

w.e.f. 2024-25

DIET23

B. Tech.
INFORMATION TECHNOLOGY
(B.Tech 2nd Year Syllabus)

Department of Information Technology



**DHANEKULA INSTITUTE OF
ENGINEERING & TECHNOLOGY**
(AUTONOMOUS)

(Approved by AICTE, Accredited by NBA (EEE|ME|ECE|CSE),
Affiliated to JNTUK, Kakinada)

Ganguru, Vijayawada
Andhra Pradesh - 521139,
INDIA.

www.diet.ac.in



DHANEKULA INSTITUTE OF ENGINEERING & TECHNOLOGY

(Autonomous)

GANGURU :: VIJAYAWADA – 521 139.

(Approved by AICTE New Delhi, Permanently Affiliated to JNTU Kakinada)
ISO 9001:2015 Certified Institution, Accredited by NBA for ME, EEE, ECE & CSE.

DEPARTMENT OF INFORMATION TECHNOLOGY

Institute Vision	Pioneering Professional Education through Quality
Institute Mission	<p>Providing Quality Education through state-of-art infrastructure, laboratories and committed staff.</p> <p>Moulding Students as proficient, competent, and socially responsible engineering personnel with ingenious intellect.</p> <p>Involving faculty members and students in research and development works for betterment of society.</p>
Department Vision	To become a leading center in Information Technology education and research, fostering innovation, technical expertise, and responsibility
Department Mission	<ul style="list-style-type: none"> • Provide learner centric education with state-of-the-art facilities. • Impart problem-solving skills to become pioneers in the global competition through training and various activities. • Equip learners with employability and entrepreneurial skills. • Promote Research environment and inculcate corporate social responsibility.
Program Educational Objectives (PEOs)	<p>Graduates of Information technology will:</p> <p>PEO1: Solve multidisciplinary problems and innovate through core IT knowledge, excelling in professional careers or higher studies.</p> <p>PEO2: Integrate IT across domains, demonstrate ethical professionalism, and embody environmental consciousness as competent, well-rounded individuals.</p> <p>PEO3: Engage in continuous learning, adapting to evolving technologies while promoting societal betterment through responsible innovation and research.</p>



**DHANEKULA INSTITUTE OF ENGINEERING & TECHNOLOGY
DEPARTMENT OF INFORMATION TECHNOLOGY**

Program Outcomes (PO's)/ Program Specific Outcomes (PSO's)

Program Outcomes

1	Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.
2	Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3	Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations
4	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6	Engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7	Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9	Individual and teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11	Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12	Life-long learning: Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes

PSO1: Design and develop Information Technology based AI systems and software applications with technical and professional skills.

PSO2: Excel in higher studies, secure employment in diverse technology sectors, contribute to research, and entrepreneurship.

B.Tech.–II Year I Semester

S.No.	Category	Title	L	T	P	Credits
1	BS&H	Discrete Mathematics & Graph Theory	3	0	0	3
2	BS&H	Universal human values–2 understanding harmony and Ethical human conduct	2	1	0	3
3	Engineering Science	Digital Logic & Computer Organization	3	0	0	3
4	Professional Core	Advanced Data Structures & Algorithm Analysis	3	0	0	3
5	Professional Core	Object Oriented Programming Through Java	3	0	0	3
6	Professional Core	Advanced Data Structures Lab	0	0	3	1.5
7	Professional Core	Object Oriented Programming Through Java Lab	0	0	3	1.5
8	Skill Enhancement course	Python Programming	0	1	2	2
9	Audit Course	Environmental Science	2	0	0	-
Total			16	2	8	20

B.Tech.–II Year II Semester

S.No.	Category	Title	L	T	P	Credits
1	Management Course-I	Optimization Techniques	2	0	0	2
2	Engineering Science / Basic Science	Probability & Statistics	3	0	0	3
3	Professional Core	Operating Systems	3	0	0	3
4	Professional Core	Database Management Systems	3	0	0	3
5	Professional Core	Software Engineering	3	0	0	3
6	Professional Core	Operating Systems & Software Engineering Lab	0	0	3	1.5
7	Professional Core	Database Management Systems Lab	0	0	3	1.5
8	Skill Enhancement Course	1. Python with Django (or) 2. Full Stack Development – I	0	1	2	2
9	BS&H	Design Thinking & Innovation (or) https://onlinecourses.swayam2.ac.in/aic23_ge17/preview	1	0	2	2
Total			15	1	10	21
Mandatory Community Service Project Internship of 08 weeks duration during summer vacation						

II-I Semester

DISCRETE MATHEMATICS AND GRAPH THEORY

Course Category:	BS&H	Credits: 3			
Course Type:	Theory	Lecture-Tutorial-Practice:	3	0	0
Prerequisites	Mathematical Foundations of Computer Science, Background in linear algebra, data structures and algorithms.	Continuous Evaluation	30M		
		Semester End Evaluation	70M		
		Total Marks	100M		

Course Outcomes:

After Successful Completion of course, the student will be able to:		
CO No:	Course Outcome Description	K - Level
CO1	Build skills in solving problems on mathematical logic.	Applying
CO2	Solve problems using sets, functions and relations.	Applying
CO3	Develop strategies for solving problems on combinatorial methods as well as recurrence relations.	Applying
CO4	Apply fundamental concepts of Graph Theory to practical purposes.	Applying
CO5	Examine the efficiency of algorithms of graphs in different scenarios.	Analysing

Note: K-Level is defined From Blooms Taxonomy

Contribution of Course Outcomes mapping with POs & PSOs (1- Low, 2 – Moderate, 3 – High)

CO No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	-	-	-	-	-	-	-	3	3	3
CO2	3	3	-	-	-	-	-	-	-	-	-	3	3	3
CO3	3	3	-	-	-	-	-	-	-	-	-	3	3	3
CO4	3	3	-	-	-	-	-	-	-	-	-	3	3	3
CO5	3	3	-	-	-	-	-	-	-	-	-	3	3	3

COURSE CONTENT:

UNIT-I: Mathematical Logic

Propositional Calculus: Statements and Notations, Connectives, Well Formed Formulas, Truth Tables, Tautologies, Equivalence of Formulas, Duality Law, Tautological Implications, Normal Forms, Theory of Inference for Statement Calculus, Consistency of Premises, Indirect Method of Proof, Predicate Calculus: Predicates, Predicative Logic, Statement Functions, Variables and Quantifiers, Free and Bound Variables, Inference Theory for Predicate Calculus.

UNIT-II: Set Theory

Sets: Operations on Sets, Principle of Inclusion-Exclusion, Relations: Properties, Operations, Partition and Covering, Transitive Closure, Equivalence, Compatibility and Partial Ordering, Hasse Diagrams, Functions: Bijective, Composition, Inverse, Permutation, and Recursive Functions, Lattice and its Properties.

UNIT-III: Combinatorics and Recurrence Relations

Basis of Counting, Permutations, Permutations with Repetitions, Circular and Restricted Permutations, Combinations, Restricted Combinations, Binomial and Multinomial Coefficients and Theorems.

Recurrence Relations: Generating Functions, Function of Sequences, Partial Fractions, Calculating Coefficient of Generating Functions, Recurrence Relations, Formulation as Recurrence Relations, Solving Recurrence Relations by Substitution and Generating Functions, Method of Characteristic, Roots, Solving Inhomogeneous Recurrence Relations

UNIT-IV: Graph Theory

Basic Concepts, Graph Theory and its Applications, Subgraphs, Graph Representations: Adjacency and Incidence Matrices, Isomorphic Graphs, Paths and Circuits, Eulerian and Hamiltonian Graphs, Topological sorting.

UNIT-V: Multi Graphs

Multigraphs, Bipartite and Planar Graphs, Euler's Theorem, Graph Colouring and Covering, Chromatic Number, Spanning Trees, Prim's and Kruskal's Algorithms, BFS and DFS Spanning Trees.

Textbooks:

1. Discrete Mathematical Structures with Applications to Computer Science, J. P. Tremblay and P. Manohar, Tata McGraw Hill, 2002
2. Elements of Discrete Mathematics-A Computer Oriented Approach, C. L.Liu and D. P. Mohapatra, 3rd Edition, Tata McGraw Hill, 2011
3. Theory and Problems of Discrete Mathematics, Schaum's Outline Series, Seymour Lipschutz and Marc Lars Lipson, 3rd Edition, McGraw Hill, 2007

Reference Books:

1. Discrete Mathematics, S. K. Chakraborty and B.K. Sarkar, Oxford, 2011.
2. Discrete Mathematics and its Applications with Combinatorics and Graph Theory, K. H. Rosen, 7th Edition (2012), Tata McGraw Hill.
3. Graph Theory with Applications to Engineering and Computer Science, NARSINGH DEO, DOVER PUBLICATIONS, INC. (2016).

E-Resources:

1. [Discrete Mathematics - Course \(nptel.ac.in\)](https://nptel.ac.in/courses/106/001/)
2. [Graph Theory - Course \(nptel.ac.in\)](https://nptel.ac.in/courses/106/002/)
3. [Graph theory in Discrete Mathematics - javatpoint](https://www.javatpoint.com/tutorial/discrete-mathematics)
4. [Discrete Mathematics Tutorial - GeeksforGeeks](https://www.geeksforgeeks.org/discrete-mathematics-tutorial/)
5. [DISCRETE MATHEMATICS AND GRAPH THEORY - PURNA CHANDRA BISWAL - Google Books](https://www.google.com/books/edition/Discrete-Mathematics-and-Graph-Theory/PURNA-CHANDRA-BISWAL)
6. [mth202.pdf \(iitk.ac.in\)](https://www.iitk.ac.in/mth202/)



**UNIVERSIAL HUMAN VALUES -2 UNDERSTANDING HARMONY AND
ETHICAL HUMAN CONDUCT**

Course Category:	BS&H	Credits: 3			
Course Type:	Theory	Lecture-Tutorial-Practice:	2	1	0
Prerequisites	No Prerequisites	Continuous Evaluation	30M		
		Semester End Evaluation	70M		
		Total Marks	100M		

Course Outcomes:

After Successful Completion of course, the student will be able to:		
CO No:	Course Outcome Description	K - Level
CO1	Aspire continuous happiness and prosperity	2
CO2	Explore harmony in the human being, the co-existence of self and body.	2
CO3	Develop competence and value human-human relationship.	2
CO4	Perceive harmony at all levels of existence.	2
CO5	Validate definitiveness of ethical human conduct	2

Note: K-Level is defined From Blooms Taxonomy

Contribution of Course Outcomes mapping with POs & PSOs (1- Low, 2 – Moderate,3 – High)

CO No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1						3	3	3	3					
CO2						3	3	3	3					
CO3						3	3	3	3					
CO4						3	3	3	3					
CO5						3	3	3	3					
CO6						3	3	3	3					

COURSE CONTENT:

The course has 28 lectures and 14 tutorials in 5 modules. The lectures and tutorials are of 1- hour duration. Tutorial sessions are to be used to explore and practice what has been proposed during the lecture sessions.

The Teacher’s Manual provides the outline for lectures as well as practice sessions. The teacher is expected to present the issues to be discussed as propositions and encourage the students to have a dialogue.

