Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2025-26

Course Information	
Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	7CS301
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 impart the 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	Compare and analyze the working of various phases of compiler	Analyzing
CO4	Verify and assess the working of various phases involved in design of a Compiler	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											3	
CO3		2	3											
CO4		2	3		1				1				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

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 2025-26

Course Information	
Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	7CS302
Course Name	Machine Learning
Desired Requisites:	Linear algebra, Calculus, Statistics, Analysis of algorithms

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 empower students to apply Machine Learning 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	understand data characteristics with Exploratory Data Analysis (EDA), basic ML concepts and categorize problems.	II	Understand
CO2	shortlist potential ML techniques for solving the problems.	III	Apply
CO3	scrutinize the model outcome, identify important factors and potentials workarounds.	V	Evaluate
CO4	customize or tweak textbook techniques for real-world adaption.	VI	Design

Module	**Module Contents**	**Hours**
I	**Foundational Maths** **Linear algebra**: Vector spaces, Basis vectors and rank, Matrix inversion, Eigen values and Eigen vectors, **Calculus:** Integration, Derivatives, **Statistics:** Basic distributions, Maximum likelihood estimation	6
II	**Exploratory Data Analysis** Data summarization, Data visualization, **Data pre-processing**: Normalization methods, Univariate and Multivariate Outlier Detection	6
III	**Linear Regression as a Foundational Model** Linear regression, Multiple linear regression, Polynomial regression, Residual analysis, Multi-collinearity, Influential outliers, Lasso and ridge regression	8
IV	**Supervised Machine Learning** **Binary classification:** Perceptron Learning, Logistic regression, Decision tree, **Multi-class classification:** Multiclass, Multi-label paradigms, Random Forest, Class imbalance problem **Non-linear Regression:** Decision tree, Random forest	8
V	**Unsupervised Learning** **Clustering:** Introduction, K-Means, DBSCAN, Hierarchical clustering, BIRCH, K-NN with K-D Tree	4
VI	**Model workflow and generalization** Categorical Data encoding, Feature engineering, Train-test split, K-fold cross validation, Hyper parameter tuning with grid search, Performance measure, and Feature importance, Bias-variance trade off, Regularization, **Ensemble methods:** Aggregation, Bagging, Stacking, Boosting	7

Textbooks	
1	Introduction to Machine Learning by Ethem Alpaydin, Publisher: MIT Press (any edition)
2	https://online.stat.psu.edu/stat501/
References	
1	Machine Learning by Tom Mitchell, Publisher: McGraw Hill
2	Pattern Recognition and Machine Learning by Christopher M. Bishop, Publisher: Springer
Useful Links	
1	StatQuest by Josh Stammer (YouTube channel): https://www.youtube.com/channel/UCtYLUTtgS3k1Fg4y5tAhLbw
2	Essence of calculus and linear algebra: https://www.youtube.com/watch?v=WUvTyaaNkzM
3	Essence of linear algebra: https://www.youtube.com/watch?v=WUvTyaaNkzM
4	Learning from data, course from Caltech, https://work.caltech.edu/telecourse

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									1	2	
CO2	3	2	2						2			1	1	
CO3	2	3	2						2	2		1	2	2
CO4	2	2	3						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)

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2025-26

Course Information	
Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	7CS303
Course Name	Computer Algorithms
Desired Requisites:	Data structures

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 and apply the algorithm analysis techniques.
2	To discuss an efficient algorithm for various problems
3	To explain and demonstrate different algorithm techniques for real-world problems
4	To compute and prove the complexity class of various algorithm 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	Discuss the fundamentals of algorithm design and analysis techniques.	II	Understanding
CO2	Utilise knowledge of computing and mathematics in algorithm design	III	Applying
CO3	Differentiate among 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	**Divide and Conquer Techniques** Multiplying square matrices, Strassen's algorithm for matrix multiplication, The substitution method for solving recurrences, The recursion-tree method for solving recurrences, The master method for solving recurrences, Proof of the continuous master theorem	7
II	**Greedy Technique** Greedy Technique – Container loading problem, Job sequencing with deadlines, Knapsack problem, Optimal Merge pattern, Huffman Trees.	6
III	**Dynamic Programming** Rod cutting, Matrix-chain multiplication, Elements of dynamic programming, Longest common subsequence, Optimal binary search trees	7
IV	**Amortized Analysis** Aggregate analysis, The accounting method, The potential method, Dynamic tables	5

V	**Graph Algorithms** The Bellman-Ford algorithm, Single-source shortest paths in directed acyclic graphs, Dijkstra's algorithm, Proofs of shortest-paths properties, Shortest paths and matrix multiplication, The Floyd-Warshall algorithm	7
VI	**Complexity classes and Approximation algorithms:** P, NP, NP Complete and NP Hard Problems, Approximation Algorithms for NP-Hard Problems, Traveling Salesperson Problem, n*n - Queen Problem, Sum of Subsets, Problem, Graph Colouring	7

Textbooks	
1	Thomas Cormen, Leiserson, Rivest, and Stein "Introduction to Algorithms", PHI Publication. 3rd Edition, 2009
2	Aho, Hopfcraft and Ullman, Addison Wesley "Design and Analysis of Algorithms"
3	Ellis Horowitz, Sartaj Sahni and Rajasekaran. "Fundamentals of Computer Algorithms" , Galgotia Publications, 2nd Edition.

