Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2023-24

Course Information	
Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	6CS301
Course Name	Compiler Design
Desired Requisites:	Formal Language and Automata Theory, Discrete Mathematics

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**ISE**	**MSE**	**ESE**	**Total**
Tutorial	-	20	30	50	100
Practical	-				
Interaction	-	**Credits: 3**			

Course Objectives	
1	To introduce fundamentals of compiler design and various tools used to design a compiler
2	To inculcate role of various phases involved during design of a compiler and impart in depth working of each phase
3	To exercise design of various phases of a compiler using compiler design tools and techniques

Course Outcomes (CO) with Bloom's Taxonomy Level		
CO1	Discuss the need of a compiler, fundamental concepts and various tools used to design a compiler.	Understanding
CO2	Demonstrate the role and working of each phase involved during compilation process.	Applying
CO3	Analyze the working of various phases of compiler	Analyzing
CO4	Compare and assess the impact of different code optimization and generation techniques and analyze the advantages and limitations of compiler construction tools and frameworks.	Evaluating

Module	**Module Contents**	**Hours**
I	**Module 1: Fundamentals of Compiler** Overview- Structure of a compiler, applications of compiler, one pass and two pass compiler. **Lexical analysis** - The role of a lexical analyzer, specification of tokens, recognition of tokens, LEX.	6
II	**Module 2 Syntax Analysis** Context-free grammar, writing grammars for context free environments, parse trees and ambiguity, role of parser, specification and recognition of tokens, top-down parsing, recursive descent and predictive parsers (LL), bottom-up parsing, operator precedence parsing, LR, SLR and LALR parsers.	9
III	**Module 3 Syntax Directed Translation & Run time environments** Syntax-directed definitions, evaluation orders for attributes of an SDD, S-attributed and L-attributed SDDs, construction of syntax tree, source language issues, storage organization and allocation strategies, parameter passing, symbol table organizations and generations, dynamic storage allocations.	6

IV	**Module 4 Intermediate Code Generation** Intermediate languages, declarations, different intermediate representations –quadruples, triples, trees, flow graphs, SSA forms, and their uses; assignment statements and Boolean expressions, case statements, back patching, procedure calls.	6
V	**Module 5 Code Optimization** Sources of optimization, basic blocks and flow graphs, optimization of basic blocks, loops in flow graphs, loop optimization, machine-independent optimization, machine-dependent optimization, dead-code Elimination, code improving transformations.	6
VI	**Module 6 Code Generation** Issues in the design of a code generator, run time storage management; simple code generator- register and address descriptors, code generation algorithm, design of the function getReg, DAG, peephole optimization, register allocation and assignment, selection of instruction, register allocation, parallel compilation, Just-in-Time compiler, study of compiler construction tools.	6

Text Books	
1	A.V. Aho, R. Shethi and J.D. Ullman, "Compilers - Principles, Techniques and Tools", Pearson Education, Second Edition, 2007.
2	D.M. Dhamdhere, "Systems Programming and Operating Systems", Tata McGraw- Hill Publishing Company limited, New Delhi, Second revised Edition, 2005.

References	
1	K Cooper, L Torczon, "Engineering a Compiler", Morgan Kaufmann, Second Edition, 2011
2	John J Donavan, "System Programming", Tata McGraw- Hill Publishing Company limited, New Delhi
3	Sumitabha Das, "Unix Concepts and Administration", TMGH, 3rd Edition
4	A.V. Aho, R. Shethiand J.D. Ullman, "Compilers - Principles, Techniques and Tools", Addison Wesley Publishing Company, 2007

Useful Links	
1	https://onlinecourses.nptel.ac.in/noc21_cs07/preview
2	https://nptel.ac.in/courses/106108052

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2												2	
CO2	3	2											2	
CO3		2	3										2	
CO4		2	3		1				1				2	

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3. ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO. ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6. For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

Walchand College of Engineering, Sangli

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AY 2023-24

Course Information	
Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	6CS302
Course Name	Design and Analysis of Algorithms
Desired Requisites:	Discrete Mathematics, Data Structure

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**ISE**	**MSE**	**ESE**	**Total**
Tutorial	-	20	30	50	100
Practical	-				
Interaction	-	**Credits: 3**			

Course Objectives	
1	To illustrate and apply the algorithm analysis techniques.
2	To discuss the efficient algorithm for various problem
3	To explain and demonstrate different algorithm techniques for real world problem
4	To compute and prove complexity class of various algorithm techniques.

