I SEM - BDES

SEMESTER	**I**					
YEAR	**I**					
COURSE CODE	**21BD1101**					
TITLE OF THE COURSE	**INTRODUCTION TO DESIGN**					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	2	**-**	**2**	**-**	**52**	**3**

Pre-requisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course

COURSE OBJECTIVES :

- To introduce the history of the design process
- To introduce the design philosophy, various definitions and facets of design, design process, design thinking, creativity and innovation
- To discuss design education, different domains of design
- To introduce to global, environmental, and cultural issues related to design and the ethical, legal considerations while practicing design
- To be able to apply and understand some of the design methods to create ideas and concepts

COURSE OUTCOMES :

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Get a broad view of design, Understand various definitions of design	L2
CO2	Appreciate the role of design in various domains, Be aware of various schools of thought in design	L1
CO3	Explain the various design stages, Explain the implications of design decisions	L2
CO4	Identify and create solutions to simple needs and problems	L5
CO5	Hands-on experience in design small products	L5

COURSE CONTENT:
MODULE 1
History of Design, Design Philosophy, Design, Definitions of design, Facets of design, Approaches to Design, Applications of Design: Product Design, UI/UX Design, Fashion

Design, Textile Design, Furniture Design, Lighting Design, Museum Design, Service Design, Web design and Game design.
MODULE 2
Introduction to Design Thinking, Creativity and Innovation, Users and Context, Product life cycle, Structure of systematic product design process, Structure of systematic product development process, Importance of systematic design, Introduction to different design processes and approaches in literature.
MODULE 3
Overview of process and steps, Phases of design, Inputs and outcomes of various phases of design, Task Clarification, Needs, Problems, Requirements, Tasks.
MODULE 4
Conceptual Design, Functions, Ideas, Solutions, Concepts, Identification of functions, Ideation and ideation methods,
MODULE 5
Morphological Chart, Concept generation, Concept evaluation and selection.

List of Laboratory/Practical Experiments activities to be conducted (if any) :	
1.	Micro Assignment 1: Design of water bottle or lunch box
2.	Micro Assignment 2: Design of stool
3.	Micro Assignment 3: Design of torch

TEXT BOOKS :

1. Pahl, G., & Beitz, W. (2013). Engineering design: a systematic approach. Springer Science & Business Media.

REFERENCES :

1. Eppinger, S., & Ulrich, K. (2015). Product design and development. McGraw-Hill Higher Education.

SEMESTER	**I**					
YEAR	**I**					
COURSE CODE	**21BD1102**					
TITLE OF THE COURSE	**BASICS OF CAD AND 3D PRINTING**					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	1	**1**	**2**	**-**	**52**	**3**

Pre-requisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course

COURSE OBJECTIVES :

- To impart knowledge about computer aided design process
- To understand the role of computer aided design software in design
- To develop skills in CAD modelling to aid in design process
- To impart knowledge about 3D printing methods and tools available
- To design and develop designs using CAD and 3D printing technology

COURSE OUTCOMES :

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Introduce to various CAD softwares and their applications	L1
CO2	Explain and appreciate the role of CAD software in design	L2
CO3	Apply modeling skills to develop models of Basic 2D and 3D objects	L3
CO4	Explain steps of 3D printing and its applications in design	L1
CO5	Use 3D printer for designing and prototyping simple products	L6

	COURSE CONTENT:
	MODULE 1
	Introduction to CAD, Context in Design process, Introduction to CAD Software
	MODULE 2
	Basic CAD 2D and 3D operations such as Extrusion, Sweep, Loft, Mirroring, etc., CAD Practical, Modelling Mechanical Components Resources Required: CAD Software such as Fusion360, SolidWorks, Autodesk Inventor, FreeCAD, etc

	MODULE 3	
	3D Printing Theory, Additive Manufacturing, Types of Additive Manufacturing Methods, Advantages and Disadvantages of 3D Printing methods, Limitations of 3D Printing methods	
	MODULE 4	
	Basic Design Principles, Tutorial on 3D Printing and 3D Printing Software, Create stl file for 3D printing, 3D Printing of a simple component Resources Required: 3D Printer and Material required for 3D-Printing	
	MODULE 5	
	3D Printing Practical, Prepare model taking into account basic design principles, 3D-printing of a mechanical component, 3D printing of a Design Resources Required: 3D Printer and Material required for 3D-Printing	

List of Laboratory/Practical Experiments activities to be conducted (if any) :	
1.	3D Printing a simple component
2.	3D Printing a mechanical component
3.	3D Printing a Design

TEXT BOOKS :

1. Zeid, I. (1991). CAD/CAM theory and practice. McGraw-Hill Higher Education.

2. Evans, B., 2012. Practical 3D printers: The science and art of 3D printing. Apress.

REFERENCES :

1. Redwood, B., Schöffer, F. and Garret, B., 2017. The 3D printing handbook: technologies, design and applications. 3D Hubs.
2. Noorani, R., 2017. 3D printing: technology, applications, and selection. CRC Press.
3. Kumar, L.J., Pandey, P.M. and Wimpenny, D.I. eds., 2019. 3D printing and additive manufacturing technologies (Vol. 311). Berlin, Germany:: Springer.

SEMESTER	**I**					
YEAR	**I**					
COURSE CODE	**21BD1103**					
TITLE OF THE COURSE	**NEED ANALYSIS METHODS**					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	2	**-**	**2**	**-**	**52**	**3**

Pre-requisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course

COURSE OBJECTIVES :

- To provide an early introduction to methods of soliciting opinion from customers or users that will be required for a design learner to know going further
- To learn various methods available for collection of data and needs
- To understand which methods to use in various situations

COURSE OUTCOMES :

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Explore different ways of questioning for seeking opinion from people	L1
CO2	Identify pros and cons of using different ways of questioning for seeking opinion	L3
CO3	Explain and choose different question types particular to the research type at hand	L2

COURSE CONTENT:
MODULE 1
Applications of User Survey in Design, Overview of the activities involved in a survey
MODULE 2
Formulation of Survey Objectives, Sources of Error, Data collection methods
MODULE 3
Questions as measures: Overview and characteristics of questions and answers that affect measurement.
MODULE 4
Characteristics of questions and answers that affect measurement, Good examples and bad examples of each characteristic of question, Designing questions to gather factual data, Question Objectives.