UNIT-I: Introduction to Value Education (6 lectures and 3 tutorials for practice session)

Lecture 1: Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education)

Lecture 2: Understanding Value Education

Tutorial 1: Practice Session PS1 Sharing about Oneself

Lecture 3: self-exploration as the Process for Value Education

Lecture4: Continuous Happiness and Prosperity – the Basic Human Aspirations

Tutorial 2: Practice Session PS2 Exploring Human Consciousness

Lecture 5: Happiness and Prosperity – Current Scenario

Lecture 6: Method to Fulfill the Basic Human Aspirations
Tutorial 3: Practice Session PS3 Exploring Natural Acceptance

UNIT-II: Harmony in the Human Being (6 lectures and 3 tutorials for practice session)

Lecture 7: Understanding Human being as the Co-existence of the self and the body.
Lecture 8: Distinguishing between the Needs of the self and the body
Tutorial 4: Practice Session PS4 Exploring the difference of Needs of self and body.
Lecture 9: The body as an Instrument of the self
Lecture 10: Understanding Harmony in the self
Tutorial 5: Practice Session PS5 Exploring Sources of Imagination in the self
Lecture 11: Harmony of the self with the body
Lecture 12: Programme to ensure self-regulation and Health
Tutorial 6: Practice Session PS6 Exploring Harmony of self with the body .

UNIT-III: Harmony in the Family and Society (6 lectures and 3 tutorials for practice session)

Lecture 13: Harmony in the Family – the Basic Unit of Human Interaction
Lecture 14: 'Trust' – the Foundational Value in Relationship
Tutorial 7: Practice Session PS7 Exploring the Feeling of Trust
Lecture 15: 'Respect' – as the Right Evaluation
Tutorial 8: Practice Session PS8 Exploring the Feeling of Respect
Lecture 16: Other Feelings, Justice in Human-to-Human Relationship
Lecture 17: Understanding Harmony in the Society
Lecture 18: Vision for the Universal Human Order
Tutorial 9: Practice Session PS9 Exploring Systems to fulfil Human Goal

UNIT-IV: Harmony in the Nature/Existence (4 lectures and 2 tutorials for practice session)

Lecture 19: Understanding Harmony in the Nature
Lecture 20: Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature
Tutorial 10: Practice Session PS10 Exploring the Four Orders of Nature
Lecture 21: Realizing Existence as Co-existence at All Levels
Lecture 22: The Holistic Perception of Harmony in Existence
Tutorial 11: Practice Session PS11 Exploring Co-existence in Existence.

UNIT-V: Implications of the Holistic Understanding – a Look at Professional Ethics
(6 lectures and 3 tutorials for practice session)

Lecture 23: Natural Acceptance of Human Values
Lecture 24: Definitiveness of (Ethical) Human Conduct
Tutorial 12: Practice Session PS12 Exploring Ethical Human Conduct
Lecture 25: A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order
Lecture 26: Competence in Professional Ethics
Tutorial 13: Practice Session PS13 Exploring Humanistic Models in Education
Lecture 27: Holistic Technologies, Production Systems and Management Models-Typical Case Studies
Lecture 28: Strategies for Transition towards Value-based Life and Profession
Tutorial 14: Practice Session PS14 Exploring Steps of Transition towards Universal Human Order

Practice Sessions for UNIT-I – Introduction to Value Education

PS1 Sharing about Oneself

PS2 Exploring Human Consciousness

PS3 Exploring Natural Acceptance

Practice Sessions for UNIT-II – Harmony in the Human Being

PS4 Exploring the difference of Needs of self and body

PS5 Exploring Sources of Imagination in the self

PS6 Exploring Harmony of self with the body

Practice Sessions for UNIT-III – Harmony in the Family and Society

PS7 Exploring the Feeling of Trust

PS8 Exploring the Feeling of Respect

PS9 Exploring Systems to fulfil Human Goal Practice Sessions for

Practice Sessions for UNIT-IV – Harmony in the Nature (Existence)

PS10 Exploring the Four Orders of Nature

PS11 Exploring Co-existence in Existence Practice Sessions for

Practice Sessions for UNIT-V – Implications of the Holistic Understanding – a Look at Professional Ethics

PS12 Exploring Ethical Human Conduct

PS13 Exploring Humanistic Models in Education

PS14 Exploring Steps of Transition towards Universal Human Order

Readings: Text Book and Teachers Manual

a. The Textbook

R R Gaur, R Asthana, G P Bagaria, A Foundation Course in Human Values and Professional Ethics, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1

b. The Teacher's Manual

R R Gaur, R Asthana, G P Bagaria, Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2

Reference Books:

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj – Pandit Sunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

Online Resources:

1. <https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%202->

- [Harmony%20in%20the%20Human%20Being.pdf](#)
2. <https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%203-Harmony%20in%20the%20Family.pdf>
 3. <https://fdp-si.aicte-india.org/UHV%201%20Teaching%20Material/D3-S2%20Respect%20July%202023.pdf>
 4. <https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%205-Harmony%20in%20the%20Nature%20and%20Existence.pdf>
 5. <https://fdp-si.aicte-india.org/download/FDPTeachingMaterial/3-days%20FDP-SI%20UHV%20Teaching%20Material/Day%203%20Handouts/UHV%203D%20D3-S2A%20Und%20Nature-Existence.pdf>
 6. <https://fdp-si.aicte-india.org/UHV%20II%20Teaching%20Material/UHV%20II%20Lecture%2023-25%20Ethics%20v1.pdf>
 7. <https://www.studocu.com/in/document/kiet-group-of-institutions/universal-human-values/chapter-5-holistic-understanding-of-harmony-on-professional-ethics/62490385>
 8. https://onlinecourses.swayam2.ac.in/aic22_ge23/preview



Course Category:	Engineering Science	Credits: 3			
Course Type:	Theory	Lecture-Tutorial-Practice:	3	0	0
Prerequisites	Basic knowledge of number systems and logic gates	Continuous Evaluation	30M		
		Semester End Evaluation	70M		
		Total Marks	100M		

Course Outcomes:

After Successful Completion of course, the student will be able to:		
CO No:	Course Outcome Description	K - Level
CO1	Apply various number systems and minimization of logic functions and design of combinational circuits	Applying
CO2	Build design of sequential logic circuits	Applying
CO3	Apply the computer arithmetic operations and Processor organization	Applying
CO4	Apply the knowledge of various types of memory to enhance system performance	Applying
CO5	Apply the knowledge of various I/O interface techniques to design and implement efficient I/O operations	Applying

Note: K-Level is defined From Blooms Taxonomy

Contribution of Course Outcomes mapping with POs & PSOs (1- Low, 2 – Moderate, 3 – High)

CO No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	-	-	-	-	-	-	-	-	3	3
CO2	3	3	-	-	-	-	-	-	-	-	-	-	3	3
CO3	3	3	-	-	-	-	-	-	-	-	-	-	3	3
CO4	3	3	-	-	-	-	-	-	-	-	-	-	3	3
CO5	3	3	-	-	-	-	-	-	-	-	-	-	3	3

COURSE CONTENT:

UNIT-I:

Data Representation: Binary Numbers, Fixed Point Representation. Floating Point Representation. Number base conversions, Octal and Hexadecimal Numbers, compliments, Signed binary numbers, Binary codes.

Digital Logic Circuits-I: Boolean Algebra, Minimization of Logic expressions, K-Map Simplification, Combinational Circuits- Decoders, Multiplexers

UNIT-II:

Digital Logic Circuits-II: Sequential Circuits, Flipflops, Binary counters, Registers, Shift Registers. Basic Structure of Computers: Computer Types, Functional units, Basic operational concepts, Bus structures, Software, Performance, multiprocessors and multi computers, Computer Generations, Von- Neumann Architecture

UNIT-III:

Computer Arithmetic: Addition and Subtraction of Signed Numbers, Multiplication of Positive Numbers, Signed-operand Multiplication, Integer Division, Floating-Point Numbers and Operations, Processor Organization: Fundamental Concepts, Execution of a Complete Instruction, Multiple-Bus Organization, Hardwired Control and Multi programmed Control.

UNIT-IV:

The Memory Organization: Basic Concepts, Semiconductor RAM Memories, Read-Only Memories, Speed, Size and Cost, Cache Memories, Performance Considerations, Virtual Memories, Memory Management Requirements, Secondary Storage

UNIT-V:

Input/Output Organization: Accessing I/O Devices, Interrupts, Processor Examples, Direct Memory Access, Buses, Interface Circuits, Standard I/O Interfaces, Introduction to GPU.

Textbooks:

1. Computer Organization, Carl Hamacher, Zvonko Vranesic, Safwat Zaky, 6th Edition, McGraw Hill, 2023.
2. Digital Design, M. Morris Mano, 6th Edition, Pearson Education, 2018.
3. Computer Organization and Architecture, 11th Edition, William Stallings, Pearson 2019.

Reference Books:

1. Computer Systems Architecture, M. Morris Mano, 3rd Edition, Pearson 2017s.
2. Computer Organization and Design, David A. Paterson, John L. Hennessy, Elsevier 2021.
3. Fundamentals of Logic Design, Roth, 5th Edition, Thomson 2006.

E-Sources:

1. <https://nptel.ac.in/courses/106/103/106103068/>



ADVANCED DATA STRUCTURES & ALGORITHM ANALYSIS

Course Category:	Professional Core	Credits: 3			
Course Type:	Theory / Tutorial /Practical	Lecture-Tutorial-Practice:	3	0	0
Prerequisites	Sound knowledge of basic data structures and implementations. Basics of Mathematics and Programming.	Continuous Evaluation	30M		
		Semester End Evaluation	70M		
		Total Marks	100M		

Course Outcomes:

After Successful Completion of course, the student will be able to:		
CO No:	Course Outcome Description	K - Level
CO1	Illustrate AVL with insights into Algorithm Analysis with Asymptotic Notations	Applying
CO2	Examine Heap Trees, Graphs and solve various applications using divide and conquer technique	Analyzing
CO3	Analyze different applications using Greedy Method and Dynamic Programming	Analyzing
CO4	Examine Backtracking, Branch and Bound to solve various problems	Analyzing
CO5	Compare NP Hard and NP Complete Problems using different problems	Analyzing

Note: K-Level is defined From Blooms Taxonomy

Contribution of Course Outcomes mapping with POs & PSOs (1- Low, 2 – Moderate,3 – High)

CO No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	3
CO2	-	3	-	-	-	-	-	-	-	-	-	-	3	3
CO3	-	3	-	-	-	-	-	-	-	-	-	-	3	3
CO4	-	3	-	-	-	-	-	-	-	-	-	-	3	3
CO5	-	3	-	-	-	-	-	-	-	-	-	-	3	3

COURSE CONTENT:

UNIT-I:

Introduction to Algorithm Analysis, Space and Time Complexity analysis, Asymptotic Notations.
AVL Trees – Creation, Insertion, Deletion operations and Applications

UNIT-II:

Heap Trees (Priority Queues) – Min and Max Heaps, Operations and Applications
Graphs – Terminology, Representations, Basic Search and Traversals, Connected Components and Biconnected Components, applications.
Divide and Conquer: The General Method, Quick Sort, Merge Sort, Strassen’s matrix multiplication.

UNIT-III:

Greedy Method: General Method, Job Sequencing with deadlines, Knapsack Problem, Minimum cost spanning trees, Single Source Shortest Paths - General Weights (Bellman Ford Algorithm),

Optimal Binary Search Trees.s

Dynamic Programming I: General Method, all pairs shortest paths.

UNIT-IV:

Dynamic Programming II: 0/1 Knapsack, String Editing, Travelling Salesperson problem.

Backtracking: General Method, 8-Queens Problem, Sum of Subsets problem, Graph Coloring, 0/1 Knapsack Problem

UNIT-V:

Branch and Bound: The General Method, 0/1 Knapsack Problem, Travelling Salesperson problem.

NP Hard and NP Complete Problems: Basic Concepts, Cook's theorem (without proof) NP Hard

Graph Problems: Clique Decision Problem (CDP), Traveling Salesperson Decision Problem (TSP)

NP Hard Scheduling Problems: Job Shop Scheduling

Textbooks:

1. Fundamentals of Data Structures in C++, HorowitzEllis, SahniSartaj, MehtaDinesh, 2ndEdition, Universities Press, 2008.
2. Computer Algorithms in C++, Ellis Horowitz, SartajSahni, Sanguthevar Rajasekaran, 2nd Edition, University Press, 2008.

