Year 2022-23 onward

B. Tech. Programme Structure

Electronics and Computer Engineering [ELC]

NIST Institute of Science and Technology (Autonomous)
Institute Park, Pallur Hills, Berhampur, Odisha, INDIA. Pin: 761008.
Web: www.nist.edu

Fourth Semester					
Theory					
Sl. No.	**Category**	**Subject Code**	**Subject Name**	**L-T-P**	**Credit**
1	HSMC	22CM4HS01T	**Humanities-I** Organizational Behavior	3-0-0	3
		22CM4HS02T	**Management-I** Engineering Economics and Costing		
2	ESC	22ELC4ES01T	Digital Electronic Circuits	3-0-0	3
3	PCC	22ELC4PC01T	**PCC-3:**Discrete Structure	3-1-0	4
4	PCC	22ELC4PC02T	**PCC-4:**Object Oriented Programming using JAVA	3-0-0	3
5	PCC	22ELC4PC03T	**PCC-5:**Design and Analysis of Algorithms	3-0-0	3
6	PEC	**Professional Elective-1:**		3-0-0	3
		22ELC4PE01T	Digital Signal Processing		
		22ELC4PE02T	Data Science for Engineers		
7	**HSMC**	**22CM4HS03T**	**Universal Human Values-II/***	**3-0-0**	**3**
Total Credit (Theory)					**22**
Practical					
1	ESC	22ELC4ES01L	Digital Electronic Circuits Laboratory	0-0-2	1
2	PCC	22ELC4PC02L	**PCC Lab-4:**Object Oriented Programming using JAVA Laboratory	0-0-2	1
3	PCC	22ELC4PC03L	**PCC Lab-5:**Design and Analysis of Algorithms Laboratory	0-0-2	1
Total Credit (Practical)					**3**
Total Semester Credit					**25**

*** For CSE/IT: theory credits are 22 and practical credits are 3: Total 25 [Due to inclusion of Discrete structure subject]. This structure can be followed by other departments based on the BoS decision

COURSE DESCRIPTION:

Degree	B. Tech.	
Level	Undergraduate	
Branch	ELC (Electronics and Computer Engineering)	
Semester	4^{th}	
Subject Name	Organizational Behavior	
Course Type	Theory	
Course Code	22CM4HS01T	
Category	HSMC (Humanities, Social Science and Management Courses)	
Credit Point	3	
Time Commitment	Lecture	36 Hours
	Tutorial	08 Hours
	Practice	Nil
	Total	44 Hours
Recommended Background Knowledge		
Subject Description		
Objectives and Outcomes	**Objectives:** The course should enable the students to: 1. Developing an understanding of the behavior of individuals and groups inside organizations by enhancing the skills in appreciating individual, interpersonal, and group processes for increase. 2. Developing effectiveness both within and outside of organizations is the goal of any organisation. 3. Through this course students will develop theoretical and practical insights.	

	4. The students will develop problem-solving capabilities for effectively managing the organizational processes.	
	Outcomes: Upon completion of this course, the student will be able to: 1. Students will understand the essential of maintaining the inter-personal relationships in organisations. 2. Personality factors will be effectively used to understand the communication among groups. 3. The reasons for conflict will be known and prescriptive methods can be devised to enhance higher productivity in organisations. 4. Being an employee in an organisation the importance of organisational change and culture can be known to all.	
Assessment/ Evaluation	Mid-Term Examination	30 %
	Quiz Test-1	2.5 %
	Quiz-Test-2	2.5 %
	Surprise Test	5 %
	Assignment-1	2.5 %
	Assignment-2	2.5 %
	Attendance	5 %
	End-Term Examination	50 %
Prescribed Text Book(s)	Organizational Behaviour, Robbins, Judge, Sanghi, Pearson.	
Reference Book(s)	1. Understanding Organizational Behaviour, Parek, Oxford 2. Organizational Behaviour, Hitt, Miller, Colella, Wiley 3. Organizational Behaviour, K. Awathappa, HPH. 4. Organizational Behaviour, VSP Rao, Excel 5. Understanding Organizational Behaviour, Parek, Oxford	
Digital Learning Resources		

CO's Mapping with PO's and PEO's

Course Outcomes	Course Outcome Statement	PO's / PEO's
CO1		
CO2		
CO3		
CO4		

DETAILED SYLLABUS:

Module No. 1	Fundamentals of OB	06 Hours
Introduction: Definition, nature and scope of OB (environmental and organizational context), Relationship between OB and the individual, Impact of IT, globalization and diversity on OB.		

Module No. 2	Foundations of Individual Behaviour	10 Hours
Personality: Meaning and definition, Determinants of personality, Personality traits, Personality and OB. Perception: Meaning and definition, Perceptual process, Importance of perception in OB. Motivation: Nature and importance, Herzberg's Two Factor Theory, Maslow's Need Hierarchy Theory, Alderfer's ERG Theory. Attitude: Definition, nature and dimensions, Attitude and OB.Learning: Nature, learning and OB.		

Module No. 3	Group Dynamics of OB-I	08 Hours
Communication: Types, interactive communication in organizations, barriers to communication, strategies to improve the follow of communication. Stress and Conflict: Meaning and types of		

stress, Meaning and types of conflict, Effect of stress on individuals, strategies to cope with stress and conflict.

Module No. 4	**Design of Synchronous and Asynchronous Sequential logic Circuits**	**06 Hours**
Power and Politics: Meaning and types of power empowerment. Groups Vs. Teams- Nature of groups, dynamics of informal groups, dysfunctions of groups and teams, teams in modern work place.		

Module No. 5	**Foundations of Organizational Behaviour**	**06 Hours**
Organizational Culture: Culture and organizational effectiveness. Organizational Change: Types of change, reasons to change, resistance to change. Organisational Structure and Development:Concepts and process.		

COURSE DESCRIPTION:

Degree	B. Tech.	
Level	Undergraduate	
Branch	ELC (Electronics and Computer Engineering)	
Semester	4th	
Subject Name	Engineering Economics and Costing	
Course Type	Theory	
Course Code	22CM4HS02T	
Category	HSMC (Humanities, Social Science and Management Courses)	
Credit Point	3	
Time Commitment	Lecture	36 Hours
	Tutorial	08 Hours
	Practice	Nil
	Total	44 Hours
Recommended Background Knowledge		
Subject Description		
Objectives and Outcomes	**Objectives:** The course should enable the students to: 1. To prepare engineering students to understand the basic concepts of Engineering economics and their application. 2. To carry out numerically the effects of changes in demand and supply on price determinations of products and services. 3. To justify or reject alternative projects in the light of changing domestic and global scenario on the eve of technological innovations.	