MODULE 5
Concepts and terms related to objective questions, reducing the effect of social desirability on answers.
MODULE 6
Questions to measure subjective states, describing and evaluating people, places and things, handling relativity.
MODULE 7
General rules for designing good survey instruments, Wording, asking and training respondents.
MODULE 8
Evaluation of questions, assessing their validity and basic statistics.

List of Laboratory/Practical Experiments activities to be conducted (if any) :	
1.	Students will apply the methodologies taught in the course on problems and will be asked to make group presentations.

TEXT BOOKS :

1. Improving Survey Questions: Design and evaluation, Floyd J. Fowler, Jr. Applied Social Research Methods Series, Volume 38, Sage Publications, 1995 ISBN 0-8039-4582-5 2.

REFERENCES :

1. Survey Methods and Practices, Statistics Canada, Published by authority of the Minister responsible for Statistics Canada, Minister of Industry 2010. ISBN 978-1-100-16410-6

SEMESTER	**I**					
YEAR	**I**					
COURSE CODE	**21DS104**					
TITLE OF THE COURSE	**FUNDAMENTALS OF PROGRAMMING**					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	2	**1**	**4**	**-**	**65**	**5**

Pre-requisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
1.			

COURSE OBJECTIVES :

- To develop algorithms for small programs
- To develop student competence in writing clear, correct, and maintainable programs that implement known algorithms.
- To be able to debug programs
- To be able to execute programs

COURSE OUTCOMES :

CO No.	**Outcomes**	**Bloom's Taxonomy Level**
CO1	Express algorithms learned implicitly in school explicitly in algorithmic form and calculate the number of basic operations (exact or upper bound)	L1
CO2	Trace the execution of short programs/code fragments involving fundamental programming constructs	L3
CO3	Write a short program/code fragment for a given task using fundamental programming constructs	L3
CO4	Debug a short program/code fragment with fundamental programming constructs manually, and debug more complex code using a modern IDE and associated tools	L5
CO5	Design a large program, conduct a personal code review, and contribute to a small-team code review focused on common coding errors and maintainability using a provided checklist	L6

COURSE CONTENT:
MODULE 1
Introduction to Problem Solving using Algorithms and Flowchart: Key features of Algorithms: Sequence, Decision, Repetition with examples. Background, structure of C program, keywords, Identifiers, Data Types, Variables, Constants, Input / Output

statements, Operators (Arithmetic, relational, logical, bitwise etc.), Expressions, Precedence and Associativity, Expression Evaluation, Type conversions. Conditional Branching Statements-if and switch statements, iterative statements (loops)-while, for, do-while statements, Loop examples, Nested loops, break, continue, go to statement
MODULE 2
Arrays: Introduction, declaration & initialization of array, reading and writing array elements, Operations on array: Traversal, searching, sorting. Declaration and Initialization of two-dimensional arrays. Matrix Operations (addition, subtraction, multiplication, transpose) using a two-dimensional array. Strings: Definition, declaration, initialization, and representation. String handling functions and character handling functions.
MODULE 3
Pointers: Definition and declaration and initialization of pointers. Accessing values using pointers. Accessing array elements using pointers. Functions: Definition and declaration. Built-in functions and User-defined functions. Categories of functions with example. Pointers as function arguments, array as function argument, Call-by-value and call-by-reference. Recursion.
MODULE 4
Structures: Purpose and usage of structures. Declaration of structures. Assignment with structures. Structure variables and arrays. Nested structures. Student and employee database implementation using structures. Unions: Declaration and initialization of a union. Difference between structures and unions. Example programs.
MODULE 5
Memory allocation in C programs: Dynamic memory allocation, memory allocation process, allocating a block of memory, releasing the used space, altering the size of allocated memory. Files: Defining, opening and closing of files. Input and output operations.

List of Laboratory/Practical Experiments activities to be conducted :
1. Design a C program to Swapping of two numbers. (Simple Expressions).
2. Design a C program to Convert Celsius to Fahrenheit.
3. Design a C program to find the simple interest as per the below conditions (Simple expressions, Integer division issues (data loss), Explicit typecasting, when p, t, r are integers and si is float.
4. Design a C program to find the largest of 3 numbers. a) Using if and no else. (Conditionals) b) Using nested if. (conditionals and Boolean expressions) c) Using Ladder if else if d) Using Ternary operator.

5. Design a program that takes three coefficients (a, b, and c) of a Quadratic equation (ax2+bx+c=0) as input and compute all possible roots.

6.Design a C program to read the vehicle type (Use c or C for car, b or B for bus, t or T for Tempo for vehicle type) and Duration of customer vehicle parked in parking slot. Parking fare is calculated as per the rates given below: print the total parking charges.

Vehicle	First Rate	Second Rate
Car	Rs 20/hr for first 2hr	Rs 30/hr for next
Bus	Rs 40/hr for first 2hr	Rs 50/hr for next
Tempo	Rs 30 /hr for first 2hr	Rs 40/hr for next

7. a Write a program to calculate the factorial of a given number.
b Write a program using four functions to check if the given number is a palindrome.

8. a Sum of natural numbers (sum(n) = n + sum(n-1);).
b. Write a program to calculate Power of a number ($b^n = b * b^{n-1}$).