Reference Books:

1. Data Structures and program design in C, Robert Kruse, 2nd Edition, Pearson Education Asia, 2006
2. An introduction to Data Structures with applications, Trembley& Sorenson, 2nd Edition, McGrawHill, 2017

E-Resources:

1. Introduction to the NPTEL MOOC on Design and Analysis of Algorithms by Prof. MUKUND MADHAVAN, IIT MADRAS, [Design and Analysis of Algorithms](https://archive.nptel.ac.in/courses/106/106/106106131/)
<https://archive.nptel.ac.in/courses/106/106/106106131/>
2. https://www.tutorialspoint.com/advanced_data_structures/index.asp
3. <http://peterindia.net/Algorithms.html>
4. Abdul Bari, Introduction to Algorithms (youtube.com)



OBJECT ORIENTED PROGRAMMING THROUGH JAVA

Course Category:	Professional Core	Credits: 3			
Course Type:	Theory / Tutorial /Practical	Lecture-Tutorial-Practice:	3	0	0
Prerequisites	Basic Programming	Continuous Evaluation	30M		
		Semester End Evaluation	70M		
		Total Marks	100M		

Course Outcomes:

After Successful Completion of course, the student will be able to:

CO No:	Course Outcome Description	K - Level
CO1	Apply object-oriented concepts, control structures in Java.	Applying
CO2	Applying Object oriented constructs such as various class hierarchies, Methods	Applying
CO3	Applying concepts like arrays, inheritances, interfaces in java	Applying
CO4	Applying packages and exception handling in java	Applying
CO5	Apply multi-threading, string methods and JDBC connections, Java FX in java	Applying

Note: K-Level is defined From Blooms Taxonomy

Contribution of Course Outcomes mapping with POs & PSOs (1- Low, 2 – Moderate,3 – High)

CO No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	3	3	3
CO2	3	-	-	-	-	-	-	-	-	-	-	3	3	3
CO3	3	-	-	-	-	-	-	-	-	-	-	3	3	3
CO4	3	-	-	-	-	-	-	-	-	-	-	3	3	3
CO5	3	-	-	-	3	-	-	-	-	-	-	3	3	3

COURSE CONTENT:

UNIT-I: Object Oriented Programming

Basic concepts, Principles, Program Structure in Java: Introduction, Writing Simple Java Programs, Elements or Tokens in Java Programs, Java Statements, Command Line Arguments, User Input to Programs, Escape Sequences Comments, Programming Style.

Data Types, Variables, and Operators :Introduction, Data Types in Java, Declaration of Variables, Data Types, Type Casting, Scope of Variable Identifier, Literal Constants, Symbolic Constants, Formatted Output with printf() Method, Static Variables and Methods, Attribute Final, Introduction to Operators, Precedence and Associativity of Operators, Assignment Operator (=), Basic Arithmetic Operators, Increment (++) and Decrement (- -) Operators, Ternary Operator, Relational Operators, Boolean Logical Operators, Bitwise Logical Operators.

Control Statements: Introduction, if Expression, Nested if Expressions, if-else Expressions, Ternary Operator?:, Switch Statement, Iteration Statements, while Expression, do-while Loop, for Loop, Nested for Loop, For-Each for Loop, Break Statement, Continue Statement.

UNIT-II:

Classes and Objects: Introduction, Class Declaration and Modifiers, Class Members, Declaration of Class Objects, Assigning One Object to Another, Access Control for ClassMembers, Accessing Private Members of Class, Constructor Methods for Class, OverloadedConstructor Methods, Nested Classes, Final Class and Methods, Passing Arguments by Value and by Reference, Keyword this.

Methods: Introduction, Defining Methods, Overloaded Methods, Overloaded Constructor Methods, Class Objects as Parameters in Methods, Access Control, Recursive Methods, Nesting of Methods, Overriding Methods, Attributes Final and Static

Java I/O and File: Java I/O API, standard I/O streams, types, Byte streams, Character streams, Scanner class, Files in Java(Text Book 2)

UNIT-III:

Arrays: Introduction, Declaration and Initialization of Arrays, Storage of Array in Computer Memory, Accessing Elements of Arrays, Assigning Array to Another Array, Dynamic Change of Array Size, Sorting of Arrays, Search for Values in Arrays, Class Arrays, Two-dimensional Arrays, Arrays of Varying Lengths, Three- dimensional Arrays.

Inheritance: Introduction, Process of Inheritance, Types of Inheritances, Universal Super Class-Object Class, Inhibiting Inheritance of Class Using Final, Access Control and Inheritance, Multilevel Inheritance, Application of Keyword Super, Constructor Method and Inheritance, Method Overriding, Dynamic Method Dispatch, Abstract Classes, Interfaces and Inheritance.

Interfaces: Introduction, Declaration of Interface, Implementation of Interface, Multiple Interfaces, Nested Interfaces, Inheritance of Interfaces, Default Methods in Interfaces, Static Methods in Interface, Functional Interfaces, Annotations.

UNIT-IV:

Packages and Java Library: Introduction, Defining Package, Importing Packages and Classes into Programs, Path and Class Path, Access Control, Packages in Java SE, Java.lang Package and its Classes, Class Object, Enumeration, class Math, Wrapper Classes, Auto-boxing and Auto-unboxing, Java util Classes and Interfaces, Formatter Class, Random Class, Time Package, Class Instant (java.time.Instant), Formatting for Date/Time in Java.

Exception Handling: Introduction, Hierarchy of Standard Exception Classes, Keywords throws and throw, try, catch, and finally Blocks, Multiple Catch Clauses, Class Throwable, Unchecked Exceptions, Checked Exception

String Handling in Java: Introduction, Interface Char Sequence, Class String, Methods for Extracting Characters from Strings, Comparison, Modifying, Searching; Class String Buffer, String Builder

UNIT-V:

Multithreaded Programming: Introduction, Need for Multiple Threads Multi-threaded Programming for Multi-core Processor, Thread Class, Main Thread-Creation of New Threads, Thread States, Thread Priority Synchronization, Deadlock and Race Situations, Inter-thread Communication - Suspending, Resuming, and Stopping of Threads.

Java FX GUI: Java FX Scene Builder, Java FX App Window Structure, displaying text and image, event handling, laying out nodes in scene graph, mouse events (Text Book 3)

Textbooks:

1. JAVA One Step Ahead, Anitha Seth, B.L. Juneja, Oxford, 2017.
2. Joy with JAVA, Fundamentals of Object-Oriented Programming, Debasis Samanta, Monalisa Sarma, Cambridge,2023.
3. JAVA 9 for Programmers, Paul Deitel, Harvey Deitel, 4thEdition, Pearson, 2017.

Reference Books:

1. The complete Reference Java, Herbert Schildt, 11th Edition, TMH, 2017.
2. Introduction to Java programming, 7th Edition, Y Daniel Liang, Pearson, 2012.

E-Resources/Digital Material:

1. <https://nptel.ac.in/courses/106/105/106105191/>
2. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_012880464547618816347_s_hared/overview



ADVANCED DATA STRUCTURES & ALGORITHM ANALYSIS LAB

Course Category:	Professional Core	Credits:1.5			
Course Type:	Theory / Tutorial / Practical	Lecture-Tutorial-Practice:	0	0	3
Prerequisites	Knowledge of implementation of basic data structures with arrays and linked lists. Basics of Mathematics and Programming.	Continuous Evaluation	30M		
		Semester End Evaluation	70M		
		Total Marks	100M		

Course Outcomes:

After Successful Completion of course, the student will be able to:		
CO No:	Course Outcome Description	K - Level
CO1	Implement data structures like AVL Trees, Heap Tree and Graphs	Applying
CO2	Solve problems using different algorithmic approaches like Divide and Conquer, Greedy method, Dynamic Programming and Backtracking	Applying

Note: K-Level is defined From Blooms Taxonomy

Contribution of Course Outcomes mapping with POs & PSOs (1- Low, 2 – Moderate,3 – High)

CO No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	3	-	-	-	3	-	-	-	3	3
CO2	3	-	-	-	3	-	-	-	3	-	-	-	3	3

COURSE CONTENT:

- Construct an AVL tree for a given set of elements which are stored in a file and implement insert and delete operation on the constructed tree. Write contents of tree into a new file using in-order.
- Construct Min and Max Heap using arrays, delete any element and display the content of the Heap.
- Implement BFT and DFT for given graph, when graph is represented by
a) Adjacency Matrix b) Adjacency Lists
- Write a program for finding the biconnected components in a given graph.
- Implement Quick sort and Merge sort and observe the execution time for various input sizes (Average, Worst and Best cases).
- Compare the performance of Single Source Shortest Paths using Greedy method when the graph is represented by adjacency matrix and adjacency lists.
- Implement Job Sequencing with deadlines using Greedy strategy.
- Write a program to solve 0/1 Knapsack problem Using Dynamic Programming.
- Implement N-Queens Problem Using Backtracking.
- Use Backtracking strategy to solve 0/1 Knapsack problem.
- Implement Travelling Salesperson problem using Branch and Bound approach.

Text Books:

1. Fundamentals of Data Structures in C++, HorowitzEllis, SahniSartaj, MehtaDinesh, 2nd Edition, Universities Press, 2008.
2. Computer Algorithms in C++, Ellis Horowitz, SartajSahni, SanguthevarRajasekaran, 2nd Edition, University Press, 2008.

Reference Books:

1. Data Structures and program design in C, Robert Kruse, 2nd Edition, Pearson Education Asia, 2006.
2. An introduction to Data Structures with applications, Trembley& Sorenson, McGrawHill, 2nd Edition, 2017.

E-Resources/Digital Material:

1. Introduction to the NPTEL MOOC on Design and Analysis of Algorithms by Prof. MUKUND MADHAVAN, IIT MADRAS, [Design and Analysis of Algorithms](https://archive.nptel.ac.in/courses/106/106/106106131/)
<https://archive.nptel.ac.in/courses/106/106/106106131/>
2. https://www.tutorialspoint.com/advanced_data_structures/index.asp
3. <http://peterindia.net/Algorithms.html>
4. Abdul Bari, Introduction to Algorithms (youtube.com)



Course Category:	PC	Credits: 3			
Course Type:	Practical	Lecture-Tutorial-Practice:	-	-	3
Prerequisites	Good programming knowledge	Continuous Evaluation	30-M		
		Semester End Evaluation	70-M		
		Total Marks	100--M		

Course Outcomes:

After Successful Completion of course, the student will be able to:		
CO No:	Course Outcome Description	K - Level
CO1	Apply the basic of concepts of programming in java.	Applying
CO2	Apply the basic of concepts of Operations, Expressions, Control-flow, and Strings.	Applying
CO3	Analyze different keywords in java	Analyzing
CO4	Analyze the concepts of inheritance in java.	Analyzing
CO5	Analyze applications using Exception Handling, Multi-threading, java FX, Event Handling packages in java.	Analyzing

Note: K-Level is defined From Blooms Taxonomy

Contribution of Course Outcomes mapping with POs & PSOs (1- Low, 2 – Moderate,3 – High)

CO No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	3	-	-	-	-	-	-	3	3	3
CO2	3	-	-	-	3	-	-	-	-	-	-	3	3	3
CO3	-	3	-	-	3	-	-	-	-	-	-	3	3	3
CO4	-	3	-	-	3	-	-	-	-	-	-	3	3	3
CO5	-	3	-	-	3	-	-	-	-	-	-	3	3	3

COURSE CONTENT:

Exercise - 1

- Write a JAVA program to display default value of all primitive data types of JAVA.
- Write a java program that displays the roots of a quadratic equation $ax^2+bx=0$. Calculate the discriminate D and basing on value of D, describe the nature of root.