References	
1	Goodman ,"Introduction to Design and Analysis of Algorithm", McGraw Hill.
2	R.C.T. Lee, S.S. Tseng, R.C. Chang, "Introduction to the Design and Analysis of Algorithm", Tata

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	2											1	2	
CO2	3	1		2								1	3	
CO3		3		2								1	2	
CO4			3									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 typically be on modules 1 to 3. ISE shall be taken throughout the semester in the form of a teacher's assessment. The mode of assessment can be a 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 of 40% marks in ESE are needed. (ESE shall be a separate head of passing)

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2025-26

Course Information	
Programme	B.Tech. (Computer Science Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	7CS345
Course Name	Mini Project-1
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 inculcate skills required for implementing 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	compare existing systems or solutions to identify gaps, and define a clear, achievable scope for the proposed project.	II	Understanding
CO2	design an effective and feasible solution for the identified problem and outline a suitable methodology for its implementation.	III	Applying
CO3	identify and use modern engineering tools, software, and techniques required for project implementation.	IV	Analyzing
CO4	validate the developed solution using multiple test cases and evaluate its performance against defined criteria and benchmarks.	V	Evaluating
CO5	build a working prototype or final solution and prepare professional documentation including design reports, technical papers, and presentations.	VI	Creating

List of Experiments / Lab Activities/Topics

List of Lab 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
CO2			3										2	2
CO3			2		3						1	1	2	2
CO4	2			3								1	2	2
CO5						1	1	2	2	2	2	1	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.				

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2025-26

Course Information

Programme	B.Tech. (Computer Science Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	7CS351
Course Name	Computer Algorithms Lab
Desired Requisites:	Data Structures

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

Course Objectives

1	Learn key techniques for designing and analysing algorithms.
2	Study fundamental concepts and notations used in Algorithm design.
3	Study and apply different algorithm design methods namely, greedy method, divide and conquer, dynamic programming, and backtracking.
4	Design and analyze the complexities of various algorithms following

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	Apply
CO2	Identify an appropriate data structure to implement selected algorithmic approach	IV	Analyze
CO3	Design and Implement an algorithm for complex problem in polynomial time.	V	Evaluate
CO4	Exhibit technical and professional skill to demonstrate and convince accomplished algorithmic solution.	VI	Create

List of Experiments / Lab Activities/Topics

List of Lab Activities:

Students will be given hands-on experience to design and implement efficient and effective algorithms for various problems based on the syllabus covered in the course Computer Algorithms in the Practical hours using any suitable programming language like C, C++, Java. The List of experiments may include 12 to 14 experiments from among the following-

1. Write a program that solves recurrence relations using the master method. Accept input in the form T(n) = aT(n/b) + f(n) and determine time complexity.
2. To implement a sorting and searching algorithms using an array as a data structure and analyze its time complexity for different values of n. The large number of elements may be generated using a Random Number generator or may be stored in a file. (Quick Sort, Merge Sort, Linear, Binary, Binary recursive)
3. To implement the Fractional Knapsack problem and activity selection problem using Greedy method.
4. Find the Minimum Cost Spanning Tree of a given undirected graph using Kruskal's & Prim's algorithm and compare.
5. To apply the Greedy method to solve problems of
   a) Job sequencing with deadlines
   b) Optimal storage on tapes
6. Implement the following using Dynamic Programming
   a) Matrix-chain multiplication
   b) Longest common subsequence
   c) Optimal binary search trees
   d) Rod Cutting Problem
7. To implement Strassen's matrix multiplication algorithm
8. From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm.
9. Find a subset of a given set S = {s1,s2,.....,sn} of n positive integers whose sum is equal to a given positive integer d. For example, if S= {1, 2, 5, 6, 8} and d = 9 there are two solutions {1,2,6} and {1,8}. A suitable message is to be displayed if the given problem instance doesn't have a solution.
10. Implement any scheme to find the optimal solution for the Traveling Salesperson problem and then solve the same problem instance using any approximation algorithm and determine the error in the approximation.
11. Implement the following using Back Tracking
    a) 8-Queen's problem
    b) Hamiltonian cycle
    c) Graph coloring Problem
12. Implement All-Pairs Shortest Paths Problem using Floyd's algorithm. Parallelize this algorithm by creating multiple threads and determine the speed-up achieved.
13. Compare and evaluate the performance of different Randomization and Approximation algorithms