Course Outcomes (CO) with Bloom's Taxonomy Level

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Discuss the fundamentals of algorithm design and analysis techniques.	II	Understanding
CO2	Apply knowledge of computing and mathematics to algorithm design	III	Applying
CO3	Critically analyze the various algorithm design techniques for a given problem.	IV	Analyzing
CO4	Classify computational problems into P, NP, NP-Hard and NP Complete.	V	Evaluating

Module	**Module Contents**	**Hours**
I	**Module 1: Introduction to Algorithm** Introduction, Evolution of Algorithms, Design of Algorithms, Need of correctness of Algorithms, Performance Analysis, Recurrence Equations: Solution of Recurrence Equations–Iteration Method and Recursion Tree Methods. Master's theorem, Towers of Hanoi.	7
II	**Module 2: Divide and Conquer Method** Binary Search, Merge Sort, Quick sort, Multiplication of Large Integers, Closest-Pair and Convex Hull Problems, Strassen's Matrix Multiplication.	6

III	**Module 3: Greedy Method** Minimum Cost Spanning Trees, Job Sequencing with Deadlines, Knapsack Problem, Optimal Merge Pattern, Huffman Trees.	6
IV	**Module 4: Dynamic Programming Method** Principle of Optimality, Floyd's Algorithm, Multi Stage Graph, Optimal Binary Search Trees, 0/1 Knapsack problem.	6
V	**Module 5: Backtracking & Branch and Bound Method** **Backtracking:** Introduction, n*n - Queen Problem, Sum of Subsets Problem, Graph Colouring, Hamiltonian Cycles. **Branch and Bound Method:** Breadth First Search & Traversal, Depth First Search & Traversal, Traveling Salesperson Problem	7
VI	**Module 6: Class of Problem & Parallel Algorithms** **Class of Problem**: P, NP, NP Complete and NP Hard Problems, Approximation Algorithms for NP-Hard Problems. **Parallel Algorithms:** Introduction, Parallel Evaluation of Expression, Basic Techniques and Parallel Algorithms.	7

Text Books	
1	Ellis Horowitz, Sartaj Sahni and Rajasekaran "Fundamentals of Computer Algorithms" , Galgotia Publications, 2nd Edition.
2	Aho, Hopfcraft and Ullman, Addison Wesley "Design and Analysis of Algorithms".

References	
1	Thomas Cormen, Leiserson, Rivest, and Stein "Introduction to Algorithms", PHI Publication.3rd Edition, 2009.
2	Goodman, "Introduction to Design and Analysis of Algorithm", McGraw Hill.
3	R.C.T. Lee, S.S. Tseng, R.C. Chang, "Introduction to the Design and Analysis of Algorithm".

Useful Links	
1	https://www.tutorialspoint.com/design_and_analysis_of_algorithms/design_and_analysis_of algorithms_tutorial.pdf
2	https://www.ebooks.com/en-in/book/1679384/algorithms-design-techniques-and-analysis/m-h-alsuwaiyel

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3									2			2	
CO2	2	3											3	2
CO3		3											2	
CO4		2		2									2	

The strength of mapping is to be written as 1,2,3; Where, 1: Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3. ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO. ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6. For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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AY 2023-24

Course Information	
Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	6CS303
Course Name	Artificial Intelligence
Desired Requisites:	Data structures, algorithm

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 3			

Course Objectives	
1	To acquaint students with the meaning, purpose, scope, applications, and effects of AI.
2	To solve problems by applying a suitable search method, and AI applications in Natural Language Processing, Computer vision and Robotics.
3	To understand and represent knowledge in AI systems.
4	To analyse real life problems and provide solutions by applying AI techniques.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	explain fundamental concepts and challenges in AI.	II	Understanding
CO2	practice the basic principles, models and algorithms of AI to recognize, model and solve problems.	III	Applying
CO3	examine knowledge representation techniques for representation power and problem solving strategies for complexity.	IV	Analysing
CO4	select suitable AI strategies to solve real life problems.	V	Evaluating

Module	**Module Contents**	**Hours**
I	**AI - Inception and Scope** **Introduction to AI:** What is AI, History of AI, Foundations of AI, Turing test, AI problems, AI application areas, AI case studies; **Intelligent Agents:** Introduction, Structure of agents, Types of agents, Environments	5
II	**Problem Solving by Search** **Solving problems by searching**: Problem solving agents, Formulating problems, Solution search; **Search strategies:** BFS, DFS, Uniform cost, Depth limited; **Informed search methods:** Best first, A*, Hill climbing, Simulated annealing	7
III	**Knowledge Representation & Reasoning-I** **Knowledge based agents:** Introduction **Propositional logic:** Syntax, Semantics, Inference, Rules **First order predicate logic:** Syntax and semantics, Extensions and notational variations, Simple reflex agent; **Knowledge base creation:** Example; **Logical reasoning systems:** Introduction, Indexing, Retrieval, Unification, Logic programming systems - Prolog	7
IV	**Knowledge Representation & Reasoning-II** **Symbolic reasoning:** Introduction and logic nonmonotonic reasoning **Statistical reasoning:** Probability and Bayes' theorem, Rule based system , Dempster-Shafer theory, Bayesian networks, Fuzzy logic	8

