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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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.

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Course Information

Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Third Year B. Tech., SemVI
Course Code	6CS321
Course Name	Cloud Computing
Desired Requisites:	Operating System, Computer Networks.

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

Course Objectives

1	An understanding of fundamental ideas behind Cloud Computing, the evolution of the paradigm, its applicability; benefits, as well as current and future challenges
2	Providing basic ideas and principles in cloud management techniques, virtualization techniques and cloud software deployment considerations
3	Exploring cloud computing driven open source and commercial systems and applications.

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 different cloud computing models and sources.	II	Understanding
CO2	illustrate the architecture and infrastructure of cloud computing.	III	Applying
CO3	identify the core issues of cloud computing such as security, privacy, and interoperability.	IV	Analysing
CO4	assess open and commercial cloud platforms to solve problems on the cloud.	V	Evaluating

Module	**Module Contents**	**Hours**
I	**Principles of distributed computing** Eras of computing, Elements of distributed computing – General concepts and definitions, components of a distributed system, architectural styles for distributed computing, models for inter-process communication, Technologies for distributed computing – Remote procedure call, distributed object frameworks. GraphQL, REST API	7
II	**Introduction to Cloud Computing** Cloud Computing (NIST Model) Introduction to Cloud Computing, History of Cloud Computing, Cloud service providers Properties, Characteristics &Disadvantages,Pros and Cons of Cloud Computing, Benefits of Cloud Computing, Cloud computing vs. Cluster computing vs. Grid computing, Role of Open Standards.	5

III	**Cloud Computing Architecture** Cloud computing stack, Comparison with traditional computing architecture (client/server), Services provided at various levels, How Cloud Computing Works, Role of Networks in Cloud computing, protocols used, Role of Web services, Service Models (XaaS), Infrastructure as a Service(IaaS), Platform as a Service(PaaS), Software as a Service(SaaS), Deployment Models: Public cloud, Private cloud, Hybrid cloud, Community cloud.	7
IV	**Virtualization** Introduction, characteristics of virtualized environments, Taxonomy of virtualization Techniques, Virtualization and cloud computing, Pros and Cons of virtualization, technology Examples, Micro-services, Serverless architecture, Hypervisors, Containerization.	6
V	**Cloud Security** Type of attack, Security stack of IaaS, PaaS, SaaS, Gartner's seven cloud computing security Risks, Other cloud security issues: Virtualization, Access Control and identity Management, Application security, Data life cycle management, AWS IAM.	6
VI	**Case Study on Open Source & Commercial Clouds** Eucalyptus, Microsoft Azure, Amazon EC2, Open Stack, Open Nebula, AWS, Free Amazon tiers and Google compute, Problems related to Big data analytics, Metering and Monitoring of cloud infrastructure.	8

Textbooks	
1	RajkumarBuyya, James Broberg, Andrzej M. Goscinski ,"Cloud Computing: Principles and Paradigms", Wiley, 1 Edition 2013. 2 3
2	GautamShroff,"Enterprise Cloud Computing - Technology, Architecture, Applications", Cambridge University Press, 2010.
3	Ronald L. Krutz, Russell Dean Vines ,"Cloud Security: A Comprehensive Guide to Secure Cloud Computing", Wiley- India,2010.
4	
References	
1	Barrie Sosinsky,"Cloud Computing Bible", Wiley-India, 2010.
2	
Useful Links	
1	
2	

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											1	
CO3		2							1	1			1	
CO4		2	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 VI
Course Code	6CS322
Course Name	Advanced Database System
Desired Requisites:	Database Engineering

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

Course Objectives	
1	An understanding of the fundamentals in object-based databases and explore the database centric design issues involved in application development, the advances in database system.
2	Providing the methodology to implement the complex and real-world database applications.
3	Evaluation and analysis of the different types of advanced databases.

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	**Exploit** the fundamental concepts involved in advanced databases and apply it in complex data handling.	III	Apply
CO2	**Analyse** the architectures and performance of different databases using **modern tools** for domain specific applications.	IV	Analyse
CO3	**Recommend** the optimal database-based solution to solve real world problem.	V	Evaluate
CO4	**Apply** the acquired knowledge in databases to **design** and **build** the different business applications.	VI	Create

Module	**Module Contents**	**Hours**
I	**Object-Based Databases** Overview, Complex Data Types, Structure Types and Inheritance in SQL, Table Inheritance, Arrays and Multiset Types in SQL, Object-Identity and Reference Types in SQL, Implementing O-R Features, Object-Relational Mapping	5
II	**Application development & Administration** Application Programs and User Interfaces, Application Architectures, Standardization, Rapid Application Development, Application Performance, Application Security. Performance Tuning, Performance Benchmarks, Other issues in Application Development	6
III	**Data Warehousing** Introduction, Data Warehouse Building Blocks, Data Warehouse Architecture, Data warehouse design process, dimensional modelling, conceptual modelling, Multi-dimensional data – cube, building the data warehouse – Data Extraction, Transformation and Loading (ETL Process)	8

IV	**Distributed and Cloud Databases** **Distributed databases:** Homogeneous & heterogeneous databases, distributed data storage, distributed transactions, concurrency control in distributed databases, distributed query processing, Heterogeneous distributed databases. **Cloud Databases – I** Introduction, Architecture of a cloud data storage system, Data Models, Transactions and replication, Deployment models, Comparison of Relational databases and Cloud databases, Challenges to develop Cloud Databases.	4 3
V	**Cloud Databases – II** Case study of any four NoSQL databases: Voldemort , MongoDB , Cassandra , Neo4J , Cloud Native , Data Lake	7
VI	**Spatial, Temporal Data and Mobility** Motivation, Time in Databases, Spatial and Geographic Data, Multimedia Databases, Mobility and Personal Databases.	6

Textbooks	
1	Silberschatz, Korth, Sudarshan "Database system concepts" MGH 6th Edition.
2	Raghu Ramkrishnan "Database Management System" MGH
3	Paulraj Ponniah "Data Warehousing - Fundamentals for IT Professional" 2nd Edition. Wiley

