Walchand College of Engineering

(Government Aided Autonomous Institute)

Vishrambag, Sangli-416415

1947

Credit System for

F. Y. M. Tech. (Computer Science & Engineering)

Semester-I and II

2023-24

PG Coordinator 28/03/23
Ms. S. S. Rohode

HOD (CSE)
Dr. Mrs. M. A. Shah

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

Credit System for F. Y. M. Tech. (Computer Science & Engineering) Sem-I AY 2023-24

Sr.No.	Category	Course Code	Course Name	L	T	P	I	Hrs	Cr	MSE/LA1	ISE/LA2	ESE	Remark
Professional Core (Theory)													
1	PC	7IC501	Research Methodology and IPR	3	0	0	0	3	3	30	20	50	
2	PC	7CO501	Advanced Data Structures	3	0	0	0	3	3	30	20	50	
3	PC	7CO502	Artificial Intelligence & Machine Learning	3	0	0	0	3	3	30	20	50	
4	PC	7CO503	Mathematical Foundations of Computer Science	3	0	0	0	3	3	30	20	50	
Professional Core (Lab)													
5	PC	7CO551	Advanced Data Structures Lab	0	0	2	0	2	1	30	30	40	
6	PC	7CO552	Artificial Intelligence & Machine Learning Lab	0	0	2	0	2	1	30	30	40	
7	PC	7CO553	Presentation and Technical Report Writing	0	0	2	0	2	1	30	30	40	
Professional Elective (Theory)													
8	PE	Refer list	Professional Elective 1	3	0	0	0	3	3	30	20	50	
9	PE	Refer list	Professional Elective 2	3	0	0	0	3	3	30	20	50	
			Total	**18**	**0**	**6**	**0**	**24**	**21**				

(Ms. S. S. Rokade)
HoD

21/08/23

21/8/2023
Dean Academics
Walchand College of Engg.
Vishrambag, Sangli - 416 415
Dean Academics

Date:

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

Professional Elective Course List for F. Y. M. Tech. (Computer Science & Engineering) Sem-I AY 2023-24

Sr.No.	Track	Course Code	Course Name
Professional Elective 1			
1	IP &CV	7CO511	Image Processing
2	Advanced Computing	7CO512	Internet of Things
3	IP &CV	7CO513	Human Computer Interaction
Professional Elective 2			
1	Artificial Intelligence	7CO514	Natural Language Processing
2	Network Security	7CO515	Advanced Network Technologies
3	Advanced Computing	7CO516	Modern Operating System

Notes:

For Theory courses: There shall be MSE, ISE and ESE. The ESE is a separate head of passing.

For Lab courses: There shall be continuous assessment (LA1, LA2, ESE). The ESE is a separate head of passing.

For further details, refer to Academic and Examination rules and regulations.

(Ms. S. S. Rokade) HoD Dean Academics

Dean Academics
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 Date:

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

Credit System for F. Y. M. Tech. (Computer Science & Engineering) Sem-II AY 2023-24

Sr.No.	Category	Course Code	Course Name	L	T	P	I	Hrs	Cr	MSE/LA1	ISE/LA2	ESE	Remark
Professional Core (Theory)													
1	PC	7CO521	Advanced Computer Algorithms	3	0	0	0	3	3	30	20	50	
2	PC	7CO522	Soft Computing	3	0	0	0	3	3	30	20	50	
3	PC	7CO523	Information Security	3	0	0	0	3	3	30	20	50	
Professional Core (Lab)													
3	PC	7CO571	Advanced Computer Algorithms Lab	0	0	2	0	2	1	30	30	40	
4	PC	7CO572	Soft Computing Lab	0	0	2	0	2	1	30	30	40	
5	PR	7CO545	Pre-dissertation Work and Seminar	0	0	2	0	2	1	30	30	40	
Professional Elective (Theory)													
6	PE	Refer list	Professional Elective 3	3	0	0	0	3	3	30	20	50	
7	PE	Refer list	Professional Elective 4	3	0	0	0	3	3	30	20	50	
Open Elective													
8	OE	Refer list	Open Elective	3	0	0	0	3	3	30	20	50	
			Total	**18**	**0**	**6**	**0**	**24**	**21**				

HoD

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Professional Elective Course List for F. Y. M. Tech. (Computer Science & Engineering) Sem-II AY 2023-24

Sr.No.	Track	Course Code	Course Name
Professional Elective 3			
1	Artificial Intelligence	7CO531	Data Science
2	Network Security	7CO532	Data Encryption & Compression
3	Network Security	7CO533	Blockchain Technology
4	IP &CV	7CO534	Theory and Applications of Remote Sensing & GIS
Professional Elective 4			
1	Artificial Intelligence	7CO535	Deep Learning
2	Network Security	7CO536	Cyber Security
3	Advanced Computing	7CO537	Advanced Database Management Systems

Open Elective Course List for F. Y. M. Tech. (Computer Science & Engineering) Sem-II AY 2023-24

Sr.No.	Offering Programme	Course Code	Course Name
1	Environmental Engg.	7OE501	Solid Waste Management
2	Structural Engg.	7OE502	Structural Health Monitoring
3	Design Engg.	7OE503	Industrial Product Design
4	Heat Power Engg.	7OE504	Waste to Energy
5	Production Engg.	7OE505	Advanced Production systems
6	Power System Engg.	7OE506	Control Techniques for Electrical Drives
7	Control System Engg	7OE506	Control Techniques for Electrical Drives
8	Electronics Engg.	7OE508	Introduction to Embedded Systems
9	Computer Science & Engg.*	7OE509	Machine Learning in Practice
10	Information Technology	7OE510	Machine Learning & Applications

Notes:

*Open Elective offered by (Computer Science Engineering) Programme is allowed for students of all other Programmes (Except Computer Science & Engg. And Information Technology Programme)

For Theory courses: There shall be MSE, ISE and ESE. The ESE is a separate head of passing.