9. Write a program to calculate nth Fibonacci number given first two numbers in the series.

Inputs	n	Output
0,1	3	2
1,5	4	11
2,4	7	42
8,1	5	19
3,5	6	34

10. a Write a program using four functions to check if the given number is a palindrome.
b. Write a program to calculate GCD of two numbers.

11. Write a program to emulate a calculator with the following operations: Addition, Subtraction, Multiplication, Division – using functions, switch and break.)

12. Write a program using four functions to compute the sine of a value using Taylor's series approximation - pass by value.

13. Write a program to find the sum of n different using four functions and arrays.
Use the following function prototype:
void input(int n, int a[n]);
int add(int n, int a[n]);
void output(int n, int a[n],int sum) and main().

14. Write a program to add two matrices using separate function for input, add matrices, display matrix and main function.

15. String handling:
a) Write a function to reverse the string in reverse and display it. (Strings))
b) Write a function to concatenate the two strings without using strcat.(Strings)
c) Write a function to find the length of the string.

16. Write a program using Bubble sort technique to sort an array of integer elements .(Sorting technique, Const array arguments.)

17. Write a program to search an array of elements of data type requested by the user for a given item using binary search algorithm. (Searching technique, Const array arguments).
18. Write a program with functions to add and multiply two complex numbers. Define a structure Complex to represent a complex number. The main function should call other functions for the purposes of input, computations and display. (Structs as arguments).
19. Write a program to add n fractions using function.
20. Define a structure, student, to store the following data about a student: rollno (integer), name (string) and marks(integer) . Your program must contain the following functions: (Array of Structures). (5 marks) · A function to read the students data. · A function to display records of each student. · A function to sort the records of student RankWise · A function print all students details · A function to search student details by Rollno · A function to print the names of the students having the highest test score

TEXT BOOKS:

1. Brian W. Kernigham and Dennis M. Ritchie, (2012) “The C Programming Language”, 2nd Edition, PHI.
2. ReemaThareja, "Programming in C". Oxford University Press, Second Edition, 2016

REFERENCES:

1. R. S Bichkar, “Programming with C and Data Structure”, University Press, 2014
2. Behrouz A. Forouzan, Richard F. Gilberg, “Computer Science - A Structured Approach Using C”,Cengage Learning, 2007
3. Brian W. Kernigham and Dennis M. Ritchie, “The C Programming Language”, 2nd Edition, PHI, 2012
4. Vikas Gupta, “Computer Concepts and C Programming”, Dreamtech Press 2013.

SEMESTER	**I**					
YEAR	**I**					
COURSE CODE	**21BD1105**					
TITLE OF THE COURSE	**MATHEMATICS FOR DESIGN-I**					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	2	**-**	**2**	**-**	**52**	**3**

Pre-requisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course

COURSE OBJECTIVES :

- to introduce basic mathematical concepts required design analysis
- to introduce basic mathematical concepts required design synthesis

COURSE OUTCOMES :

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Appreciate role of math in design synthesis and analysis	
CO2	Appreciate form geometrically and the necessity for a mathematical basis to analyze	
CO3	Apply mathematical concepts to reduce product geometry into elements for analysis	

COURSE CONTENT:
MODULE 1
Lines and Functions, Plotting polynomial functions, Periodic Functions, Trigonometric functions, Transformation of Functions
MODULE 2
Applications of Calculus, Foundations of Calculus, Limits, Continuity, Derivative, Applications of the Derivative
MODULE 3
Integral-introduction, and infinite integrals, Area between two curves, Rules of integration, methods of integration, Applications of Integral, Modeling and calculation of material volume in irregular shapes, Optimization of dimensions / cost / energy usage using maxima and minima.
MODULE 4
Introduction to Matrix Algebra, Matrix operations, Systems of equations, Gaussian Elimination, Eigen Values and Eigen Vectors. Developing equations for Identifying Consumer preferences.

MODULE 5	
Introduction to Numerical Methods of Integrations- The trapezoidal Rule, Simpson's Rule. Simple problems on rendering equations and on projectile motion (for gaming).	
MODULE 6	
Introduction to Matlab Environment,Curve Fitting.	

TEXT BOOKS :

1. "Higher Engineering Mathematics", B S Grewal, Khanna Publishers, 40th Edition, 2007

REFERENCES :

1. “Calculus”, Robert T. Smith, Roland B. Minton, McGraw Hill, 4th Edition, ISBN ISBN 0–07–338311–2
2. "Introduction to Matrix Algebra", Autar Kaw, 2nd Edition, 2010
3. "Getting Started with MATLAB : A Quick Introduction for Scientists and Engineers", RudraPratap,Oxford University Press, 2016

SEMESTER	**I**					
YEAR	**I**					
COURSE CODE	**21BD1106**					
TITLE OF THE COURSE	**PHYSICS FOR DESIGN**					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	2	**-**	**2**	**-**	**52**	**3**

Pre-requisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
1	--	--	--

COURSE OBJECTIVES :

- To introduce the basic concepts of Quantum mechanics which are essential in understanding and solving problems in engineering
- To review different types of Engineering materials –Electronic, electrical, mechanical and Magnetic materials Properties and their applications in Science and Engineering
- To understand Band structure of solids, Semiconductors and electrical conductivity of SC's, and their applications
- To explain semiconductor devices like LED, Photodiode and Solar cell and Semiconductor BJT
- To explain Thin-film Phenomena, Thin-film fabrication Process and their applications in engineering
- To learn how to fabricate Nano materials by using Top-down and Bottom –up approach
- To review Nano science and technology and its practical applications in biology, engineering and medicine

COURSE OUTCOMES:

CO No.	**Outcomes**	**Bloom's Taxonomy Level**
CO1	Describe the concepts of Quantum mechanics and applications of Schrodinger time independent wave equation in one dimensions	L2
CO2	Discuss the different engineering materials such as Electronic, electrical and mechanical materials properties and their applications in engineering	L1
CO3	Illustrate Semiconductors , Semiconductor devices like Photo diode, LED, Solar cell and BJT and its applications	L1
CO4	Classify Lattice parameters of different crystalline solids by using X-ray diffraction methods and Summarize theoretical background of laser, construction and working of different types of lasers and its applications in science and engineering	L2

CO5	Interpret Basic concepts of Thin films and Thin film deposition processes and their applications leads to Sensors and engineering devices	L2
CO6	Discuss Nano materials ,Properties and fabrication of Nano materials by using Top-down and Bottom –up approach's-Applications for Science and technology	L1

COURSE CONTENT:

MODULE 1

Quantum Mechanics: Foundations of quantum theory, Wave function and its properties, Uncertainty principle. One dimensional time independent Schrodinger wave equation, Eigen values and Eigen functions. Applications: one dimensional motion of an electron in a potential-well.

