ST. VINCENT PALLOTTI COLLEGE OF ENGINEERING & TECHNOLOGY, NAGPUR

(An autonomous institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B. Tech. Scheme of Examination & Syllabus 2025-26

ARTIFICIAL INTELLIGENCE

SEMESTER II

Sr No	Course Category	Course Code	Course Title	Hours per Week			Credits	Maximum Marks				Minimum Passing Marks	Duration
				L	T	P		Mid-Sem Examination	Continual Assessment	End Sem Examination	Total		No. of Hrs for ESE
1	BSC	25AI201T	Engineering Physics and Materials Science	2	-	-	2	10	10	30	50	23	1.5
2	BSC	25AI201P	Engineering Physics and Materials Science Lab	-	-	2	1	-	25	25	50	25	-
3	BSC	25AI202T	Statistics and Probability	3	-	-	3	20	20	60	100	45	3
4.	BSC	25AI202P	Statistics and Probability Lab	-	-	2	1	-	25	25	50	25	-
5.	ESC	25AI203T	Python Programming	3	-		3	20	20	60	100	45	3
6.	ESC	25AI203P	Python Programming Lab	-	-	2	1	-	25	25	50	25	-
7.	ESC	25AI204T	Computer Organization	2	-	-	2	10	10	30	50	23	1.5
8.	PCC	25AI205T	AI Knowledge Representation and Reasoning	2	-	-	2	10	10	30	50	23	1.5
9.	AEC	25AI206P	Business Communication Skills – II Lab	-	-	2	1	-	25	25	50	25	-
10.	SEC	25AI207T	Design Thinking #	2	-	-	2	10	10	30	50	23	1.5
11.	CC	25AI208P	Co-curricular Courses – II	-	-	4	2	-	50	-	50	25	-
Total				14	0	12	20	80	230	340	650	-	-

 # To be conducted online through NPTEL.

		July 2025	NEP 3.0	Applicable for 2025-26
Chairman - BoS	Dean – Academics	Date of Release	Version	

SECOND SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
						MSE	CA	ESE	Total
25AI201T	Engineering Physics and Materials Science	2	--	--	2	10	10	30	50

Course Objectives	Course Outcomes
This course is intended 1. To understand the basic laws of physics and their application in engineering and technology. 2. To develop scientific temper and analytical capability.	Students will be able to 1. Explain the fundamental concepts of solid-state physics including free electron theory, band formation, semiconductors, magnetic materials, and their applications in electronic and storage devices. 2. Analyze the principles of optical communication by understanding light propagation in optical fibers, numerical aperture, modes of propagation, fiber losses, and fiber optic sensors. 3. Apply the concepts of quantum physics such as wave–particle duality, de Broglie hypothesis, uncertainty principle, and wave function to physical systems. 4. Evaluate the role of semiconductors, magnetic materials, optical fibers, and quantum mechanics in modern technologies, including communication systems, storage devices, and quantum computing applications.

Unit I BASICS OF SOLID-STATE PHYSICS	**[11 Hrs]**
Semiconductors: Free electron Theory (qualitative idea) and its features; Idea of band formation in solids, Classification of solids: Metal, Insulator, Semiconductor; Fermi Energy, Types - Intrinsic and Extrinsic Semiconductors, Applications of solid state devices - p-n junction diode and transistor. **Magnetic materials**: Terms and definitions, Types of magnetic materials, characteristics of Diamagnetic, Paramagnetic and Ferromagnetic Materials, Applications of soft and hard magnetic materials with a special emphasis on storage devices such as hard disk, floppy disk and magnetic tapes, advantages & disadvantages.	
Unit II OPTICAL COMMUNICATION	**[11 Hrs]**
Introduction, Optical Fiber, Total Internal Reflection, Propagation of light through an Optical Fiber, Fractional Refractive Index Change, Numerical Aperture, Modes of Propagation, Classification of Optical Fibers, The Three types of fibers, Comparative characteristics, V-Number, Losses in Optical Fiber, Fiber Optic Communication System, Merits of Optical Fibers, Fiber Optic Sensors (Temperature sensor and Liquid Level detector)	
Unit III QUANTUM PHYSICS	**[08 Hrs]**
Dual nature, de-Broglie hypothesis, Wave packet, phase and group velocity, Uncertainty principle - physical significance and its application, Wave function - probability and normalization, Brief idea of application of quantum mechanics in quantum computing.	