References	
1	Thomas Connolly & Carolyn Begg "Database Systems : A practical approach to design, implementation & Management" Pearson 3rd Edition
2	RamezElmasri and ShamkantNavathe, "Fundamentals of Database Systems" Benjamin Cummings, 2nd Ed, 1994.
3	Open source databases official websites
4	W. H. Inmon, "Building the Data Warehouse" Wiley Dreamtech India Pvt. Ltd...
5	RALPH KIMBALL, "The Data Warehouse Life cycle Tool kit" WILEY STUDENT EDITION

Useful Links	
1	https://nptel.ac.in/courses/106/106/106106093/
2	https://freevideolectures.com/course/2280/database-design/37
3	https://onlinecourses.nptel.ac.in/noc21_cs04/preview
4	https://onlinecourses.nptel.ac.in/noc21_cs58/preview
5	https://docs.oracle.com/en/database/oracle/oracle-database/21/dwhsg/

CO-PO Mapping

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

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 VI
Course Code	6CS323
Course Name	Machine Learning
Desired Requisites:	Basic knowledge of mathematics 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 acquaint students with the meaning, purpose, scope, stages, applications, and effects of machine learning concepts.
2	To share the basic tasks and algorithms in machine learning.
3	To provide understanding of how system learns in supervised and unsupervised learning.
4	To understand how machine learning algorithms works for real life problems.

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 techniques in Exploratory Data Analysis (EDA) and Machine Learning (ML) tasks.	II	Understanding
CO2	use different ML algorithms to provide solution for various problems.	III	Applying
CO3	identify different learning paradigms, EDA and ML techniques to solve real world problems.	IV	Analysing
CO4	assess the performance of various machine learning algorithms using standard performance metrics.	V	Evaluating

Module	**Module Contents**	**Hours**
I	**Data and Exploratory Data Analysis** Data types and sources, Data summarization, Data visualization, Data pre-processing, Types of learnings	6
II	**Supervised Machine Learning: Regression** Linear regression, Multiple linear regression, Train, dev and test dataset, Performance measure, Bias-variance trade off, Regularization	7
III	**Supervised Machine Learning: Classification** **Binary classification:** Logistic regression, Decision tree based CART, C4.5, SVM, **Multi-class classification:** Multiclass, Multi-label paradigms, Extension of SVM; **Ensemble methods:** Bagging, Boosting, Random Forest	7
IV	**Supervised learning: Advanced** Introduction, Logistic regression using single neuron, Implementing neural networks in python, Activation functions, Multi-layer perceptron, Hyperparameters	7
V	**Unsupervised Learning** **Anomaly Detection:** Introduction, Basic techniques for univariate data, LOF, iForest, **Clustering:** Introduction, BIRCH, Fuzzy clustering	6

VI	**Reinforcement Learning and case study** Introduction, Elements of RL, Bellman equation, Q-learning, Recommender system, Case study of the state-of-the-art application	7

Textbooks	
1	Andriy Burkov , The Hundred-Page Machine Learning Book
2	Mitchell T. M., "Machine Learning", MGH
3	Marsland S., "*Machine Learning: An Algorithmic Perspective*", Chapman & Hall/CRC, 2nd edition 2014.
4	Oliver Theobald, Machine Learning for Absolute Beginners

References	
1	AI and Machine Learning For Coders: A Programmer's Guide to Artificial Intelligence by Laurence Moroney
2	Machine Learning in Action by Peter Harrington

Useful Links	
1	Introduction to Machine Learning Course on NPTEL: Link
2	Machine Learning Specialization on deeplearning.ai: 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										2	
CO2	3	2	2						2				1	
CO3	2	3	2						2	2			2	2
CO4	2	2	1						2				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)

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 VI
Course Code	6CS371
Course Name	Advanced Database System Laboratory
Desired Requisites:	Database Engineering

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

Course Objectives

1	Practicing the concepts/techniques studied in theory course.
2	Providing hands-on with different database servers / platforms / tools.
3	Designing and implementation of the database based applications.

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	Scrutinize different database servers, application architectures / models, frameworks and identify optimal one, suitable for particular application.	IV	Analyze
CO2	Select the advanced/modern databases and recommend for prediction and modelling of complex real world data.	V	Evaluate
CO3	Design and build the different enterprise applications using modern tools.	VI	Create

List of Experiments / Lab Activities/Topics

List of Topics(Applicable for Interaction mode):

List of Lab Activities:

1. Minimum 12 assignments or 6 mini-projects should be practice/perform based on the understanding of concepts covered in theory course.
2. The detail list of assignments/mini-projects will be display by subject teacher.
3. Explore to all the state of the art technology related to each module in theory course.
4. Use industry standard development tools for above laboratory work.
5. All assignments/laboratory work should follow software engineering standards.

Textbooks

1	Silberschatz, Korth, Sudarshan "Database system concepts" MGH 4th Edition
2	Raghu Ramkrishnan "Database Management System" MGH

References

1	Thomas Connolly & Carolyn Begg "Database Systems : A practical approach to design, implementation & Management" Pearson 3rd Edition

2	RamezElmasri and ShamkantNavathe, “Fundamentals of Database Systems” Benjamin Cummings 2nd Ed, 1994
3	Official websites of open source databases
Useful Links	
1	Parallel processing :- https://docs.oracle.com/cd/A58617_01/server.804/a58238/ch2_succ.htm
2	Distributed database:- https://docs.oracle.com/database/121/ADMIN/ds_concepts.htm#ADMIN12134
3	www.mongodb.com , https://cassandra.apache.org
4	https://neo4j.com/developer/cypher/

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1													2	
CO2					2								2	
CO3					3						1		2	3
CO4													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 Engineering)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	6CS372
Course Name	Machine Learning Lab
Desired Requisites:	Knowledge of mathematics, statistics and 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 perform practical implementation of the different ML algorithms and techniques.
2	To introduce application machine learning algorithms to real-life problems.
3	To get insights of how pure ML algorithms can be used.
4	To develop research interest towards this field.