Textbooks	
1	Thomas Cormen, Leiserson, Rivest, and Stein "Introduction to Algorithms", PHI Publication. 3rd Edition, 2009
2	Aho, Hopfcraft and Ullman, Addison Wesley "Design and Analysis of Algorithms"
3	Ellis Horowitz, Sartaj Sahni and Rajasekaran. "Fundamentals of Computer Algorithms" , Galgotia Publications, 2nd Edition.
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", Tata
Useful Links	
1	https://www.codechef.com/roadmap/data-structures-and-algorithms
2	Learn Data Structures and Algorithms - Roadmap

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				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.				

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2025-26

Course Information

Programme	B.Tech. (Computer Science Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	7CS352
Course Name	Cutting Edge Technologies Lab
Desired Requisites:	Basics of programming

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

Course Objectives

1	To provide hands-on experience and practical implementation skills in one of the cutting-edge technologies. Currently following are the specialized domains: 1. iOS App Development 2. Robotics 3. Parallel Programming.
2	Students will choose one lab based on interest or departmental allocation.
3	To enhance domain-specific skills and prepare students for industry-relevant projects.

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 fundamental concepts and apply domain-specific tools and techniques to solve real-world problems.	III	Applying
CO2	demonstrate technical proficiency by implementing standard solutions	IV	Analysing
CO3	select appropriate components/methods to solve real-world problems.	V	Evaluating
CO4	build an application, individually or in a team for solving real-world problems.	VI	Creating

1. iOS Application Development

List of Experiments / Lab Activities/Topics

List of Lab Activities:

1. Introduction to swift and playground.
2. Programs based on data types, control statements and operators.
3. Programs based on Functions, Strings.
4. Programs based on Structures, Classes and Optional.
5. Controls in Action, Auto Layout and Stack Views.
6. Segues, Navigation and Tab bar Controllers.
7. Type Casting and Inspection, Guard, Constant and Variable Scope, Enumerations.
8. Application design cycle, iterate over the design, create a prototype.
9. Data collection using swift.
10. Connecting the app to the database.

Textbooks

1	Develop in swift fundamentals – Apple Education
2	Develop in swift Data Collections - Apple Education
3	Neil Smyth, "Android Studio 3.6 Development Essentials - Java Edition: Developing Android 10 (Q) Apps Using Android Studio 3.6, Java and Android Jetpack", Payload Media, 2020, ISBN-13: 978-1951442156

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
3	Dawn Griffiths, David Griffiths, "Head First Android Development", O'Reilly Media, 2nd Edition, 2017, ISBN: 9781491974056
Useful Links	
1	https://docs.swift.org/swift-book/documentation/the-swift-programming-language/
2	https://developer.android.com/docs

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1				2	2								1	2
CO2				2	2								1	1
CO3				3	2								1	1
CO4				2	2			2	2	2	1	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, and preferably to only one PO.

2. Robotics

List of Experiments / Lab Activities/Topics

List of Lab Activities:

1. Introduction to robotics
2. Installation of dubot studio
3. Implementation of suction cup end effector with
4. Dubot studio teach and play back application
5. Implementation of suction cup end effector with
6. Blockly and script application
7. Implementation of gripper end effector with teach & play back, blockly and script application
8. Implementation of dobot magician
9. Implementation pen end effector of dobot magician
10. Study of blender a 3d animation tool
11. Generate api to connect and move dobot arm from
12. One location to another using python
13. Implementation of blender
14. Study of intel depth realsense camera.
15. Implementation of intel depth realsense camera with assigned tasks
16. Study and implementation of rtk module
17. Study and implementation of lidars
18. Study and implementation of turtlebot

Textbooks	
1	**Introduction to Robotics: Mechanics and Control** – *John J. Craig, Pearson (4th Edition)*
2	**Learning ROS for Robotics Programming** – *Aaron Martinez, Enrique Fernandez, Packt Publishing (2nd Edition)*
3	**Python Robotics Projects** – *Joseph Howse, Packt Publishing*
References	
1	http://wiki.ros.org/
2	https://www.dobot-robots.com/
3	http://emanual.robotis.com/docs/en/platform/turtlebot3/overview/
Useful Links	
1	https://www.youtube.com/playlist?list=PLjEaoINr3zgFX8ZsChQVQsuDSjEqdWMAD
2	https://oceanservice.noaa.gov/facts/lidar.html#:~:text=Lidar%2C%20which%20stands%20for%20Light,variable%20distances)%20to%20the%20Earth.

3	https://www.intelrealsense.com/depth-camera-d435/

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	-	-	-	-	-	-	-	-	-	-	-
CO2	2	3	2	-	2	-	-	-	-	-	-	-	-	-
CO3	2	3	2	1	3	-	-	-	-	-	-	-	-	-
CO4	1	3	1	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.