Dielectrics: Introduction –Dielectric polarization– Dielectric Polarizability, Susceptibility and Dielectric constant-types of polarizations: Electronic and Ionic (Quantitative), Orientation polarizations (qualitative) – Lorentz Internal field – Claussius-Mossoti equation – Applications of Dielectrics. Numericals.

MODULE 2

Semiconductor Physics: Band structure, Fermi level in intrinsic and extrinsic semiconductors, Density of energy states in conduction and valence bands of a semiconductor (Mention the expression), Expression for concentration of electrons in conduction band (Derivation), Hole concentration in valance band (Mention the expression), Intrinsic carrier concentration Conductivity of semiconductors.

Semiconducting devices for optoelectronics applications: - Principle and working of LED, photodiode, Solar cell and.BJT, Numericals

MODULE 3

Introduction to Engineering materials: Classification of Engineering Materials such as Conductors, Semiconductors, Insulators. Electrical conductivity of metals and Semiconductors. Effect of temperature, composition on resistivity of materials.

Mechanical Engineering Materials – mechanical properties: stress- strain curve for different materials. Introduction to Tensile strength, Compressive strength, Ductility, Toughness, Brittleness, Impact strength, Fatigue, Creep. Testing of engineering materials: Hardness Tests: Brinell and Vickers hardness test

Crystallography: Lattice, unit cell, lattice parameters, crystal systems, Bravais lattices, Packing fraction for SCC,BCC and FCC crystal systems. Introduction to Miller Indices. Determination of Crystal structure by Miller Indices. Expression for Inter-planar distance. X-ray diffraction, Bragg's law and Determination of Crystal structure by Powder method. Numericals

MODULE 4	
Thin films technology: Introduction to thin-films-Advantages of thin-films over bulk materials. Thin film deposition processes- Physical vapour deposition (Thermal evaporation technique, and sputtering technique) process, Applications of Thin films.	
MODULE 5	
Nano Science &technology: Introduction to Nano materials, Classification of nano materials, Size dependent properties of materials, Top-down and Bottom-up approach- Ball-milling and Photolithography, Process. Fundamental Principles of Bio-Physics &Applications of Nano technology in Biology and Engineering.	

List of Laboratory/Practical Experiments activities to be conducted (if any) :	
1.	I-V characteristics of a Zener Diode: I–V Characteristics of a Zener diode in forward and reverse bias condition(Module 2)
2.	Planck's constant: Measurement of Planck's constant using LED(Module 2)
3.	Transistor characteristics: Input and output characteristics of a NPN transistor in C-E configuration(Module2)
4.	Dielectric constant: Determination of dielectric constant of a dielectric material (Module 2)
5.	Torsional Pendulum: Determination of moment of inertia of a circular disc using torsional pendulum
6.	Diffraction grating: Determination of wavelength of a laser light using diffraction grating (Module 4)
7.	LCR series and parallel resonance: Study the frequency response of a series and parallel LCR circuit (Module 3)
8.	Band gap energy: Determination of energy gap of an intrinsic semiconductor (Module 2)

TEXT BOOKS :

1. Engineering Physics (2017),DSU WILEY Publications
2 M N Avadhanulu, P G Kshirsagar, TVS Arun Murthy (2018), A textbook of Engineering Physics, S Chand, New Delhi.

REFERENCES :

1. Engineering Physics (2019), DSU Pearson, New Delhi
2. Engineering Physics Laboratory manual, DSU
3. M. Young (1977), Optics & Lasers An Engineering Physics approach, Springer.
4. S. O. Pillai (2018), Solid State Physics, revised edition, New Age International Publishers, New Delhi.
5. Thin-Films Phenomena-K L Chopra, McGraw -Hill Publishing

SEMESTER	**I**					
YEAR	**I**					
COURSE CODE	**21BD1202**					
TITLE OF THE COURSE	**DESIGN SKETCHING**					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	1	**-**	**4**	**-**	**65**	**3**

Pre-requisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course

COURSE OBJECTIVES :

- To learn basic skills required for sketching
- To understand fundamentals of drawing, theory of perspectives
- To understand concept of lighting and material in sketching
- To learn sketching ideas and concepts
- To model complicated systems by sketching and diagrams

COURSE OUTCOMES :

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Model complicated systems and services through the use of diagrams	L3
CO2	Quickly sketch ideas for interfaces by hand	L3
CO3	Communicate through sketching, both in a formal capacity as well as in a real-time, facilitation style	L3
CO4	Quickly iterate through interface design, using input from real users to inform decisions	L3

COURSE CONTENT:
MODULE 1
Object drawing fundamentals, theory of perspectives, exploded views, sectional views.
MODULE 2
Fundamentals of lighting, idea representation and communication methods and pitfalls.
MODULE 3
Materials, tools and techniques of representation in various media like pencil, ink, colour etc.