Text Books

Sr.No	Title	Authors	Edition	Publisher
1	Fundamentals of Physics	David Halliday, Robert Resnick and Jerle Walker	8e extended	John-Wiley India
2	Electronic Engineering Materials and Devices	John Allision	10th edition reprint	TMH
3	Engineering Physics	M. N. Avadhanulu	Latest edition	S. Chand & Co.

Reference Books

Sr.No	Title	Authors	Edition	Publisher
1	Solid State Physics	Charles Kittel	Eighth edition	John Wiley & Sons, Inc
2	Optical Fiber Communication - Principles & Practice	John M. Senior	3rd Edition	Prentice Hall
3	Quantum Mechanics	Schiff	First Edition	McGraw-Hill Book Company, Inc.

Online Resources

1	https://www.britannica.com/science/semiconductor#ref233890
2	https://www.geeksforgeeks.org/semiconductors/
3	https://www.sciencedirect.com/topics/chemistry/magnetic-material
4	https://www.livescience.com/33816-quantum-mechanics-explanation.html

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SECOND SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
25AI201P	Engineering Physics and Materials Science Lab	--	--	2	1	25	25	50

Course Objectives	Course Outcomes
This course is intended 1. To understand the basic laws of physics and their application in engineering and technology. 2. To develop scientific temper and analytical capability.	**Students will be able to** 1. Verify principles/ laws by selecting and using proper measuring instruments, interpret result and draw conclusions. 2. Find various parameters using various properties of light. 3. Apply the concepts of Semiconductors and Quantum Mechanics.

Expt. No.	Title of the experiment
1	Study of semiconductor diodes
2	Study of Phenomenon of Diffraction
3	Study of Interference
4	Study of Birefringence
5	Determination of Numerical Aperture (NA) of given Optical Fiber
6	Determination of Planck's Constant using LED
7	Guoy's Balance Method a) Determination of Magnetic Susceptibility of different magnetic materials. b) Identification of different types of Magnetic Materials
8	Study of Planck's Constant by means of LED
9	Determination of Curie Temperature of Ferromagnetic Material.
10	Study of Transistors.
11	Study of Hall Effect.
12	Experiment on 'Quantum Eraser'.
13	Demonstration of phenomena of Optics using Laser.

Text Books

Sr.No	Title	Authors	Edition	Publisher
1	Fundamentals of Physics	David Halliday, Robert Resnick and Jerle Walker	8e extended	John-Wiley India
2	A Textbook of Engineering Physics	Dr. M. N. Avdhanulu, Dr. P. G. Kshirsagar	Latest edition	S. Chand Publication.
3	Principles of Physics	David Halliday, Robert Resnick, Jearl Walker	10th Edition	John Wiley and Sons (2017)

Reference Books

Sr.No	Title	Authors	Edition	Publisher
1	Solid State Physics	Charles Kittel	Eighth edition	John Wiley & Sons, Inc
2	Solid State Physics	R.L. Singhal	Eighth edition	Kedarnath Ramnath
3	University Physics	Young and Freedman	Fifteenth edition	Pearson Education

Online Resources

1	https://www.britannica.com/science/semiconductor#ref233890
2	https://www.geeksforgeeks.org/semiconductors/
3	https://www.sciencedirect.com/topics/chemistry/magnetic-material

SECOND SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
						MSE	CA	ESE	Total
25AI202T	Statistics and Probability	3	-	-	3	20	20	60	100

Course Objectives	Course Outcomes
This Course is intended to 1. To equip students with the skills to analyze, interpret, and model statistical data using appropriate computational and analytical techniques. 2. To equip learners with the skills to analyze random phenomena, compute expectations, and interpret results using probability distributions.	**Students will be able to** 1. Solve numerical integration and find analytical solutions to difference equations. 2. Apply statistical methods such as regression, correlation, and least squares fitting to analyze data. 3. Apply probability theory and expectations to analyze data and solve engineering problems. **4.** Apply probability distributions to model and interpret random phenomena.