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 various Exploratory Data Analysis (EDA) techniques and Machine Learning (ML) algorithms on given dataset.	III	Applying
CO2	use python fundamentals, relevant libraries and tools for applying EDA and ML techniques.	III	Applying
CO3	study performance of supervised and unsupervised ML algorithms on a given dataset using standard performance metrics.	IV	Analysing
CO4	select specific learning paradigm and algorithm best suited for solving real life problems.	V	Evaluating

List of Experiments / Lab Activities/Topics

List of Topics (Applicable for Interaction mode):

List of Lab Activities:

1. Exploratory Data Analysis: Perform following operations on any open dataset available in Python/Kaggle:
   a. Load data into a data frame from a .cvs or any other file format.
   b. Identification of variables and data types.
   c. Display number of rows and columns.
   d. Find Missing Values.
   e. Replace/eliminate missing values
   f. Change column name(s) to short/easy names if required.
   g. Drop unessential columns (feature selection).
   h. Add new columns, if required.
   i. Display first/last n (=5 or 10) rows.
   j. Find mean/min/max of numeric columns.
   k. Find mode of non-numeric columns.
   l. Display unique values in each column.
   m. Display summary of dataframe.
2. Data visualization: Using various plots such as Scatter plot, bar graph, histogram, box plot, explore the relationship between attributes of a dataset using python or t-SNE.
3. Implement and train linear/multiple regression on any open dataset. Report accuracy and F - score.
4. Implement and train logistic regression on any suitable dataset. Report accuracy and F - score.
5. Implement and train SVM classification algorithm using python libraries. Report accuracy and F - score.
6. Implement and train CART for classification task. Report accuracy and F - score.
7. Implement and train single neuron network for logistic regression. Report accuracy and F - score.
8. Implement and train single neuron network for linear regression. Report accuracy and F - score.
9. Implement and train Random Forest. Report accuracy and F - score.
10. Implement LOF algorithm for anomaly detection.
11. Implement BIRCH clustering.
12. Implement Fuzzy-KMeans clustering.
13. Observe effect of dimensionality reduction by implementing a ML model with and without PCA.
14. Design and analyze reinforcement learning based problem.

Textbooks	
1	Bell J., "*Machine Learning Hands-On for Developers and Technical Professionals*", Wiley 2015
2	Müller, Andreas C., and Sarah Guido. Introduction to machine learning with Python: a guide for data scientists. " O'Reilly Media, Inc.", 2016.
3	Marsland S., "*Machine Learning: An Algorithmic Perspective*", Chapman & Hall/CRC, 2nd edition 2014.
References	
1	Grus, Joel. Data science from scratch: first principles with python. O'Reilly Media, 2019.
Useful Links	
1	Introduction to Machine Learning Course on NPTEL: Link
2	Machine Learning Course on Coursera: Link
3	Machine Learning with Python ebook 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								2	1
CO2	3	2	2	1	2								1	

CO3	2	3	3	1	2								2	2
CO4	1	1	1	1	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.

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AY 2023-24

Course Information

Programme	B.Tech. (Computer Science Engineering)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	6CS342
Course Name	Mini Project-II
Desired Requisites:	Nil

Teaching Scheme		**Examination Scheme (Marks)**			
Practical	4 Hrs/Week	**LA1**	**LA2**	**Mini project 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.Mini Project 2 should be on customer specific requirements useful to real life or industry specific, major focus should be on AI/Machine learning /Cyber Security/cloud computing/ Image Processing / Internet (Web) of Things

2. At the end of the semester the project group should achieve all the proposed objectives of the problem statement.

3. The work should be completed in all aspects of design, implementation and testing.

4. Project report should be prepared and submitted in soft and hard form along with all the code and datasets.

5. Group should demonstrate the work with various test cases and results obtained and explain future scope.

6. The group should participate in technical symposiums, paper presentations to demonstrate their work and findings in technical community.

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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Course Information	
Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	6CS331
Course Name	Elective II:Remote Sensing &GIS
Desired Requisites:	Fundamentals of Image processing

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 the fundamentals of Remote Sensing (RS) and geographical information systems (GIS)
2	To explore various Remote Sensing satellites, their characteristics and data products
3	To inculcate advantages, limitations and interdisciplinary applications of RS and GIS

Course Outcomes (CO) with Bloom's Taxonomy Level		
CO1	explain fundamental concepts of RS and GIS	Understanding
CO2	Interpret and Demonstrate various satellite sensor data, GIS data collected from different resources and GIS database management system.	Applying
CO3	compare and Analyze RS and GIS data using modern tools and techniques	Analyzing
CO4	select and Verify suitable RS and GIS data and data products to design solutions for various interdisciplinary problems using RS and GIS tools and techniques.	Evaluating

Module	Module Contents	Hours
I	**Concepts and Foundation of Remote Sensing** Introduction, Remote Sensing System, Electromagnetic Energy, Electromagnetic Spectrum and its Characteristics, Energy Interaction in the Atmosphere and with the Earth‟s Surface, Resolution in Remote Sensing, Applications of Remote Sensing.	7
II	**Sensors, Platforms and Satellite Data Products** Broad Classifications of Sensors and Platform, Earth Observation Satellite and Sensors, Data Reception, Transmission and Processing, Remote Sensing Data and Data Products	6
III	**Satellite Image Interpretation and Processing** Interpretation Procedure and Elements, Interpretation strategies and keys, Digital Image processing and Image Analysis steps, Image Rectification and Restoration, Image Enhancement, Image Transformation	7

IV	**GIS – An Overview** Introduction, Geographical concepts and Terminology, Difference between Image Processing system and GIS, Various GIS packages and their salient features, Essentials components of GIS, Utility of GIS, Applications of GIS, GPS, Introduction to ArcGIS	7
V	**GIS Data** Introduction, GIS Data types and Data Representation, Data Acquisition, Georeferencing of GIS Data, Raster and Vector data, Remote Sensing Data in GIS, GIS Database and Database Management System	7
VI	**Spatial Data Analysis** Measurements in GIS-Lengths, Perimeters, and Areas, Queries, Reclassification, Buffering and Neighborhood Functions, Map Overlay, Spatial Interpolation	5