MODULE 4
Rendering techniques, air brush illustration. Idea documentation.
MODULE 5
Fundamentals of photography, videography and digital media. Dark room techniques. Studio assignments in all the above topics. Mock-up modeling and simulation in various materials

TEXT BOOKS :

1. Geometry of design: Studies in proportion and composition, ISBN : 1568982496,Foundation of Art & Design 1856693759,Earle, J.E., Engineering Design Graphics, Addison Wesley, ISBN 020111318x

REFERENCES :

1. How to draw and paint by Bodo W.Jaxtheimer. Publisher: Thames and Hudson; 1982.
2. Rendering with Pen and Ink by Robert W.Gill.Publisher: Thames and Hudson; 1984.

II SEM - DESIGN

SEMESTER	**II**					
YEAR	**I**					
COURSE CODE	**21BD1201**					
TITLE OF THE COURSE	**CoLS – COGNITION IN DESIGN**					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	2	**-**	**0**	**-**	**26**	**2**

Pre-requisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course

COURSE OBJECTIVES :

- To understand central concepts and methods in the interaction design field
- To relate these central concepts and methods to cognitive science field
- To develop the cognitive perspective, analyze user experience.

COURSE OUTCOMES :

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Understand central concepts and methods in the interaction design field	L2
CO2	Relate these central concepts and methods to cognitive science field	L3
CO3	Analyze user experience	L5
CO4	Develop the cognitive perspective	L6

COURSE CONTENT:
MODULE 1
Understanding cognitive issues
MODULE 2
Understanding theories issues
MODULE 3
Basic insight into interaction design; interface construction from design perspective
MODULE 4
User perspectives, typography, layout and general graphic design

MODULE 5	
Visual Expression of the Interface Design	

TEXT BOOKS :

1. Goodwin, K. (2011). Designing for the digital age: How to create human-centered products and services. John Wiley & Sons.

REFERENCES :

1. Löwgren, J., &Stolterman, E. (2004). Thoughtful interaction design: A design perspective on information technology. Mit Press.

SEMESTER	**I/II**					
YEAR	**I**					
COURSE CODE	**21BD1107**					
TITLE OF THE COURSE	**ENGINEERING GRAPHICS & DESIGN**					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	1	**-**	**4**	**-**	**65**	**3**

COURSE OBJECTIVES :

- To create awareness and emphasize the need for Engineering Graphics
- To understand the principles of geometrical curves and construct manually
- To learn using professional CAD software for construction of geometry
- To construct orthographic projection of points, lines, planes and solids
- To develop the lateral surfaces of solids
- To construct isometric projections of planes and solids
- To create simple engineering 3D components and assembly

COURSE OUTCOMES :

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Explain usage of instruments, dimensioning & tolerances, conventions and standards related to working drawings	L2
CO2	Construct points, lines, planes and solids using orthographic projections principles	L6
CO3	Construct geometries of planes and solids using isometric projection principles	L6
CO4	Sketch & Prepare the lateral surfaces of the given solid by applying the basic concepts	L3
CO5	Sketch & Construct lateral surfaces of solids using geometry development principles	L3
CO6	Create associative models at the component and assembly levels for product design	L6

COURSE CONTENT:
MODULE 1
Introduction: Fundamentals, Drawing standard - BIS, dimensioning, Lines, lettering, scaling of figures, symbols and drawing instruments, Introduction to orthographic & perspective projection. Types of projections, Principles of Orthographic projection **Plain & Miscellaneous Curves**: Construction of ellipse, parabola, hyperbola, Construction of Tangent and Normal at any point on these curves. Construction of Cycloid, Epicycloid

and Hypocycloid, Involute of a circle. Construction of Tangent and Normal at any point on these curves.
MODULE 2
Projection of Points and Lines: Projections of points located in same quadrant and different quadrants. Projection of straight lines inclined to both the principal planes – Determination of true lengths and true inclinations by rotating line method. **Projection of planes:** Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by change of position method.
MODULE 3
Projection of Solids: Projection of solids such as prisms, pyramids, cone, cylinder, tetrahedron, Projections of solids with axis perpendicular and parallel to HP and VP, solids with axis inclined to one or both the planes, suspension of solids.
MODULE 4
Sections of Solids: Sectioning of solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other, obtaining true shape of section. **Development of Surfaces:** Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones.
MODULE 5
Isometric Projection: Principles of isometric projection, isometric scale, Isometric projections of simple solids and truncated solids – Prisms, pyramids, cylinders, cones, combination of two solid objects in simple vertical positions, Conversion of orthographic views into isometric projection and vice versa
MODULE 6
Computer Aided Design: Introduction to computer aided drafting and tools to make drawings. Layout of the software, standard tool bar/menus and description, drawing area, dialog boxes and windows, Shortcut menus, setting up and use of Layers, layers to create drawings, customized layers, create, zoom, edit, erase and use changing line lengths through modifying existing lines (extend/lengthen) and other commands **Demonstration of a simple team design project:** Product Design- Introduction, stages, Design Geometry and topology of engineered components creation of engineering models and their presentation in standard 3D view. Use of solid-modeling software for creating associative models at the component and assembly levels; include: simple mechanical components-bolts, nuts, couplings; simple civil fixtures -windows, doors, bath, sink, shower, etc. Applying colour coding to the components.

General Note:
1. First angle projection to be followed.

2. Module I & VI- Self-study & Demonstration purpose only, not to be included in examinations.
3. Module II, III, IV & V- Will appear for exams

TEXT BOOKS :

1. Gopalakrishna, K. R. and Sudheer Gopala Krishna (2015).“Computer Aided Engineering Drawing”, Subash Publishers, Bangalore, India.
2. Bhatt N.D. (2019).“Engineering Drawing”, 53rd Edition, Charotar Publishing House, Gujarat, India.