Unit I	**[9hrs]**
Finite Differences: Operator E and delta, Factorial Polynomial, Numerical integration: Trapezoidal rule, Simpson's 1/3 rule, Simpson's 3/8 rule, Difference equations with constant coefficients.	
Unit II	**[9hs]**
Statistics: Fitting of straight line, parabola and exponential curves by method of least squares, Coefficient of correlation and lines of regressions, Rank correlation, Multiple regression.	
Unit III	**[9hrs]**
Probability: Random Variable: Discrete & Continuous random Variable, Probability function, Distribution function, Baye's rule, Mathematical expectations, Variance and Standard deviation.	
Unit IV	**[9hrs]**
Joint probability: Joint probability function of discrete random variable, Marginal probability function and Conditional distribution of discrete random variable, Mathematical expectation of discrete random variable, Variance and Standard deviation, and Covariance of joint distribution.	
Unit V	**[9hrs]**
Probability Distributions: Binomial Distribution, Poison's Distribution, Normal Distribution.	

Text Books

Sr.No	Title	Authors	Edition	Publisher
1	Higher Engineering Mathematics	B. S. Grewal	40th	Khanna Publishers, New Delhi.
2	Higher Engineering Mathematics	H. K. Dass and Er. Rajnish Verma	1st	S. Chand & Co. Pvt. Ltd., New Delhi.

Reference Books

Sr.No	Title	Authors	Edition	Publisher
1	Higher Engineering Mathematics	B. V. Ramana	11th reprint, 2010.	Tata McGraw-Hill Publications, New Delhi.
2	A Text Book of Engineering Mathematics	Peter O' Neil	8th	Thomson Asia Pvt. Ltd., Singapore.

SECOND SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
25AI202P	Statistics and Probability Lab	--	--	2	1	25	25	50

Course Objectives	Course Outcomes
This Course is intended to: 1. To develop students' ability to analyze and interpret statistical data using SageMath. 2. To enable students to model, simulate, and interpret probability distributions and compute associated measures using SageMath's computational tools.	**Students will be able to:** **1.** Apply symbolic and numerical computation techniques using SageMath to solve problems in calculus and discrete mathematics. **2.** Analyze and interpret mathematical models using data fitting, correlation, and regression techniques. **3.** Evaluate and interpret statistical parameters for joint and marginal probability distributions using SageMath. **4.** Model, compute, and visualize discrete probability distributions using SageMath tools.

List of Experiments: -

Experiment No.	List of Experiment
1	To compute factorial polynomials for a given algebraic function with the help of SageMath.
2	To evaluate definite integrals by employing SageMath using Numerical Techniques.
3	To fit linear and quadratic models by means of the SageMath environment using least squares method.
4	To calculate the correlation coefficient and derive regression lines through the use of SageMath tools.
5	To determine Spearman's rank correlation coefficient with the help of SageMath.
6	To evaluate statistical parameters of a given probability distribution with the help of SageMath.
7	To construct and interpret joint and marginal distributions Using SageMath functionality.
8	To model and visualize the Poisson distribution executed through SageMath.
9	To compute and plot the Binomial distribution within the SageMath platform.
10	To analyze the Normal distribution using SageMath's statistical and graphical tools.

Text Books

Sr.No	Title	Authors	Edition	Publisher
1	Computational Mathematics with SageMath	Paul Zimmermann	1st	SIAM Publications Library.
2	Basics of SageMath : Mathematics(Practicals)	Varun Kumar	1st	Amazon KDP

Reference Books

Sr.No	Title	Authors	Edition	Publisher
1	Mathematics-SageMath Math Software System	Indrajeet Varhadpande & Dr. Kirti Sahu	1st	Himalaya Publication
2	Applied Mathematics Using SageMath	Dr. Kirti Sahu and Dr. Sajid Anwar	1st	Himalaya Publication

SECOND SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
						MSE	CA	ESE	Total
25AI203T	Python Programming	3	-	-	3	20	20	60	100

Course Objectives	Course Outcomes
This course is intended to 1. Learn the basics of python programming. 2. Gain hand-on knowledge about functions and syntax of python programming.	**Students will be able to** 1. Interpret the basics of Python programming. 2. Develop the ability to use Python data structures such as strings, lists, tuples, dictionaries, and sets. 3. Learn Conditional Statements and Loops and Functions for problem solving. 4. Comprehend File Handling and Object-Oriented Programming Language in Python. 5. Develop ethical and real-world Python application skills relevant to industry and technology fields.