Exercise - 2

- Write a JAVA program to search for an element in a given list of elements using binary search Mechanism.
- Write a JAVA program to sort for an element in a given list of elements using bubble sort.
- Write a JAVA program using String Buffer to delete and remove characters.

Exercise - 3

- Write a JAVA program to implement class mechanisms. Create a class, methods and invoke them inside main method.
- Write a JAVA program implements method overloading.
- Write a JAVA program to implement constructor.
- Write a JAVA program to implement constructor overloading.

Exercise - 4

- a) Write a JAVA program to implement Single Inheritance.
- b) Write a JAVA program to implement multi level Inheritance.
- c) Write a JAVA program for abstract class to find areas of different shapes

Exercise - 5

- a) Write a JAVA program give example for “super” keyword.
- b) Write a JAVA program to implement Interface. What kind of Inheritance can be achieved?
- c) Write a JAVA program that implements Runtime polymorphism

Exercise - 6

- a) Write a JAVA program that describes exception handling mechanisms.
- b) Write a JAVA program Illustrating Multiple catch clauses.
- c) Write a JAVA program for creation of Java Built-in Exceptions.
- d) Write a JAVA program for creation of User Defined Exception.

Exercise - 7

- a) Write a JAVA program that creates threads by extending Thread class. First thread display “Good Morning “every 1 sec, the second thread displays “Hello “every 2 seconds and the third display “Welcome” every 3 seconds,(Repeat the same by implementing Runnable)
- b) Write a program illustrating is **Alive and join ()**
- c) Write a Program illustrating **Daemon Threads**.
- d) Write a JAVA program Producer Consumer Problem

Exercise – 8

- a) Write a JAVA program that imports and uses the user defined packages.
- b) Without writing any code, build a GUI that display text in label and image in an Image View (use Java FX)
- c) Build a Tip Calculator app using several Java FX components and learn how to respond to user Interactions with the GUI

TEXTBOOKS:

1. JAVA One Step Ahead, Anitha Seth, B.L.Juneja, Oxford, 2017.
2. Joy with JAVA, Fundamentals of Object-Oriented Programming, Debasis Samanta, Monalisa Sarma, Cambridge,2023.
3. JAVA 9 for Programmers, Paul Deitel, Harvey Deitel, 4thEdition, Pearson, 2017.

REFERENCE BOOKS:

1. The complete Reference Java, Herbert Schildt, 11thEdition, TMH, 2017.
2. Introduction to Java Programming, Y Daniel Liang, 7th Edition, Pearson, 2012.

E-RESOURCES/DIGITAL MATERIAL:

1. <https://nptel.ac.in/courses/106/105/106105191/>
2. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_012880464547618816347_shared/overview
3. https://www.youtube.com/watch?v=3b-Wprhc_P8&list=PLsyeobzWxl7qcjd9Cx7W7ViDQk9TcfUIQs



PYTHON PROGRAMMING

Course Category:	Skill Enhancement Course	Credits :2			
Course Type:	Tutorial & Practical	Lecture-Tutorial-Practice:	0	1	2
Prerequisites	Basic programming knowledge	Continuous Evaluation	30M		
		Semester End Evaluation	70M		
		Total Marks	100M		

Course Outcomes:

After Successful Completion of course, the student will be able to:		
CO No:	Course Outcome Description	K - Level
CO1	Apply Python's fundamental components, construct control flow statements, perform input/output operations, manage exceptions, and develop well-structured, efficient, and robust Python programs.	Applying
CO2	Apply functions and their arguments, manage variable scope and lifetime, handle command line arguments, manipulate strings and lists using various operations and methods, and utilize built-in functions and commonly used modules to develop efficient Python programs.	Applying
CO3	Apply built-in functions and methods on dictionaries, tuples, and sets, utilize tuples and sets for efficient data handling.	Applying
CO4	Utilize file methods and modules to perform file operations, define and apply object-oriented programming principles by developing classes and objects, and implement encapsulation, inheritance, and polymorphism to construct robust and maintainable Python programs.	Applying
CO5	Apply functional programming principles, work with JSON and XML data formats, utilize NumPy for numerical computations, and manipulate data efficiently using Pandas to perform data science tasks and analyses effectively.	Applying

Note: K-Level is defined From Blooms Taxonomy

Contribution of Course Outcomes mapping with POs & PSOs (1- Low, 2 – Moderate,3 – High)

CO No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	3	-	-	-	-	-	-	3	3	3
CO2	3	-	-	-	3	-	-	-	-	-	-	3	3	3
CO3	3	-	-	-	3	-	-	-	-	-	-	3	3	3
CO4	3	-	-	-	3	-	-	-	-	-	-	3	3	3
CO5	3	-	-	-	3	-	-	-	-	-	-	3	3	3

COURSE CONTENT:

UNIT-I:

History of Python Programming Language, Thrust Areas of Python, Installing Anaconda Python Distribution, Installing and Using Jupyter Notebook.

Parts of Python Programming Language: Identifiers, Keywords, Statements and Expressions, Variables, Operators, Precedence and Associativity, Data Types, Indentation, Comments, Reading Input, Print Output, Type Conversions, the type () Function and Is Operator, Dynamic and Strongly

Typed Language.

Control Flow Statements: if statement, if-else statement, if...elif...else, Nested if statement, while Loop, for Loop, continue and break Statements, Catching Exceptions Using try and except Statement.

Sample Experiments:

1. Write a program to find the largest element among three Numbers.
2. Write a Program to display all prime numbers within an interval
3. Write a program to swap two numbers without using a temporary variable.
4. Write a program to add and multiply complex numbers
5. Write a program to print multiplication table of a given number.

UNIT-II:

Functions: Built-In Functions, Commonly Used Modules, Function Definition and Calling the function, return Statement and void Function, Scope and Lifetime of Variables, Default Parameters, Keyword Arguments, *args and **kwargs, Command Line Arguments.

Strings: Creating and Storing Strings, Basic String Operations, Accessing Characters in String by Index Number, String Slicing and Joining, String Methods, Formatting Strings.

Lists: Creating Lists, Basic List Operations, Indexing and Slicing in Lists, Built-In Functions Used on Lists, List Methods, del Statement.

Sample Experiments:

1. Write a program to define a function with multiple return values.
2. Write a program to define a function using default arguments.
3. Write a program to find the length of the string without using any library functions.
4. Write a program to check if the substring is present in a given string or not.
5. Write a program to perform the given operations on a list:
 - i. addition
 - ii. Insertion
 - iii. Slicing

UNIT-III:

Dictionaries: Creating Dictionary, Accessing and Modifying key: value Pairs in Dictionaries, Built-In Functions Used on Dictionaries, Dictionary Methods, del Statement.

Tuples and Sets: Creating Tuples, Basic Tuple Operations, tuple () Function, Indexing and Slicing in Tuples, Built-In Functions Used on Tuples, Relation between Tuples and Lists, Relation between Tuples and Dictionaries, Using zip () Function, Sets, Set Methods, Frozen set.

Sample Experiments:

- 1 Write a program to create tuples (name, age, address, college) for at least two members and concatenate the tuples and print the concatenated tuples.
- 2 Write a program to count the number of vowels in a string (No control flow allowed)
- 3 Write a program to check if a given key exists in a dictionary or not.
- 4 Write a program to add a new key-value pair to an existing dictionary.
- 5 Write a program to sum all the items in a given dictionary.

UNIT-IV:

Files: Types of Files, Creating and Reading Text Data, File Methods to Read and Write Data, Reading and Writing Binary Files, Pickle Module, Reading and Writing CSV Files, Python os and os.path Modules.

Object-Oriented Programming: Classes and Objects, Creating Classes in Python, Creating Objects in Python, Constructor Method, Classes with Multiple Objects, Class Attributes Vs Data Attributes, Encapsulation, Inheritance, Polymorphism.

Sample Experiments:

- 1 Write a program to sort words in a file and put them in another file. The output file should have only lower-case words, so any upper-case words from source must be lowered.

- 2 Python program to print each line of a file in reverse order.
- 3 Python program to compute the number of characters, words and lines in a file.
- 4 Write a Python program to create a class that represents a shape. Include methods to calculate its area and perimeter. Implement subclasses for different shapes like circle, triangle, and square.

UNIT-V:

Introduction to Data Science: Functional Programming, JSON and XML in Python, NumPy with Python, Pandas.

Sample Experiments:

1. Python program to check whether a JSON string contains complex object or not.
2. Python Program to demonstrate NumPy arrays creation using array () function.
3. Python program to demonstrate use of ndim, shape, size, dtype.
4. Python program to demonstrate basic slicing, integer and Boolean indexing.
5. Python program to find min, max, sum, cumulative sum of array.
6. Create a dictionary with at least five keys and each key represent value as a list where this list contains at least ten values and convert this dictionary as a pandas data frame and explore the data through the data frame as follows:
 - a) Apply head () function to the pandas data frame
 - b) Perform various data selection operations on Data Frame
- 5 Select any two columns from the above data frame and observe the change in one attribute with respect to other attribute with scatter and plot operations in matplotlib.

Textbooks:

1. Lambert, Kenneth A., and Martin Osborne. Fundamentals of PYTHON. Cengage, 2023.
2. Kurama, Vamsi. Python Programming: A Modern Approach. Pearson Education India, 2018ss.

Reference Books:

1. Gowrishankar, S., and A. Veena. Introduction to Python programming. Chapman and Hall/CRC, 2018.
2. Python Programming, S Sridhar, J Indumathi, V M Hariharan, 2nd Edition, Pearson, 2024
3. Liang, Y. Daniel. Introduction to programming using Python. Pearson, 2017s.

E-Resources/Digital Material:

1. <https://www.coursera.org/learn/python-for-applied-data-science-ai>
2. <https://www.coursera.org/learn/python?specialization=python#syllabus>

Regulation
D23

ENVIRONMENTAL SCIENCE



Course Category:	Audit Course	Credits: -			
Course Type:	Theory	Lecture-Tutorial-Practice:	2	0	0
Prerequisites	Science	Continuous Evaluation	30M		
		Semester End Evaluation	-		
		Total Marks	-		

Course Outcomes:

After Successful Completion of course, the student will be able to:		
CO No:	Course Outcome Description	K - Level
CO1	Understand multi-disciplinary nature of environmental studies and various renewable and non-renewable resources	Understanding
CO2	Understand flow and bio-geo-chemical cycles and ecological pyramids.	Understanding
CO3	Understand various causes of pollution and solid waste management and related preventive measures.	Understanding
CO4	Understand the concepts of rain water harvesting, watershed management, ozone layer depletion, and waste land reclamation.	Understanding
CO5	Illustrate the causes of population explosion, value education, and welfare programs.	Applying

Note: K-Level is defined From Blooms Taxonomy

Contribution of Course Outcomes mapping with POs & PSOs (1- Low, 2 – Moderate, 3 – High)

CO No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	3
CO2	3	-	-	-	-	-	-	-	-	-	-	-	3	3
CO3	3	-	-	-	-	-	-	-	-	-	-	-	3	3
CO4	-	3	-	-	-	-	-	-	-	-	-	-	3	3
CO5	-	3	-	-	-	-	-	-	-	-	-	-	3	3

COURSE CONTENT:

UNIT-I:

Multidisciplinary Nature of Environmental Studies: Definition, Scope and Importance Need for Public Awareness. Natural Resources: Renewable and non-renewable resources – Natural resources and associated problems – Forest resources – Use and over – exploitation, deforestation, case studies – Timber extraction – Mining, dams and other effects on forest and tribal people – Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems–Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies–Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.–Energy resources:

UNIT-II:

Ecosystems: Concept to fan ecosystem. –Structure and function of an ecosystem–Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids–Introduction, types, characteristic features, structure and function of the following ecosystem:

- a. Forest ecosystem.
- b. Grassl and ecosystem
- c. Desert ecosystem
- d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) Biodiversity

And Its Conservation: Introduction Definition: genetic, species and ecosystem diversity–Bio-geographical classification of India–Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-sports of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts– Endangered and endemic species of India –Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT-III:

Environmental Pollution: Definition, Cause, effects and control measures of:

- a. Air Pollution.
- b. Water pollution
- c. Soil pollution
- d. Marine pollution
- e. Noise pollution
- f. Thermal pollution
- g. Nuclear hazards

Solid Waste Management: Causes, effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone and landslides.

