and Pearson low cost.	2012
Reference Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication / Reprint**
1	Statistical Quality Control, Eugene L. Grant, McGraw-Hill Series in Industrial Engineering and Management	2017
2	Introduction to Statistical Quality Control, Douglas C. Montgomery, John Wiley & Sons	2016
3	Reliability Engineering, L.S.Srinath, East-West Press	2005

Equivalent MOOCs courses

Sr. No.	**Course Links**	**Offered by**
1	https://onlinecourses.nptel.ac.in/noc23_ge20/preview	NPTEL
2	https://onlinecourses.nptel.ac.in/noc21_mg47/preview	NPTEL