<table>
<tr><td></td><td colspan="2">4. To analyze the macroeconomic environment and financial system of the country and its impact on business society and enterprise.</td></tr>
<tr><td></td><td colspan="2">Outcomes:
Upon completion of this course, the student will be able to:

1. Students will understand how to solve economic problems and the art of taking the right decision on scarce resources.
2. This will help to solve different microeconomic problems related to production, cost, and revenue maximization.
3. Students will be understood different market structures and levels of competition and determine the price.
4. This will help engineering students while evaluating and determining the cost of a project. This is also helpful in determining the value of money for future courses of action.
5. This will help to understand basic microeconomic concepts like inflation, national income, and money market.</td></tr>
<tr><td rowspan="9">Assessment/ Evaluation</td><td>Mid-Term Examination</td><td>30 %</td></tr>
<tr><td>Quiz Test-1</td><td>2.5 %</td></tr>
<tr><td>Quiz-Test-2</td><td>2.5 %</td></tr>
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<tr><td>Attendance</td><td>5 %</td></tr>
<tr><td>End-Term Examination</td><td>50 %</td></tr>
<tr><td>Prescribed Text Book(s)</td><td colspan="2">Principles of Economics: Deviga Vengedasalam & Karunagaran Madhavan-Oxford Publication</td></tr>
<tr><td>Reference Book(s)</td><td colspan="2">1. Engineering Economics and Costing: D. M. Methani & Suresh Chandra Das-Himalaya Publishing House
2. Engineering Economics and Costing: Sasmita Mishra-PH Learning Private Limited
3. R. Panneerselvam, ‘Engineering Economics’, PHI
4. Riggs, Bedworth and Randhwa, ‘Engineering Economics’, McGrow Hill Education India</td></tr>
</table>

	5. Engineering Economics and Costing: Mahendra P. Agasty, Scitech Publications (INDIA) Pvt.Ltd.
Digital Learning Resources	

CO's Mapping with PO's and PEO's

Course Outcomes	Course Outcome Statement	PO's / PEO's
CO1		
CO2		
CO3		
CO4		

DETAILED SYLLABUS:

Module No. 1	Engineering Economics	10 Hours
Engineering Economics: Nature and Scope, Basic Problems of an Economy, Micro and Macro Economics; Demand: Meaning of demand, Determinants of demand, Demand function, Law of demand and its exceptions, Elasticity of demand and its measurement, (Simple numerical problems to be solved). Supply: Meaning of Supply, Determinants of Supply, Supply function, Law of Supply and its exception, Elasticity of Supply.		

Module No. 2	Production	07 Hours
Production: Factors of Production, Production Function; Laws of Returns: Law of Variable Proportions, Law of Returns to Scale, Cost and Revenue Concepts: Short Run Total Costs, Long Run Average Cost Curves, Total Revenue, Average Revenue and Marginal Revenue		

Module No. 3	Market Structures	06 Hours
Market Structures: Basic understanding of different Market Structures; Determination of Equilibrium Price under Perfect Market Competition and Monopoly. Margin of safety and Break Even Analysis: Linear Approach (Simple numerical problems to be solved).		

Module No. 4	Time Value of Money and Evaluation of Engineering Projects	10 Hours
Time Value of Money: Interest- Simple and Compound, Nominal and Effective Rate of Interest, Cash flow diagrams, Principles of Economic Equivalence. Evaluation of Engineering Projects: Present, Future and Annual worth Method, Rate of Return Analysis; Cost-Benefit Analysis		

Module No. 5	Inflation	07 Hours
Inflation: Meaning of Inflation, Types, Causes and Measures to Control Inflation. National Income: Definition, Concepts of National Income and its measurement, Banking: Commercial Bank, Functions of Commercial Bank, Central Bank, Functions of Central Bank.		

COURSE DESCRIPTION:

Degree	B. Tech.	
Level	Undergraduate	
Branch	ELC (Electronics and Computer Engineering)	
Semester	4^{th}	
Subject Name	Digital Electronic Circuits	
Course Type	Theory	
Course Code	22ELC4ES01T	
Category	ESC (Engineering Science Courses)	
Credit Point	3	
Time Commitment	Lecture	36 Hours
	Tutorial	Nil
	Practice	Nil
	Total	36 Hours
Recommended Background Knowledge	Basics of Digital Electronics	
Subject Description	The Digital Revolution marked the beginning of the Information Age. Adoption of digital computers and digital data storage devices followed by development of Semiconductors leverage the digital technology to touch all the needs of society. In this course, the basic building blocks like gates and their uses to design logic function is discussed followed by function simplification using Boolean algebra and Mapping method. The course postulates the fundamental blocks like combinational and sequential logic circuits to design complex Digital systems. The application of CMOS logic family is revealed to design the basic and universal logic gates. The inherited knowledge cited here enables the students for understanding Digital VLSI technology.	
Objectives and	**Objectives:** The course should enable the students to: 1. Comprehend insight about the requirement of designing low cost and	

<table>
<tr><td rowspan="2">Outcomes</td><td colspan="2">high speed Digital systems.
2. Gain inclusive knowledge about combinational and sequential logic blocks.
3. Learn memory and application of CMOS to design basic logic gates that help to design digital integrated circuits.
4. Demonstrate the idea of designing complex digital circuits.</td></tr>
<tr><td colspan="2">Outcomes:
Upon completion of this course, the student will be able to:

1. Acquire the fundamental knowledge about digital electronics.
2. Understand the behavior of combinational arithmetic and logic circuits for development of complex digital systems.
3. Employ the functionality of basic memory elements for designing synchronous and asynchronous sequential circuits.
4. Apply the knowledge of CMOS logic family to design complex Integrated circuits.</td></tr>
<tr><td rowspan="8">Assessment/ Evaluation</td><td>Mid-Term Examination</td><td>30 %</td></tr>
<tr><td>Quiz Test-1</td><td>2.5 %</td></tr>
<tr><td>Quiz-Test-2</td><td>2.5 %</td></tr>
<tr><td>Surprise Test</td><td>5 %</td></tr>
<tr><td>Assignment-1</td><td>2.5 %</td></tr>
<tr><td>Assignment-2</td><td>2.5 %</td></tr>
<tr><td>Attendance</td><td>5 %</td></tr>
<tr><td>End-Term Examination</td><td>50 %</td></tr>
<tr><td>Prescribed Text Book(s)</td><td colspan="2">M. Morris Mano, Michael D Ciletti, Digital Design, 5th Edition, Pearson Publication, 2016, New Delhi.</td></tr>
<tr><td>Reference Book(s)</td><td colspan="2">1. Charles H. Roth and Larry L. Kinney, Fundamentals of Logic Design, 7th Edition, Cengage Learning, 2013.
2. Donald P Leach, Albert Paul Malvino, Goutam Saha, Digital Principles And Applications, 8th Edition ,Tata McGraw Hill Education, 2015, New Delhi.
3. A. Anand Kumar, Fundamentals of digital circuits, 4th edition, PHI, 2016, New Delhi.
4. T.L. Floyd and R. P. Jain, Digital Fundamentals, 7th Edition, Pearson Education, 2005, Bangalore</td></tr>
</table>