UNIT-IV:

Social Issues and the Environment: From Unsustainable to Sustainable development– Urban problems related to energy – Water conservation, rainwater harvesting, watershed management – Resettlement and rehabilitation of people; its problems and concerns. Case studies – Environmental ethics: Issues and possible solutions–Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies – Wastel and reclamation. – Consumerism and waste products. – Environment Protection Act. – Air (Prevention and Control of Pollution) Act. –Water (Prevention and control of Pollution) Act–Wildlife Protection Act–Forest Conservation Act–Issues involved in enforcement of environment legislation–Public awareness.

UNIT-V:

Human Population and The Environment: Population growth, variation among nations. Population explosion – Family Welfare Programmes. – Environment and human health – Human Rights – Value Education–HIV/AIDS–Women and Child Welfare–Role of information Technology in Environment and human health–Case studies.

Field Work: Visit to a local area to document environmental assets River/ forest grassland/ hill/ mountain – Visit to a local polluted site-Urban/Rural/Industrial/Agricultural Study of common plants, insects, and birds–river, hills lopes, etc..

Text Books:

1. Text book of Environmental Studies for Undergraduate Courses Erach Bharucha for University Grants Commission, Universities Press.
2. Palani swamy, “Environmental Studies”, Pearson education.
3. S.AzeemUnnisa, “Environmental Studies” Academic Publishing Company
4. K.RaghavanNambiar, “Text book of Environmental Studies for Undergraduate Courses as per UGC model syllabus”, Scitech Publications (India), Pvt.Ltd

Reference Books:

1. Deeksha Dave and E.Sai Baba Reddy, “Text book of Environmental Science”, Cengage Publications
2. M.Anji Reddy, “Textbook of Environmental Sciences and Technology”, BSPublication
3. J.P.Sharma, Comprehensive Environmental studies, Laxmi publications
4. J.Glynn Henry and Gary W.Heinke, “ Environmental Sciences and Engineering”, Prentice Hall of India Private limited
5. G.R. Chatwal, “AText Book of Environmental Studies” Himalaya Publishing House
6. Gilbert M.Masters and Wendell P.Ela, “Introduction to Environmental Engineering and Science, Prentice Hall of India Private limited

E-Resources:

1. https://onlinecourses.nptel.ac.in/noc23_hs155/preview
2. <https://archive.nptel.ac.in/courses/120/108/120108004/>
3. https://onlinecourses.nptel.ac.in/noc24_ge19/preview
4. https://onlinecourses.swayam2.ac.in/cec19_bt03/preview
5. <https://www.classcentral.com/course/swayam-environmental-science-184135>

II-II Semester



OPTIMIZATION TECHNIQUES

Course Category:	Management Course- I	Credits: 2			
Course Type:	Theory	Lecture-Tutorial-Practice:	2	0	0
Prerequisites	Knowledge of optimization problems	Continuous Evaluation	30M		
		Semester End Evaluation	70M		
		Total Marks	100M		

Course Outcomes:

After Successful Completion of the course, the student will be able to:		
CO No:	Course Outcome Description	K - Level
CO1	Formulate the engineering problems as an optimization problem by using classical optimization techniques	2
CO2	Solve Linear programming problem using simplex method	3
CO3	Apply methods such as the Northwest Corner Method, Least Cost Method, and Vogel's Approximation Method to find initial feasible solutions to transportation problems.	3
CO4	Solve nonlinear optimization problems using appropriate techniques.	3
CO5	Formulate and solve problems using dynamic programming techniques.	3

Note: K-Level is defined From Blooms Taxonomy

Contribution of Course Outcomes mapping with POs & PSOs (1- Low, 2 – Moderate, 3 – High)

CO No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	-	-	-	-	-	-	-	3	3	3
CO2	3	3	-	-	-	-	-	-	-	-	-	3	3	3
CO3	3	3	-	-	-	-	-	-	-	-	-	3	3	3
CO4	3	3	-	-	-	-	-	-	-	-	-	3	3	3
CO5	3	3	-	-	-	-	-	-	-	-	-	3	3	3

COURSE CONTENT:

UNIT-I: Introduction and Classical Optimization Techniques:

Statement of an Optimization problem, design vector, design constraints, constraint surface, objective function, objective function surfaces, classification of Optimization problems. **Classical Optimization Techniques:** Single variable Optimization, multi variable Optimization without constraints, necessary and sufficient conditions for minimum/maximum, multivariable Optimization with equality constraints. Solution by method of Lagrange multipliers, multivariable Optimization with inequality constraints, Kuhn – Tucker conditions

UNIT-II: Linear Programming:

Standard form of a linear programming problem, geometry of linear programming problems, definitions and theorems, solution of a system of linear simultaneous equations, pivotal reduction of a general system of equations, motivation to the simplex method, simplex algorithm

UNIT–III: Transportation Problem:

Finding initial basic feasible solution by north – west corner rule, least cost method and Vogel’s approximation method, testing for optimality of balanced transportation problems, Special cases in transportation problem.

UNIT–IV: Nonlinear Programming:

Unconstrained cases, One – dimensional minimization methods: Classification, Fibonacci method, Univariate method, steepest descent method. Constrained cases– Characteristics of a constrained problem, Classification, Basic approach of Penalty Function method, Basic approaches of Interior and Exterior penalty function methods,

UNIT–V: Dynamic Programming:

Dynamic programming multistage decision processes, types, concept of sub optimization and the principle of optimality, computational procedure in dynamic programming, examples illustrating the calculus method of solution, examples illustrating the tabular method of solution.

Textbooks:

1. “Engineering optimization: Theory and practice”, S. S.Rao, New Age International (P) Limited, 3rd edition, 1998.
2. “Introductory Operations Research”, H.S. Kasene& K.D. Kumar, Springer (India), Pvt.LTd.

ReferenceBooks:

1. “Optimization Methods in Operations Research and systems Analysis”, by K.V. Mital and C. Mohan, New Age International (P) Limited, Publishers, 3rd edition, 1996
2. Operations Research, Dr.S.D.Sharma, Kedarnath, Ramnath& Co

E-Resources:

1. <https://nptel.ac.in/courses/111105039>
2. https://onlinecourses.nptel.ac.in/noc21_me10/preview



PROBABILITY AND STATISTICS

Course Category:	Professional Core	Credits: 3			
Course Type:	Theory	Lecture-Tutorial-Practice:	3	0	0
Prerequisites	Basic knowledge on Definition of probability and Graphs	Continuous Evaluation	30M		
		Semester End Evaluation	70M		
		Total Marks	100M		

Course Outcomes:

After Successful Completion of course, the student will be able to:		
CO No:	Course Outcome Description	K - Level
CO1	Classify the concepts of data science and its importance	2
CO2	Classify the concepts of data science and employ descriptive statistical methods.	Applying
CO3	Interpret the association of characteristics and through correlation and regression tools	Analyzing
CO4	Apply discrete and continuous probability distributions.	Applying
CO5	Apply Sampling techniques to get estimates of the population	Applying

Note: K-Level is defined From Blooms Taxonomy

Contribution of Course Outcomes mapping with POs & PSOs (1- Low, 2 – Moderate, 3 – High)

CO No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	-	-	-	-	-	-	-	3	3	3
CO2	3	3	-	-	-	-	-	-	-	-	-	3	3	3
CO3	3	3	-	-	-	-	-	-	-	-	-	3	3	3
CO4	3	3	-	-	-	-	-	-	-	-	-	3	3	3
CO5	3	3	-	-	-	-	-	-	-	-	-	3	3	3

COURSE CONTENT:

UNIT-I: Descriptive statistics and methods for data science

Data science–Statistics Introduction–Population vs Sample–Collection of data–primary and secondary datatype of variable: dependent and independent Categorical and Continuous variables –Data visualization – Measures of Central tendency – Measures of Variability–Skewness–Kurtosis.

UNIT-II: Correlation and Regression

Correlation–Correlation coefficient–Rank correlation.

Linear Regression: Straight line – Multiple Linear Regression - Regression coefficients and properties–Curvilinear Regression: Parabola–Exponential–Power curves.

UNIT-III: Probability and Distributions

Probability– Conditional probability and Baye’s theorem – Random variables – Discrete and Continuous random variables–Distribution functions–Probability mass function, Probability density function and Cumulative distribution functions–Mathematical Expectation and Variance–Binomial, Poisson, **Uniform** and Normal distributions.

UNIT-IV: Sampling Theory

Introduction–Population and Samples–Sampling distribution of Means and Variance (definition only)–Point and Interval estimations–Maximum error of estimate–Central limit theorem (without proof)–Estimation using t , χ^2 and F-distributions.

UNIT-V: Tests of Hypothesis

Introduction–Hypothesis–Null and Alternative Hypothesis–Type I and Type II errors–Level of significance–One tail and two-tail tests–Test of significance for large samples and Small Samples: Single and difference means–Single and two proportions–Student's t test, F-test, χ^2 test

Textbooks:

1. Miller and Freund's, Probability and Statistics for Engineers, 7/e, Pearson, 2008.
2. S.C.Gupta and V.K.Kapoor, Fundamentals of Mathematical Statistics, 11/e, Sultan Chand & Sons Publications, 2012.

Reference Books:

1. Shron L. Myers, Keying Ye, Ronald E Walpole, Probability and Statistics Engineers and the Scientists, 8th Edition, Pearson 2007.
2. Jayl. Devore, Probability and Statistics for Engineering and the Sciences, 8th Edition, Cengage.
3. Sheldon M. Ross, Introduction to probability and statistics Engineers and the Scientists, 4th Edition, Academic Foundation, 2011.
4. Johannes Ledolter and Robert V. Hogg, Applied statistics for Engineers and Physical Scientists, 3rd Edition, Pearson, 2010

E-Resources:

1. [Probability and Statistics - Course \(nptel.ac.in\)](https://nptel.ac.in/courses/106/001/106001001/)
2. <https://www.coursera.org/browse/data-science/probability-and-statistics>

Websites:

1. <https://www.bing.com/pros/search?q=Statistics>
2. <https://www.khanacademy.org/math/statistics-probability>
3. <https://ocw.mit.edu/courses/18-05-introduction-to-probability-and-statistics-spring-2022/>



OPERATING SYSTEMS

Course Category:	Professional Core	Credits: 3			
Course Type:	Theory	Lecture-Tutorial-Practice:	3	0	0
Prerequisites	Understanding of basics of Computer Organization	Continuous Evaluation	30M		
		Semester End Evaluation	70M		
		Total Marks	100M		

Course Outcomes:

After Successful Completion of course, the student will be able to:		
CO No:	Course Outcome Description	K - Level
CO1	Define the functional aspects and implementation methods of different modules in a general-purpose operating system.	Understanding
CO2	Apply scheduling algorithms, multithreaded programming and inter-process communication through examples.	Applying
CO3	Identify deadlock detection, recovery, prevention and avoidance algorithms	Applying
CO4	Solve various memory management strategies such as paging and segmentation, virtual memory, swapping and page replacement algorithms.	Applying
CO5	List various security measures and system protection techniques.	Applying

Note: K-Level is defined From Blooms Taxonomy

Contribution of Course Outcomes mapping with POs & PSOs (1- Low, 2 – Moderate, 3 – High)

CO No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	-	-	-	-	3	3
CO2	3	-	-	-	-	-	-	-	-	-	-	-	3	3
CO3	3	-	-	-	-	-	-	-	-	-	-	-	3	3
CO4	3	-	-	-	-	-	-	-	-	-	-	-	3	3
CO5	3	-	-	-	-	-	-	-	-	-	-	-	3	3

COURSE CONTENT:

UNIT-I:

Operating Systems Overview: Introduction, Operating system functions, Operating systems operations, Computing environments, Free and Open-Source Operating Systems System Structures: Operating System Services, User and Operating-System Interface, system calls, Types of System Calls, system programs, Operating system Design and Implementation, Operating system structure, Building and Booting an Operating System, Operating system debugging.