V	**Game playing and Introduction to Planning** **Game playing**: Introduction, Minimax search procedure, Alpha beta pruning; **Planning:** Introduction, Components of planning, Goal stack planning, Partial order planning	8
VI	**Learning and case study** **Learning:** Introduction, Rote learning, Inductive learning, Learning from examples, Explanation based learning; **Case study:** State of the art AI systems	5

Textbooks	
1	Elaine Rich and Kerin Knight, Artificial Intelligence, 3rd Edition, McGraw Hill. ISBN13: 9780070087705
2	Eugene, Charniak, Drew Mcdermott, Introduction to artificial intelligence, AddisonWesley. ISBN 0-07-052263-4.
3	Deepak Khemani,"A First Course in Artificial Intelligence", McGraw Hill Education (India), 2013.
4	Stuart Russell, Peter Norvig, "Artificial Intelligence A Modern Approach", Prentice Hall, 3rd Edition, 2009

References	
1	Khemani D., "*Artificial Intelligence: Knowledge Representation and Reasoning*", IIT Madras, Lecture Notes.
2	Herbert A. Simon, The Sciences of the Artificial, MIT Press, 3rd Edition, 1998. ISBN: 9780262190510. George F Luger, Artificial Intelligence: Structures and Strategies for Complex Problem Solving, Pearson Edu., 4th Edition. ISBN-13: 978-0-321-54589-3

Useful Links	
1	Artificial Intelligence: Knowledge Representation and Reasoning Course on NPTEL: Link
2	Artificial Intelligence Search Methods for Problem Solving Course on NPTEL: Link

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1	1	1							1			1	
CO2	3	2	2						2	1			2	2
CO3	2	3	2						2	1			2	
CO4	1	2	2						2	1			1	1

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3. ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO. ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6. For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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AY 2023-24

Course Information

Programme	B.Tech. (Computer Science Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	6CS351
Course Name	Design and Analysis of Algorithms Laboratory
Desired Requisites:	Knowledge of Mathematics, Data Structure & Programming Concepts

Teaching Scheme		**Examination Scheme (Marks)**			
Practical	2 Hrs/ Week	**LA1**	**LA2**	**Lab ESE**	**Total**
Interaction	-	30	30	40	100
		Credits: 1			

Course Objectives

1	To build solid foundation in algorithms and their applications.
2	To employ various design strategies for problem solving.
3	To provide a practical exposure of all algorithms.
4	To Synthesize efficient algorithms in common engineering design situations.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Practice different algorithm techniques for given problem	III	Applying
CO2	Identify appropriate data structure to implement selected algorithmic approach.	IV	Analyzing
CO3	Design and Implement an algorithm for complex problem.	VI	Creating
CO4	Exhibit technical and professional skill to demonstrate and convince accomplished algorithmic solution	III	Applying

List of Experiments / Lab Activities/Topics

List of Topics (Applicable for Interaction mode):

List of Experiments:

1. To implement the Towers of Hanoi problem.
2. To implement (Quick Sort/Merge Sort) Sorting algorithm using array as a data structure.
3. To implement different Search techniques (Linear/Binary) using array and/or trees.
4. To implement the Convex Hull problem using divide and conquer method.
5. To implement Strassen's Matrix Multiplication algorithm.
6. Find Minimum Cost Spanning Tree of a given undirected graph using Kruskal's & Prim's algorithm and compare.
7. To implement the Huffman Coding algorithm.
8. To implement 0/1 Knapsack problem using dynamic programming.
9. From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm.
10. Implement All-Pairs Shortest Paths Problem using Floyd's algorithm.
11. To implement n*n Queen problem using Backtracking.
12. To implement the Hamiltonian cycle using Backtracking.
13. Implement any scheme to find the optimal solution for the Traveling Salesperson problem.