3. Parallel Programming

List of Experiments / Lab Activities/Topics

List of Lab Activities:

1. Introduction to parallel programming, OpenMP installation, simple “Hello World” programs.
2. Parallel region creation, thread identification using OpenMP.
3. Parallelizing loops with #pragma omp parallel for, and applying scheduling clauses.
4. Use of private, shared, firstprivate, lastprivate clauses in OpenMP.
5. Synchronization constructs: critical, barrier, atomic, ordered, nowait.
6. Reduction operations and nested loop parallelism using collapse.
7. Introduction to MPI: simple point-to-point communication using MPI_Send and MPI_Recv.
8. Collective communication: broadcast, scatter, gather, reduce in MPI.
9. Matrix-vector multiplication using MPI with row-wise distribution.
10. Comparison of OpenMP and MPI versions of the same problem (e.g., sum of array elements).
11. Mini Project Phase I: Choose a problem and plan hybrid or comparative OpenMP/MPI solution.
12. Mini Project Phase II: Final implementation and Performance Analysis.

Textbooks

1	Quinn, M. J. “Parallel Programming in C with MPI and OpenMP”, 1st Edition, Tata McGraw Hill Education, 2003.
2	Pacheco, P. “An Introduction to Parallel Programming”, 1st Edition, Morgan Kaufmann, 2011.
3	Grama, A., Gupta, A., Karypis, G., & Kumar, V. “Introduction to Parallel Computing”, 2nd Edition, Pearson Education, 2003.

References

1	Gropp, W., Lusk, E., & Skjellum, A. “Using MPI: Portable Parallel Programming with the Message-Passing Interface”, 2nd Edition, MIT Press, 1999.
2	Snu, V. S. “Parallel Programming: Concepts and Practice”, PHI Learning, 2020.
3	Chandra, R., Menon, R., Dagum, L., Kohr, D., Maydan, D., & McDonald, J. “Parallel Programming in OpenMP”, Morgan Kaufmann, 2001.

Useful Links

1	https://mpitutorial.com
2	https://openmp.org

CO-PO Mapping

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

(Government Aided Autonomous Institute)

AY 2025-26

Course Information

Programme	B. Tech. (Computer Science Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	7CS353
Course Name	Machine Learning Lab
Desired Requisites:	Linear algebra, Calculus, Statistics, Analysis of algorithms, Data structures

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 acquaint students with the purpose, scope, stages, applications, and effects of Machine Learning concepts.
2	To empower students to apply Machine Learning 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	use python fundamentals and relevant libraries for applying EDA and ML techniques on a distribution or dataset.	III	Apply
CO2	study performance of supervised and unsupervised ML techniques scientifically.	IV	Analyse
CO3	shortlist potential ML techniques for solving the problems.	V	Evaluate
CO4	customize or tweak textbook techniques for real world adaption.	VI	Design

List of Experiments / Lab Activities/Topics

Lab activities will be conducted based on following topics:

1. Data visualization
2. Normalization
3. Univariate and multivariate outlier detection
4. Linear regression
5. Polynomial regression
6. Multiple regression
7. Logistic regression
8. Decision tree based classification
9. Random forest
10. Non-linear regression
11. Ensemble methods
12. Clustering
13. Hyperparameter tuning
14. Regularization
15. Feature importance

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	2	1	1	1	1						1		2	1
CO2	3	2	2	1	2						1		1	
CO3	2	3	3	1	2						1		2	2
CO4	1	2	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.

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2025-26

Course Information	
Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Third Year B. Tech., SemVI
Course Code	7CS321
Course Name	Cloud Computing
Desired Requisites:	Operating System, 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	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, Microservices, 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.
Useful Links	
1	

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)

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2025-26

Course Information	
Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	7CS322
Course Name	Cryptography and Network Security
Desired Requisites:	Computer Networks

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 2			

Course Objectives	
1	Discuss cryptography and its need to various applications
2	Understand various block cipher and stream cipher models.
3	Describe the principles of public key cryptosystems, hash functions and digital signature.