For Lab courses: There shall be continuous assessment (LA1, LA2, ESE). The ESE is a separate head of passing.

For further details, refer to Academic and Examination rules and regulations.

(Ms. S. S. Rohade)

HoD

for

Dean Academics

Dean Academics
Walchand College of Engg.
Vishrambag, Sangli

Date:

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2023-24

Course Information

Programme	M.Tech. (Computer science and engineering)
Class, Semester	First Year M.Tech., Sem I
Course Code	7IC501
Course Name	Research Methodology
Desired Requisites:	None

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

Course Objectives

1	To develop a research orientation among the students and to acquaint them with fundamentals of research methods.
2	To develop understanding of the basic framework of research process and techniques
3	To identify various sources of information for literature review and data collection.
4	To develop an understanding of the ethical dimensions of conducting applied research.
5	To develop understanding about patent process.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO1	**Classify** various methods to solve research problem.	Apply
CO2	**Construct** a research problem in respective engineering domain.	Apply
CO3	**Investigate** various data analysis techniques for a research problem.	Analyze
CO4	**Identify** various Intellectual Property Rights procedures	Apply

Module	**Module Contents**	**Hours**
I	**Research Fundamentals** What is research, types of research, the process of research, Literature survey and review , Formulation of a research problem.	4
II	**Research Methods** Research design- Meaning, Need and Types , Research Design Process, Measurement and scaling techniques, Data Collection – concept, types and methods, Processing and analysis of data, Design of Experiment	5
III	**Analysis Techniques** Quantitative Techniques, Sampling fundamentals, Testing of hypothesis using various tests like Multivariate analysis, Use of standard statistical software, Data processing, Preliminary data analysis and interpretation, Uni-variate and bi-variate analysis of data, testing of hypotheses.	5
IV	**Research Communication** Writing a conference paper, Journal Paper, Technical report, dissertation/thesis writing. Presentation techniques, software used for report writing such as WORD, Latex etc. Types of journal/conference papers	4

V	**Intellectual Property Rights** Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.	5
VI	**Patents and Patenting Procedures** Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications. New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs	4

Text Books	
1	C. R. Kothari, Research Methodology, New Age international
2	Deepak Chopra and Neena Sondhi, Research Methodology : Concepts and cases, Vikas Publishing House, New Delhi

References	
1	E. Philip and Derek Pugh, How to get a Ph. D. – a handbook for students and their supervisors, open university press
2	Stuart Melville and Wayne Goddard, Research Methodology: An Introduction for Science & Engineering Students

Useful Links	
1	NPTEL Lectures

CO-PO Mapping

	Programme Outcomes (PO)														
	1	2	3	4	5	6									
CO1	2		1												
CO2					2	2									
CO3				2											
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.

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.

Assessment Plan based on Bloom's Taxonomy Level (Marks) (For lab Courses)				
Bloom's Taxonomy Level	**ISE**	**MSE**	**ESE**	**Total**
Remember				
Understand				
Apply	15			**15**
Analyze	15	10		**25**
Evaluate		10	20	**30**
Create		10	20	**30**
Total Marks	**30**	**30**	**40**	**100**

Walchand College of Engineering, Sangli

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AY 2023-24

Course Information

Programme	M.Tech. (Computer science and engineering)
Class, Semester	First Year M.Tech., Sem I
Course Code	**7CO501**
Course Name	**Advanced Data Structures**
Desired Requisites:	UG level course in Data Structures

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

Course Objectives

1	To impart knowledge of advanced data structures such as temporal data structures and geometric data structures
2	To make students familiar with advanced concepts related to trees, graphs, hashing and string matching.
3	To contribute in choosing appropriate data structures and using them for solving real world problems.
4	
5	

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO1	interpret and summarize the purpose and operation of advanced data structures	UNDERSTAND
CO2	apply and demonstrate knowledge of advanced data structures for solving real world problems	ANAYSE
CO3	analyze algorithms, compare data structures and evaluate the performance of the advanced data structures	APPLY
CO4		

Module	**Module Contents**	**Hours**
I	**Module 1: Advanced Trees** AVL Trees: Insertion, Deletion, and Rotations Red-Black Trees: Properties, Insertion, Deletion B-Trees and B+ Trees: Operations, Search, Insertion, Deletion	8
II	Module 2: Hashing and Graphs Extendable Hashing and Linear Hashing Graph Representations: Adjacency List, Adjacency Matrix Topological Sorting and Strongly Connected Components	6

III	Module 3: Heaps and Priority Queues Binomial Heaps Fibonacci Heaps D-Heaps and Priority Queue Concepts	6
IV	Module 4: String and Trie Structures Suffix Trees Compressed Tries Trie Data Structure and Applications	8
V	Module 5: Disjoint Sets and Amortized Analysis Union-Find Data Structure with Path Compression and Union by Rank Amortized Analysis: Aggregate, Accounting, and Potential Methods	6
VI	Module 6: Geometric and Specialized Data Structures Range Trees Data Structures for Text Editors Data Structures for Spatial Databases	6

Text Books	
1	Cormn Thomas H., Leiserson Charles E., Rivest Ronald L., Stein Clifford, "Introduction to Algorithms," PHI, Third Edition, 2009
2	Mark de Berg, Otfried Cheong, Marc van Kreveld, Mark Overmars , "Computational Geometry - Algorithms and Applications", Springer, Third Edition, 2008
3	Erik Demaine, Lecture Notes on MIT Courseware
References	
1	O'Rourke Joseph, "Computational Geometry in C", Cambridge University Press
2	Diestel Reinhard, "Graph Theory", Springer-Verlag, 2000
3	Brass Peter, "Advanced Data Structures", Cambridge University Press.
Useful Links	
1	NPTEL Lectures