Text Books	
1	Chandra, A.M. and Ghosh, S.K., "Remote Sensing and GIS", Narosa Publishing House. 2008
2	Lo, C.P. and Young, A.K.W., "Concepts and Techniques of Geographical Information System", Prentice Hall India. 20012
3	

References	
1	Lillesand, T.M. and Kieffer, "Remote Sensing and Image Interpretation", - 6th Edition, John Wiley and Sons. 2012
2	Chang, K, "Introduction to Geographical Systems", 4th Edition, Tata McGraw-Hill. 2010

Useful Links	
1	https://nptel.ac.in/noc/courses/noc19/SEM1/noc19-ce08
2	https://nptel.ac.in/noc/courses/noc18/SEM1/noc18-ce10
3	https://www.usgs.gov
4	https://bhuvan.nrsc.gov.in/bhuvan_links.php#

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													
CO3		2			3				1				3	
CO4			2		2								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

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 VI
Course Code	6CS332
Course Name	Professional Elective II - Soft Computing
Desired Requisites:	Basic knowledge of 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	Understand comparative performance of soft and hard computing approaches.
2	Provide to students a sound foundation of mathematical, scientific and engineering principles to formulate, solve and analyse learning problems using soft computing.
3	Imbibe capability for innovation in soft computing.
4	Understand hybrid applications of ANN, Fuzzy and GA

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO1	Interpret soft computing schemes using knowledge of discrete mathematics, data structures, theory of computer science and computer architectures.	Understanding
CO2	Demonstrate machine learning processes.	Applying
CO3	Design schemes using soft computing	Applying
CO4	Compare and analyse soft computing schemes.	Analysing
CO5	Evaluate various schemes of soft computing	Evaluating

Module	**Module Contents**	**Hours**
I	**Module 1: Fundamentals of Neural Networks** Introduction: Soft Computing vs. Hard Computing, Why Soft Computing? Basics: Human Brain, Model of Artificial Neuron, Neural Network Architectures, Characteristics of Neural Networks, Learning Methods; McCulloch-Pitts model.	6
II	**Module 2: Back Propagation Networks (BPN)** BPN Architecture, Back propagation learning, applications: Parity Problem, Encoder Decoder, CNN, RCNN, LeNet, AlexNet, Case study on Post-Blast Re-Entry Time Prediction.	7
III	**Module 3: Unsupervised Learning** Introduction, Self-Organising Maps, ARTI Architecture, ART1 Algorithm, Applications of ART1, case study on anomaly detection	7
IV	**Module 4: Fuzzy Systems** Introduction to Fuzzy logic, Fuzzy sets and membership functions, Operations on Fuzzy sets, Fuzzy relations, rules, propositions, implications and inferences, Defuzzification techniques, Fuzzy logic controller design, Some applications of Fuzzy logic.	7
V	**Module 5: Genetic Algorithm** Concept of "Genetics" and "Evolution" and its application to probabilistic search techniques, Basic GA framework and different GA architectures, GA operators: Encoding, Crossover, Selection, Mutation, etc.	7

	Solving single-objective optimization problems using GAs.	
VI	**Module 6: Hybrid Systems** Integration of neural networks, fuzzy logic and genetic algorithms: Hybrid Systems; Neuro-Fuzzy hybrids, Neuro-Evolutionary Hybrids, Fuzzy-Evolutionary Hybrids, GA-based BPN, Simplified Fuzzy ARTMAP.	5

Text Books	
1	"Neural Networks, Fuzzy Logic and Genetic Algorithms", S. Rajasekaran, G. A. VijayalakshmiPai, PHI (ECE).
References	
1	MIT-OCW
2	Hertz, Krogh, Palmer"Introduction to the Theory of Neural Computation"
3	B. Yegnanarayana, PHI, "Artificial Neural Networks"
4	David E. Goldberg, Addison Wesley, "Genetic Algorithms"
Useful Links	
1	https://cse.iitkgp.ac.in/~dsamanta/courses/sca/index.html

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	
CO3	3	1												
CO4		2	1						1	1			2	
CO5		1	2						1	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.

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 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 VII
Course Code	6CS333
Course Name	Elective II (Wireless Sensor Network)
Desired Requisites:	Computer Networks

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

Course Objectives

1	To introduce various protocols required to understand the working of WSN.
2	To develop skills to solve real-world problems..
3	To introduces latest trends in WSN.
4	

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	realize concepts, needs and constraints related to WSN.	II	Understanding
CO2	illustrate challenges and technologies for wireless networks	III	Applying
CO3	analyze various network architecture, protocols, communication & processing mechanism used with WSN.	IV	Analysing
CO4	apply integrations, nodes, tools & techniques to Crete applications pertaining to domain specific requirements effectively	V	Evaluating

Module	**Module Contents**	**Hours**
I	**WSN CONCEPTS & ARCHITECTURES** **Concepts**: Need, Challenges, Benefits, Design principles & Enabling Technologies for Wireless Sensor Networks. Data acquisition, Preprocessing analysis & Mining. **Architecture** Single Node & 3 layer Architecture – Four Components [Sensing, Processing, Trans-receiver & Power unit], Energy Consumption of Sensor Nodes, Optimization Goals and Figures of Merit	7
II	**WSN NETWORK AND PROTOCOLS** Network types, Devices, Communications. Classifications (static, mobile, deterministic & Non-deterministic) MAC Protocols, Low Duty Cycle Protocols And Wakeup Concepts – S-MAC, The Mediation Device Protocol, Contention based protocols – PAMAS, Schedule based protocols, Routing Protocols Energy Efficient Routing, Challenges and Issues in Transport layer protocol	7
III	**WSN Interoperability:** IoT, Cloud platforms, Drones, Robotics, AR/VR and AI, Coverage and connectivity issues in WSN Localization techniques in WSN.	6