Textbooks	
1	Ellis Horowitz, Sartaj Sahni and Rajasekaran "Fundamentals of Computer Algorithms" , Galgotia Publications, 2nd Edition.
2	Aho, Hopfcraft and Ullman, Addison Wesley "Design and Analysis of Algorithms".
References	
1	Thomas Cormen, Leiserson, Rivest, and Stein "Introduction to Algorithms", PHI Publication.3rd Edition, 2009.
2	Goodman ,"Introduction to Design and Analysis of Algorithm", McGraw Hill.
3	R.C.T. Lee, S.S. Tseng, R.C. Chang, "Introduction to the Design and Analysis of Algorithm".
Useful Links	
1	https://www.tutorialspoint.com/data_structures_algorithms/algorithms_basics.htm
2	https://www.codechef.com/certification/data-structures-and-algorithms/prepare

CO-PO Mapping														
	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1				1									2	
CO2				2									2	
CO3				3	2								2	1
CO4				3	3								2	1
The strength of mapping is to be written as 1,2,3; where, 1: Low, 2: Medium, 3: High Each CO of the course must map to at least one PO, and preferably to only one PO.														

Assessment				
There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate head of passing.(min 40 %), LA1+LA2 should be min 40%				
Assessment	**Based on**	**Conducted by**	**Typical Schedule**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 9 to Week 16 Marks Submission at the end of Week 16	30
Lab ESE	Lab activities, journal/ performance	Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	40
Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any.				

Walchand College of Engineering, Sangli

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AY 2023-24

Course Information

Programme	B.Tech. (Computer Science & Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	6CS352
Course Name	Programming Laboratory -III
Desired Requisites:	Basics of Object-Oriented Programming

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	-	**LA1**	**LA2**	**ESE**	**Total**
Tutorial	-	30	30	40	100
Practical	2 Hrs/week				
Interaction	1 Hrs/week	**Credits: 2**			

Course Objectives

1	To inculcate understanding of World Wide Web, Internet, the concepts of web applications development and web programming languages as well to inculcate understanding of state-of-the-art front-end and back-end development frameworks of web programming
2	To introduce selection of appropriate concepts of internet and web programming such as HTML, CSS, JavaScript, and other server-side scripting languages.
3	To introduce selection of appropriate concepts from different state-of-the-art frameworks/libraries and tools for developing a web application.
4	To infuse skills of combining different components from state-of-the-art technologies to design a web and mobile app to solve real world problems.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO1	summarize the different concepts and components of WWW, web development technologies and web security as well as state-of-the-art front-end, back-end web app development technologies & frameworks.	Understanding
CO2	illustrate the concepts of various state-of-the-art front-end, back-end web and mobile app development technologies & frameworks using different web development tools.	Applying
CO3	test the concepts and components of various state-of-the-art front-end, back-end web and mobile app development technologies & frameworks using web development tools.	Analyzing
CO4	select appropriate front-end, back-end web app development technologies, frameworks, tools and their components to solve real-world problems.	Evaluating
CO5	build a web app, individually or in a team by combining various state-of-the-art front-end, back-end app development technologies & frameworks for real-world problems.	Creating

Module	Module Contents	Hours
I	**Module 1: Introduction to World Wide Web, Markup Languages, Style sheet Languages** Client, Server, Communication, Protocols, Ports, Client-Server Architectures, Internet, World Wide Web, HTTP, HTTP Status Codes, Web Clients/Browsers, and Web Servers. **Experiments:** 1. Describe client, server, communication, ports, protocols, HTTP, browsers and web servers. Distinguish between client and server, Internet, WWW, and client-server architectures. 2. Get header information of a web page using browser's developer mode. Installation of web server. 3. Design and develop web pages using fundamental HTML elements, such as head, title, body, header, comment, etc. Also using HTML Formatting elements, such as abbr, address, etc 4. Design and develop web pages that embed images and client-side maps, audio and video and links, lists and tables, embed YouTube videos, graphics using canvas and SVG. 5. Design and develop web pages with styles, semantics and layouts, such as header, footer, section, data, div, etc. also using HTML APIs, web components. 6. Design and develop web pages by applying CSS text formatting properties, such as Text Alignment, Text Decoration, Text Transformation, Text Spacing, Text Shadow, Font Family, Font Style, Font Size, etc. Also apply CSS colors and backgrounds properties, such as colour, RGB, HEX, HSL values, background image, background color, etc. 7. Design and develop web pages by applying CSS borders and margin properties, such as Border Width, Border Color, Margins, etc. Also apply CSS floating, overflow and positioning properties, such as float, overflow, position, etc. 8. Design and develop web pages by applying CSS page layout properties, such as display, padding, height, width, max-width, align, etc. 9. Design and develop web pages by applying CSS properties to links, lists and tables. 10. Design and develop web pages by using CSS navigation bars and dropdowns. 11. Design and develop web pages by using CSS Selectors. 12. Design and develop web pages by using inline CSS, internal CSS and external CSS.	