CO-PO Mapping						
	Programme Outcomes (PO)					
	1	**2**	**3**	**4**	**5**	**6**
CO1				2		
CO2	2			3	1	2
CO3	3		1			

The strength of mapping is to be written as 1,2,3; Here, 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		**ISE**	**MSE**	**ESE**	**Total**
1	Remember				
2	Understand				
3	Apply	10	15	25	**50**
4	Analyze	10	15	25	**50**
5	Evaluate				
6	Create				
Total		**20**	**30**	**50**	**100**

Walchand College of Engineering, Sangli

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AY 2023-24

Course Information	
Programme	M. Tech. (Computer Science and Engineering)
Class, Semester	First Year M. Tech., Sem I
Course Code	7CO502
Course Name	Artificial Intelligence and Machine Learning
Desired Requisites:	Data structures, Algorithms, 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 acquaint students with the meaning, purpose, scope, applications, and effects of AI.
2	To solve problems by applying a suitable search method, knowledge representation
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	Understand
CO2	Apply the basic principles, models and algorithms of AI to recognize, model and solve problems.	III	Apply
CO3	Analyze knowledge representation techniques and problem solving strategies to common AI applications.	IV	Analyze
CO4	Apply the basic principles, models and algorithms of ML to recognize, model and solve problems.	V	Evaluate

Module	**Module Contents**	**Hours**
I	**Introduction to AI and Problem Solving by Search** **Introduction to AI:** What is AI, Turing test, AI problems, AI application areas, **Intelligent Agents:** Introduction, Structure of agents, Types of agents, Environments **Informed search methods:** Best first, A*, Hill climbing, Simulated annealing, Admissibility of A*, AO*	5
II	**Knowledge Representation & Reasoning** **First order predicate logic:** Syntax and semantics, Extensions and notational variations, Simple reflex agent; **Inference in First Order Logic:** Inference rules involving Quantifiers, Generalized modus ponens, Forward and Backward chaining, Completeness	7
III	**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	7
IV	**Supervised Machine Learning: Regression and Classification** **Regression:** Linear regression, Multiple linear regression, Train, dev and test dataset, Performance measure, Bias-variance trade off, Regularization **Classification:** Binary classification: Logistic regression, Decision tree, SVM, **Ensemble methods:** Bagging, Boosting, Random Forest	8

V	**Reinforcement learning** **Introduction to RL:** The RL Problem, **Markov Decision Process (MDP):** Markov Process, Markov Reward Process, Markov Decision Process and Bellman Equations; **Planning by Dynamic Programming (DP):** Policy Evaluation, Value Iteration, Policy Iteration, DP Extensions and Convergence using Contraction Mapping	8
VI	**Unsupervised learning and Case study** **Anomaly Detection:** Introduction, Basic techniques for univariate data, LOF, iForest, **Clustering:** Introduction, BIRCH, Fuzzy clustering **Case study:** State-of-the-art AI and ML application	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	3		1										1	
CO2	2	3	2										2	2
CO3		3							2				2	
CO4	2	2							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

(Government Aided Autonomous Institute)

AY 2023-24

Course Information	
Programme	M.Tech. (Computer science and engineering)
Class, Semester	First Year M.Tech., Sem I
Course Code	**7CO503**
Course Name	**Mathematical foundations of Computer Science**
Desired Requisites:	Discrete Mathematics

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

Course Objectives	
1	To introduce the mathematical fundamentals for computer science and engineering.
2	To study various sampling and classification problems
3	
4	
5	

Course Outcomes (CO) with Bloom's Taxonomy Level		
At the end of the course, the students will be able to,		
CO1	explain the basic notions of discrete and continuous probability.	APPLY
CO2	analyze the methods of statistical inference, and the role that sampling distributions play in those methodS	ANALYSE
CO3	perform correct and meaningful statistical analysis of simple to moderate complexity.	CREATE
CO4		

Module	**Module Contents**	**Hours**
I	**Probability** Probability mass, density, and cumulative distribution functions, Parametric families of distributions, Expected value, variance, conditional expectation, Applications of the univariate and multivariate Central Limit Theorem, Probabilistic inequalities, Markov chains	6
II	**Sampling** Random samples, sampling distributions of estimators, Methods of Moments and Maximum Likelihood	7

III	**Statistical inference** Statistical inference, Introduction to multivariate statistical models: regression and classification problems, principal components analysis, The problem of overfitting model assessment.	7
IV	**Graph Theory** Graph Theory: Isomorphism, Planar graphs, graph coloring, Hamiltonian circuits and Euler cycles. Permutations and Combinations with and without repetition. Specialized techniques to solve combinatorial enumeration problems	8
V	**Computer science and engineering applications** Computer science and engineering applications: Data mining, Network protocols, analysis of Web traffic, Computer security, Software engineering, Computer architecture, Operating systems, Distributed systems, Bioinformatics, Machine learning.	8
VI	**Recent Trends** Recent Trends in various distribution functions in mathematical field of computer science for varying fields like bioinformatics, soft computing, and computer vision.	6

Text Books	
1	Trivedi K., Probability and Statistics with Reliability, Queuing, and Computer Science Applications. Wiley.
2	
References	
1	John Vince, Foundation Mathematics for Computer Science, Springer.
2	Mitzenmacher M. and Upfal E., Probability and Computing: Randomized Algorithms and Probabilistic Analysis, Cambridge University Press.
3	Tucker Alan, Applied Combinatorics, Wile
Useful Links	
1	