IV	**NODES, PLATFORMS & TOOLS** Sensor Node Hardware – Berkeley Motes, Programming Challenges, Nodelevel software platforms – TinyOS, nesC, CONTIKIOS, Node-level Simulators – NS2 and its extension to sensor networks, COOJA, TOSSIM, Programming beyond individual nodes – State centric programming.	7
V	**SENSOR NETWORK PRIVACY & SECURITY** Network Security Requirements, Issues and Challenges in Security Provisioning, Network Security Attacks, Layer wise attacks in wireless sensor networks, possible solutions for jamming, tampering, black hole attack, flooding attack. Key Distribution and Management, Secure Routing – SPINS, reliability requirements in sensor networks	7
VI	**APPLICATION DOMAINS & CASE STUDIES** **Domains**: Surveillance, HealthCare & Medical, IoT, Forecasting etc. **Potential Case studies**: Under Water Sensor Network, Environmental monitoring, Industrial automation and control, Smart cities and Internet of Things (IoT) integration, Case studies based on 5G/6G, Smart devices and mobile emerging technologies	6

Textbooks	
1	C. Siva Ram Murthy and B. S. Manoj, ―Ad Hoc Wireless Networks Architectures and Protocols‖, Prentice Hall, PTR, 2004.
2	Holger Karl , Andreas willig, ―Protocol and Architecture for Wireless Sensor Networks‖, John wiley publication, Jan 2006.
3	"Wireless Sensor and Robot Networks: From Topology Control to Communication Aspects" by Abdelhamid Mellouk and Nadjib Badache.

References	
1	Feng Zhao, Leonidas Guibas, ―Wireless Sensor Networks: an information processing approach‖, Elsevier publication, 2004
2	Charles E. Perkins, ―Ad Hoc Networking‖, Addison Wesley, 2000.

Useful Links	
1	Wireless Ad Hoc and Sensor Networks- https://nptel.ac.in/courses/106105160
2	https://www.coursera.org/learn/smart-device-mobile-emerging-technologies

CO-PO Mapping

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

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2023-24

Course Information

Programme	B.Tech. (Computer Science Engineering)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	6CS381
Course Name	Elective III Lab: iOS Lab
Desired Requisites:	Programming Lab III

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

Course Objectives

1	To inculcate understanding of swift fundamentals for iOS mobile app development.
2	To introduce selection of appropriate concepts of swift fundamentals for iOS mobile app development.
3	To infuse skills of combining different components for iOS mobile app development 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,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	illustrate the concepts of fundamentals of Swift for iOS application development	III	Applying
CO2	test the concepts and components of swift for iOS app development technologies	IV	Analysing
CO3	select appropriate components of swift for iOS app development technologies to solve real-world problems.	V	Evaluating
CO4	build an iOS app, individually or in a team by combining Swift iOS app development concepts for real-world problems.	VI	Creating

List of Experiments / Lab Activities/Topics

List of Lab Activities:

Experiments based on the following concepts will be conducted.

Module 1: Getting Started with App Development

Introduction to swift and playground (Xcode 14), debugging, building and running an app, and Interface Builder

Module 2: Swift Language Basics

Core Data Types, Constants & Variables, String Type, Tuples & Optionals, Statements &Operators, Control Flow & Decisions, Functions, Strings

Module 3: Basic Object-Oriented Programming using Swift

Structures: Types versus instances, Member and static methods, Custom initialization & De-initialization, Classes: Initialization, Methods, Properties

Module 4: Introduction to UIKit

Introduction to UIKit, Displaying Data, Controls in Action, Auto Layout and Stack Views

Module 5: Navigation and Workflows

Optionals, Type Casting and Inspection, Guard, Constant and Variable Scope, Enumerations, Segues and Navigation Controllers

Module 6: Build Your App

Application design cycle, iterate over the design, create a prototype

Textbooks	
1	Develop in swift fundamentals – Apple Education
2	Develop in swift Data Collections - Apple Education
References	
1	Develop in swift fundamentals notes
2	Best Book for Step-by-step Learners: Swift: A Step-by-Step Guide for Absolute Beginners by Daniel Bell
Useful Links	
1	https://docs.swift.org/swift-book/GuidedTour/GuidedTour.html
2	https://docs.swift.org/swift-book/documentation/the-swift-programming-language/

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1				3	2								1	2
CO2				2	2								1	1
CO3				2	2								1	1
CO4				2	2								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, 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 and Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	6CS382
Course Name	Professional Elective III- Robotics Lab
Desired Requisites:	Basic programming skills (e.g., proficiency in Python or C++) Understanding of linear algebra and calculus Familiarity with algorithms and data structures

Teaching Scheme		Examination Scheme (Marks)			
Lecture	-	**ISE**	**MSE**	**ESE**	**Total**
Tutorial	-	20	30	60	100
Practical	2 Hrs/week				
Interaction	1 Hrs/week	**Credits: 2**			

Course Objectives	
1	Understand the fundamental concepts and terminologies related to robotics.
2	Design and analyze the kinematics and dynamics of robotic systems.
3	Implement robot perception algorithms for sensing and interpreting the environment.
4	Develop motion planning algorithms to generate optimal robot trajectories.
5	Design and implement robot control algorithms for various tasks.
6	Gain practical experience in programming and controlling robotic systems.

Course Outcomes (CO) with Bloom's Taxonomy Level		
CO1	Apply kinematic equations to solve robot manipulator positioning problems.	Applying
CO2	Analyze the performance of a robotic system based on kinematic and dynamic models.	Analyzing
CO3	Evaluate the impact of uncertainty and noise on robot perception and control algorithms.	Evaluating
CO4	Create novel solutions by integrating perception, planning, and control algorithms for a given robotic application.	Creating

Module	Module Contents	Hours

I	Introduction to Robotics • Definition of robotics • History and evolution of robotics • Applications and domains of robotics Robot Kinematics and Dynamics • Coordinate systems and transformations • Forward and inverse kinematics • Jacobians and velocity control • Robot dynamics and control	02
II	Robot Perception • Sensor types and characteristics • Localization and mapping • Object recognition and tracking • Introduction to computer vision techniques	02
III	Motion Planning • Path planning algorithms (e.g., A*, Dijkstra's) • Sampling-based algorithms (e.g., RRT, PRM) • Trajectory generation and optimization • Collision avoidance techniques	02
IV	Robot Control • PID control and its variants • Adaptive and robust control • Force and impedance control • Task-level control and behavior-based architectures	02
V	Robot Programming and Simulation • Robot programming languages (e.g., ROS, Python) • Simulation environments (e.g., Gazebo, V-REP) • Integration of perception, planning, and control	02
VI	Robot Applications and Emerging Trends • Robotic manipulation • Mobile robotics and autonomous navigation • Human-robot interaction • Current trends in robotics research and industry • Automated drone Application and its demonstration	03

Experiment List

Introduction to Robotics:

- Introduction to basic robotic hardware and components.
- Familiarization with robotic systems and architectures.
- Basic programming of robotic systems using robot-specific languages or platforms.