II	**Module 2: Client-side Programming and Server-side Programming** JavaScript: Introduction to JavaScript, Basic Syntax, Variables, Data Types, Statements, Operators, Conditions, Loops, Functions, Arrays, Objects, Form Validation, DOM, JavaScript Objects, JavaScript Functions, Asynchronous JavaScript and any one of the state-of-the-art JavaScript libraries. Introduction to Server-side Programming, Installation of Web and database Server, Process user input, Efficient storage and delivery of information to and from databases, File handling and controlled access to the content, store session/state information, cookies, notifications and communication. **Note:** 1. One of the following server-side scripting languages can be used for the implementation: PHP, Node.js, or other state-of-art scripting languages. 2. One of the following databases can be used for data storage and retrieval: MySQL, MongoDB, Firebase or other state-of-art databases. **Experiments:** 1. Implement a script using JavaScript that changes HTML content, HTML attributes hides and show HTML elements, HTML output and window alert box for web pages. 2. Implement a script using JavaScript that shows use of JavaScript variables, data types and statements for web pages. 3. Implement a script using JavaScript that shows use of JavaScript Arithmetic, Assignment and String Concatenation operations for web pages. 4. Implement a script using JavaScript that shows use of JavaScript conditionals and loops for web pages. 5. Implement a script using JavaScript that shows use of JavaScript Functions, Arrays, and Objects for web pages. 6. Implement a script using JavaScript that shows use of Asynchronous JavaScript. 7. Design and develop web pages and insert JavaScript in head tag, body tag, external file, external URL and external folder. 8. Implement a script using JavaScript library. 9. Implement basic functionalities of server-side scripting language, such as data types, operators, conditionals, and loops. 10. Implement basic functionalities of server-side scripting language, such as objects, arrays, and functions. 11. Implement web page form validations using server-side scripting language. 12. Implement file handling using server-side scripting language. 13. Implement cookies using server-side scripting language. 14. Implement sessions using server-side scripting language. 15. Implement CRUD operations on database using server-side scripting language.
III	**Module 3: Web Application Framework/Library** State-of-the-art Front-End Framework library: One of the following technologies will be considered: Angular, React.js or other state-of-the-art front-end development framework/library. **Experiments:** 1. Installing framework and configuring Integrated Development Environment (IDE), and its dependencies. 2. Creating workspace, project and setting up the necessary environment. 3. Implementing the fundamental syntaxes and components of the framework. 4. Building and testing the application. 5. Deploying the application. 6. Implementing the fundamental syntaxes and components of the framework.

IV	**Module 4: Server-side Development Framework/Library Part I** State-of-the-art server-side Technology: Ruby on Rails, Flask or other state-of-the-art back-end development framework/library. Experiments: 1. Installing framework and configuring Integrated Development Environment (IDE), and its dependencies. 2. Creating workspace, project and setting up the necessary environment. 3. Implementing the fundamental syntaxes and components of the framework. 4. Implementing server-side validations and authentication for web application. 5. Implementing CRUD operations for web application. 6. Building and testing the application. 7. Deploying the application.
V	**Module 5: Server-side Development Framework/Library Part II** Django or another state-of-the-art framework/library. Experiments: 1. Installing framework and configuring Integrated Development Environment (IDE), and its dependencies. 2. Creating workspace, project and setting up the necessary environment. 3. Implementing the fundamental syntaxes and components of the framework. 4. Implementing server-side validations and authentication for web application. 5. Implementing CRUD operations for web application. 6. Building and testing the application. 7. Deploying the application
VI	**Module 6: Hosting Web Applications, Web Security** Building web application and Hosting web application. Web Security: Introduction, types of web threats, and prevention measures. **Experiments:** 1. Choosing a hosting server and selecting a plan for web hosting. 2. Choosing and configuring DNS address. 3. Uploading, configuring and running the website over the internet.
Text Books	
1	Vasan Subramanian, "Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node", Apress, 2nd Edition, 2019, ISBN-13: 978-1484243909
2	Azat Mardan, "Full Stack JavaScript: Learn Backbone.js, Node.js, and MongoDB", Apress, 2nd Edition, 2018, ISBN-13: 978-1484237175
References	
1	Felipe Coury, Ari Lerner, Carlos Taborda, "ng-book: The Complete Guide to Angular", Create Space Independent Publishing Platform, 5th Edition, 2018, ISBN-13: 978-1985170285
Useful Links	
1	www.w3schools.com
2	Official framework websites for Documentation/Help

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1													1
CO2	3	2	2		1				1	1		1		2
CO3		3												1
CO4		2	1	3								1		1
CO5			3	2	1				3					2

The strength of mapping is to be written as 1,2,3; Where, 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment				
There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation.				
Assessment	**Based on**	**Conducted by**	**Typical Schedule (for 26-week Sem)**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 6 Marks Submission at the end of Week 6	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 7 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Lab activities, attendance, journal	Lab Course Faculty	During Week 15 to Week 18 Marks Submission at the end of Week 18	40
Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments.				