	5. Norman Balabanian & Bradley Carlson, Digital Logic Design Principles, 2nd edition, John Wiley & Sons, 2004, New York.
Digital Learning Resources	<table><tr><td>Course Name</td><td>Digital Circuits and Systems</td></tr><tr><td>Course Link</td><td>https://nptel.ac.in/courses/117106086/</td></tr><tr><td>Course Instructor</td><td>Prof. S. Srinivasan, IIT Madras</td></tr></table> <table><tr><td>Course Name</td><td>Digital Circuits</td></tr><tr><td>Course Link</td><td>https://nptel.ac.in/courses/117103064/</td></tr><tr><td>Course Instructor</td><td>Prof. Anil Mahanta, Prof. Roy Paily Palanthinkal, IIT Guwahati</td></tr></table>

CO's Mapping with PO's and PEO's

Course Outcomes	Course Outcome Statement	PO's / PEO's
CO1	Acquire the fundamental knowledge about digital electronics.	PO1, PO2, PO3, PO4
CO2	Understand the behavior of combinational arithmetic and logic circuits for development of complex digital systems.	PO1, PO2, PO3, PO4,PO5, PO6,PO7
CO3	Employ the functionality of basic memory elements for designing synchronous and asynchronous sequential circuits.	PO1, PO2, PO3, PO4,PO5, PO6,PO7
CO4	Apply the knowledge of CMOS logic family to design complex Integrated circuits.	PO1, PO2, PO3, PO4, PO5, PO6

DETAILED SYLLABUS:

Module No. 1	Digital Fundamentals and Binary Codes	06 Hours
Signed Binary representation, Arithmetic Operation using 1's and 2`s Complements, Binary codes (BCD and 8421), Canonical Logic Forms, Extracting Canonical Forms, K-Maps: Two, Three and Four variable K-maps.		

Module No. 2	Combinational Logic Design	10 Hours
Function Implementations: Specifying the Problem, NAND, NOR, AND-OR, OR-AND, NAND-NAND, NOR-NOR, AOI, OAI. Arithmetic Circuits: Half Adder, Full Adder, Half Subtractor, Full Subtractor, Binary Parallel Adder, Multiplier, Magnitude Comparator Logic Circuits: Gray to Binary and Binary to Gray Code Converters, Multiplexer, De-Multiplexer, Decoder, Encoder, Priority encoder		

Module No. 3	Fundamentals of Sequential Circuits	06 Hours
Storage elements, Latches(SR and D), Analysis of Flip-Flops(SR, D, JK, T): Functional Table, Characteristic Table, Characteristic Equation, State Diagram, Excitation Table, Timing Diagram, Positive-Edge-Triggered D Flip-Flop, Master-Slave JK-FF, Flip-Flop conversions.		

Module No. 4	Design of Synchronous and Asynchronous Sequential logic Circuits	08 Hours
Sequential Circuits Design: Design Procedure, Counter: Asynchronous and Synchronous Counter, Analysis and Synthesis of Clocked Sequential Circuits, FSM Fundamentals: Melay and Moore Machines. Shift Registers: Shifting of Binary Bits, SISO, SIPO, PISO, PIPO, Ring Counter, Johnson Counter.		

Module No. 5	Fundamentals of Memory and CMOS logic family	06 Hours
Fundamentals of Memory: Types of memory, RAM and ROM, Memory decoding, 1-bit SRAM and DRAM cell. CMOS logic family: Characteristics, Fan out, Fan in, Power dissipation, Average Power, Propagation delay, Noise margin, Application of CMOS to design basic logic gates.		

COURSE DESCRIPTION:

Degree	B. Tech.

Level	Undergraduate	
Branch	ELC (Electronics and Computer Engineering)	
Semester	4th	
Subject Name	Discrete Structure	
Course Type	Theory	
Course Code	22ELC4PC01T	
Category	PCC (Professional Core Courses)	
Credit Point	4	
Time Commitment	Lecture	36 Hours
	Tutorial	12 Hours
	Practice	Nil
	Total	48 Hours
Recommended Background Knowledge		
Subject Description	.	
Objectives and Outcomes	**Objectives:** The course should enable the students to: 1. To develop logical thinking and its application to computer science 2. How to count some different types of discrete structures; 3. Reason mathematically about basic data types and structures(such as numbers, sets, graphs, and trees) used in computer algorithms and systems; distinguish rigorous definitions and conclusions from merely plausible ones; synthesize elementary proofs, especially proofs by induction. 4. Model and analyze computational processes using analytic and combinatorial methods.	
	Outcomes:	

<table>
<tr><td></td><td colspan="2">Upon completion of this course, the student will be able to:

1. Applying set theory and logic for solving problems
2. Apply number theory and linear algebra to solve problems
3. Solving different problems using graph theory and trees</td></tr>
<tr><td rowspan="9">Assessment/ Evaluation</td><td>Mid-Term Examination</td><td>30 %</td></tr>
<tr><td>Quiz Test-1</td><td>2.5 %</td></tr>
<tr><td>Quiz-Test-2</td><td>2.5 %</td></tr>
<tr><td>Surprise Test</td><td>5 %</td></tr>
<tr><td>Assignment-1</td><td>2.5 %</td></tr>
<tr><td>Assignment-2</td><td>2.5 %</td></tr>
<tr><td>Attendance</td><td>5 %</td></tr>
<tr><td>End-Term Examination</td><td>50 %</td></tr>
<tr><td></td><td></td></tr>
<tr><td>Prescribed Text Book(s)</td><td colspan="2">1. Kenneth H. Rosen, “Discrete Mathematics and its Applications”, Mc.Graw Hill, 2002.
2. C. L. Liu, D. P. Mohapatra, Elements of Discrete Mathematics: A computer Oriented Approach, McGraw Hill Education (India) Private Limited, 4th Edition, 2013.
3. Joe L. Mott, A. Kandel, and T. P. Baker, Discrete Mathematics for Computer Scientists &Mathematics, Prentice Hall of India, 2nd Edition, 2006
4. N. Deo, Graph Theory with applications to Engineering & Computer Science, Prentice Hall of India, 2006.
5. S. Lipschutz, Discrete Mathematics, Tata McGraw Hill, 2005.</td></tr>
<tr><td>Reference Book(s)</td><td colspan="2"></td></tr>
</table>

Digital Learning Resources	

Course Name	**Discrete Structure**
Course Link	https://nptel.ac.in/syllabus/106106094/
Course Instructor	Prof. Kamala Krithivasan, IIT Madras

CO's Mapping with PO's and PEO's

Course Outcomes	Course Outcome Statement	PO's / PEO's

DETAILED SYLLABUS:

Module No. 1	Set Theory	08 Hours
Set Theory: Definition of Sets, Venn Diagrams, complements, cartesian products, power sets, counting principle, cardinality and countability (Countable and Uncountable sets). Propositional logic: Proposition logic, basic logic, logical connectives, truth tables, tautologies, contradiction, normal forms(conjunctive and disjunctive), modus ponens and modus tollens, validity, predicate logic, universal and existential quantification. Theory of inference, Methods of proof: proof by implication, converse, inverse, contrapositive, negation, and contradiction, direct proof, proof by using truth table, proof by counter example.,proof by induction.		