Robot Control and Motion Planning:

- Implementing basic robot control algorithms (e.g., open-loop control, closed-loop control).
- Programming robot movements and trajectories.
- Implementing motion planning algorithms for robot path planning.

Sensors and Perception:

- Working with different sensors used in robotics (e.g., proximity sensors, range finders, vision sensors).
- Calibrating and integrating sensors with the robot system.
- Implementing perception algorithms for tasks such as object detection, tracking, and localization.

Robot Localization and Mapping:

- Implementing localization techniques (e.g., odometry, sensor fusion) to determine the robot's position in the environment.
- Implementing mapping algorithms to create a map of the robot's surroundings.
- Implementing Simultaneous Localization and Mapping (SLAM) algorithms.

Robot Vision and Image Processing:

- Implementing image processing techniques for robot vision tasks.
- Implementing object recognition and tracking algorithms.
- Integrating vision capabilities for tasks such as pick-and-place or visual servoing.

Robot Path Planning and Navigation:

- Implementing path planning algorithms (e.g., A*, Dijkstra's algorithm) for robot navigation.
- Implementing obstacle avoidance algorithms for safe robot movement.
- Integrating perception, localization, and mapping for autonomous robot navigation.

Robot Manipulation and Grasping:

- Implementing robot manipulation algorithms for tasks like pick-and-place or object manipulation.
- Implementing grasping algorithms to enable the robot to grasp and manipulate objects.
- Designing end-effectors and grippers for specific manipulation tasks.

Human-Robot Interaction:

- Implementing human-robot interaction techniques (e.g., speech recognition, gesture recognition).
- Developing robot behavior and interaction protocols for specific applications.
- Designing and implementing interfaces for intuitive robot control and communication.

Robot Simulations and Virtual Environments:

- Using simulation environments (e.g., ROS, Gazebo) to simulate robot behavior and test algorithms.
- Creating virtual robots and environments for testing and evaluation.
- Developing and testing robot algorithms in simulated environments.

Mini-Project/Robot Competition:

- Working on a mini-project or participating in a robot competition.
- Designing and implementing a complete robotic system to solve a specific task.
- Integrating multiple robotics concepts and technologies into a practical application.

Text Books	
1	"Robotics: Modelling, Planning, and Control" by Roland Siegwart, et al. Link: https://link.springer.com/book/10.1007/978-3-319-60042-0
2	"Robotics: Science and Systems" edited by Sebastian Thrun, et al. Link: http://www.roboticsproceedings.org/
3	"Introduction to Robotics: Mechanics and Control" by John J. Craig Link: http://cat.middlebury.edu/~shields/jennings/classes/s09/cs462/materials/craig-introduction_to_robotics_mechanics_and_control.pdf
4	"Robotics, Vision and Control: Fundamental Algorithms in MATLAB" by Peter Corke Link: http://www.petercorke.com/RVC/
5	"Robotics: Discover the Science and Technology of the Future" by Harry Henderson Link: https://archive.org/details/Robotics_202102
6	"Robotics: A Project-Based Approach" by James L. Adams Link: https://archive.org/details/roboticsprojectb00adam
References	
1	"Introduction to Autonomous Robots: From Kinematics to Control" by Nikolaus Correll, et al.
2	"Robotics: Modelling, Planning, and Control" by Roland Siegwart, et al.
3	"Introduction to Robotics: Mechanics and Control" by John J. Craig
4	"Robotics, Vision and Control: Fundamental Algorithms in MATLAB" by Peter Corke
Useful Links	
1	https://www.ros.org/
2	http://www.petercorke.com/RTB/
3	http://gazebosim.org/
4	https://gym.openai.com/
5	https://robotacademy.net.au/
6	(https://www.cyberbotics.com/) and RoboDK (https://robodk.com/).

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

Assessment
The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level (Marks)					
Bloom's Taxonomy Level		**LA1**	**LA2**	**ESE**	**Total**
1	Remember				
2	Understand	10	5	5	20
3	Apply	5	15	5	25
4	Analyze	5	10	25	40
5	Evaluate			15	15
6	Create				
Total		**20**	**30**	**50**	**100**

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 VI
Course Code	6OE378
Course Name	Open Elective II - Soft Computing
Desired Requisites:	

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	Understand comparative performance of soft and hard computing approaches.
2	Provide to students a sound foundation of mathematical, scientific and engineering principles to formulate, solve and analyse learning problems using soft computing.
3	Imbibe capability for innovation in soft computing.
4	Understand hybrid applications of ANN, Fuzzy and GA

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO1	describe soft computing techniques.	Understand
CO2	illustrate different Artificial Neural Network processes.	Apply
CO3	illustrate different fuzzy logic and genetic algorithm techniques.	Apply
CO4	Compare and analyse soft computing schemes.	Analyse