UNIT-II:

Processes: Process Concept, Process scheduling, Operations on processes, Inter-process communication.

Threads and Concurrency: Multithreading models, Thread libraries, Threading issues.

CPU Scheduling: Basic concepts, Scheduling levels, Pre-emptive versus Non-Pre-emptive scheduling, Scheduling criteria, Scheduling algorithms, Multiple Processor Scheduling.

UNIT-III:

Synchronization Tools: The Critical Section Problem, Peterson's Solution, Mutex Locks, Semaphores, Monitors, Classic problems of Synchronization.

Deadlocks: system Model, Deadlock characterization, Methods for handling Deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from Deadlock.

UNIT-IV:

Memory-Management Strategies: Introduction, Contiguous memory allocation, Paging, Structure of the Page Table, Swapping.

Virtual Memory Management: Introduction, Demand paging, Copy-on-write, Page replacement, Allocation of frames, Thrashing Storage Management: Overview of Mass Storage Structure, HDD Scheduling.

UNIT-V:

File System: File System Interface: File concept, Access methods, Directory Structure; File system Implementation: File-system structure, File-system Operations, Directory implementation, Allocation method, Free space management.

File-System Internals: File-System Mounting, Partitions and Mounting, File Sharing.

Protection: Goals of protection, Principles of protection, Protection Rings, Domain of protection, Access matrix.

Textbooks:

1. Operating System Concepts, Silberschatz A, Galvin P B, Gagne G, 10thEdition, Wiley, 2018.
2. Modern Operating Systems, Tanenbaum A S, 4thEdition, Pearson, 2016

Reference Books:

1. Operating Systems -Internals and Design Principles, Stallings W, 9th edition, Pearson, 2019
2. Operating Systems: A Concept Based Approach, D.M Dhamdhere, 3rd Edition, McGraw- Hill, 2017

E-Resources/Digital Material:

1. <https://nptel.ac.in/courses/106/106/106106144/>
2. <http://peterindia.net/OperatingSystems.html>

DATABASE MANAGEMENT SYSTEMS



Course Category:	Professional Core	Credits: 3			
Course Type:	Theory	Lecture-Tutorial-Practice:	3	0	0
Prerequisites	Understanding of data concepts like data types, structures and relationships	Continuous Evaluation	30M		
		Semester End Evaluation	70M		
		Total Marks	100M		

Course Outcomes:

After Successful Completion of course, the student will be able to:		
CO No:	Course Outcome Description	K - Level
CO1	Apply knowledge of database system structures and environments to analyze real world scenarios	Applying
CO2	Apply ER model for database design	Applying
CO3	Make use of SQL queries on relational database to create, maintain and manipulate a relational database.	Applying
CO4	Analyze different normalization techniques for effective database design.	Analyzing
CO5	Analyze transaction management and indexing techniques for a database.	Analyzing

Note: K-Level is defined From Blooms Taxonomy

Contribution of Course Outcomes mapping with POs & PSOs (1- Low, 2 – Moderate, 3 – High)

CO No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	3	3	3
CO2	3	-	-	-	3	-	-	-	-	-	-	3	3	3
CO3	3	-	-	-	3	-	-	-	-	-	-	3	3	3
CO4	-	3	-	-	-	-	-	-	-	-	-	3	3	3
CO5	-	3	-	-	-	-	-	-	-	-	-	3	3	3

COURSE CONTENT:

UNIT-I:

Introduction: Database system, Characteristics (Database Vs File System), Database Users, Advantages of Database systems, Database applications. Brief introduction of different Data Models; Concepts of Schema, Instance and data independence; Three tier schema architecture for data independence; Database system structure, environment, Centralized and Client Server architecture for the database.

Entity Relationship Model: Introduction, Representation of entities, attributes, entity set, relationship, relationship set, constraints, sub classes, super class, inheritance, specialization, generalization using ER Diagrams.

UNIT-II:

Relational Model: Introduction to relational model, concepts of domain, attribute, tuple, relation, importance of null values, constraints (Domain, Key constraints, integrity constraints) and their importance, Relational Algebra, Relational Calculus. BASIC

SQL: Simple Database schema, data types, table definitions (create, alter), different DML operations (insert, delete, update)

UNIT-III:

SQL: Basic SQL querying (select and project) using where clause, arithmetic & logical operations, SQL functions (Date and Time, Numeric, String conversion). Creating tables with relationship, implementation of key and integrity constraints, nested queries, sub queries, grouping, aggregation, ordering, implementation of different types of joins, view (updatable and non-updatable), relational set operations, Triggers.

UNIT-IV:

Schema Refinement (Normalization): Purpose of Normalization or schema refinement, concept of functional dependency, normal forms based on functional dependency Lossless join and dependency preserving decomposition, (1NF, 2NF and 3 NF), concept of surrogate key, Boyce-Codd normal form (BCNF), MVD, Fourth normal form(4NF), Fifth Normal Form(5NF).

UNIT-V:

Transaction Concept: Transaction State, ACID properties, Concurrent Executions, Serializability, Recoverability, Implementation of Isolation, Testing for Serializability, lock based, time stamp based, optimistic, concurrency protocols, Deadlocks, Failure Classification, Storage, Recovery and Atomicity, Recovery algorithm.

Introduction to Indexing Techniques: B+ Trees, operations on B+Trees, Hash Based Indexing

Textbooks:

1. Database Management Systems, Raghurama Krishnan, Johannes Gehrke, 3rd Edition, TMH, 2014.
2. Database System Concepts, Silberschatz, Korth, Sudarsan, 7th Edition, TMH,2020.

Reference Books:

1. Introduction to Database Systems, C J Date, 8th Edition, Pearson,2006.
2. Database Management System, Ramez Elmasri, Shamkant B. Navathe, 7th Edition, Pearson, 2017.
3. Database Principles Fundamentals of Design Implementation and Management, Corlos Coronel, Steven Morris, Peter Robb, 10thEdition,Cengage Learning, 2013.

E-Resources:

1. <https://nptel.ac.in/courses/106/105/106105175/>
2. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01275806667282022456_shared/overview
3. <http://www.c4learn.com/>
4. <https://www.geeksforgeeks.org/dbms/>
5. https://onlinecourses.nptel.ac.in/noc22_cs91/preview
6. <https://www.tutorialspoint.com/dbms/index.htm>



Course Category:	Professional Core	Credits: 3			
Course Type:	Theory	Lecture-Tutorial-Practice:	3	0	0
Prerequisites	Basic knowledge of algorithms, data analysis and software	Continuous Evaluation	30M		
		Semester End Evaluation	70M		
		Total Marks	100M		

Course Outcomes:

After Successful Completion of course, the student will be able to:		
CO No:	Course Outcome Description	K - Level
CO1	Understand phases of software development and conventional software methods	Understanding
CO2	Utilize Empirical estimation techniques like COCOMO, Halstead's software science for project management and implement various specifications	Applying
CO3	Construct various software designs and cost models	Applying
CO4	Develop skills to design, implement, and execute test cases at various levels with quality management	Applying
CO5	Implement software maintenance, reuse approaches and make use of CASE Tools	Applying

Note: K-Level is defined From Blooms Taxonomy

Contribution of Course Outcomes mapping with POs & PSOs (1- Low, 2 – Moderate, 3 – High)

CO No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	-	-	-	-	3	3
CO2	3	-	-	-	-	-	-	-	-	-	-	-	3	3
CO3	3	-	-	-	-	-	-	-	-	-	-	-	3	3
CO4	3	-	-	-	-	-	-	-	-	-	-	-	3	3
CO5	3	-	-	-	-	-	-	-	-	-	-	-	3	3

COURSE CONTENT:

UNIT-I:

Introduction: Evolution, Software development projects, Exploratory style of software developments, Emergence of software engineering, Notable changes in software development practices, Computer system engineering.

Software Life Cycle Models: Basic concepts, Water fall model and its extensions, Rapid application development, Agile development model, Spiral model.

UNIT-II:

Software Project Management: Software project management complexities, Responsibilities of a software project manager, Metrics for project size estimation, Project estimation techniques, Empirical Estimation techniques, COCOMO, Halstead's software science, risk management.

Requirements Analysis and Specification: Requirements gathering and analysis, Software Requirements Specification (SRS), Formal system specification, Axiomatic specification, Algebraic specification, Executable specification and 4GL.

UNIT-III:

Software Design: Overview of the design process, how to characterize a good software design? Layered arrangement of modules, Cohesion and Coupling, approaches to software design.

Agility: Agility and the Cost of Change, Agile Process, Extreme Programming (XP), Other Agile Process Models-SCRUM, Tool Set for the Agile Process (TextBook2)

Function-Oriented Software Design: Overview of SA/SD methodology, Structured analysis, Developing the DFD model of a system, Structured design, Detailed design, and Design Review.

User Interface Design: Characteristics of a good user interface, Basic concepts.

UNIT-IV:

Coding And Testing: Coding, Code review, Software documentation, Testing, Black-box testing, White-Box testing, Debugging, Program analysis tools, Integration testing.

Software Reliability and Quality Management: Software reliability. Statistical testing, Software quality, Software quality management system, ISO9000.SEI Capability maturity model, Few other important quality standards and Six Sigma.

UNIT-V:

Computer-Aided Software Engineering (CASE): CASE and its scope, CASE environment, CASE support in the software life cycle, other characteristics of CASE tools, Towards second generation CASE Tool and Architecture of a CASE Environment.

Software Maintenance: Characteristics of software maintenance, Software reverse engineering, Software maintenance process models and Estimation of maintenance cost.

Software Reuse: reuse-definition, introduction, reason behind no reuse so far, Basic issues in any reuse program, A reuse approach.

Textbooks:

1. Fundamentals of Software Engineering, RajibMall,5thEdition, PHI, 2018.
2. Software Engineering A practitioner's Approach, Roger S.Pressman, 9thEdition,Mc-Graw Hill International Edition, 2023.

Reference Books:

1. Software Engineering, IanSommerville,10thEdition, Pearson, 2017s.
2. Software Engineering, Principles and practices, Deepak Jain, Oxford University Press,2008.