Module No. 2	Sequences and Summations Counting	08 Hours
Sequences and Summations Counting: basic counting rules. permutations, combinations. Numeric Functions and Generating Functions: Discrete Numeric functions, Generating		

Functions, Recurrence Relations and Recursive Algorithms: Recurrence relations, Linear recurrence relations with constant coefficients, Solution of recurrence relations by the method of generating functions, Divide and conquer algorithms

Module No. 3	**Relations**	**08 Hours**
Relations: representation of relations by graphs; properties of relations; equivalence relations and partitions; Closure of relations, Warshall's algorithm, Partial orderings; Posets; Linear and well-ordered sets; Definition and elementary properties of groups, semigroups, monoids, rings, fields, vectorspaces and lattices; Boolean Algebras: Lattices and algebraic systems, Principle of duality, Distributive and complemented lattices, Boolean functions and Boolean expressions.		

Module No. 4	**Graphs and Trees**	**08 Hours**
Graphs and Trees: Basic terminology, Diagraphs and relations, representation of Graphs, operations on graphs, paths and circuits, graph traversals, shortest path in weighted graphs, Eulerian paths and circuits, Hamiltonian paths and circuits, Traveling sales person's problem, Planar graphs, Graph Coloring.		

Module No. 5	**Trees**	**04 Hours**
Trees, Rooted trees, Binary search trees, Spanning trees, Minimum spanning trees, Kruskal's Algorithm, Prim's Algorithm.		

COURSE DESCRIPTION:

Degree	B. Tech.	
Level	Undergraduate	
Branch	ELC (Electronics and Computer Engineering)	
Semester	4th	
Subject Name	Object-Oriented Programming using JAVA	
Course Type	Theory	
Course Code	22ELC4PC02T	
Category	PCC (**Professional Core Courses**)	
Credit Point	3	
Time Commitment	Lecture	36 Hours
	Tutorial	Nil
	Practice	Nil
	Total	36 Hours
Recommended Background Knowledge		
Subject Description		
Objectives and Outcomes	**Objectives:** The course should enable the students to: 1. Learn the syntax, semantics and idioms of the Java programming language. 2. Gain confidence in object oriented programming principles through lots of practical exercises that provide useful exposure to the core Java	

<table>
<tr><td></td><td colspan="2">class libraries.</td></tr>
<tr><td></td><td colspan="2">Outcomes:
Upon completion of this course, the student will be able to:

1. Implement and apply various Object Oriented programming concepts.
2. Applying Collection Classes and Files, Multiple Threads & handle Exceptions in developing java applications.
3. Developing a Java standalone application having front end design and back end.</td></tr>
<tr><td rowspan="9">Assessment/ Evaluation</td><td>Mid-Term Examination</td><td>30 %</td></tr>
<tr><td>Quiz Test-1</td><td>2.5 %</td></tr>
<tr><td>Quiz-Test-2</td><td>2.5 %</td></tr>
<tr><td>Surprise Test</td><td>5 %</td></tr>
<tr><td>Assignment-1</td><td>2.5 %</td></tr>
<tr><td>Assignment-2</td><td>2.5 %</td></tr>
<tr><td>Attendance</td><td>5 %</td></tr>
<tr><td>End-Term Examination</td><td>50 %</td></tr>
<tr><td>Prescribed Text Book(s)</td><td colspan="2">Java: One Step Ahead by Anita Seth (Author), B.L. Juneja (Author) Oxford University Press. Head First Java 2nd edition Kathy Sierra & Bert Bates</td></tr>
<tr><td>Reference Book(s)</td><td colspan="2">JAVA Complete Reference (9th Edition) Herbert Schildt.
https://www.udemy.com/java-the-complete-java-developer-course/
Java Programming Masterclass for Software Developers Created by Tim Buchalka, Tim Buchalka's Learn Programming Academy, Goran Lochert</td></tr>
<tr><td>Digital Learning</td><td colspan="2"></td></tr>
</table>

Resources	

CO's Mapping with PO's and PEO's

Course Outcomes	Course Outcome Statement	PO's / PEO's
CO1		
CO2		
CO3		
CO4		

DETAILED SYLLABUS:

Module No. 1		8 Hours
Introduction to Java and Java programming Environment. Object Oriented Programming Concepts: Encapsulation, Abstraction, Inheritance, Polymorphism. Fundamental Programming Structure: Data Types, variable, keywords, typecasting, Arrays, Operators and their precedence. Control Flow: Java's Control Statements (if, switch, iteration, statement, while, do-while, for, Nested loop). Concept of Objects and Classes, Using Existing Classes building your own classes, constructor overloading, static , final, this keyword.		

Module No. 2		8 Hours
Inheritance: Introduction, types of inheritance. Use of super keyword. Method overriding, Dynamic method Dispatch, Using Abstract Classes, Using final with inheritance. The Object Class. Packages & Interfaces: Packages, Access Protection, Importing package, Interface,		

Implementing Interfaces, variables in Interfaces, Interfaces can be extended. Exception Handling: Fundamentals, Types Checked , Unchecked exceptions, Using try & catch, Multiple catch, throw , throws, finally, Java's Built in exceptions, user defined exception.

Module No. 3		**8 Hours**
Multi Threading: Java Thread Life Cycle, Thread Priorities, Synchronization, Creating a thread, Runnable interface, Creating Multiple threads, Using isAlive () and join (), wait () & notiCS(). String Handling: String constructors, String length, Character Extraction, String Comparison, Modifying a string. Java I/O: Classes & Interfaces, Stream classes, Byte streams, Character streams, Serialization.		

Module No. 4		**6 Hours**
Wrapper Classes : Wrapper classes and its methods. Collection Framework: Introduction, interfaces, List, Set, Map etc, List interfaces and its classes. Introduction to Database: Introduction to DataBase. Driver Types, Registering Driver, Creating Connection, Executing SQL query using Statement, PreparedStatment. ResultSet methods.		

Module No. 5		**6 Hours**
Event Handing: Event Delegation Model, Event Classes, Event Listener Interfaces, Adapter classes. AWT: AWT Classes window fundamentals, component, container, panel, Window, Frame, working with Graphics , Control Fundamentals , Layout managers, Handling Events by Extending AWT components. Swing: Icons & Labels, Text fields, Buttons, Combo boxes, Tabbed panes, Scroll panes, Trees, Tables.		

COURSE DESCRIPTION:

Degree	B. Tech.	
Level	Undergraduate	
Branch	ELC (Electronics and Computer Engineering)	
Semester	4th	
Subject Name	Design and Analysis of Algorithms	
Course Type	Theory	
Course Code	22ELC4PC03T	
Category	PCC (**Professional Core Courses**)	
Credit Point	3	
Time Commitment	Lecture	36 Hours
	Tutorial	Nil
	Practice	Nil
	Total	36 Hours
Recommended Background Knowledge		
Subject Description		
Objectives and Outcomes	**Objectives:** The course should enable the students to: 1. Translating a plain text problems to convert into an algorithm 2. Calculate best case, worst case time complexity and space complexities of different algorithm and choosing the best solution from the available options 3. Applying different design paradigm to solve different problems and comparing their best case, worst case scenarios. 4. Designing and applying different data structures over different algorithms for solving different problems.	