Module	**Module Contents**	**Hours**
I	**Module 1 Introduction to Soft Computing and Fundamentals of Neural Networks:** Introduction: Soft Computing, Soft Computing Vs. Hard Computing. Neural Networks, Fuzzy Logic, Genetic Algorithms. Artificial Neural Network: Fundamental Concept, Evolution of Neural Networks, Basic Models of Artificial Neural Network, Important Terminologies of ANNs	7
II	**Module 2 Supervised Learning Network:** Perceptron Networks, Adaptive Linear Neuron (Adaline), Multiple Adaptive Linear Neurons, Back-Propagation Network, Radial Basis Function Network, Time Delay Neural Network, Functional Link Networks, Tree Neural Networks.	7
III	**Module 3 Unsupervised Learning Networks:** Fixed Weight Competitive Nets, Kohonen Self- Organizing Feature Maps, Learning Vector Quantization, Counter propagation Networks, Adaptive Resonance Theory Network Stability Analysis of a Class of Artificial Neural Network Systems: Stability Conditions of a Class of Non-Linear Systems	5
IV	**Module 4 Introduction to Fuzzy Logic and Fuzzy Logic Controller:** Classical Sets and Fuzzy Sets, Fuzzy Relations, Membership Functions, Operations on Fuzzy sets, Fuzzification Methods, Defuzzification Methods **Fuzzy Rule Base and Approximate Reasoning:** Truth Values and Tables in Fuzzy Logic, Fuzzy Propositions, Formation of Rules, Decomposition of Rules, Aggregation of Fuzzy Rules, Fuzzy Reasoning, Fuzzy Inference Systems, Fuzzy Expert System, Fuzzy Decision Making **Fuzzy Logic Control Systems:** Control System Design, Architecture and Operation of FLC System, FLC System Models, Application of FLC	8

	Systems	
V	**Module 5 Genetic Algorithm** Fundamentals: Biological background, Creation of Offsprings, Working Principle, Encoding, Reproduction ; Mathematical Foundations; Data Structure: Mutation, Crossover, Selection; Applications	7
VI	**Module 6 Hybrid Systems** Integration of neural networks, fuzzy logic and genetic algorithms: Hybrid Systems; Neuro-Fuzzy hybrids, Neuro-Evolutionary Hybrids, Fuzzy-Evolutionary Hybrids, GA-based BPN, Simplified Fuzzy ARTMAP. Applications of Soft Computing to different engineering systems.	5

Text Books	
1	"Neural Networks, Fuzzy Logic and Genetic Algorithms",S. Rajasekaran, G.A.VijayalakshmiPai, PHI (ECE).
2	Principles of Soft Computing, S. N. Sivanandam and S. N. Deepa, John Wiley & Sons, 2018, 3rdEdition.

References	
1	Hertz, Krogh, Palmer"Introduction to the Theory of Neural Computation"
2	B. Yegnanarayana, PHI, "Artificial Neural Networks"
3	David E. Goldberg, Addison Wesley, "Genetic Algorithms"
4	Fusion of Neural Networks, Fuzzy Systems and Genetic Algorithms: Industrial Applications, Lakshmi C. Jain, N. M. Martin, CRC Press, 1998.

Useful Links	
1	https://cse.iitkgp.ac.in/~dsamanta/courses/sca/index.html

CO-PO Mapping

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

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 2023-2024

Course Information	
Programme	Third Year B.Tech
Class, Semester	Sem I and Sem II
Course Code	6HS303
Course Name	Humanities II : German Language
Desired Requisites:	10+2 level English

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

Course Objectives	
1	To acquire German language skills both written and spoken
2	Enable students to communicate in German language in day to day situations

Course Outcomes (CO) with Bloom's Taxonomy Level		
CO1	Communicate clearly in German in different scenario	Apply
CO2	Handle oral and written communications in German language confidently	Understand

Module	**Module Contents**	**Hours**
I	**Module 1 : Greetings** 1. To introduce oneself and others 2. Greeting people/colleagues at office/work-place etc. 3. Exchanging information about country of origin 4. Place of residence, professions 5. Things that we eat and drink	4
II	**Module 2 :** 1. Date and Days of Week 2. Names of months 3. Numbers 1 to 1000 4. Names of Continents, Countries and their Capitals 5. Languages and Nationalities, main cultural festivals 6. Health and Parts of body	5
III	**Module 3 :** **Sentence Structure and Vocabulary Building** 1.Alphabet, 2.Personal Pronouns 3.German Articles 4.Genders 5.Plural Forms 6. Nouns	2
IV	**Module 4 :Grammar** 1.Forming questions, 2.Prepositions, 3. Conjunctions,4.Verbs ,5.Dative and Accusative forms with examples, 6. Opposites	6
V	**Module 5 : Oral Communication** 1. Asking for and telling telephone numbers with dial code numbers 2. Making request 3. Word order in sentences/statements and full question 5. Speak on given topic 6. Asking questions (Forming Question)	5

VI	**Module 6** : **Written Communication : Basic Writing Skills** 1. Paragraph Writing 2. Comprehension 3. Short Essay Writing 4. Filling in Personal Information	4

Text Books	
1	.Hartmut Auf der strasse, Heiko Bock, Mechthild Gerdes, Jutta Mueller, Helmut Mueller,"Themen Aktuell1- Deutsch als Fremdsprache-Kursbuch",Max Hueber Verlag,Munich,Germany and Langers International Pvt.Ltd.,New Delhi ,ISBN: 3-19-0001690-9,Reprint 2014
2	.Hartmut Auf der strasse, Heiko Bock, Mechthild Gerdes, Jutta Mueller,Helmut Mueller,"Themen Aktuell1- Deutsch als Fremdsprache-Arbeitsbuch",Max Hueber Verlag,Munich,Germany and Langers International Pvt.Ltd.,New Delhi ,ISBN: 3-19-011690-3,Reprint 201
3	Alan B, Jones A."Themen Aktuell 1- Deutsch als Fremdsprache - Glossar",Max Hueber Verlag, Munich,Germany and Langers International Pvt.Ltd.,New Delhi ,ISBN: 3-19-0001690-9,Reprint 2014
References	
1	Archana Gogate, "German Workbook", Shubhasha Publications,Pune, Reprint July 2016
2	Stefanie Dengler,Paul Rusch,Helen Schmitz,Tanja Sieber, "Netzwerk A1- Deutsch als FremdspracheKursbuch ",Klett Langenscheidt, Munich,Germany and GOYAL Publishers Pvt. Ltd.,New Delhi, First Indian edition-2015
3	Stefanie Dengler,Paul Rusch,Helen Schmitz,Tanja Sieber, "Netzwerk A1- Deutsch alsFremdspracheArbeitsbuch ",Klett Langenscheidt,Munich,Germany and GOYAL Publishers Pvt.Ltd.,New Delhi, First Indian edition-2015
4	Stefanie Dengler,Paul Rusch,Helen Schmitz,Tanja Sieber, Gavin Schalliol"Netzwerk A1- Deutsch alsFremdsprache- Glossar ",Klett Langenscheidt, Munich, Germany and GOYAL Publishers Pvt.Ltd.,New Delhi, First Indian edition-2015
Useful Links	
1	www.klett-sprachen.de/netzwerk
2	www.cornelsen.de/studio-d

CO-PO Mapping															
	Programme Outcomes (PO)												**PSO**		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1										1					
CO2										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.															