CO-PO Mapping						
	Programme Outcomes (PO)					
	1	**2**	**3**	**4**	**5**	**6**
CO1			3			
CO2	1			2		1
CO3	2		3	2	1	2

The strength of mapping is to be written as 1,2,3; Here, 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		**ISE**	**MSE**	**ESE**	**Total**
1	Remember				
2	Understand				
3	Apply	10	15	25	**50**
4	Analyze	10	15	25	**50**
5	Evaluate				
6	Create				
Total		**20**	**30**	**50**	**100**

Walchand College of Engineering, Sangli

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AY 2023-24

Course Information

Programme	M.Tech. (Computer Science & Engineering)
Class, Semester	First Year M. Tech., Sem I
Course Code	**7CO551**
Course Name	**Advanced Data Structures Lab**
Desired Requisites:	UG level course in Data Structures Lab

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

Course Objectives

1	To impart knowledge of advanced data structures such as temporal data structures and geometric data structures.
2	To make students familiar with advanced concepts related to trees, graphs, hashing and string matching.
3	To contribute in choosing appropriate data structures and using them for solving real world problems.
4	

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO1	apply and demonstrate knowledge of advanced data structures for solving real world problems.	Apply
CO2	analyse algorithms, compare data structures and evaluate the performance of the advanced data structures	Evaluate
CO3	Create an application using novel data structures and/ or create our own abstract data type	Create

Mini Project Guidelines

Course Contents:

Students are expected to carry out independent research work on the chosen topic in this domain. Initially, student would be able to understand the usage of different data structures, use them and apply its operations for solving real-world problems. In discussion with the concerned faculty during laboratory hours, the student would plan the Mini project and prepare a synopsis. The progress of the work done and discussion would be documented from time-to-time. The final system would be checked if it meets the requirements specified and the corrections if any would be incorporated in discussion with the faculty. Student would submit a brief Project Report that must include proper documentation including Introduction, Literature survey, Hardware & Software Requirements, System Design Architecture or Block Diagram, Implementation Details (with proper screenshots), Complexity of using particular data structure, Conclusion and Future work.

Implement the following using C/C++/Java

1. Write a program to perform the following operations on singly linked list. i) Creation ii) Insertion iii) Deletion iv) Traversal.
2. Write a program to perform the following operations on doubly linked list. i) Creation ii) Insertion iii) Deletion iv) Traversal in both ways
3. Write a program that implements stack (its operations) using i) Arrays ii) linked list
4. Write a programs that implements Queue (its operations) using i) Arrays ii) linked list
5. Write C program that implements the Quick sort method to sort a given list of integers in ascending order.
6. Write C program that implement the Merge sort method to sort a given list of integers in ascending order.
7. Write C program that implement the SHELL sort method to sort a given list of integers in ascending order. (ex. WALCHAND COLLEGE OF ENGINEERING SANGLI 2023 Batch)
8. Write a program to perform the following: i) Creating a Binary Tree of integers ii) Traversing the above binary tree in preorder, inorder and postorder.
9. Write a C program to perform the following: i) Creating a AVL Tree of integers ii) Traversing the above binary tree in preorder, inorder and postorder.
10. Write a C program that uses functions to perform the following: i) Creating a SplayTree of integers ii) Traversing the above binary tree in preorder, inorder and postorder.
11. Write a C program to perform the following: i) Creating a B-Tree of integers ii) Traversing the above binary tree in preorder, inorder and postorder.
12. Write a program that implements Kruskals algorithm using a disjoint set data structure. The program takes as input a file (data.txt), in which each line either represents a vertex or an edge. For the edge lines, the first integer on that line representing the starting vertex, the second the ending vertex, and the third the weigh of the edge. Use this file to construct, line by line, the graph upon which Kruskal‟s algorithm will be run (do NOT hardcode this graph!).
13. Write a program to simulate various graph traversing algorithms.
14. Write a program to find the minimal spanning tree of a graph using the Prim‟s algorithm. The program should be able to read in the weight matrix of a graph and produce the minimal spanning tree Generate weight matrices (using a random number generator) with a large number of nodes and estimate the time complexity of the algorithm.
15. Write a program to find the closest pair of points using a divide and conquer strategy. Use the random number generator to generate a large number of points in a unit square as input to the algorithm. Test the correctness of the algorithm by using a brute force method.
16. Use dynamic programming to find the optimal binary search tree for a given set of numbers together with their probabilities. Remember that the numbers may be generated in any order, so, a presorting step is also required.

Text Books	
1	Cormen Thomas H., Leiserson Charles E., Rivest Ronald L., Stein Clifford, *Introduction to Algorithms* PHI, Third Edition, 2009
2	Mark de Berg, Otfried Cheong, Marc van Kreveld, Mark Overmars , *Computational Geometry - Algorithms and Applications*, Springer, Third Edition, 2008
3	Erik Demaine, Lecture Notes on MIT Courseware
References	
1	O'Rourke Joseph, *Computational Geometry in C*, Cambridge University Press
2	Diestel Reinhard, *Graph Theory*, Springer-Verlag, 2000
3	Brass Peter, *Advanced Data Structures*, Cambridge University Press.
Useful Links	

1	NPTEL Videos of 'Data Structures and Algorithms' Course: Link
2	Data Structures with Visualization: Link
3	Lecture Videos from Erik Demaine from MIT: Link
4	

CO-PO Mapping						
	Programme Outcomes (PO)					
	1	**2**	**3**	**4**	**5**	**6**
CO1			2			
CO2	3					2
CO3		2		2	1	
The strength of mapping is to be written as 1,2,3; Here, 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**	**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
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.				