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AY 2023-24

Course Information

Programme	B.Tech. (Computer Science Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	6CS341
Course Name	Mini Project-I
Desired Requisites:	Nil

Teaching Scheme		**Examination Scheme (Marks)**			
Practical	4 Hrs/Week	**LA1**	**LA2**	**Lab ESE**	**Total**
Interaction	-	30	30	40	100
		Credits: 2			

Course Objectives

1	To provide hands-on experience in developing a small-scale software project.
2	To undergo project management techniques and project design principles.
3	To implement the project with appropriate programming languages and testing tools.
4	To develop analytical vision and skills to analyse, compare the outcome with other techniques.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	understand existing solutions and define the scope of a project accordingly.	II	Understanding
CO2	illustrate project design and its methodology of implementation for identified problem.	III	Applying
CO3	identify use of modern engineering tools, software, and techniques utilized during project implementation.	IV	Analyzing
CO4	verify developed solution for different test cases and measure the performance of the system for various parameters.	V	Evaluating
CO5	build a solution for identified problem and prepare comprehensive project documentation including reports, technical papers, and design documents	VI	Creating

List of Experiments / Lab Activities/Topics

List of Mini Project Activities:

1. Identify a real-world problem or challenge that requires a software solution.

2. Conduct a comprehensive analysis of existing technologies, research findings, and industry practices relevant to the problem.

3. Design an innovative software solution considering the identified problem and available resources.

4. Apply advanced project management techniques to create a project plan, including tasks, timelines, and resource allocation.

5. Collaborate within a team to execute the project plan, ensuring effective communication, task assignment, and progress monitoring.

6. Implement the software solution using appropriate programming languages, tools, and technologies.

7. Test and validate the developed software solution, ensuring its functionality, usability, and performance.

8. Evaluate the impact and effectiveness of the software solution, comparing it with existing alternatives and identifying areas for enhancement.

9. Prepare a comprehensive project report, including documentation, code, and other artifacts.

10. Present the mini project findings and outcomes through a technical presentation and demonstration.

Textbooks	
1	Nil

References	
1	Nil

Useful Links	
1	Nil

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2			2	2								2	2
CO2			3					2	2	2			2	2
CO3					3								2	2
CO4				2									2	2
CO5								2	2	2	2		2	2

The strength of mapping is to be written as 1,2,3; where, 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO, and preferably to only one PO.

Assessment

There are three components of lab assessment, LA1, LA2 and Lab ESE.
IMP: Lab ESE is a separate head of passing (min 40 %), LA1+LA2 should be min 40%

Assessment	**Based on**	**Conducted by**	**Typical Schedule**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	30

LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 9 to Week 16 Marks Submission at the end of Week 16	30
Lab ESE	Lab activities, journal/ performance	Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	40
Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any.				

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AY 2023-24

Course Information	
Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Third Year B. Tech SEM V
Course Code	6CS311
Course Name	Elective 1: Image Processing
Desired Requisites:	Basic knowledge of Graphics

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**ISE**	**MSE**	**ESE**	**Total**
Tutorial	-	20	30	50	100
Practical	-				
Interaction	-	**Credits: 3**			

Course Objectives	
1	To learn fundamental of digital image processing.
2	To learn the concepts of image enhancement, image segmentation, compression etc and apply the algorithms to build applications.
3	To compare various algorithms and select the appropriate for a particular application.
4	To create initial background of the area of Image Processing to excel in this stream for further Research.
5	To develop engineering skills and intuitive understanding of the tools used in Image Processing.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO1	Perceive general terminology of digital image processing.	Understanding-II
CO2	Apply various image processing algorithms that can be used in practical applications.	Applying-III
CO3	Analyze working of various algorithms specific to image processing techniques.	Analyzing-IV
CO4	Evaluate working of various image processing algorithm.	Evaluate-V

Module	**Module Contents**	**Hours**
I	**Digital Image Fundamentals** Introduction and applications, Fundamental Steps and Components of Image Processing System Digital Image Fundamentals: Image Acquisition, A simple imagemodel, Sampling and Quantization, Imaging, Different types of digital images	6
II	**Image Transforms** 2D systems and Necessary Mathematical preliminaries, 2D Orthogonal and Unitary Transforms, Discrete Fourier Transform, KL-Transforms, Hadamard Transforms	6
III	**Image Enhancement** Point Processing, Basic Gray Level Transformations, Convolution and Correlation, HistogramProcessing, Spatial domain Filtering	6
IV	**Image Segmentation and Analysis** Edge Detection – using first and second order derivatives, LoG, Canny edge detector, Boundary Extraction – Connectivity, Heuristic Graph Search,Region-based Segmentation –region growing, region	8

	splitting and merging	
V	**Morphological Image Processing** Mathematical Morphology, Erosion and Dilation, Opening and Closing, Hit-or-Miss transformation, Basic morphological algorithm: Boundary extraction, Hole filling, Extracting of connected components. Thinning, Thickening	7
VI	**Image Compression** Fundamentals, Compression model, Lossless Vs Lossy Compression, Fundamentals of Information Theory, Run-length coding, Huffman coding,Dictionary-based compression, Image CompressionStandards	6