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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Course Information

Programme	Third Year B.Tech
Class, Semester	Sem I and Sem II
Course Code	6HS304
Course Name	Humanities II : French Language
Desired Requisites:	10+2 level English

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

Course Objectives

1	To acquire French language skills both written and spoken
2	Enable students to communicate in French language in day to day situations

Course Outcomes (CO) with Bloom's Taxonomy Level

CO1	Communicate clearly in French in different scenario	Apply
CO2	Handle oral and written communications in French language confidently	Understand

Module	Module Contents	Hours
I	**Module 1 :** 1. To introduce oneself and others 2. Greeting people/colleagues at office/work-place etc. 3. Exchanging information about country of origin 4. Place of residence, professions 5. Things that we eat and drink	4
II	**Module 2 :** 1. Date and Days of Week 2. Names of months 3. Numbers 1 to 1000 4. Names of Continents, Countries and their Capitals 5. Languages and Nationalities, main cultural festivals 6. Health and Parts of body	5
III	**Module 3 :** **Sentence Structure :** 1.Alphabet, 2.Personal Pronouns 3. French Articles 4.Genders 5.Plural Forms 6. Nouns	2
IV	**Module 4: Grammar** 1.Opposites ,2. Plurals, 3.preposition, 4. Adjectives,5. Gender, 6. Negation	6
V	**Module 5 : Spoken Language** 1. Asking for and telling telephone numbers with dial code numbers 2. Making request 3. Word order in sentences/statements and full question 5. Speak on given topic 6. Asking questions (Forming Question)	5

VI	**Module 6** : **Basic Writing Skills** 1. Paragraph Writing 2. Comprehension 3. Short Essay Writing 4. Filling in Personal Information	4

Text Books	
1	Jumelage
2	En Èchanges
Refe	

CO-PO Mapping															
	Programme Outcomes (PO)												**PSO**		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1										1					
CO2										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.															

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. (all branches)
Class, Semester	Third Year B. Tech., Sem. V/VI
Course Code	6HS306
Course Name	Humanities II: Introduction to Entrepreneurship
Desired Requisites:	--

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3Hrs/week	**LA1**	**LA1**	**ESE**	**Total**
Tutorial	-	30	30	40	100
Practical	-				
Interaction	-	**Credits: 2**			

Course Objectives	
1	To create the awareness among the students for innovation, startup and the entrepreneurial eco system.
2	To provide the platform of the entrepreneurial process for the generation of creative ideas to explore the feasibility of enterprise formation.
3	To provide the background, tools, and life skills to participate in the entrepreneurial process within a large company, in a new venture, or as an investor.

Course Outcomes (CO) with Bloom's Taxonomy Level		
CO1	**Exploit** the concept, meaning and features of entrepreneurship.	Apply
CO2	**Analyse** the business environment in order to identify business opportunities	Analyse
CO3	**Evaluate** the legal and financial conditions for starting a business venture.	Evaluate
CO4	**Interpret** the business plan, pitch to the investor and **build** the enterprise.	Create

Module	**Module Contents**	**Hours**
I	**THE ENTREPRENEURIAL PERSPECTIVE** The Entrepreneurial Mind-Set , Corporate Entrepreneurship , Generating and Exploiting New Entries	4
II	**FROM IDEA TO THE OPPORTUNITY** Human Centric Design Approaches, Creativity and the Business Idea , Identifying and Analysing Domestic and International Opportunities , Protecting the Idea and Other Legal Issues for the Entrepreneur	5
III	**FROM THE OPPORTUNITY TO THE BUSINESS PLAN** The Business Plan: Creating and Starting the Venture , The Marketing Plan , The Organizational Plan , The Financial Plan	4
IV	**FROM THE BUSINESS PLAN TO FUNDING THE VENTURE** Sources of Capital , Informal Risk Capital, Venture Capital, and Going Public	4
V	**FROM FUNDING THE VENTURE TO LAUNCHING, GROWING, AND ENDING THE NEW VENTURE** Strategies for Growth and Managing the Implications of Growth , Accessing Resources for Growth from External Sources , Succession Planning and Strategies for Harvesting and Ending the Venture	5

VI	**Case Study and Experience Sharing** Case study of 3 to 4 successful entrepreneurs covering above theory. Case study of 2 to 3 failure entrepreneurs.	4

Text Books	
1	Robert D. Hisrich, Michael P. Peters, Dean A. Shepherd , "ENTREPRENEURSHIP" MGH 10th Edition.
2	Howard , Allan , Donald "Entrepreneurship : Theory / Process / Practice" Cengage Learning 4th Edition
3	William Bygrave , Andrew Zacharakis "Entrepreneurship" Wiley 2nd Edition
References	
1	Lee A. Swanson "Entrepreneurship and Innovation Toolkit" 3rd Edition
2	Lee A. Swanson "BUSINESS PLAN DEVELOPMENT GUIDE" 8th Edition
3	Hitesh Jhanji "ENTREPRENEURSHIP AND SMALL BUSINESS MANAGEMENT" Lovely Professional University, India
Useful Links	
1	https://www.youtube.com/watch?v=uhU5I2LcshU
2	https://open.umn.edu/opentextbooks/textbooks/business-plan-development-guide
3	https://open.umn.edu/opentextbooks/textbooks/entrepreneurship-and-innovation-toolkit

CO-PO Mapping

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

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.(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.