REFERENCES :

1. Dhananjay .A .J, (2018).“Engineering Drawing with Introduction to AutoCAD”, Tata McGraw-Hill Publishing Company Ltd.

SEMESTER	**II**					
YEAR	**I**					
COURSE CODE	**21BD1203**					
TITLE OF THE COURSE	**MINI PROJECT 1 –PRODUCT DESIGN**					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	1	**-**	**4**	**-**	**65**	**3**

Pre-requisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course

COURSE OBJECTIVES :

- To familiarize students with task clarification stage
- To familiarize students with ideation stage
- To familiarize students with concept generation stage
- To develop of table top models and prototyping of concepts
- To evaluate the solutions generated during design process

COURSE OUTCOMES :

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Identify the requirements	L3
CO2	Formulate design problem	L6
CO3	Use design methods for creation of new ideas	L6
CO4	Creation of concepts and low fidelity prototypes	L6
CO5	Evaluation of concepts for selection	L5

COURSE CONTENT:
MODULE 1
Study of product evolution
MODULE 2
Design process, Introduction to Design Methods
MODULE 3
Problem identification, Design brief, Requirements List, Checklist for preparation of requirements, Applications of methods for task clarification.

MODULE 4
Concept generation, Concept Generation Methods and Application of these methods
MODULE 5
Concept selection, Concept Selection Methods and Application of these methods

List of Laboratory/Practical Experiments activities to be conducted (if any) :	
1.	Identification of needs and requirements
2.	Ideation using different design methods
3.	Concept generation
4.	Table-top modelling
5.	Prototyping using available facilities

TEXT BOOKS :

1. Ulrich, K. T. (2003). Product design and development. Tata McGraw-Hill Education.

REFERENCES :

1. Pahl, G., & Beitz, W. (2013). Engineering design: a systematic approach. Springer Science & Business Media.
2. Roozenburg, N.F.M., Eekels, J. Product Design, Fundamentals and Methods, Wiley, Chichester, 1995.
3. French, M. J., Gravdahl, J. T., & French, M. J. (1985). Conceptual design for engineers. London: Design Council.

SEMESTER	**II**					
YEAR	**I**					
COURSE CODE	**21BD1204**					
TITLE OF THE COURSE	**MINI PROJECT 1 – UIUX DESIGN**					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	1	**-**	**4**	**-**	**65**	**3**

Pre-requisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course

COURSE OBJECTIVES :

- To familiarize students with experience design and its application
- To familiarize students with activities of experience design
- To use various methods for creation of ideas and concepts in experience design
- To create simple applications
- To evaluate simple applications

COURSE OUTCOMES :

CO No.	**Outcomes**	**Bloom's Taxonomy Level**
CO1	Various applications of experience design	L1
CO2	Identifying different activities invarious stages of experience design	L3
CO3	Use design methods in experience design to create ideas	L6
CO4	Create simple applications	L6
CO5	Use various methods of testing for evaluation	L5

COURSE CONTENT:	
MODULE 1	
Introduction UI and UX Design, Visual Communication Design, Applications of UI and UX Design, Difference between UI and UX Design	
MODULE 2	
UX Research	
MODULE 3	
UX Strategy	

MODULE 4	
Information Architecture	
MODULE 5	
Usability Testing	

List of Laboratory/Practical Experiments activities to be conducted (if any) :	
1.	Identification of needs and requirements using UX research
2.	Ideation using UX Strategy
3.	Creation of Information architecture
4.	Creation of sample application
5.	Testing of developed application

TEXT BOOKS :

1. G. Allanwood and P. Beare (2019), User Experience Design: A Practical Introduction (Basics Design).

REFERENCES :

SEMESTER	**II**					
YEAR	**I**					
COURSE CODE	**21BD1205**					
TITLE OF THE COURSE	**MATHEMATICS FOR DESIGN-II**					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	2	**1**	**0**	**-**	**39**	**3**

Pre-requisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course

COURSE OBJECTIVES :

- Appreciating the role of maths in increasing the aesthetic value and usability of designs.
- Assessing the benefits of pursuing a design problem.
- Decision making at various stages of design problem solving

COURSE OUTCOMES :

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Apply the knowledge of Maths in modelling 3D objects.	L3
CO2	Develop more usable and aesthetic design	L6
CO3	Select design problem to be addressed	L5

COURSE CONTENT:
MODULE 1
Normal Distribution, Inferential Statistics, Parametric and Non-Parametric Methods for Data Evaluation
MODULE 2
Cost Benefit Analysis, Efficiency, Effectiveness, Factor of Safety, Tournament structure of opportunity identification, Decision Matrix
MODULE 3
Golden Ratio, Fibonacci Numbers, Fractals, 80:20 Rule, Feedback loop, Uncertainty Principle, Trade off, Closure, Common Fate, Confirmation, Consistency, Constraint, Control, Entry Point, Figure Ground Relationship
MODULE 4

Flexibility Usability Trade-off, Errors, Forgiveness, Scaling Fallacy, Weakest Link, Fitts's Law, Modularity, Affordances
MODULE 5
Product process change matrix, Design Structure Matrix – Tearing and Sequencing

TEXT BOOKS :

1. Lidwell, W., Holden, K., & Butler, J. (2010). Universal principles of design, revised and updated: 125 ways to enhance usability, influence perception, increase appeal, make better design decisions, and teach through design. Rockport Pub.