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 the fundamental concepts of network security, and the foundations of modern cryptography.	II	Understanding
CO2	Apply symmetric and asymmetric cryptographic algorithms to ensure data confidentiality and secure key exchange.	III	Applying
CO3	Analyze message authentication codes, hash functions and digital signatures	IV	Analyzing
CO4	Evaluate various network security protocols (SSL/TLS, IPsec, PGP, etc.) and tools used to defend against intrusions and system vulnerabilities.	V	Evaluating

Module	**Module Contents**	**Hours**
I	**INTRODUCTION** OSI security architecture – Classical encryption techniques: substitution techniques, transposition techniques, steganography- Foundations of modern cryptography, product cryptosystem – cryptanalysis	4
II	**SYMMETRIC KEY CRYPTOGRAPHY** SYMMETRIC KEY CIPHERS: Block cipher Principles of DES – Strength of DES , Block cipher design principles – Block cipher mode of operation – Advanced Encryption Standard(AES)	4

III	**PUBLIC KEY CRYPTOGRAPHY** ASYMMETRIC KEY CIPHERS: RSA cryptosystem – Key distribution – Key Management – Diffie-Hellman key exchange -ElGamal cryptosystem –Elliptic curve cryptography.	5
IV	**MESSAGE AUTHENTICATION AND INTEGRITY** Hash functions, MD2, MD5 and SHA, keyed hash functions, attacks on hash functions, Digital signature– Authentication applications – Kerberos, X.509.	4
V	**Transport Layer Security and IP Security** Transport Layer Security, Secure Socket Layer(SSL), TLS, IP Security	4
VI	**Email, Web and System Security** Email Security: Pretty Good Privacy(PGP),S/MIME, Web Security, Secure Electronic Transaction, Intrusion Detection System(IDS), Firewalls, Honey Pots, Software Vulnerabilities, Malicious software	5

Text Books	
1	William Stallings, *"Cryptography and Network Security: Principles and Practice",* Prentice Hall of India.
2	Behrouz A. Forouzan "*Cryptography And Network Security*". Tata Mcgraw-Hill, New Delhi India.

References	
1	"Applied Cryptography, Protocols Algorithms and Source Code in C", Bruce Schneier, Wiley.
2	"Cryptography and Network Security", Atul Kahate, Tata Mc Graw Hill.
3	Alfred J. Menezes, Paul C. van Oorschot and Scott A. Vanstone, "Handbook of Applied Cryptography", CRC Press.
4	Johannes A. Buchmann, *"Introduction to Cryptography",* Springer.

Useful Links	

CO-PO Mapping

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

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2025-26

Course Information	
Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	7CS323
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)

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2025-26

Course Information

Programme	B.Tech. (Computer Science Engineering)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	7CS371
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

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

(Government Aided Autonomous Institute)

AY 2025-26

Course Information

Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	7CS372
Course Name	Cryptography and Network Security Lab
Desired Requisites:	Computer Networking

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

Course Objectives

1	To learn different cipher techniques
2	To implement the algorithms DES, AES, RSA,MD5,SHA-1
3	To use network security tools and vulnerability assessment tools

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	develop code for classical Encryption Techniques to solve the real life problems	III	Apply
CO2	analyze the network security system using open source tools	IV	Analyze
CO3	evaluate the securities of different security protocols	V	Evaluate
CO4	design and implement symmetric and asymmetric key encryption algorithms	VI	Create

List of Experiments:

1. Perform encryption, decryption using the following substitution techniques
    a. Ceaser cipher,
    b. playfair cipher
    c. Hill Cipher
    d. Vigenere cipher
2. Perform encryption and decryption using following transposition techniques
    a. Rail fence
    b. row and Column Transformation
3. Implementation of Euclidean and Extended Euclidean Algorithm
4. Implementation of Chinese Remainder Theorem (CRT)
5. Apply DES algorithm for practical applications
6. Apply AES algorithm for practical applications
7. Implementation of RSA Algorithm
8. Implement the Diffie-Hellman Key Exchange algorithm for a given problem
9. Calculate the message digest of a text using the SHA-1 algorithm
10. Implement the SIGNATURE SCHEME – Digital Signature Standard
11. Demonstration of SSL using Wireshark
12. Demonstrate intrusion detection system (ids) using any tool eg. Snort or any other s/w
13. Exploring a Vulnerability Assessment Tool

Text Books	
1	William Stallings, *"Cryptography and Network Security: Principles and Practice",* Prentice Hall of India.
2	Behrouz A. Forouzan "*Cryptography And Network Security*". Tata Mcgraw-Hill, New Delhi India.
References	
1	"Applied Cryptography, Protocols Algorithms and Source Code in C", Bruce Schneier, Wiley.
2	"Cryptography and Network Security", Atul Kahate, Tata Mc Graw Hill.
3	
4	
Useful Links	

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

(Government Aided Autonomous Institute)

AY 2025-26

Course Information	
Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	7CS331
Course Name	Program Elective I: Remote Sensing & GIS
Desired Requisites:	Fundamentals of Image Processing

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**ISE**	**MSE**	**ESE**	**Total**
Tutorial	-	20	30	50	100
		Credits: 2			

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 impart knowledge of various GIS data sets and DBMS for GIS data storage and management
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	Understand
CO2	Interpret and demonstrate various satellite sensor data, GIS data collected from different resources and GIS database management system.	Apply
CO3	Compare and analyse various satellite images and GIS data from various resources	Analyze
CO4	Select and verify suitable RS and GIS data and data products to design solution for various interdisciplinary problems.	Evaluate