Text Books	
1	R. C. Gonzalez, R. E. Woods, Digital Image Processing, 4th Edition. 2018, PHI
2	A. K. Jain, Fundamentals of Digital Image Processing, PHI

References	
1	Milan Sonka, Vaclav Hlavac, Boyle, Digital Image Processing and Computer Vision, Cengage Learning
2	S. Jayaraman, S. Esakkirajan, T. Veerkumar, Digital Image Processing, Tata McGrawHill
3	Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, Digital Image Processing Using MATLAB, 2nd ed.

Useful Links	
1	NPTEL course: Link
2	NPTEL course: Link

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
CO1	2														
CO2	3	2											2		
CO3		3		2									2		
CO4			2	2											
1:Low, 2:Medium, 3:High															

Assessment (for Theory Course)

The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3. ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments, quiz etc. and is expected to map at least one higher order PO. ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.

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Course Information

Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	6CS312
Course Name	Elective 1: Internet of Things
Desired Requisites:	Basic programming knowledge, Networking Basics

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 3			

Course Objectives

1	To illustrate the basic concepts of Internet of Things.
2	To demonstrate working of Arduino, Node-MCU & Raspberry pi.
3	To develop the skill of providing solution for real life problems using IoT.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Explain concepts of designing and development of applications in IoT.	II	Understanding
CO2	Illustrate the working of various protocols for communication among IoT devices.	III	Apply
CO3	Analyze and compare different IoT tools and techniques.	IV	Analyze
CO4	Evaluate a solution to address real-world problems.	V	Evaluate

Module	**Module Contents**	**Hours**
I	**Introduction to Internet of Things** Introduction, Physical design of IoT, Logical Design of IoT, IoT Enabling Technology, Introduction to Arduino, Raspberry-Pi	07
II	**Communication Protocols & Interoperability** Basics of Networking, Communication Protocols, Sensor Networks, Machine-to Machine Communications, Interoperability.	06
III	**Data Analytics for IoT** Apache Hadoop, Apache Oozie, Apache Spark, Using Apache Storm for real time Data analysis.	06
IV	**Industrial IoT** Introduction to IIoT, AWS-IoT, Introduction to Lora-wan, Security challenges in IIoT, Cyber-Physical Systems, Industrial Control System	07
V	**Edge Computing** Introduction to Edge Computing, Benefits and challenges in edge computing, Edge device architecture, Security challenges in Edge Computing, Edge analytics and processing techniques.	07
VI	**Domain Specific IOT Case Studies** Home Automation, Smart Cities, Retail, Logistic, Agriculture, Industry, Healthcare.	06

Textbooks

1	S. Misra, A. Mukherjee, and A. Roy, 2020. Introduction to IoT. Cambridge University Press.
2	S. Misra, C. Roy, and A. Mukherjee, 2020. Introduction to Industrial Internet of Things and Industry 4.0. CRC Press.

References	
1	Arashdeep Bahga ,Vijay Madisetti Internet of Things an Hands on Approach,University Press.

Useful Links	
1	https://onlinecourses.nptel.ac.in/noc21_cs17

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1		2										2	
CO2	1		2	1					1					
CO3		2			2				1	1			1	
CO4				1	2		2		1	1			2	

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3. ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO. ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6. For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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Course Information	
Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	6OE371
Course Name	Open Elective 1: Data Science
Desired Requisites:	Probability and Statistics

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 3			

Course Objectives	
1	To provide the knowledge and expertise to become a proficient data scientist.
2	To critically evaluate data visualizations based on their design and use for communicating.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	acquaint core concepts and technologies in Data Science.	II	Understanding
CO2	illustrate various data collection and preprocessing techniques.	III	Applying
CO3	use visualization techniques to show relationship within datasets.	III	Applying
CO4	analyse possible relationship within large datasets and identify suitable prediction technique to solve real-world problems.	IV	Analyzing