<table>
<tr><td></td><td colspan="2">5. Understand different P-class, NP class problems</td></tr>
<tr><td></td><td colspan="2">Outcomes:
Upon completion of this course, the student will be able to:

1. Given a English language problem description define the problem precisely with input/output requirements, examine its inherent complexity and develop a generic or set of initial solutions and justify their correctness.
2. Given an algorithm descriptions, analyse the time and space complexity of the algorithm in the worst case, average case, and amortized scenario as needed in terms of asymptotic order of complexity.
3. Given a problem definition explore different alternative algorithmic solutions, compare them with respect to time and space complexity and choose the design scheme and /or design parameter and data structure appropriately to obtain the best possible choice(s) that can be converted to an executable programs.
4. Examine and prove whether a problem is of polynomial complexity, hard(np complete) or otherwise and develop optimal and approximate algorithm for them as applicable.</td></tr>
<tr><td rowspan="8">Assessment/ Evaluation</td><td>Mid-Term Examination</td><td>30 %</td></tr>
<tr><td>Quiz Test-1</td><td>2.5 %</td></tr>
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<tr><td>Prescribed Text Book(s)</td><td colspan="2">1. Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein, Introduction to Algorithms, Third Edition, MIT Press/McGraw-Hill, 2009.
2. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, Computer Algorithms/ C++, Second Edition, Universities Press, 2007.</td></tr>
</table>

Reference Book(s)	1. Sanjoy Dasgupta, Christos H. Papadimitriou and Umesh V. Vazirani, Algorithms, McGraw- Hill, 2008. 2. Jon Kleinberg and Éva Tardos, Algorithm Design, Addison-Wesley/PEARSON EDUCATION- 2006. 3. S. Sridhar, ―Design and Analysis of Algorithms‖, Oxford university press, First Edition, 2015.
Digital Learning Resources	Prof. Abhiram G Ranade, Prof. Ajit A Diwan, Prof. Sundar Viswanathan, IIT Bombay, https://nptel.ac.in/courses/106101060/
	Prof. Madhavan Mukund, Chennai Mathematical Institute, https://nptel.ac.in/courses/106106131/ Reyna Hulett, CS161, Stanford School of Engineering, https://online.stanford.edu/courses/cs161-design-and-analysis-algorithms

CO's Mapping with PO's and PEO's

Course Outcomes	Course Outcome Statement	PO's / PEO's
CO1		
CO2		
CO3		
CO4		

DETAILED SYLLABUS:

Module No. 1		**10 Hours**
Introduction to problems and algorithms , Mathematics for algorithm analysis , Insertion sort Analysing algorithms, Designing of algorithms, Asymptotic notation Standard notations and common functions, Recurrence relations, The substitution method, The recursion-tree method, The master method, Divide and conquer: Min-Max Heap, Priority queue,Heapsort , Quicksort, Merge Sort, Sorting in Linear Time: Lower bounds for sorting: Counting sort, Radix sort, Bucket sort, Fast Fourier transform , Finding the convex hull : Graham Scan, Finding the closest pair of points.		

Module No. 2		**8 Hours**
Greedy method: Elements of the greedy strategy, Huffman codes, task-scheduling problem, Fractional Knapsack problem, Coin change problem, Dynamic programming: Assembly-line Scheduling, Matrix-Chain Multiplication, Longest Common Subsequence(LCS), 0/1 Knapsack problem, Rod Cutting problem		

Module No. 3		**6 Hours**
Graph algorithms: Basic Definitions and Application, Representations of graphs, Breadth-first search and Depth-first search, Data Structures for Disjoint Sets, Strongly connected components, Minimum Spanning Trees: The algorithms of Kruskal and Prim		

Module No. 4		**6 Hours**
Single-Source Shortest Paths: The Bellman-Ford algorithm, Dijkstra's algorithm, All-Pairs Shortest Paths-Shortest paths and matrix multiplication, The Floyd-Warshall algorithm String Matching: The naive string-matching algorithm, The Rabin-Karp algorithm, The Knuth-		

Morris-Pratt algorithm.

Module No. 5		**6 Hours**
Network Flow: Flow networks, The Ford-Fulkerson method, Maximum bipartite matching. Backtracking – n-Queen problem – Hamiltonian Circuit Problem – Subset Sum Problem. Branch and Bound – LIFO Search and FIFO search – Assignment problem – Knapsack Problem, NP- Completeness: Classes P and NP, NP-complete problems.: Reduction of 3SAT to Subset Sum, Approximation Algorithm for TSP		

COURSE DESCRIPTION:

Degree	B. Tech.
Level	Undergraduate

Branch	ELC (Electronics and Computer Engineering)	
Semester	4th	
Subject Name	Digital Signal Processing	
Course Type	Theory	
Course Code	22ELC4PE02T	
Category	PEC (Professional Elective)	
Credit Point	3	
Time Commitment	Lecture	36 Hours
	Tutorial	Nil
	Practice	Nil
	Total	36 Hours
Recommended Background Knowledge	Basic of Signals and Systems.	
Subject Description	Digital Signal Processing (DSP) is concerned with the representation, transformation and manipulation of signals. After half a century advances, DSP has become an important field, and has proved its usefulness in wide range of application systems, such as consumer electronics, digital communications, medical imaging and so on. The digital signal processing is becoming increasingly important with time as evident for various applications in industries. This course will introduce the basic concepts and techniques for processing discrete-time signal. This is followed by an introduction of the Z transform, DFT and FFT. The foundations of digital filter design and realization are built up. By the end of this course, the students should be able to understand the most important principles in DSP.	
Objectives and Outcomes	**Objectives:** The course should enable the students to: 1. Understand the basic concepts and techniques for signal processing. 2. Analyze the discrete time signal in frequency domain. 3. Learn Mathematical modeling of digital filters. 4. Demonstrate structural implementation of digital filters.	