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.	5
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	4
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	4

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	5
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	4
VI	**Spatial Data Analysis** Measurements in GIS-Lengths, Perimeters, and Areas, Queries, Reclassification, Buffering and Neighborhood Functions, Map Overlay, Spatial Interpolation	4

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								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)

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2025-26

Course Information	
Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	7CS332
Course Name	Professional Elective-1 Internet of Things
Desired Requisites:	Basics of Networking and Programming

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 02			

Course Objectives	
1	Understand the fundamentals of IoT architecture and its role in modern applications.
2	Develop familiarity with IoT hardware platforms, sensors, and communication protocols.
3	Explore data handling, cloud integration, and security challenges in IoT systems.
4	Apply IoT system design methodologies to real-life problems using case studies and projects.

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	Describe the components, architecture, and application domains of IoT systems.	II	Understand
CO2	Identify and integrate appropriate IoT devices and communication technologies for given real-time scenarios.	III	Apply
CO3	Differentiate between various data management strategies, cloud service models, and security mechanisms used in IoT systems	IV	Analyse
CO4	Evaluate IoT system architectures and assess suitable hardware, communication, and integration strategies for various application scenarios.	V	Evaluate

Module	**Module Contents**	**Hours**
I	**Introduction to IoT** Definition, Characteristics, and Applications, IoT Architecture: 3-layer and 5-layer models, Cyber-Physical Systems Overview, IoT Opportunities and Challenges	3
II	**IoT Hardware and Software Platforms** IoT Devices: Sensors, Actuators, Embedded Systems, Overview of Development Boards: Arduino, Raspberry Pi, ESP32, Introduction to IoT Programming Environments	4
III	**Communication Protocols in IoT** Overview of M2M Communication Models, Wireless Technologies: Wi-Fi, Bluetooth, ZigBee, LoRa, Networking and Transport Protocols: IPv6, 6LoWPAN, RPL Application Protocols: MQTT, CoAP, HTTP	5
IV	**Data Management and Cloud Integration (4 hours)** Data Acquisition and Processing Techniques, Introduction to Cloud Services (AWS IoT, Google IoT Core), Basics of Edge and Fog Computing, Conceptual Case Study: Cloud Dashboard Integration	4

V	**IoT Security and Privacy (5 hours)** IoT Security Challenges, Device and Data-Level Security, Encryption Techniques and Secure Protocols, Authentication and Authorization Mechanisms.	5
VI	**IoT System Design and Applications** IoT System Design Methodology, Prototyping and Development Life Cycle, Case Studies and Use Cases: o Smart Home o Industrial IoT (IIoT) o Smart Agriculture o Smart Healthcare	5

Textbooks	
1	Adrian Mcewen, Hakin Cassimally, "Designing The Internet of Things", First Edition, Wiley, 2014.
2	Keysight Technologies, "The Internet of Things: Enabling Technologies and Solutions for Design and Test", Application Note, 2016.
3	Vijay Madisetti, Arshdeep Bahga," Internet of Things A Hands-On- Approach",2014, ISBN:978 0996025515.

References	
1	Raj Kamal , " Internet of Things: Architecture and Design", McGraw Hill.2nd edition June 2022
2	Pethuru Raj, Anupama C. Raman," The Internet of Things Enabling Technologies, Platforms, and Use Cases", Taylor and Francis group. February 2017
3	Peter Waher, "Mastering Internet of Things: Design and create your own IoT applications using Raspberry Pi 3", First Edition, Packt Publishing, 2018.

Useful Links	
1	https://onlinecourses.nptel.ac.in/noc19_cs65/preview

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	1	1	2						1	1			2	
CO3		1	2	2	1	2		1					3	1
CO4		1	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)

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2025-26

Course Information	
Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Third Year B. Tech., Sem (VI)
Course Code	7CS333
Course Name	Advanced Machine Learning
Desired Requisites:	Machine Learning

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 2			

Course Objectives	
1	To emphasise significance of Artificial Neural Networks and Deep architectures.
2	To educate participants on use of deep learning architectures for real life scenarios.
3	To infuse skills required to optimize performance of deep learning architectures.
4	To enable participants to choose appropriate deep learning techniques to solve 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	grasp fundamentals of neural networks and deep learning using foundation of mathematics.	II	Understand
CO2	use suitable deep learning architecture for a given problem.	III	Apply
CO3	examine performance of deep learning architectures using suitable performance metrics and hyperparameter tuning techniques.	IV	Analyse
CO4	recommend appropriate deep learning architecture, performance improvement measures and regularization techniques for a given problem scenario.	V	Evaluate