Assessment Plan based on Bloom's Taxonomy Level (Marks)				
Bloom's Taxonomy Level	**LA1**	**LA2**	**ESE**	**Total**
Remember				
Understand				
Apply	20	10	5	35
Analyze	10	10	10	30
Evaluate		10	10	20
Create			15	15
Total	**30**	**30**	**40**	**100**

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Course Information	
Programme	B.Tech. (Computer Science & Engineering)
Class, Semester	First Year M. Tech., Sem I
Course Code	7CO552
Course Name	Artificial Intelligence and Machine Learning Lab
Desired Requisites:	Data structures, Algorithms, Probability and Statistics

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

Course Objectives	
1	To make students do practical implementation of the different AI and ML concepts and techniques.
2	To make students familiar with steps involved in applying machine learning algorithms to real-life problems
3	To get insights of how AI 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,

	Course Outcome Statement/s	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Apply AI and ML algorithms to solve real world problems and analyse the results.	III, IV	Apply, Analyse
CO2	Design and provide best solution to AI and ML problems by measuring the performance of different algorithms/tools, and comparing them.	V, VI	Evaluate, Create

List of Topics (Applicable for Interaction mode):

List of Lab Activities:

1. Represent knowledge in different forms a) Logical Representation. b) Semantic Networks c) Production Rules d) Frame Representation.
2. Implement Uniform Cost algorithm to solve 8-queens' problem.
3. Implement A* algorithm.
4. Use Minimax approach to find optimal move in a Tic-Tac-Toe Game.
5. Perform regression on given House Prices dataset considering one variable (Area) and multiple variables.
6. Design and implementation of Naïve Bayes Algorithm to find the probability of playing a Golf or not playing it, under given environmental conditions.
7. Apply logistic regression on given dataset of penguins.
8. Use breast cancer dataset from UCI repository and apply random forest to predict if a data sample has breast cancer. Report P, R and F values.
9. Adopt procedures to handle imbalanced datasets and compare performance.
10. Implement GridWorld problem using Reinforcement Learning.
11. Implement K-means and KNN Clustering algorithm to given dataset by varying the number of clusters and compare the results.
12. Apply LOF and kNN algorithm to detect credit card fraud.

Text Books	
1	Web Technology: Theory and Practice by M. Srinivasan, Released June 2012, Publisher(s): Pearson India, ISBN: 9788131774199
References	
1	Web Application Security by Andrew Hoffman, Released March 2020, Publisher(s): O'Reilly Media, Inc. ISBN: 9781492053118
2	Web Technologies by Achyut Godbole and Atul Kahate, Publication: Tata McGraw-Hill Education Pvt. Ltd., ISBN13: 9781259062681
Useful Links	
1	https://www.w3schools.com/

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		2		3				3				2	3
CO3	1		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

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,	Lab Course Faculty	During Week 9 to Week 16 Marks Submission at the end of Week 16	30

	journal			
Lab ESE	Lab activities, journal/ performance	Lab Course Faculty	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	M. Tech. (Computer Science and Engineering)
Class, Semester	First Year M. Tech., Sem I
Course Code	**7CO553**
Course Name	**Presentation and Technical Report Writing**
Desired Requisites:	

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

Course Objectives	
1	To provide an opportunity to students to do work independently on a topic.
2	To encourage creative thinking process in technical report writing
3	To enable students for good technical report writing and effective presentations.

Course Outcomes (CO) with Bloom's Taxonomy Level At the end of the course, students will be able to,		
CO1	demonstrate the characteristics of technical and business writing.	Apply
CO2	use a variety of materials to produce appropriate visual presentation for documents, such as instructions, descriptions, and research reports.	Evaluate
CO3	produce documents related to technology and writing in the workplace and will have improved their ability to write clearly, concisely, and accurately.	Create

Course Content

This course introduces students to the discipline of technical communication. Preparation of visuals to supplement text, workplace communication, descriptions of mechanisms, explanations of processes, and writing reports are the major topics included.
This course is designed for students enrolled in technical degree programs for making them industry ready.

Text Books	
1	Suitable books based on the contents of the topic.

References	
1	Suitable books based on the contents of the selected topic and research papers from reputed national and international journals and conferences.

Useful Links	
1	As per the need of the topic of report and presentation

CO-PO Mapping						
	Programme Outcomes (PO)					
	1	**2**	**3**	**4**	**5**	**6**
CO1		3	1			

CO2		3	1			
CO3		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

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.

Assessment Plan based on Bloom's Taxonomy Level (Marks) (For lab Courses)

Bloom's Taxonomy Level	LA1	LA2	Lab ESE	Total
Remember				
Understand				
Apply	15	15	15	**45**
Analyze				
Evaluate	15	15	15	**45**
Create			10	**10**
Total Marks	**30**	**30**	**40**	**100**

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Course Information

Programme	M.Tech. (Computer science and engineering)
Class, Semester	First Year M.Tech., Sem I
Course Code	**7CO511**
Course Name	**Image Processing**
Desired Requisites:	None

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

Course Objectives

1	To provide knowledge about fundamentals of digital image processing.
2	To illustrate concepts of image transforms, image enhancement, image segmentation, morphological operations, color image processing, compression
3	To apply the image processing algorithms to real world problems.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO1	explain fundamental concepts of digital image processing, mathematical transforms, image enhancement, segmentation, morphology, compression	Understand
CO2	apply image processing algorithms to solve real life problems and compare the results	Apply
CO3	design and compare different image processing algorithms	Analyze
CO4		