<table>
<tr><td></td><td colspan="2">Outcomes:
Upon completion of this course, the student will be able to:

1. Analyze discrete time signals and system in time domain.
2. Apply the Z transform and DFT to analyze the discrete time signals in frequency domain.
3. Implement FFT algorithm for realization of efficient systems.
4. Design and analyze digital filters for filtering different real world signal.</td></tr>
<tr><td rowspan="9">Assessment/ Evaluation</td><td>Mid-Term Examination</td><td>30 %</td></tr>
<tr><td>Quiz Test-1</td><td>2.5 %</td></tr>
<tr><td>Quiz-Test-2</td><td>2.5 %</td></tr>
<tr><td>Surprise Test</td><td>5 %</td></tr>
<tr><td>Assignment-1</td><td>2.5 %</td></tr>
<tr><td>Assignment-2</td><td>2.5 %</td></tr>
<tr><td>Attendance</td><td>5 %</td></tr>
<tr><td>End-Term Examination</td><td>50 %</td></tr>
<tr><td></td><td></td></tr>
<tr><td>Prescribed Text Book(s)</td><td colspan="2">1. J. G. Proakis and D. G. Manolakis, Digital Signal Processing – Principles, Algorithms and Applications, 4th Edition, PHI Learning Pvt. Ltd, 2007.
2. Tarun Kumar Rawat, Digital Signal Processing, 1st Edition, Oxford university press, 2015</td></tr>
<tr><td>Reference Book(s)</td><td colspan="2">1. S. Salivahanan, A. Vallavaraj, C. Gnanapriya, Digital Signal Processing, 2nd Edition, The McGraw-Hill, 2008.
2. Sanjit K. Mitra, Digital Signal Processing: A Computer - Based Approach, 4th Edition, TMH, 2013.</td></tr>
<tr><td>Digital Learning Resources</td><td colspan="2"><table><tr><td>Course Name</td><td>DIGITAL SIGFNAL PROCESSING</td></tr><tr><td>Course Link</td><td>https://nptel.ac.in/courses/117/102/117102060/</td></tr><tr><td>Course Instructor</td><td>Prof. S.C. Dutta Roy, IIT Delhi</td></tr></table></td></tr>
</table>

Course Name	DIGITAL SIGFNAL PROCESSING
Course Link	https://nptel.ac.in/courses/117/105/117105144/
Course Instructor	Prof. Govind Sharma, IIT Kanpur

CO's Mapping with PO's and PEO's

Course Outcomes	Course Outcome Statement	PO's / PEO's
CO1	Analyze discrete time signals and system in time domain.	PO1, PO2, PO3, PO4, PO5, PO7, PO8, PO10, PO11, PO12, PEO1, PEO2.
CO2	Apply the Z transform and DFT to analyze the discrete time signals in frequency domain.	PO1, PO2, PO3, PO4, PO5, PO7, PO8, PO10, PO11, PO12, PEO1, PEO2.
CO3	Implement FFT algorithm for realization of efficient systems.	PO1, PO2, PO3, PO4, PO5, PO7, PO8, PO10, PO11, PO12, PEO1, PEO2.
CO4	Design and analyze digital filters for filtering different real world signal.	PO1, PO2, PO3, PO4, PO5, PO7, PO8, PO10, PO11, PO12, PEO1, PEO2.

DETAILED SYLLABUS:

Module No. 1	**Discrete time signals and systems**	**8 Hours**
Discrete time signals and systems, The Convolution Sum and its properties, Difference Equation, Implementation of DT System, Correlation.		

Module No. 2	Z-Transform & its Applications	8 Hours
Overview of Discrete time signals and systems. Z-Transform and Its Application to the Analysis of LTI Systems: Direct Z-Transform, Properties of the Z- Transform, Inverse Z-Transform by Power Series Expansion, and Partial-Fraction Expansion, Analysis of Linear Time Invariant Systems in the Z-Domain.		

Module No. 3	Discrete Fourier Transform	8 Hours
Frequency-Domain Sampling and Reconstruction of Discrete-Time Signals, DFT as a Linear Transformation, Relationship of DFT to other Transforms, Properties of DFT. Use of DFT in Linear Filtering: Sectional Convolution. Introduction to the Fast Fourier Transform (FFT) algorithm, Radix 2 Decimation in Time (DIT), Radix 2 Decimation in Frequency (DIF).		

Module No. 4	Digital Filter Design	8 Hours
Design of FIR filters: Impulse Response of ideal LPF, HPF, BPF and BSF, Frequency response of linear phase FIR filters by Windowing methods and Frequency Sampling method. Design of IIR filters: Butterworth, and Chebyshev, Conversion to digital IIR Filter using Impulse Invariance Technique and Bilinear Transformation. Frequency transformation in analog and digital domain.		

Module No. 5	Structure and Implementation of FIR and IIR Filter	4 Hours
Structure of IIR Systems: Direct form – I realization Direct form – II realization. Structure of FIR Systems: Direct- Form Structure, Cascade-Form Structure, and Frequency Sampling Structure.		

COURSE DESCRIPTION:

Degree	B. Tech.
Level	Undergraduate
Branch	ELC (Electronics and Computer Engineering)
Semester	4^{th}

<table>
<tr><td>Subject Name</td><td colspan="2">Data Science for Engineers</td></tr>
<tr><td>Course Type</td><td colspan="2">Theory</td></tr>
<tr><td>Course Code</td><td colspan="2">22ELC4PE03T</td></tr>
<tr><td>Category</td><td colspan="2">PEC (Professional Elective)</td></tr>
<tr><td>Credit Point</td><td colspan="2">3</td></tr>
<tr><td rowspan="4">Time Commitment</td><td>Lecture</td><td>36 Hours</td></tr>
<tr><td>Tutorial</td><td>Nil</td></tr>
<tr><td>Practice</td><td>Nil</td></tr>
<tr><td>Total</td><td>36 Hours</td></tr>
<tr><td>Recommended Background Knowledge</td><td colspan="2"></td></tr>
<tr><td>Subject Description</td><td colspan="2"></td></tr>
<tr><td rowspan="2">Objectives and Outcomes</td><td colspan="2">Objectives:

The course should enable the students to:

1. Introduce R as a programming language
2. Introduce the mathematical foundations required for datascience
3. Introduce the first level data science algorithms
4. Introduce a data analytics problem solving framework
5. Introduce a practical capstone case study</td></tr>
<tr><td colspan="2">Outcomes:
Upon completion of this course, the student will be able to:

1. Describe a flow process for data science problems (Remembering)
2. Classify data science problems into standard typology (Comprehension)
3. Develop R codes for data science solutions (Application)
4. Correlate results to the solution approach followed (Analysis)
5. Construct use cases to validate approach and identify modifications required</td></tr>
</table>

Assessment/ Evaluation	Mid-Term Examination	30 %
	Quiz Test-1	2.5 %
	Quiz-Test-2	2.5 %
	Surprise Test	5 %
	Assignment-1	2.5 %
	Assignment-2	2.5 %
	Attendance	5 %
	End-Term Examination	50 %
Prescribed Text Book(s)	1. Principles of Data Science, Sinan Ozdemir, Packt Publishing Ltd 2016. 2. Doing Data Science, Straight Talk From The Frontline, Cathy O'Neil and Rachel Schutt., O'Reilly. 2014. 3. An Introduction to Statistical Learning with Applications in R. James G, Witten D, Hastie Tibshirani R, Springer, 2013. 4. Hands-On Data Science with R: Techniques to perform data manipulation and ...,Vitor Bianchi Lanzetta, Nataraj Dasgupta, Ricardo Anjoleto Farias, Packt publishing ltd, 2018. 5. Data Science for Engineers: https://swayam.gov.in/nd1_noc19_cs60/preview (Prof. Raghunathan Rengasamy & Prof. Shankar Narasimhan, IIT Madras). 6. https://www.udemy.com/course/data-science-and-machine-learning-bootcamp-with-r/ (Created by Jose Portilla) 7. https://www.udemy.com/machinelearning/ Machine Learning A-Z™: Hands-On Python & R In Data Science By: Kirill Eremenko, Hadelin de Ponteves	
Reference Book(s)		
Digital Learning Resources		