Unit I: Introduction to Python Programming	**[9 Hrs]**
Overview and applications areas of Python, Python installation, Comments, Keywords, Identifiers, Variables declaration, Standard Data types, id(), type(), quotations for string literals, data type conversion methods, Input/Output statements, escape characters, round( ), importing 'math' package	
Unit II: Python Data Objects – Strings, Tuple, List	**[8 Hrs]**
Operators: Arithmetic, Assignment, Comparison, Logical, Bitwise, Reference or identity (is/ is not), Membership (in /not in) , Strings in Python, String Syntax, String Functions, Tuple in Python, Tuple Functions, List in Python, List Functions	
Unit III: Dictionary, Sets and Conditional Statements	**[10 Hrs]**
Dictionary – Dictionary Syntax, Dictionary Functions, Set – Set Syntax, Set Functions, Set Operators, Set Theory using Python, Control Statements: conditional statements (if, else, elif), Nested conditions, Relational and logical operators, Decision-making programs with real-world examples.	
Unit IV: Python Loops and Functions	**[9 Hrs]**
Loop statements in Python (for, while) Nested loops, looping with lists, tuples, dictionaries, and strings, Statements - break, continue, pass statement. Functions and Recursion Default arguments, keyword arguments, Variable-length arguments: *args, **kwargs, Anonymous (lambda) functions, Recursion and recursive problem-solving.	
Unit V: File Handling and Object-Oriented Programming Language	**[9 Hrs]**
File Handling, File handling functions, Reading and writing operations, File modes: r, w, a, r+, etc. Object-Oriented Programming Language using Python, Classes and objects, Constructors (__init__), Instance and class variables, Methods (instance, class, static) Python Ethics and Python Applications in Real-World Scenarios.	

Text Books

Sr. No.	Title	Authors	Edition	Publisher
1	Python Programming: An Introduction to Computer Science	John Zelle	2nd Edition	Addison Wesley.
2	Learning Python	Mark Lutz	5th Edition	O'Reilly Media

Reference Books

Sr. No.	Title	Authors	Edition	Publisher
1	Python Cookbook	David Beazley, Brian K. Jones	3rd Edition	O'Reilly Media

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SECOND SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
25AI203P	Python Programming Lab	-	-	2	1	25	25	50

Course Objectives	Course Outcomes
This course is intended to 1. To learn the installation of Python and understand its basic syntax and programming environment. 2. To understand and apply Python data types, variables, operators, control statements, functions, and recursion. 3. To develop problem-solving skills using Python for string, list, tuple, dictionary operations, and small projects.	**Students will be able to** 1. Write Python programs using basic syntax, data types, operators, and control structures. 2. Implement Python programs for strings, lists, tuples, dictionaries, recursion, and arithmetic operations. 3. Design and develop small Python-based projects, demonstrating programming skills and problem-solving ability.

Experiment No.	Title of the Experiment
1	To understand installation of Python and learning basic syntax.
2	Write a Python program to demonstrate variables, data types,type conversion and arithmetic operations.
3	Write a program to perform string manipulation using built-in functions of strings.
4	To Demonstrate tuple immutability and list mutability by creating python program using different functions for tuple and list.
5	A string is given to you e.g. "aabaacdaadd". Create a dictionary of each character in the given string and its frequency, i.e. output={'a': 6, 'b': 1, 'c': 1, 'd': 3}
6	To Write a Python program using if, elif, else: Check whether a number is prime number or not and Calculating Leap Year using Conditional Statements.
7	Write a program to check whether the given integer number or given string is Palindrome or not.
8	Write a Recursive function to generate ith term of a Fibonacci Series 0,1,1,2,3,5,8,13,... Generate n terms of Fibonacci Series using this recursive function.
9	Micro-Project based on Python Programming, Game Building or Module based projects.