Module	**Module Contents**	**Hours**
I	**Digital Image Fundamentals** **Introduction**: Concept, Fundamental Steps and Components of Image Processing System **Digital Image Fundamentals:** Image Acquisition, A simple image model, Sampling and Quantization, Imaging Geometry, Different types of digital images	6
II	**Image Transforms** 2D systems and Necessary Mathematical preliminaries, 2D Orthogonal and Unitary Transforms, 1-D DFT, KL-Transforms, Cosine, Hadamard Transforms, Introduction to Wavelet transforms	8

III	**Image Enhancement** Point Processing, Basic Gray Level Transformations, Histogram Processing, Spatial domain Filtering, Frequency 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, Hough Transform, Active Contour, Watershed Transform, Region-based Segmentation – region growing, region splitting and merging, Feature Extraction	8
V	**Image Compression** Fundamentals, Compression model, Lossless Vs Lossy Compression, Fundamentals of Information Theory, Run-length coding, Huffman coding, Dictionary-based compression, Predictive coding, Transform-based coding, Image Compression Standards	6
VI	**Morphological Image Processing** Introduction, Dilation and Erosion, Opening and Closing, The Hit-or-miss transformation, Basic Morphological Algorithms, Boundary Extraction, Region Filling, Extraction of connected components, Thinning, Thickening	6

Text Books	
1	Gonzalez R. C., Woods R. E., "Digital Image Processing", PHI, Second Edition. 2002
2	Jain A. K., "Fundamentals of Digital Image Processing", PHI

References	
1	Sonka Milan, Vaclav Hlavac, Boyle, "Digital Image Processing and Computer Vision", Cengage Learning, Third edition, 2013
2	S. Jayaraman, S. Esakkirajan, T. Veerkumar, "Digital Image Processing", Tata McGrawHill, Third edition, 2010

Useful Links	
1	NPTEL Lectures

CO-PO Mapping

	Programme Outcomes (PO)					
	1	**2**	**3**	**4**	**5**	**6**
CO1	1		1		3	
CO2				3	1	2
CO3	1			2		2

The strength of mapping is to be written as 1,2,3; Here, 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		**ISE**	**MSE**	**ESE**	**Total**
1	Remember				
2	Understand				
3	Apply	10	15	25	**50**
4	Analyze	10	15	25	**50**
5	Evaluate				
6	Create				
Total		**20**	**30**	**50**	**100**

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Course Information	
Programme	M.Tech. (Computer science and engineering)
Class, Semester	First Year M.Tech., Sem I
Course Code	**7CO512**
Course Name	**Internet of Things**
Desired Requisites:	

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

Course Objectives	
1	To discuss various topics related to wireless sensor networks significant towards emerging internet-of-things (IoT).
2	To impart knowledge of hardware, operating systems, distributed systems, networking, security and databases required for IoT technology.
3	To illustrate wireless sensor network (WSN) /Internet of Things (IoT) specific issues such as localization, time synchronization, and topology control.
4	
5	

Course Outcomes (CO) with Bloom's Taxonomy Level		
At the end of the course, the students will be able to,		
CO1	describe requirements from emerging Smart applications, communication systems, protocols and middleware.	UNDERSTAND
CO2	compare and analyze communication and network protocols used in IoT	APPLY
CO3	assess and evaluate mechanisms and algorithms for time synchronization, security and localization in WSNs and IoT	ANALYZE
CO4		

Module	**Module Contents**	**Hours**
I	**Introduction and Applications:** smart transportation, smart cities, smart Living, smart energy, smart health, and smart learning. Examples of research areas include for instance: Self-Adaptive Systems, Cyber Physical Systems, Systems of	6

	Systems, Software Architectures and Connectors, Software Interoperability, Big Data and Big Data Mining, Privacy and Security.	
II	**IoT Reference Architecture** Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views. **Real-World Design Constraints-** Introduction, Technical Design constraints hardware, Data representation and visualization, Interaction and remote control.	7
III	**Industrial Automation** Service-oriented architecture-based device integration, SOCRADES: realizing the enterprise integrated Web of Things, IMC-AESOP: from the Web of Things to the Cloud of Things. **Commercial Building Automation-** Introduction, Case study: phase one-commercial building automation today, Case study: phase two- commercial building automation in the future.	7
IV	**hardware Platform for IoT** Hardware Platforms and Energy Consumption, Operating Systems, Time Synchronization, Positioning and Localization, Medium Access Control, Topology and Coverage Control, Routing: Transport Protocols, Network Security, Middleware, Databases.	8
V	**IOT Physical Devices & Endpoints** What is an IOT Device, Exemplary Device Board, Linux on Raspberry , Interface and Programming & IOT Device.	7
VI	**Recent trends in IoT with case studies:** Recent trends in sensor network and IOT architecture, Automation in Industrial aspect of IOT.	5
Text Books		
1	Mandler B., Barja J., Campista Mitre, M.E., Cagá_ová, D. Chaouchi, H. Zeadally, S. Badra, M. Giordano, S. Fazio, M. Somov, A. Vieriu, R.-L., "Internet of Things. IoT Infrastructures" , Springer International Publishing, Second International Summit, IoT 360° 2015, Rome, Italy, October 27-29, 2015. Revised Selected Papers, Part I	
2	Kyung, C.-M., Yasuura, H. Liu, Y. Lin, Y.-L., "Smart Sensors and Systems", Springer International Publishing,2017.	