CO's Mapping with PO's and PEO's

Course Outcomes	Course Outcome Statement	PO's / PEO's
CO1		
CO2		
CO3		
CO4		

DETAILED SYLLABUS:

Module No. 1	Introduction	8 Hours
Introduction: Introduction to Data Science, Data Science Venn Diagram, Relation to data mining, machine learning, big data and statistics, Business Intelligence (BI) vs. Data Science. Types of Data: Structured v/s unstructured data, Examples of data pre-processing, Quantitative vs qualitative data, Four levels of data. Stages of a data science project: Defining the goal, Data collection and management, Explore the data, Modeling, Model evaluation and critique, Presentation and documentation.		

Module No. 2	Introduction to Linear algebra for data science	8 Hours

Introduction to Linear algebra for data science: Vectors and matrices.

Introduction to Probability: Bayesian versus Frequentist, Frequentist approach, The law of large numbers, Compound events, Conditional probability, Bayesian ideas revisited, Bayes theorem , More applications of Bayes theorem, Random variables, Discrete random variables.

Basic Statistics: Obtaining data (Observational, Experimental), Sampling data, Probability sampling, Random sampling, Unequal probability sampling, measurement of statistics , Measures of center (Mean, Median, Mode, Skewness, Quantile, Percentile), Measures of variation, Measures of relative standing, Correlations in data, The Empirical rule.

Module No. 3	Data Visualization	12 Hours

Data Visualization: Basic principles, ideas and tools for data visualization, Identify effective and ineffective visualization (Scatter plots, Line graphs, Bar charts, Histograms, Box plots), Correlation versus causation, Simpson's paradox, Verbal communication.

Machine Learning Essentials: Machine learning, Working principles, Types of machine learning (Supervised learning, Unsupervised learning, Reinforcement learning), How does statistical modeling fit. Some Basic Algorithms like Linear Regression, k-Nearest Neighbors (k-NN), k-Means, Decision Tree. Feature Extraction, Eigen vectors and Eigen values, Principal Component Analysis (PCA).

Module No. 4	Beyond the Essentials	6 Hours

Beyond the Essentials: The bias variance tradeoff (Error due to bias, Error due to variance, Two extreme cases of bias/variance tradeoff, How bias/variance play into error functions), K folds cross-validation, Grid searching (Visualizing training error versus cross-validation error), Ensembling techniques (Random forests, Comparing Random forests with decision trees),

Introduction to structure of Neural networks.

Module No. 5		**6 Hours**
Hands on laboratory using R Language for example like Data Visualization (Scatter plots, Line graphs, Bar charts, Histograms, Box plots), Some Basic Algorithms like Linear Regression, k-Nearest Neighbors (k-NN), k-Means, Decision Tree. Principal Component Analysis (PCA), Random Forests, Neural Networks		

COURSE DESCRIPTION:

Degree	B. Tech.
Level	Undergraduate
Branch	ELC (Electronics and Computer Engineering)
Semester	4^{th}
Subject Name	Digital Electronic Circuits Laboratory
Course Type	Laboratory
Course Code	22ELC4ES01L

<table>
<tr><td>Category</td><td colspan="2">ESC (Engineering Science Courses)</td></tr>
<tr><td>Credit Point</td><td colspan="2">1</td></tr>
<tr><td rowspan="4">Time Commitment</td><td>Lecture</td><td>05 Hours</td></tr>
<tr><td>Tutorial</td><td>Nil</td></tr>
<tr><td>Practice</td><td>20 Hours</td></tr>
<tr><td>Total</td><td>25 Hours</td></tr>
<tr><td>Recommended Background Knowledge/Course Pre-requisites</td><td colspan="2">Knowledge of basics of digital electronics and digital IC</td></tr>
<tr><td>Subject Description</td><td colspan="2">There is a notable increase in the use of the word 'digital' for products and services that are becoming part of our everyday life. Examples are digital camera, digital watch, digital weighing machine, digital signature, digital payment, digital art and so on. Digital Electronics Lab is helpful for the students to acquire the basic knowledge of digital logic gates and its application to design digital electronics circuits. This course will help students to perform the design, analysis and trouble shoot the various combinational and sequential circuits.</td></tr>
<tr><td rowspan="2">Objectives and Outcomes</td><td colspan="2">Objectives:
The course should enable the students to:
1. Understand the uses of basic digital ICs.
2. Comprehend the basic building blocks of combinational and sequential logic circuits.
3. Design and test various combinational circuits.
4. Implement and troubleshoot different sequential circuits.</td></tr>
<tr><td colspan="2">Outcomes:
Upon completion of this course, the student will be able to:

1. Apply the knowledge of various logic gate ICs in design of logic circuits.
2. Design and analyze various combinational circuits.
3. Implement and test different sequential circuits.
4. Understand the basic requirements for a system design and a cost-</td></tr>
</table>

<table>
<tr><td></td><td colspan="2">effective solution.</td></tr>
<tr><td rowspan="7">Assessment/ Evaluation</td><td>Lab Experiments</td><td>20%</td></tr>
<tr><td>Record Writing</td><td>10%</td></tr>
<tr><td>Behavior/ Attitude</td><td>05%</td></tr>
<tr><td>Quiz</td><td>10%</td></tr>
<tr><td>Attendance</td><td>05%</td></tr>
<tr><td>Final Lab Test</td><td>30%</td></tr>
<tr><td>Final Viva/ Final Lab Quiz Test</td><td>20%</td></tr>
<tr><td>Prescribed Text Book(s)</td><td colspan="2">1. M. Morris Mano, Michael D Ciletti, Digital Design, 5th Edition, Pearson Publication, 2016, New Delhi</td></tr>
<tr><td>Digital Learning Resources</td><td colspan="2">
<table>
<tr><td>Course Name</td><td>Digital Electronic Circuits Laboratory</td></tr>
<tr><td>Course Link</td><td>https://nptel.ac.in/courses/117106086/</td></tr>
<tr><td>Course Instructor</td><td>Prof. S. Srinivasan, Department of Electrical Engineering, IIT Madras.</td></tr>
</table>
<table>
<tr><td>Course Name</td><td>Digital Electronic Circuits Laboratory</td></tr>
<tr><td>Course Link</td><td>https://nptel.ac.in/courses/117103064/</td></tr>
<tr><td>Course Instructor</td><td>Prof. Anil Mahanta, Prof. Roy Paily Palanthinkal, IIT Guwahati</td></tr>
</table>
</td></tr>
</table>