Reference Books

Sr. No.	Title	Authors	Edition	Publisher
1	Python Cookbook	David Beazley, Brian K. Jones	3rd Edition	O'Reilly Media

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SECOND SEMESTER

`Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
						MSE	CA	ESE	Total
25AI204T	Computer Organization	2	-	-	2	10	10	30	50

Course Objectives	Course Outcomes
This course is intended 1. To introduce the fundamental concepts of computer architecture, instruction formats, addressing modes, and data representation. 2. To develop an understanding of CPU organization, control unit design, instruction execution, and pipelining techniques. 3. To explain the memory hierarchy, including RAM, ROM, and cache. 4. To provide knowledge of input/output organization, interrupts and Bus Architecture. 5. To enable learners to understand overall system design and the interaction between CPU, memory, and I/O devices.	**Students will be able to** 1. Get fundamentals of computer architecture, instruction formats, addressing modes and CPU organization 2. Analyze the functioning of the control unit, ALU operations and pipelining 3. Formulate Memory hierarchy, cache architecture, input/output organization, interrupts

Unit I: Fundamentals of Computer Architecture	**[10Hrs]**
Introduction to digital computers, Von Neumann and Harvard architectures, RISC vs CISC, and the stored-program concept. Data representation (binary, octal, hexadecimal), number conversions, and basic logic gates. Instruction set basics including instruction formats and addressing modes, Instruction cycle: Fetch, Decode, Execute, Types of instructions (Data transfer, Arithmetic, Logical, Branch)	
Unit II: CPU Organization and Instruction Execution	**[10Hrs]**
CPU components: ALU, control unit, register organization, and micro-operations, Hardwired vs Microprogrammed control unit , Pipelining , Pipeline stages (IF, ID, EX, MEM, WB), Pipeline hazards (Data, Control, Structural), Techniques to reduce hazards, Memory System, Types of memory: RAM, ROM, Cache, Memory hierarchy	
Unit III Input-Output Organization and System Design	**[10Hrs]**
I/O mapped vs memory mapped I/O, Interrupt types and interrupt handling, DMA: Need, Working, and Controller design, Bus structure and bus arbitration, Synchronous and asynchronous data transfer, Performance metrics (CPI, MIPS, FLOPS).	

Text Books

Sr. No.	Title	Authors	Edition	Publisher
1	Computer Organization and Architecture	William Stallings	10th	Pearson
2	Computer Architecture and Organization	John P. Hayes	3rd	McGraw Hill Education
3	Computer System Architecture	M. Morris Mano	3rd	Pearson

Reference Books

Sr. No.	Title	Authors	Edition	Publisher
1	Computer Architecture: A Quantitative Approach	John L. Hennessy, David A. Patterson	6th	Morgan Kaufmann
2	Modern Processor Design: Fundamentals of Superscalar Processors	John P. Shen, Mikko H. Lipasti	1st	McGraw Hill
3	Structured Computer Organization	Andrew S. Tanenbaum	6th	Pearson

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Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
						MSE	CA	ESE	Total
25AI205T	AI Knowledge Representation and Reasoning	2	-	-	2	10	10	30	50

Course Objectives	Course Outcomes
This course is intended to 1. Explain fundamental concepts of knowledge, types of knowledge, and basic knowledge representation techniques. 2. Apply advanced knowledge representation methods like FOL, frames, scripts, and semantic networks for modelling real-world domains. **3.** Analyse and implement reasoning techniques such as rule-based inference, non-monotonic reasoning, and probabilistic reasoning.	**Students will be able to** 1. Define and explain knowledge types, KR models, and propositional logic. 2. Construct and apply knowledge representation schemes using FOL, frames, scripts, and semantic networks. 3. Analyze and use reasoning and inference mechanisms including resolution, unification, and Bayesian reasoning.

Unit I: Introduction Knowledge Representation	**[6 Hrs]**
What is knowledge? Knowledge progression, Bellinger Knowledge model, various types of knowledge, Poole's framework of Knowledge representation, knowledge representation schemes, Challenges in Knowledge Representation, Approaches to knowledge representation, Applications of Knowledge Representation in AI, Propositional logic: Syntax, semantics, truth tables.	
Unit II: Advanced knowledge representation & application	**[11 Hrs]**
Logic-Based Representation - First-Order Logic (FOL): Predicates, quantifiers, variables, Inference rules, Resolution in predicated logic, horns clause, Unification algorithm, **Knowledge structures: Frames** - Structure of frames: slots, fillers, inheritance, **Scripts** - Scripts for modeling events: entry conditions, results, roles, **Semantic network** - Nodes, relationships, inheritance.	
Unit III: Reasoning techniques & inference mechanisms	**[13 Hrs]**
Reasoning in AI - Concepts of reasoning: Deductive, Inductive, Abductive, Forward vs Backward reasoning, Reasoning under uncertainty. **Inference Mechanisms -** Knowledge inference cycle, Rule-based inference, Unification concept, Resolution refutation, Horn clauses. **Non-monotonic Reasoning -** Need for non-monotonic reasoning, Default reasoning, Circumscription. **Probabilistic Reasoning -** Bayesian reasoning, Bayes theorem with examples, Bayesian networks: Nodes, edges, conditional probability, Simple reasoning examples using Bayesian nets.	