References	
1	Hersent Olivier, Boswarthick David , Elloumi Omar , “The Internet of Things: Key Applications and Protocols”, Wiley-Blackwell, Second Edition ,2012
2	
Useful Links	
1	NPTEL Lectures

CO-PO Mapping						
	Programme Outcomes (PO)					
	1	**2**	**3**	**4**	**5**	**6**
CO1	1		1		3	
CO2				3	1	2
CO3	1			2		2
The strength of mapping is to be written as 1,2,3; Here, 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		**ISE**	**MSE**	**ESE**	**Total**
1	Remember				
2	Understand				
3	Apply	10	15	25	**50**
4	Analyze	10	15	25	**50**
5	Evaluate				
6	Create				
Total		**20**	**30**	**50**	**100**

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Course Information	
Programme	M.Tech. (Computer science and engineering)
Class, Semester	First Year M.Tech., Sem I
Course Code	**7CO513**
Course Name	**Human Computer Interaction**
Desired Requisites:	UG level course in Data Structures

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

Course Objectives	
1	Understand Human-Centered Design Principles
2	Learn User Research Techniques
3	to design for positive user experiences, considering emotional design aspects, aesthetics, and the overall impact of the technology on users' feelings and perceptions.
4	
5	

Course Outcomes (CO) with Bloom's Taxonomy Level		
At the end of the course, the students will be able to,		
CO1	Demonstrate a clear understanding of the fundamental principles, concepts, and theories that underpin human-computer interaction.	UNDERSTAND
CO2	Design intuitive and user-friendly interfaces by employing interaction design principles, arranging interface elements effectively, and optimizing information architecture.	ANAYSE
CO3	Implement different interaction techniques, such as touch interfaces, voice interfaces, and gestures, for various platforms and technologies.	APPLY
CO4		

Module	**Module Contents**	**Hours**
I	**Module 1: Introduction to Human-Computer Interaction** Definition and importance of HCI Historical development and evolution of HCI Key principles and goals of HCI Human-centered design and user-centered design	8
II	**Module 2: User Research and Understanding Users** User personas and scenarios Ethnographic studies and field observations	6

	Surveys and questionnaires Cognitive models and mental models Task analysis and user workflows	
III	**Module 3: Interaction Design** Interface design principles Interaction design models (e.g., Norman's model) User interface elements and controls Visual design and aesthetics Information architecture and navigation design	6
IV	**Module 4: Usability and User Experience (UX)** Usability testing methods and usability heuristics User feedback and usability evaluation Accessibility and inclusive design User experience design and emotional design User journey mapping and touchpoints	8
V	**Module 5: Interaction Techniques and Technologies** Input and output devices Gestural interfaces and touch interaction Voice user interfaces (VUIs) Virtual reality (VR) and augmented reality (AR) Multi-modal interaction and cross-device interaction	6
VI	**Module 6: User-Centered Development and Evaluation** Rapid prototyping and iterative design User-centered evaluation methods A/B testing and usability metrics User feedback analysis and iteration Design thinking and creativity in HCI	6

Text Books	
1	"The Design of Everyday Things" by Donald A. Norman This book introduces fundamental principles of design and usability, providing insights into how people interact with everyday objects and technologies.
2	"Interaction Design: Beyond Human-Computer Interaction" by Jenny Preece, Yvonne Rogers, and Helen Sharp
3	"Don't Make Me Think, Revisited: A Common Sense Approach to Web Usability" by Steve Krug

References	
1	"Human-Computer Interaction" by Alan Dix, Janet E. Finlay, Gregory D. Abowd, and Russell BealeA comprehensive HCI textbook that covers a wide range of topics, including user-centered design, usability evaluation, and cognitive models.

2	"Interaction Design for Complex Problem Solving: Developing Useful and Usable Software" by Barbara Mirel Focusing on designing software for complex problem-solving scenarios, this book emphasizes the importance of user-centered design in software development.
3	"The Elements of User Experience: User-Centered Design for the Web and Beyond" by Jesse James GarrettThis book breaks down the user experience design process, from strategy and scope to the final user interface, providing insights into creating holistic user experiences.
Useful Links	
1	NPTEL Lectures

CO-PO Mapping						
	Programme Outcomes (PO)					
	1	**2**	**3**	**4**	**5**	**6**
CO1				2		
CO2	2			3	1	2
CO3	3		1			
The strength of mapping is to be written as 1,2,3; Here, 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		**ISE**	**MSE**	**ESE**	**Total**
1	Remember				
2	Understand	10			**10**
3	Apply	10	15	25	**50**
4	Analyze		15	25	**40**
5	Evaluate				
6	Create				
Total		**20**	**30**	**50**	**100**

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Course Information

Programme	M.Tech. (Computer science and engineering)
Class, Semester	First Year M. Tech., Sem II
Course Code	7CO514
Course Name	Natural Language Processing
Desired Requisites:	Mathematics – Linear Algebra, Probability Theory

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

Course Objectives

1	To build AI applications such that it will enable computer to read text, hear speech and interpret it.
2	To acquaint students with the basics of text processing
3	To illustrate steps involved in building text mining applications
4	To share the importance of different set of features for machine learning tasks

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO1	explain fundamental concepts of text processing	Understand
CO2	apply text processing algorithms to derive different representations of text	Apply
CO3	automate the real-life problems by choosing appropriate features and models	Evaluate
CO4	develop models for Information Retrieval and Chatbot application	Creating

Module	**Module Contents**	**Hours**
I	**Introduction** Introduction, Steps Involved, Tokenization, Stemming, Lemmatization, Regular expressions- extraction of information using Regex, Text Normalization, Minimum edit distance, Document Similarity measures - Cosine and cluster measures, exploration of python libraries like NLTK, SciPy, re.	4
II	**Language Models** Information Retrieval & Language Models Introduction, IDF, Tf-Idf, Boolean Model, Vector Space Model, N-gram Language Models, Spelling correction - Edit distance, Advanced smoothing for language modelling, POS tagging, Performance Measures, Precision, Recall, F-measure	5
III	**Distributed Word Representation** Vector Space Model - word vectors, GloVe/Word2Vec model, word embedding, Contextual Embeddings, Deriving Word Vectors from Corpus, Word Senses and WordNet	4