Module	**Module Contents**	**Hours**
I	**Introduction to core concepts and technologies** Introduction, Terminology, data science process, data science toolkit, Types of data, Example applications	4
II	**Data Collection and Management** Introduction, Sources of data, Data collection, Exploring and fixing data,Data storage and management, Using multiple data sources.	7
III	**Data Preprocessing** Data Cleaning, Data Integration, Data Reduction, Data Transformationand Data Discretization.	8
IV	**Data Visualization** Introduction, Types of data visualization, Data for visualization: Datatypes, Data encodings, Retinal variables, Mapping variables to encodings, visual encodings.	6
V	**Data Analysis** Introduction, Terminology and concepts, Introduction to statistics, Central tendencies and distributions, Variance, Distribution properties and arithmetic, Samples/CLT, Correlation, Linear Regression, Least Squares, Residuals, Regression Inference, classification, classifiers.	8
VI	**Recent trends** Recent trends in various data collection and analysis techniques, various visualization techniques, Case Study, application development methods used in data science.	6

Textbooks

1	Adhikari Ani and DeNero John. Computational and Inferential Thinking, The Foundations of Data Science, UC Berkeley.
2	Jiawei Han, Micheline Kamber and Jian Pei. Data Mining Concepts and Techniques. Morgan Kaufmann, Third Edition.

References	
1	O'Neil Cathy and Schutt Rachel. Doing Data Science, Straight Talk From The Frontline. O'Reilly.
2	Leskovek Jure, Rajaraman Anand and Ullman Jeffrey. Mining of Massive Datasets. v2.1, Cambridge University Press.

Useful Links	
1	https://onlinecourses.nptel.ac.in/noc22_cs32/preview

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	-	-	-	-	-	-	-	-	-	-	-	2	-
CO2	3	2	-	-	-	-	-	-	1	1	-	-	2	-
CO3	3	2	-	-	-	-	-	-	1	1	-	-	2	-
CO4	2	2	-	-	-	-	-	-	1	1	-	-	2	-

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3. ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO. ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6. For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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Course Information

Programme	B.Tech. (Computer Science Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	6CS353
Course Name	Humanities I-Project Management and Ethics
Desired Requisites:	Software Engineering

Teaching Scheme		**Examination Scheme (Marks)**			
Practical	Hrs/ Week	**LA1**	**LA2**	**Lab ESE**	**Total**
Interaction	2 Hrs/ Week	30	30	40	100
		Credits:			

Course Objectives

1	To provide an overview of project management principles.
2	To inculcate ethical awareness during project development.
3	To introduce the various project management tools used in the IT industry.
4	To practice and provide hands-on exploration of various project management tools used for Software Development.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Explain project management principles, concepts and tools used for software development in industry.	II	Understanding
CO2	Apply ethical principles and demonstrate responsible decisions taking ability during all phases of a project development.	III	Applying
CO3	Compare and Analyze the different project management tools used for development of various software applications.	IV	Analyzing
CO4	Select appropriate project management tool to achieve industry standards during project development process.	V	Evaluating

List of Experiments / Lab Activities/Topics

List of Lab Activities:

1. Overview of different project management tools (e.g Jira).
2. Perform version control and code management using GitHub and SVN.
3. Understanding Version management using Jira.
4. Understanding Workflow and task management.
5. Understanding user and role management.
6. Understanding Project Monitoring and Reporting.
7. Understanding Issue management.
8. Understanding Bug tracking and reporting.
9. Performing software testing using tools (e.g Testlink)
10. Ethical Conduct for Engineers

Textbooks

1	Jira Project Management A Complete Guide - 2019 by Gerardus Blokdyk . The Art of Service
2	Jira Quick Start Guide: Manage your projects efficiently using the all-new Jira by Ravi Sagar
3	Dr.K.V.K.K.Prasad, "Software Testing Tools"

References

1	JIRA Essentials, Third Edition, Patrick Li,Packt enterprise
2	Nina Godbole, "Software Quality Assurance: Principles And Practice", Alpha Science International, Ltd (August 1, 2004)

Useful Links	
1	https://www.atlassian.com/
2	https://www.javatpoint.com/jira-tutorial
3	https://www.javatpoint.com/software-engineering-case-tools-for-software-metrics
4	https://www.javatpoint.com/github
5	https://www.javatpoint.com/software-testing-tutorial

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2											2	
CO2	2	2												
CO3					3									
CO4				2	2									2

The strength of mapping is to be written as 1,2,3; where, 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO, and preferably to only one PO.

Assessment

There are three components of lab assessment, LA1, LA2 and Lab ESE.
IMP: Lab ESE is a separate head of passing (min 40 %),LA1+LA2 should be min 40%

Assessment	Based on	Conducted by	Typical Schedule	Marks
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 9 to Week 16 Marks Submission at the end of Week 16	30
Lab ESE	Lab activities, journal/ performance	Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	40

Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any.