Text Books

Sr. No.	Title	Authors	Edition	Publisher
1.	AI Knowledge Representation and Reasoning	Mr. Ronald Brachman, Hector Levesque	3rd	O'Reilly
2.	Knowledge Representation and Reasoning	Ronald J. Brachman, Hector J. Levesque	8th	Morgan Kaufmann, 2004.
3.	A First Course in Artificial Intelligence	Deepak Khemani.	3rd	McGraw Hill Education (India), 2013.

Reference Books

Sr. No.	Title	Authors	Edition	Publisher
1.	Artificial Intelligence	Elaine Rich, Kevin Knight, & Shivashankar B Nair	3rd	McGraw Hill
2.	Artificial Intelligence	Saroj Kaushik	1st	Cengage Learning India.

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SECOND SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
25AI206P	Business Communication Skills – II Lab	-	-	2	1	25	25	50

Course Objectives	Course Outcomes
To empower students to develop a career oriented mindset while harnessing the power of LSRW skills.	**Students would be able to:** 1. Participate in Group Discussions. 2. Improve their reading and formal writing skills. 3. Develop upon their listening skills to engage in meaningful conversations. 4. Develop oratory skills to engage and inform audiences. 5. 5. Prepare themselves for participating in business meetings.

Expt. No.	Title of the experiment
1	Group Discussion
2	Reading for Competitive Exams II
3	Listening Skills II
4	Presenting a TED Talk
5	Media Interaction
6	Business Correspondence II
7	Report Writing
8	Mock Meeting

Reference Books

Sr.No	Title	Authors	Edition	Publisher
1.	Communication Skills for Engineers	C. Muralikrishna & Sunita MIshra	2nd Edition, 2011	Pearson India Education Services
2.	Communication Skills	Dr. L .Bisen, Dr. B. Agrawal& Dr. N. T. Kalyani	1st Edition, 2021	Himalaya Publishing House
3.	Barron's IELTS Superpack	Lin Lougheed	2012	Barrons Educational Series

SECOND SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
						MSE	CA	ESE	Total
25AI207T	Design Thinking	2	-	-	2	10	10	30	50

Course Objectives	Course Outcomes
1. Learn design thinking concepts and principles 2. Use design thinking methods in every stage of the problem 3. Learn the different phases of design thinking 4. Apply various methods in design thinking to different problems	1. Define key concepts of design thinking 2. Practice design thinking in all stages of problem solving 3. Apply design thinking approach to real world problems

Unit I **[10 Hrs**

INTRODUCTION: Why Design? - Four Questions, Ten Tools - Principles of Design Thinking - The process of Design Thinking - How to plan a Design Thinking project.
UNDERSTAND, OBSERVE AND DEFINE THE PROBLEM: Search field determination - Problem clarification - Understanding of the problem – Problem analysis - Reformulation of the problem - Observation Phase - Empathetic design - Tips for observing - Methods for Empathetic Design - Point-of-View Phase - Characterization of the target group - Description of customer needs.

Unit II **[10 Hrs**

IDEATION AND PROTOTYPING: Ideate Phase - The creative process and creative principles - Creativity techniques - Evaluation of ideas - Prototype Phase - Lean Startup Method for Prototype Development - Visualization and presentation techniques.

Unit III **[10 Hrs**

TESTING AND IMPLEMENTATION: Test Phase - Tips for interviews - Tips for surveys - Kano Model - Desirability Testing - How to conduct workshops - Requirements for the space - Material requirements - Agility for Design Thinking.
FUTURE:Design Thinking meets the corporation – The New Social Contract – Design Activism – Designing tomorrow.

Text Books

S.N	Title	Authors	Edition	Publisher
1.	Handbook of Design Thinking - Tips & Tools for how to design thinking	Christian Mueller-Roterberg	2021	Independently Published
2.	Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation	Tim Brown	2019	HarperCollins

Reference Books

S.N	Title	Authors	Edition	Publisher
1.	Design Thinking for Strategic Innovation	Idris Mootee		Wiley

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