REFERENCES :

1. Eppinger, S. D., & Ulrich, K. T. (1995). Product design and development.
2. Vladimir Serdarushich (2016), Vectors and Coordinate Geometry

SEMESTER	**II**					
YEAR	**I**					
COURSE CODE	**21BD1206**					
TITLE OF THE COURSE	**CHEMISTRY FOR DESIGN**					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	2	**-**	**2**	**-**	**52**	**3**

Pre-requisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course

COURSE OBJECTIVES :

- To provide chemical concepts most relevant to engineering students and demonstrate them in an applied context
- To expose students to the principles required to understand important contemporary topics like alternate energy sources, corrosion control, polymer technology, nano-materials and green chemistry and catalysis.
- To emphasize on applications of these concepts to real world problems

COURSE OUTCOMES :

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Appreciate the basic principles of electrochemistry, use of different types of electrodes in analysis and evaluate cell potential for different cell reactions.	L2
CO2	Know construction, working and applications of various energy storage devices such as batteries, fuel cells and supercapacitors.	L2
CO3	Understand basic principles of corrosion and apply suitable techniques for corrosion control. Also know the technological importance and processes involved in metal finishing.	L2
CO4	Know the synthesis, structure –property relationship and applications of commercially important polymers and polymer composites.	L2
CO5	Understand properties and applications of nanomaterials. Also learn the principles of green chemistry for a sustainable and eco-friendly world.	L2

COURSE CONTENT:	
MODULE 1	

Chemical Energy Source: Introduction to energy; Fuels - definition, classification,importance of hydrocarbons as fuels; Calorific value-definition, Gross and Net calorific values (SI units). Determination of calorific value of a solid / liquid fuel using Bomb calorimeter. Numerical problems on GCV&NCV. Petroleum cracking-fluidized catalytic cracking. Reformation of petrol. Octane number, cetane number, anti-knocking agents, power alcohol, Biodiesel & Biogas-Dry gas harvesting and its efficiency.

Note: Video lecture on

(i) Fractional distillation of crude petroleum

(ii) Biogas and (iii) Biodiesel

Solar Energy: Thermal energy: Photovoltaic cells- Introduction, definition, importance, working of PV cell. Solar grade silicon physical and chemical properties relevant to photo-voltaics, doping of silicon by diffusion technique.

MODULE 2

Energy Science and Technology: Single electrode potential - Definition, origin, sign conventions. Standard electrode potential- Definition-Nernst equation expression and its Applications. EMF of a cell-Definition, notation and conventions. Reference electrodes–Calomel electrode, Ag/AgCl electrode. Measurement of standard electrode potential. Numerical problems on electrode potentials and EMF. Ion-selective electrode- glass electrode-Derivation electrode potential of glass electrode.

Battery technology: Basic Concepts including characteristics of anode, cathode, electrolyte and separator. Battery characteristics. Classification of batteries–primary, secondary and reserve batteries. State of the art Batteries-Construction working and applications of Zn-air, Lead acid battery, Nickel-Metal hydride and Lithium ion batteries.

Introduction to fuel cells, types of fuel cells. Construction, working and application of Methanol-Oxygen fuel cell.

MODULE 3

Corrosion Science: Definition, Chemical corrosion and Electro-chemical theory of corrosion, Types of corrosion, Differential metal corrosion, Differential aeration corrosion (pitting and water line corrosion), Stress corrosion. Factors affecting the rate of corrosion, Corrosion control: Inorganic coatings-Anodization. Metal coatings-Galvanization, Tinning and its disadvantages. Cathodic protection of Corrosion: Sacrificial anode method and current impression method.

Surface Modification Techniques: Definition, Technological importance of metal finishing. Significance of polarization, decomposition potential and over-voltage in electroplating processes. Electroplating of Chromium. Electroless Plating. Distinction between electroplating and Electroless plating, advantages of electroless plating. Electroless plating of copper.

Note: Video lecture on surface modification using polymer

MODULE 4

High Polymers: Introduction to polymers,Glass transition temperature, structure and property relationship. Synthesis, properties and applications of Teflon. PMMA. Elastomers - Deficiencies of natural rubber and advantages of synthetic rubber. Synthesis and application of silicone rubber. Conducting polymers-Definition, mechanism of conduction in polyacetylene. Structure and applications of conducting Polyaniline.

Nanotechnology: Introduction, properties, synthesis by sol-gel. Fullerenes, Carbon nanotubes, dendrimers and nano-composites-metal oxide-polymer nano-composite
Note: Video lecture on metal oxide-polymer nano-composite.

Advances in engineering chemistry: Synthesis of carbon and sulphur containing compounds.

MODULE 5

Water Technology: Impurities in water. Hardness of Water: Types of Hardness and determination of total hardness of water by using disodium salt of ethylenediaminetetraacetic acid method. Alkanity. Potable water treatment by Electrodialysis and Reverse Osmosis. Water analysis-Biochemical oxygen demand and Chemical oxygen demand. Determination of COD. Numerical problems onCOD. Sewage treatment, problems on quantity of flocculent required in sewage treatment. Principle and applications of green chemistry

Instrumental Methods of Analysis: Instrumental methods of analysis, Principles of spectroscopy-Beer's Lambert's law, Difference between spectrometer and spectrophotometer, Potentiometry, Conductometry (Strong acid against strong base, weak acid against strong base, mixture of strong acid and a weak acid against strong base) and viscometer.

List of Laboratory/Practical Experiments activities to be conducted (if any) :	
1.	Evaluation of quality of water in terms of total hardness by Complexometic titration.
2.	Determination of Chemical Oxygen Demand (COD) of the given industrial waste water sample.
3.	Determination of Alkalinity of the given water sample
4.	Preparation of MgO nanoparticles by solution combustion method (Demonstration experiment) and spectrometric analysis.
5.	Electroless plating of copper (Demo experiment)
6.	Preparation of Polyaniline (Demo experiment)
7.	Potentiometric titration–Estimation of FAS using standard K2Cr2O7 solution.
8.	Conductometric estimation of hydrochloric acid using standard sodium hydroxide solution
9.	Determination of viscosity coefficient, surface tension, density of a given liquid Colorimetric estimation of copper in a given solution
10.	Determination of Pka of given weak acid.
11.	Determination of calorific value of coal/oil using Bomb calorimeter (Group experiment)

TEXT BOOKS :

1. S. Vairam, Engineering Chemistry, Wiley-India Publishers, 2017

REFERENCES :

1. S. S. Dara and S. S. Umare, “A Textbook of Engineering Chemistry”, S. Chand & CompanyLTD, New Delhi, 2015
2. PrasantaRath, “Engineering Chemistry”, Cengage Learning India PVT, LTD, Delhi, 2015
3. ShikhaAgarwal, “Engineering Chemistry-Fundamentals and Applications”, CambridgeUniversity Press, Delhi, 2015
4. J. Bassett, R.C. Denny, G.H. Jeffery, Vogels, Text book of quantitative inorganic analysis, 4th Edition.
5. Dayananda Sagar University laboratory manual.