Module	**Module Contents**	**Hours**
I	**Introduction to Artificial Neural Networks** Artificial neuron, Backpropagation, Activation functions, Neural network fundamentals	4
II	**Deep Neural Networks** Deep L architectures, Bias - variance, Regularization techniques, Optimizers – GD, SGD, Adam, Hyperparameter tuning, Batch normalization, Multiclass-classification	5
III	**Convolutional Neural Networks (CNN) and Object Detection** CNN Building blocks: Layer Types, convolutional layers, activation layers, Pooling Layers, Fully-connected Layers, Fundamentals of Object detection, R-CNN, You only look once (YOLO), state-of-the-art case study	4
IV	**Sequence models** Need for sequence models, RNN architecture, Vanishing gradient problem, LSTM, state-of-the-art case study	5
V	**Advanced sequence models** Word embedding, Encoder - Decoder (seq2seq) model, Attention mechanism, Transformers, state-of-the-art case study	4

VI	**Language Models** Introduction to language modelling, Large Language Models, Retrieval Augmented Generation, state-of-the-art models	4

Textbooks	
1	Ian Goodfellow, Yoshua Bengio and Aaron Courville Deep Learning, MIT Press, 2016
2	Dive into Deep Learning, Mu Li, Aston Zhang, Zachary Lipton, Alexander J. Smola (Online)

References	
1	Jiang, Peiyuan, et al. "A Review of Yolo algorithm developments." Procedia computer science 199 (2022): 1066-1073.
2	Al-Selwi, Safwan Mahmood, et al. "RNN-LSTM: From applications to modeling techniques and beyond—Systematic review." Journal of King Saud University-Computer and Information Sciences (2024): 102068.
3	Vaswani, Ashish, et al. "Attention is all you need." Advances in neural information processing systems 30 (2017).

Useful Links	
1	https://nptel.ac.in/courses/106/106/106106184/
2	https://www.coursera.org/specializations/deep-learning
3	https://huggingface.co/course/chapter1/1?fw=pt

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	1			2	
CO2	2	3	2	1					2	2			3	
CO3	2	3	2	1					2	2			3	
CO4	1	1	2	1					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 2025-26

Course Information	
Programme	B.Tech. (Computer Science Engineering)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	7CS771
Course Name	Program Elective - 1 Lab: Remote Sensing & GIS
Desired Requisites:	Fundamentals of Image Processing

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 introduce RS and GIS Tools
2	To provide a hands-on exposure of performing various operations using satellite images and GIS data sets
3	To discuss and identify the various interdisciplinary applications of RS and GIS.

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	Discuss and perceive features of various RS and GIS tools	Understanding	2
CO2	Practice and examine various RS and GIS data sets for different applications	Applying	3
CO3	Compare and analyse RS and GIS data using modern tools and techniques	Analyzing	4
CO4	Select and verify suitable RS and GIS data and data products to design solution for various interdisciplinary problems.	Evaluating	5

List of Experiments / Lab Activities/Topics

List of Lab Activities:

1. Introduction to ErdasImagine: Install and familiarize the ErdasImagine RS tool
2. Download and analyse various satellite data sets from different resources
3. Layer stacking of multispectral Images and FCC and TCC creation
4. Image sub setting
5. Classification, supervised and unsupervised
6. NDVI calculation
7. Project: Urban sprawl analysis (Monitor city expansion over a decade)
8. Introduction to ArcGIS pro : Installation, Exploring panes, ribbons, Toolboxes and catalog.
9. Creating and managing Geodatabase
10. Coordinate system and projection, creating map layout
11. Geo referencing a raster image
12. Digitization and feature editing
13. Attribute table management and queries

Textbooks

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
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	

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	3				3									2
CO4	3	2	3				2						3	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, 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

(Government Aided Autonomous Institute)

AY 2025-26

Course Information

Programme	B.Tech. (Computer Science Engineering)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	7CS772
Course Name	Professional Elective-1 Internet of Things Lab
Desired Requisites:	Basics of Networking and Programming

Teaching Scheme		**Examination Scheme (Marks)**			
Practical	2 Hrs/ Week	**LA1**	**LA2**	**Lab ESE**	**Total**
Interaction	-	30	30	40	100
		Credits: 01			

Course Objectives

1	Understand the fundamental concepts of IoT systems, including sensors, actuators, microcontrollers, and communication protocols.
2	Apply microcontroller programming skills to interface various sensors and actuators for real-world IoT applications.
3	Analyse and interpret sensor data through local displays, web servers, and cloud platforms to monitor and control IoT devices.
4	Design and develop functional IoT prototypes using cloud integration, wireless communication, and automation technologies.