CO's Mapping with PO's and PEO's

Course Outcomes	Course Outcome Statement	PO's / PEO's

CO1	Apply the knowledge of various logic gate ICs in design of logic circuits.	PO1, PO2, PO3, PO4, PO5
CO2	Design and analyze various combinational circuits.	PO1, PO2, PO3, PO5
CO3	Implement and test different sequential circuits.	PO1, PO2, PO3, PO4, PO5, PO6
CO4	Understand the basic requirements for a system design and a cost- effective solution.	PO1, PO2, PO3, PO4, PO5, PO6

DETAILED SYLLABUS (EXPERIMENTS):

Sl. No.	**Name of Experiments**	**Duration in Hrs**
1	Digital Logic Gates: Investigate logic behavior of AND, OR, NAND, NOR, EX-OR, and Inverter gates.	2
2	Gate-level minimization: Two level and multi-level implementation of Boolean functions.	2
3	Design and Testing of combinational circuits: Half-Adder, Half-Subtraction, and Full Adder.	2
4	Design of binary to Gray, Gray to Binary Code Converter, and Seven Segment Display Decoder.	2
5	Design and implementation of 2-bit Binary Multiplier.	2
6	Testing of Multiplexer and function implementation using suitable Multiplexer.	2
7	Testing of Decoder and function implementation using suitable Decoder.	2
8	Testing of basic SR Latch and FFs: D-FF, JK-FF.	2
9	Design and Testing of SISO, SIPO Shift Registers.	2

10	Design and testing of 3-bit binary Asynchronous UP-Counter and Modulo-6 counter.	2

COURSE DESCRIPTION:

Degree	B. Tech.
Level	Undergraduate
Branch	ELC (Electronics and Computer Engineering)
Semester	4^{th}
Subject Name	Object-Oriented Programming Using Java Laboratory
Course Type	Laboratory
Course Code	22ELC4PC02L
Category	PCC(Professional Core Courses)

<table>
<tr><td>Credit Point</td><td colspan="2">1</td></tr>
<tr><td rowspan="4">Time Commitment</td><td>Lecture</td><td>05 Hours</td></tr>
<tr><td>Tutorial</td><td>Nil</td></tr>
<tr><td>Practice</td><td>20 Hours</td></tr>
<tr><td>Total</td><td>25 Hours</td></tr>
<tr><td>Recommended Background Knowledge/Course Pre-requisites</td><td colspan="2"></td></tr>
<tr><td>Subject Description</td><td colspan="2"></td></tr>
<tr><td rowspan="2">Objectives and Outcomes</td><td colspan="2">Objectives:

The course should enable the students to:

1. Learn and implement programs with the syntax, semantics and idioms of the Java programming language.
2. Implement practical exercises
3. Develop a standalone application.</td></tr>
<tr><td colspan="2">Outcomes:
Upon completion of this course, the student will be able to:

1. Understand and implement various Object Oriented Concepts like inheritance, abstraction and polymorphism.
2. Work with Collection Classes and Files, Multiple Threads, & handle Exceptions.
3. Develop applications to interact with a Database.
4. Design and implement Graphical User Interface(GUI) Applications in Java using AWT and Swing.</td></tr>
<tr><td rowspan="4">Assessment/ Evaluation</td><td>Lab Experiments</td><td>20%</td></tr>
<tr><td>Record Writing</td><td>10%</td></tr>
<tr><td>Behavior/ Attitude</td><td>05%</td></tr>
<tr><td>Quiz</td><td>10%</td></tr>
</table>

	Attendance	05%
	Final Lab Test	30%
	Final Viva/ Final Lab Quiz Test	20%
Prescribed Text Book(s)	Java: One Step Ahead by Anita Seth (Author), B.L. Juneja (Author) Oxford University Press. Head First Java 2nd edition Kathy Sierra & Bert Bates JAVA Complete Reference (9th Edition) Herbert Schildt. https://www.udemy.com/java-the-complete-java-developer-course/ Java Programming Masterclass for Software Developers Created by Tim Buchalka, Tim Buchalka's Learn Programming Academy, Goran Lochert	
Digital Learning Resources		

CO's Mapping with PO's and PEO's

Course Outcomes	Course Outcome Statement	PO's / PEO's
CO1		
CO2		
CO3		
CO4		

DETAILED SYLLABUS (EXPERIMENTS):

Sl. No.	Name of Experiments	Duration

		in Hrs
1	Data types & variables, decision control structures: if, nested if etc Loop control structures: do, while, for etc.	2
2	Classes and objects.	2
3	Data Abstraction & Data hiding, Inheritance	2
4	Interfaces and inner classes, wrapper classes.	2
5	Exception handlings	2
6	Threads	2
7	IO Files	2
8	Collections	2
9	Database Connectivity.	2
10	Applets AWT and Swing.	2

COURSE DESCRIPTION:

Degree	B. Tech.
Level	Undergraduate
Branch	ELC (Electronics and Computer Engineering)
Semester	4^{th}
Subject Name	Design and Analysis of Algorithms Laboratory
Course Type	Laboratory
Course Code	22ELC4PC03L
Category	PCC(**Professional Core Courses**)
Credit Point	1

Time Commitment	Lecture	05 Hours
	Tutorial	Nil
	Practice	20 Hours
	Total	25 Hours
Recommended Background Knowledge/Course Pre-requisites	Each student should have a good knowledge on basic data structures like Stack, Queue, List, Heap, Matrix	
Subject Description		
Objectives and Outcomes	**Objectives:** The course should enable the students to:	
	Outcomes: Upon completion of this course, the student will be able to:	
Assessment/ Evaluation	Lab Experiments	20%
	Record Writing	10%
	Behavior/ Attitude	05%
	Quiz	10%
	Attendance	05%
	Final Lab Test	30%
	Final Viva/ Final Lab Quiz Test	20%
Prescribed Text Book(s)		
Digital Learning Resources		

CO's Mapping with PO's and PEO's

Course Outcomes	Course Outcome Statement	PO's / PEO's
CO1		
CO2		
CO3		
CO4		

DETAILED SYLLABUS (EXPERIMENTS):

Sl. No.	Name of Experiments	Duration in Hrs
1	Insertion Sort/ Selection Sort	2
2	Divide and Conquer: Fibonacci search/Binary search	2
3	Divide and Conquer: Merge Sort/Quicksort/Heap Sort	2
4	Divide and Conquer: Convex hull/Finding closet pair	2
5	Dynamic Programming: MCM/LCS	2
6	Dynamic Programming: Rod Cutting problem /Assembly line Scheduling	2
7	Greedy method: Activity Selection/Huffman Coding	2
8	Graph Search: BFS/DFS	2
9	Graph Greedy MST: Kruskal/Prim's	2

10	Graph Greedy Shortest Path: Bellman ford/Dijkstra	2
11	Rabin Karp string matching algorithm/Subset Sum problem using Branch and Bound	