SEMESTER	**II**					
YEAR	**I**					
COURSE CODE	**21BD1207**					
TITLE OF THE COURSE	**ELEMENTS OF MECHANICAL ENGINEERING (THEORY & PRACTICE)**					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	2	**1**	**2**	**-**	**65**	**4**

COURSE OBJECTIVES :

Theory Component:

The objectives of the Course are to:

- Explain the basic concepts of renewable & non-renewable energy resources
- State first and second laws of thermodynamics
- Describe Carnot, Otto, diesel, Brayton, Rankine & refrigeration cycles
- Discuss 4 stroke petrol & diesel engines, turbines and pumps
- Study materials types, properties and stress- strain diagram
- Explain simple stresses, strains, elastic constants and power trains
- Discuss the operations of lathe, drilling, shaper, milling, and grinding machines
- Describe Joining Processes and foundry
- Explain mechatronics, PLC, instrumentation & control systems
- Explain robot anatomy, configurations, sensors and applications
- Discuss rapid prototyping, 3D printing and electric mobility

Lab Component:

- To impart knowledge and skills to use tools, machines, equipment, and measuring instruments
- To cultivate safety aspects in handling of tools and equipments
- To provide hands-on training on fitting, sheet metal, carpentry, casting , smithy, machining operations
- To provide hands-on training on soldering and welding processes

COURSE OUTCOMES :

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Explain various energy resources, laws of thermodynamics, gas and vapour cycles, prime movers and pumps	L2
CO2	Apply & Discuss fundamentals of materials and mechanical design aspects	L3
CO3	Describe basics of machine tools, joining processes and foundry	L1
CO4	Explain & illustrate advanced topics in mechanical engineering	L5
CO5	Construct different types of fitting, welding, sheet metal, turning models	L6

CO6	Demonstrate working of engines, turbines, pumps, 3D printing; wood working, foundry & smithy operations	L5

COURSE CONTENT:

MODULE 1

Energy Conversion

Renewable & Nonrenewable energy resources – Introduction to Steam, Hydro & Nuclear power plants, solar, wind and biomass energy based power plants, Effect of power generation on environment

Thermodynamics- First and second laws of thermodynamics, Efficiency, COP, Carnot theorem, Numericals

MODULE 2

Prime Movers & Pumps

Gas and Vapour cycles -Carnot, Otto, Diesel, Brayton, Rankine & Refrigeration cycles

Prime movers- 4 stroke- petrol and Diesel engines, Gas turbines-open and closed Cycle, steam turbines-Impulse and reaction, Numericals.

Introduction to pumps-working of centrifugal and reciprocating

MODULE 3

Materials & Mechanical Design

Materials- Introduction to ferrous, non-ferrous & composites,Stress-strain diagrams, Mechanical Properties for materials

Mechanical Design-Introduction,Simple Stresses and strains, Elastic constants,

Power Transmission- Gear & Belt Drives, Numerical problems

MODULE 4

Manufacturing Processes

Metal cutting: Introduction, classification of machine tools, basic operations on lathe, drilling, shaper, milling, grinding, introduction to CNC machining

Joining Processes- Welding- classification, gas, arc, laser & friction welding, brazing and soldering

Foundry- Basic terminology, Types of patterns, sand moulding

MODULE 5

Advanced Technologies In Mechanical Engineering

Mechatronics - Introduction,Mechatronics, PLC, Instrumentation & control systems

Robotics- Introduction, Robot anatomy, configurations, Sensors, applications

Rapid prototyping & 3D Printing- Introduction & applications, powder-based additive manufacturing processes

Electric Mobility -Introduction, electric, hybrid and autonomous vehicles

List of Laboratory/Practical Experiments activities to be conducted :
Simple Exercises on : 1. Fitting Shop- Simple exercises involving fitting work-Dove tail. 2. Welding Shop- Simple butt and Lap welded joints using arc welding 3. Sheet-metal Shop- Fabrication of tray, Making Funnel complete with soldering 4. Lathe machining on plain and step turning
Demonstration of: 1. Pelton wheel and Francis turbine 2. 4 stroke petrol and diesel engines 3. Lathe, milling, drilling, grinding & CNC milling machines and wood turning lathe 4. Foundry and smithy operations 5. 3D printing parts
Industrial Visit- Report making

TEXT BOOKS :

1. Nag P K (2017).“Basics and applied thermodynamics”, Second edition, Tata McGraw Hill, New Delhi.
2. P.N. Rao (2018). “Manufacturing Technology-Foundry, Forming and Welding”, Volume 1, 4thEdition, Tata McGraw Hill Publishing Co Ltd.
3. P.N. Rao (2018). “Manufacturing Technology- Metal Cutting and Machine Tools”, Volume 2, 4thEdition, Tata McGraw Hill Publishing Co Ltd.

REFERENCES :

. 1. El –Wakil M. M (2017).“Power plant technology”, Tata McGraw Hill edition, New Delhi.
2. Larminie J,Lowry J (2017).“Electric vehicle technology explained”, John Wiley and & Sons Ltd. USA.
3. William D. Callister and David G. Rethwisch (2011). “Fundamentals of Materials Science and Engineering: An Integrated Approach”, John Wiley & Sons; 4th Edition.