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 the fundamental concepts, architectures, and applications of the Internet of Things (IoT), including key components such as sensors, actuators, and communication protocol.	II	Understand
CO2	Implement IoT applications by interfacing microcontrollers with sensors and actuators using appropriate programming techniques.	III	Apply
CO3	Analyse sensor data and network behaviour in IoT systems using local and remote data handling methods such as web servers and cloud platforms.	IV	Analyse
CO4	Evaluate and develop integrated IoT prototypes with cloud connectivity and automation features to solve real-world problems.	V	Evaluate

List of Experiments / Lab Activities/Topics

List of Lab Activities:

1. Blinking LED using Arduino.
2. Reading Temperature and Humidity using DHT11 Sensor.
3. Controlling LED using Web Interface (ESP8266/ESP32).
4. Controlling Servo Motor using IoT Interface.
5. Creating a Wi-Fi Based Web Server using ESP8266/ESP32.
6. Sending Sensor Data to ThingSpeak Cloud Platform.
7. Displaying Sensor Data on OLED Display.
8. Implementing MQTT Protocol using ESP and Public Broker.
9. IoT-Based Home Automation System.
10. Data Logging on SD Card using Arduino.
11. Smart Parking System using IR Sensor.
12. Voice-Controlled Device using Google Assistant and IFTTT.
13. Smart Street Light System using LDR.

Textbooks	
1	Vijay Madisetti, Arshdeep Bahga," Internet of Things A Hands-On- Approach",2014, ISBN:978 0996025515.
2	Jeeva Jose "Internet of Things", January 2018, ISBN:978-9386173591
References	
1	Dieter Uckelmann, Mark Harrison, Florian Michahelles, "Architecting the Internet of Things", April 2011, ISBN:978-3642191572
2	Adrian Mcewen , Hakim Cassimally, "Designing the Internet of Things", December 2013, ISBN: 978-1118430620
Useful Links	
1	https://nptel.ac.in/courses/106105166

CO-PO Mapping

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

(Government Aided Autonomous Institute)

AY 2025-26

Course Information

Programme	B.Tech. (Computer Science Engineering)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	7CS773
Course Name	Advanced Machine Learning Lab
Desired Requisites:	Machine Learning, Python, Data Structures and algorithms

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

Course Objectives

1	To emphasise significance of Artificial Neural Networks and Deep architectures.
2	To educate participants on use of deep learning architectures for real life scenarios.
3	To infuse skills required to optimize performance of deep learning architectures.
4	To enable participants to choose appropriate deep learning techniques to solve 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	use suitable deep learning techniques and tools for a given problem with fine tuning and regularization.	III	Apply
CO2	assess and diagnose model.	IV	Analyse
CO3	recommend appropriate deep learning architecture, performance improvement measures and regularization techniques for a given problem scenario.	V	Evaluate
CO4	design a model architecture to solve a given problem scenario.	VI	Create

List of Experiments / Lab Activities/Topics

List of Lab Activities: Lab activities will be based on following topics using contemporary tools such as PyTorch, Keras, Tensorflow, LM Studio, Groq etc.

1. Artificial neural network
2. Deep neural network architecture
3. Regularization
4. Optimizers
5. Convolutional neural networks
6. Object detection
7. Basic RNN
8. LSTM
9. Encoder - Decoder (seq2seq) model
10. Transformers
11. Exploration of large language models

Textbooks

1	Aurelien Geron, "Hands-On Machine Learning with Scikit-Learn & TensorFlow", O'REILLY, Dec 2017
2	Deep Learning with PyTorch, Eli Stevens, Luca Antiga, and Thomas Viehmann, Manning Publications

References

1	https://onlinecourses.nptel.ac.in/noc19_cs85/preview

Useful Links

1	https://www.youtube.com/@vizuara
2	https://www.youtube.com/@statquest

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

(Government Aided Autonomous Institute)

AY 2025-26

Course Information

Programme	B.Tech. (Computer Science Engineering)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	7VSCS346
Course Name	Mini Project-2
Desired Requisites:	Nil

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 provide hands-on experience in developing a small-scale software project.
2	To undergo project management techniques and project design principles.
3	To inculcate skills required for implementing 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	compare existing systems or solutions to identify gaps, and define a clear, achievable scope for the proposed project.	II	Understanding
CO2	design an effective and feasible solution for the identified problem and outline a suitable methodology for its implementation.	III	Applying
CO3	identify and use modern engineering tools, software, and techniques required for project implementation.	IV	Analyzing
CO4	validate the developed solution using multiple test cases and evaluate its performance against defined criteria and benchmarks.	V	Evaluating
CO5	build a working prototype or final solution and prepare professional documentation including design reports, technical papers, and presentations.	VI	Creating

List of Experiments / Lab Activities/Topics

List of Lab Activities:

1. Mini project-2 topic can be considered as an extension of Mini project-1 topic based on the scope. Or identify a new 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
CO2			3										2	2
CO3			2		3						1	1	2	2
CO4	2			3								1	2	2
CO5						1	1	2	2	2	2	1	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.				