E-Resources/Digital Material:

1. <https://nptel.ac.in/courses/106/105/106105182/>
2. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01260589506387148827_shared/overview
3. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013382690411003904735_shared/overview



OPERATING SYSTEMS & SOFTWARE ENGINEERING LAB

Course Category:	Professional Core	Credits: 1.5			
Course Type:	Practical	Lecture-Tutorial-Practice:	0	0	4
Prerequisites	Practical	Continuous Evaluation			
		Semester End Evaluation			
		Total Marks			

Course Outcomes:

After Successful Completion of course, the student will be able to:		
CO No:	Course Outcome Description	K - Level
CO1	Make use of Linux environment for Unix utilities and perform basic shell and file access control.	Applying
CO2	Solve various CPU Scheduling, deadlocks and page replacement algorithms.	Applying
CO3	Apply concepts of Inter process communication and P threads in operating systems.	Applying
CO4	Build SRS document, design document, test cases and software configuration management and risk management related document.	Applying
CO5	Develop modern engineering tools necessary for software project management, estimations, time management and software reuse.	Applying
CO6	Apply test cases for software testing.	Applying

Note: K-Level is defined From Blooms Taxonomy

Contribution of Course Outcomes mapping with POs & PSOs (1- Low, 2 – Moderate, 3 – High)

CO No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	3	-	-	-	-	-	-	3	3	3
CO2	3	3	-	-	3	-	-	-	-	-	-	3	3	3
CO3	3	3	-	-	3	-	-	-	-	-	-	3	3	3
CO4	3	3	-	-	3	-	-	-	-	-	-	3	3	3
CO5	3	3	-	-	3	-	-	-	-	-	-	3	3	3
CO6	3	3	-	-	3	-	-	-	-	-	-	3	3	3

COURSE CONTENT:

1. Practicing Basic UNIX Commands.
2. Write programs using the following UNIX operating system calls fork, exec, getpid, exit, wait, close, stat, opendir and readdir
3. Simulate UNIX commands like cp, ls, grep, etc.,
4. Simulate the following CPU scheduling algorithms
a) FCFS b) SJF c) Priority d) Round Robin
5. Control the number of ports opened by the operating system with
a) Semaphore b) Monitors.
6. Write a program to illustrate concurrent execution of threads using pthreads library.

7. Write a program to solve producer-consumer problem using Semaphores.
8. Implement the following memory allocation methods for fixed partition
a) First fit b) Worst fit c) Best fit
9. Simulate the following page replacement algorithms a) FIFO b) LRU c) LFU
10. Simulate Paging Technique of memory management.
11. Implement Bankers Algorithm for Dead Lock avoidance and prevention
12. Simulate the following file allocation strategies a) Sequential b) Indexed c) Linked

Sample Experiments in Software Engineering:

- 1) Perform the following, for the following experiments:
 - i. Do the Requirement Analysis and Prepare SRS
 - ii. Draw E-R diagrams, DFD, CFD and structured charts for the project.
 - a. Course Registration System
 - b. Students Marks Analyzing System
 - c. Online Ticket Reservation System
 - d. Stock Maintenance
- 2) Consider any application, using COCOMO model, estimate the effort.
- 3) Consider any application, calculate effort using FP oriented estimation model.
- 4) Draw the UML Diagrams for the problem a,b,c,d.
- 5) Design the test cases for e-Commerce application(Flipkart, Amazon)
- 6) Design the test cases for a Mobile Application (Consider any example from Appstore)
- 7) Design and Implement ATM system through UML Diagrams

Reference Books:

1. Operating System Concepts, Silberschatz A, Galvin P B, Gagne G, 10th Edition, Wiley, 2018.
2. Modern Operating Systems, Tanenbaum A S, 4th Edition, Pearson, 2016
3. Operating Systems -Internals and Design Principles, Stallings W, 9th edition, Pearson, s2018
4. Operating Systems: A Concept Based Approach, D.M Dhamdhare, 3rd Edition, McGraw- Hill, 2017
5. Requirements Engineering: A Good Practice Guide, Ian Sommerville, Pete Sawyer, Wiley India Pvt Ltd, 2011s
6. Lecture on "System Analysis and Design", NPTEL

Online Learning Resources:

1. <https://www.cse.iitb.ac.in/~mythili/os/>
2. <http://peterindia.net/OperatingSystems.html>
3. www.cs.washington.edu/~tom/nachos



Course Category:	Professional Core	Credits :1.5			
Course Type:	Practical	Lecture-Tutorial-Practice:	0	0	3
Prerequisites	Understanding of data concepts like data types, structures and relationships	Continuous Evaluation	30M		
		Semester End Evaluation	70M		
		Total Marks	100M		

Course Outcomes:

After Successful Completion of course, the student will be able to:		
CO No:	Course Outcome Description	K - Level
CO1	Analyze various SQL queries to perform operations on database	Analyzing
CO2	Examine PL/SQL programs for procedures, functions, cursors and triggers.	Analyzing
CO3	Inspect different indexing techniques on a table and JDBC concept.	Analyzing

Note: K-Level is defined From Blooms Taxonomy

Contribution of Course Outcomes mapping with POs & PSOs (1- Low, 2 – Moderate,3 – High)

CO No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	s	3	-	-	3	-	-	-	-	-	-	3	3	3
CO2	3	3	-	-	3	-	-	-	-	-	-	3	3	3
CO3	3	3	-	-	3	-	-	-	-	-	-	3	3	3

COURSE CONTENT:

Exercise 1: Creation, altering and dropping of tables and inserting rows into a table (use constraints while creating tables) examples using SELECT command.

Exercise 2: Queries (along with sub-Queries) using ANY, ALL, IN, EXISTS, NOTEXISTS, UNION, INTERSET, Constraints. Example: - Select the roll number and name of the student who secured fourth rank in the class.

Exercise 3: Queries using Aggregate functions (COUNT, SUM, AVG, MAX and MIN), GROUP BY, HAVING and Creation and dropping of Views.

Exercise 4: Queries using Conversion functions (to_char, to_number and to_date), string functions (Concatenation, lpad, rpad, ltrim,rtrim, lower, upper, initcap, length, substr and instr), date functions (Sysdate, next_day, add_months, last_day, months_between, least, greatest, trunc, round, to_char, to_date)

Exercise 5: i. Create a simple PL/SQL program which includes declaration section, executable section and exception –Handling section (Ex. Student marks can be selected from the table and printed for those who secured first class and an exception can be raised if no records were found)
ii. Insert data into student table and use COMMIT, ROLLBACK and SAVEPOINT in PL/SQL block.

Exercise 6: Develop a program that includes the features NESTED IF, CASE and CASE expression. The program can be extended using the NULLIF and COALESCE functions.

Exercise 7: Program development using WHILE LOOPS, numeric FOR LOOPS, nested loops using ERROR Handling, BUILT-IN Exceptions, USE defined Exceptions, RAISE-APPLICATION ERROR.

Exercise 8: Programs development using creation of procedures, passing parameters IN and OUT of PROCEDURES.

Exercise 9: Program development using creation of stored functions, invoke functions in SQL Statements and write complex functions.

Exercise 10: Develop programs using features parameters in a CURSOR, FOR UPDATE CURSOR, WHERE CURRENT of clause and CURSOR variables.

Exercise 11:

Develop Programs using BEFORE and AFTER Triggers, Row and Statement Triggers and INSTEAD OF Triggers

Exercise 12:

Create a table and perform the search operation on table using indexing and non-indexing techniques. Implement indexing using B-trees.

Exercise 13: Write a Java program that connects to a database using JDBC

Exercise 14: Write a Java program to connect to a database using JDBC and insert values into it

Exercise 15: Write a Java program to connect to a database using JDBC and delete values from it

Text Books:

1. Oracle: The Complete Reference by Oracle Press, 12c, 2013.
2. Nilesh Shah, "Database Systems Using Oracle", 2nd Edition PHI, 2016
3. Rick F Vander Lans, "Introduction to SQL", 4th Edition, Pearson Education, 2007

Reference Books:

1. The Complete Reference MYSQL, Vikram Vaswani, McGraw-Hill Education, 1st Edition, 2017.
2. Fundamentals of Database Systems, Ramez Elmasri, Shamkant B. Navathe, 7th Edition, Pearson, 2016.

E-Resources/Digital Material:

1. Prof Arnab Bhattacharya IIT Kanpur, SQL Introduction
<https://nptel.ac.in/courses/106104135/10>
2. Prof Arnab Bhattacharya IIT Kanpur SQL: Updates, Joins, Views and Triggers
<https://nptel.ac.in/courses/106104135/11>
3. Geoff Allix and Graeme Malcolm: Microsoft , Querying with Transact-SQL (edX) <https://www.mooc-list.com/course/querying-transact-sql-edx>



PYTHON WITH DJANGO

Course Category:	Skill Enhancement Course	Credits : 2			
Course Type:	Theory / Tutorial /Practical	Lecture-Tutorial-Practice:	0	1	2
Prerequisites	PYTHON PROGRAMMING	Continuous Evaluation	30M		
		Semester End Evaluation	70M		
		Total Marks	100M		

Course Outcomes:

After Successful Completion of course, the student will be able to:		
CO No:	Course Outcome Description	K - Level
CO1	Experimenting with Python libraries for web development	Applying(L3)
CO2	Make use of Django Framework for creating Models	Applying(L3)
CO3	Constructing Accounts & Authentication on Django	Applying(L3)
CO4	Utilizing SQLite with Django	Applying(L3)
CO5	Developing and Deploying Django Web Application on Cloud	Applying(L3)

Note: K-Level is defined From Blooms Taxonomy

Contribution of Course Outcomes mapping with POs & PSOs (1- Low, 2 – Moderate,3 – High)

CO No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	2	-	-	-	-	-	-	-	3	3
CO2	3	-	-	-	2	-	-	-	-	-	-	-	3	3
CO3	3	-	-	-	2	-	-	-	-	-	-	-	3	3
CO4	3	-	-	-	2	-	-	-	-	-	-	-	3	3
CO5	3	-	-	-	2	-	-	-	-	-	-	-	3	3

COURSE CONTENT:

UNIT-I

Python libraries for web development: Collections-Container datatypes, Tkinter-GUI applications, Requests-HTTP requests, BeautifulSoup4-web scraping, Scrapy, Zappa, Dash, CherryPy, Turbo Gears, Flask, Web2Py, Bottle, Falcon, Cubic Web, Quixote, Pyramid.

Sample Experiments:

1. Write a Python GUI program to import Tkinter package and create a window. Set its title and add a label to the window.
2. Write a Python program that designs a simple login form with labels and Entry widgets, arranging them in a grid using the Grid geometry manager.
3. Write a program using BeautifulSoup4 library for web scraping for a given URL
4. Develop a sample Hello World page using Flask framework
5. Develop a sample web page using CherryPy / Web2Py / Bottle Framework

UNIT-II

Introduction to Django Framework Understanding Django environment, Features of Django and Django architecture, MVC and MTV, Urls and Views, Mapping the views to URLs, Django Template, Template inheritance Django Models, creating model for site, Converting the model into a table, Fields in Models, Integrating Bootstrap into Django, creating tables, creating grids, Creating carousels.

Sample Experiments:

1. Create a Sample “Hello World” Application using Django
2. Create a Login and Registration Page using MVC architecture in Django Framework
3. Create a sample page in Django by integrating Bootstrap.
4. Create an application with Tables, grids in Django
5. Create a Django App with Carousels feature.

UNIT III

Integrating Accounts & Authentication on Django Introduction to Django Authentication System, Security Problem & Solution with Django Creating Registration Form using Django, Adding Email Field in Forms, configuring email settings, sending emails with Django, Adding Grid Layout On Registration Page, Adding Page Restrictions, Login Functionality Test and Logout.

Sample Experiments:

1. Create a registration page using Authentication System
2. Create an application in Django to send emails using email settings and Grid Layout
3. Create an application in Django using page restriction / authentication with Login and Logout Functionality
4. Create a sample form using Django Forms

UNIT-IV

Connecting SQLite with Django Database Migrations, Fetch Data from Database, Displaying Data On Templates, Adding Condition On Data, sending data from url to view, Sending data from view to template, Saving objects into database, Sorting objects, Filtering objects, Deleting objects, Difference between session and cookie, Creating sessions and cookies in Django.

Sample Experiments:

1. Create an app in Django which fetches data from database and show as list and also save objects in database
2. Create an app in Django for performing CRUD operations on records in a database
3. Create an app in Django which uses session management and cookies to store and manage user sessions.

UNIT-V

Deploying Django Web Application on Cloud Creating a functional website in Django, Four Important Pillars to Deploy, registering on Heroku and GitHub, Push project from Local System to GitHub, working with Django Heroku, Working with StaticRoot, Handling WSGI with gunicorn, setting up Database & adding users.

Sample Experiments:

1. Create a website in Django with login, and registration page.
2. Register on GitHub, and Heroku and deploy the website on Heroku with all the functionalities developed.
3. Configure Django to handle static files.

Text books:

1. Martin C. Brown, "Python: The Complete Reference Paper back", 4th Edition 2018, McGraw Hill Education.
2. Reema Thareja, "Python Programming: Using Problem Solving Approach", 3rd Edition 2017, Oxford.
3. Daniel Rubio, Apress, "Beginning Django Web Application Development and Deployment with Python", 2nd Edition 2017, Apress.

Reference Books:

1. Tom Aratyn, "Building Django 2.0 Web Applications: Create enterprise-grade, scalable Python web applications easily with Django 2.0", 2nd Edition 2018, Packt Publishing.
2. Harry Percival, "Test-Driven Development with Python: Obey the Testing Goat: sUsing Django, Selenium and JavaScript", 2nd Edition 2019, Kindle Edition.



FULL STACK DEVELOPMENT –I

Course Category:	Skill Enhancement Course	Credits: 2			
Course Type:	Tutorial & Practical	Lecture-Tutorial-Practice:	0	1	2
Prerequisites	knowledge of basic web programming	Continuous Evaluation	30M		
		Semester End Evaluation	70M		
		Total Marks	100M		

Course Outcomes:

After Successful Completion of course, the student will be able to:		
CO No:	Course Outcome Description	K - Level
CO1	Applying the basics of full stack web development	Applying
CO2	Develop responsive web pages using HTML and CSS	Applying
CO3	Implement client-side scripting using JavaScript and Build interactive web pages using Node.JS	Applying

Note: K-Level is defined From Blooms Taxonomy

Contribution of Course Outcomes mapping with POs & PSOs (1- Low, 2 – Moderate, 3 – High)

CO No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	3	-	-	-	-	-	-	3	3	3
CO2	3	-	-	-	3	-	-	-	-	-	-	3	3	3
CO3	3	-	-	-	3	-	-	-	-	-	-	3	3	3

COURSE CONTENT:

Experiments covering the Topics:

- Lists, Links and Images
- HTML Tables, Forms and Frames
- HTML 5 and Cascading Style Sheets, Types of CSS
- Selector forms
- CSS with Color, Background, Font, Text and CSS Box Model
- Applying JavaScript - internal and external, I/O, Type Conversion
- JavaScript Conditional Statements and Loops, Pre-defined and User-defined Objects
- JavaScript Functions and Events
- Node.js

Sample Experiments:

1. Lists, Links and Images

a. Write a HTML program, to explain the working of lists.

Note: It should have an ordered list, unordered list, nested lists and ordered list in an unordered list and definition lists.

b. Write a HTML program, to explain the working of hyperlinks using <a> tag and href, target Attributes.

c. Write a HTML program, in such a way that, rather than placing large images on a page, the

preferred technique is to use thumbnails by setting the height and width parameters to something like to 100*100 pixels. Each thumbnail image is also a link to a full sized version of the image. Create an image gallery using this technique

2. HTML Tables, Forms and Frames

- a. Write a HTML program, to explain the working of tables. (use tags: <table>, <tr>, <th>, <td> and attributes: border, rowspan, colspan).
- b. Write a HTML program, to explain the working of tables by preparing a timetable. (Note: Use <caption> tag to set the caption to the table & also use cell spacing, cell padding, border, rowspan, colspan etc.).
- c. Write a HTML program, to explain the working of forms by designing Registration form. (Note: Include text field, password field, number field, date of birth field, checkboxes, radio buttons, list boxes using <select>&<option> tags, <text area> and two buttons ie: submit and reset. Use tables to provide a better view).
- d. Write a HTML program, to explain the working of frames, such that page is to be divided into 3 parts on either direction. (Note: first frame □ image, second frame □ paragraph, third frame □ hyperlink. And also make sure of using “no frame” attribute such that frames to be fixed).

3. HTML 5 and Cascading Style Sheets, Types of CSS

- a. Write a HTML program, that makes use of <article>, <aside>, <figure>, <figcaption>, <footer>, <header>, <main>, <nav>, <section>, <div>, tags.
- b. Write a HTML program, to embed audio and video into HTML web page.
- c. Write a program to apply different types (or levels of styles or style specification formats) – inline, internal, external styles to HTML elements. (identify selector, property and value).

4. Selector forms

- a. Write a program to apply different types of selector forms
 - i. Simple selector (element, id, class, group, universal)
 - ii. Combinator selector (descendant, child, adjacent sibling, general sibling)
 - iii. Pseudo-class selector
 - iv. Pseudo-element selector
 - v. Attribute selector

5. CSS with Color, Background, Font, Text and CSS Box Model

- a. Write a program to demonstrate the various ways you can reference a color in CSS.
- b. Write a CSS rule that places a background image halfway down the page, tilting it horizontally. The image should remain in place when the user scrolls up or down.
- c. Write a program using the following terms related to CSS font and text:
 - i. font-size ii. font-weight iii. font-style
 - iv. text-decoration v. text-transformation vi. text-alignment
- d. Write a program, to explain the importance of CSS Box model using
 - i. Content ii. Border iii. Margin iv. padding

6. Applying JavaScript - internal and external, I/O, Type Conversion

- a. Write a program to embed internal and external JavaScript in a web page.
- b. Write a program to explain the different ways for displaying output.
- c. Write a program to explain the different ways for taking input.
- d. Create a webpage which uses prompt dialogue box to ask a voter for his name and age. Display the information in table format along with either the voter can vote or not

7. Java Script Pre-defined and User-defined Objects

- a. Write a program using window object properties and methods.
- b. Write a program using array object properties and methods.
- c. Write a program using math object properties and methods.
- d. Write a program using string object properties and methods.
- e. Write a program using regex object properties and methods.
- f. Write a program using date object properties and methods.
- g. Write a program to explain user-defined object by using properties, methods, accessors, constructors and display.

8. Java Script Conditional Statements and Loops

- a. Write a program which asks the user to enter three integers, obtains the numbers from the user and outputs HTML text that displays the larger number followed by the words “LARGER NUMBER” in an information message dialog. If the numbers are equal, output HTML text as “EQUAL NUMBERS”.
- b. Write a program to display week days using switch case.
- c. Write a program to print 1 to 10 numbers using for, while and do-while loops.
- d. Write a program to print data in object using for-in, for-each and for-of loops
- e. Develop a program to determine whether a given number is an ‘ARMSTRONG NUMBER’ or not. [Eg: 153 is an Armstrong number, since sum of the cube of the digits is equal to the number i.e., $1^3 + 5^3 + 3^3 = 153$]
- f. Write a program to display the denomination of the amount deposited in the bank in terms of 100’s, 50’s, 20’s, 10’s, 5’s, 2’s & 1’s. (Eg: If deposited amount is Rs.163, the output should be 1-100’s, 1-50’s, 1- 10’s, 1-2’s & 1-1’s)

9. Java Script Functions and Events

- a. Design a HTML having a text box and four buttons named Factorial, Fibonacci, Prime, and Palindrome. When a button is pressed an appropriate function should be called to display
 - i. Factorial of that number
 - ii. Fibonacci series up to that number
 - iii. Prime numbers up to that number
 - iv. Is it palindrome or not
- b. Write a program to validate the following fields in a registration page
 - i. Name (start with alphabet and followed by alphanumeric and the length should not be less than 6 characters)
 - ii. Mobile (only numbers and length 10 digits)
 - iii. E-mail (should contain format like `xxxxxxx@xxxxxx.xxx`)

Text Books:

1. Programming the World Wide Web, Robert W Sebesta, 7th Edition, Pearson, 2013.
2. Web Programming with HTML5, CSS and JavaScript, John Dean, Jones & Bartlett Learning, 2019 (Chapters 1-11).
3. Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node, Vasan Subramanian, 2nd Edition, APress, O’Reilly, 2019s.

Web Links:

1. <https://www.w3schools.com/html>
2. <https://www.w3schools.com/css>
3. <https://www.w3schools.com/js/>
4. <https://www.w3schools.com/nodejs>



DESIGN THINKING & INNOVATION

Course Category:	BS&H	Credits: 2			
Course Type:	Theory& Practical	Lecture-Tutorial-Practice:	1	0	2
Prerequisites	Innovative, Logical thinking and Generating Ideas	Continuous Evaluation	30M		
		Semester End Evaluation	70M		
		Total Marks	100M		

Course Outcomes:

After Successful Completion of course, the student will be able to:		
CO No:	Course Outcome Description	K - Level
CO1	Define the concepts related to design thinking.	1
CO2	Explain the fundamentals of Design Thinking and innovation.	2
CO3	Apply the design thinking techniques for solving problems in various sectors.	3
CO4	Analyze to work in a multidisciplinary environment.	4
CO5	Evaluate the value of creativity.	5

Note: K-Level is defined From Blooms Taxonomy

Contribution of Course Outcomes mapping with POs & PSOs (1- Low, 2 – Moderate,3 – High)

CO No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	2	-	-	2	2	-	2	-	-
CO2	3	3	3	3	3	2	-	-	2	2	-	2	-	-
CO3	3	3	3	3	3	2	-	-	2	2	-	2	-	-
CO4	3	3	3	3	3	2	-	-	2	2	-	2	-	-
CO5	3	3	3	3	3	2	-	-	2	2	-	2	-	-

COURSE CONTENT:

UNIT-I:

Introduction to Design Thinking: Introduction to elements and principles of Design, basics of design-dot, line, shape, form as fundamental design components. Principles of design. Introduction to design thinking, history of Design Thinking, New materials in Industry.

UNIT-II: Design Thinking Process

Design thinking process (empathize, analyze, idea & prototype), implementing the process in driving inventions, design thinking in social innovations. Tools of design thinking - person, customer, journey map, brainstorming, product development

Activity: Every student presents their idea in three minutes, every student can present design process in the form of flow diagram or flow chart etc. Every student should explain about product development.

UNIT-III: Innovation

Art of innovation, Difference between innovation and creativity, role of creativity and innovation in organizations. Creativity to Innovation. Teams for innovation, Measuring the impact and value of creativity.

Activity: Debate on innovation and creativity, Flow and planning from idea to innovation, Debate on value-based innovation.

UNIT-IV: Product Design

Problem formation, introduction to product design, Product strategies, Product value, Product planning, product specifications. Innovation towards product design Case studies.

Activity: Importance of modeling, how to set specifications, Explaining their own product design.

UNIT-V: Design Thinking in Business Process

Design Thinking applied in Business & Strategic Innovation, Design Thinking principles that redefine business – Business challenges: Growth, Predictability, Change, Maintaining Relevance, Extreme competition, Standardization. Design thinking to meet corporate needs. Design thinking for Startups. Defining and testing Business Models and Business Cases. Developing & testing prototypes.

Activity: How to market our own product, about maintenance, Reliability and plan for startup.

Textbooks:

1. Tim Brown, Change by design, 1/e, Harper Bollins, 2009.
2. Idris Mootee, Design Thinking for Strategic Innovation, 1/e, Adams Media, 2014.

Reference Books:

1. David Lee, Design Thinking in the Classroom, Ulysses press, 2018.
2. Shrrutin N Shetty, Design the Future, 1/e, Norton Press, 2018.
3. William lidwell, Kritinaholden, &Jill butter, Universal principles of design, 2/e,Rockport Publishers, 2010.
4. Chesbrough.H, The era of open innovation, 2003.

E-Resources:

1. <https://nptel.ac.in/courses/110/106/110106124/>
2. <https://nptel.ac.in/courses/109/104/109104109/>
3. https://swayam.gov.in/nd1_noc19_mg60/preview
4. https://onlinecourses.nptel.ac.in/noc22_de16/preview
5. https://onlinecourses.swayam2.ac.in/aic23_ge17/preview