IV	**Text Classification** Constituency Grammars, Context-Free Grammar, Constituency Parsing, Dependency Parsing, Lexicons for Sentiment, Distributional Semantics, Topic Models, Sentiment Classification	4
V	**Sequence Classification** Sequence Labelling for Parts of Speech and Named Entities, Deep Learning Architectures for Sequence Processing, Models for Sequential tagging – MaxEnt, CRF, Recurrent Neural network relevant to NLP	5
VI	**Case Study** Machine Translation and Encoder-Decoder Models, Discourse Coherence, Question Answering, Chatbots & Dialogue Systems, Sentiment Analysis and Opinion Mining, Text Generation using Language Models	4

Text Books	
1	Steven Bird, Ewan Klein, and Edward Loper, "*Natural Language Processing with Python*", O'reilly Publications, 2009.
2	Yoav Goldberg**, "***Neural Network Methods for Natural Language Processing",* Synthesis Lectures on Human Language Technologies, 2017

References	
1	Dan Jurafsky and James H. Martin, "*Speech and Language Processing*", Standford University, 3rd Edition, 2020
2	Jason Brownlee, "*Deep Learning for Natural Language Processing*", 2017.

Useful Links	
1	NLP 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	3
CO1	1														
CO2	2		3												
CO3			2	1											
CO4		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 Plan based on Bloom's Taxonomy Level (Marks) (For lab Courses)				
Bloom's Taxonomy Level	**ISE**	**MSE**	**ESE**	**Total**
Remember				
Understand	5	5	10	**20**
Apply	5	5	20	**30**
Analyze	5	5	10	**20**
Evaluate	5	5	10	**20**
Create			10	**10**
Total Marks	**20**	**20**	**60**	**100**

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Course Information

Programme	M.Tech. (Computer science and engineering)
Class, Semester	First Year M. Tech., Sem II
Course Code	7CO515
Course Name	Advanced Network Technology
Desired Requisites:	Computer networks

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

Course Objectives

1	understanding of advanced network protocols, architectures, and technologies, including their roles and functionalities in modern networking.
2	Gain expertise in network security principles, cryptography, and encryption techniques to design and implement secure communication systems.
3	Acquire specialized knowledge in wireless and mobile networks, covering cellular technologies, wireless LANs, and mobile ad hoc networks.
4	

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO1	Exhibit a strong grasp of advanced networking protocols, architectures, and technologies, and their roles in modern communication systems.	Understand
CO2	Implement advanced security mechanisms and encryption techniques to ensure data integrity, confidentiality, and authentication in network communication.	Apply
CO3	Design and implement wireless and mobile networking solutions, considering factors such as coverage, mobility, and scalability.	Evaluate
CO4	Analyze emerging networking trends and technologies, evaluate their potential impact, and make informed decisions about their adoption.	Creating

Module	**Module Contents**	**Hours**
I	Module 1: Network Protocols and Security OSI and TCP/IP reference models IPv6 and its features Network security fundamentals Cryptography and encryption algorithms Secure socket layer (SSL) and transport layer security (TLS)	6
II	Module 2: Wireless and Mobile Networks Cellular networks (3G, 4G, 5G) Wireless LANs and IEEE 802.11 standards Mobile IP and mobile ad hoc networks	7

	IoT communication protocols (MQTT, CoAP)	
III	Module 3: Software-Defined Networking (SDN) and Cloud Networking SDN architecture and OpenFlow protocol Network virtualization and NFV Cloud networking and virtualization Virtualization in cloud environments	6
IV	Module 4: Internet of Things (IoT) Networking and Edge Computing IoT architectures and middleware IoT security and privacy considerations Edge computing and fog computing for IoT IoT communication protocols	6
V	Module 5: Quality of Service (QoS) and Network Management Quality of Service metrics and parameters Traffic engineering and congestion control Network monitoring tools and techniques SNMP (Simple Network Management Protocol)	7
VI	Module 6: Advanced Routing, Switching, and Future Trends BGP (Border Gateway Protocol) and its configurations MPLS (Multiprotocol Label Switching) Emerging network technologies and trends Quantum networking and blockchain applications in networking	7

Text Books	
1	"Computer Networking: Principles, Protocols and Practice" by Olivier Bonaventure
2	"Computer Networks" by Andrew S. Tanenbaum and David J. Wetherall
References	
1	"Computer Networking: A Top-Down Approach" by James F. Kurose and Keith W. Ross
2	"TCP/IP Illustrated, Volume 1: The Protocols" by W. Richard Stevens
Useful Links	
1	NPTEL

CO-PO Mapping

	Programme Outcomes (PO)														
	1	2	3	4	5	6									
CO1	1														
CO2	2		3												
CO3			2	1											
CO4		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 Plan based on Bloom's Taxonomy Level (Marks) (For lab Courses)				
Bloom's Taxonomy Level	**ISE**	**MSE**	**ESE**	**Total**
Remember				
Understand	5	5	10	**20**
Apply	5	5	20	**30**
Analyze	5	5	10	**20**
Evaluate	5	5	10	**20**
Create			10	**10**
Total Marks	**20**	**20**	**60**	**100**

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Course Information	
Programme	M.Tech. (Computer Science and Engineering)
Class, Semester	First Year M. Tech., Sem I
Course Code	**7CO516**
Course Name	**Modern Operating System**
Desired Requisites:	Operating System

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	**Credits: 3**			

Course Objectives	
1	To deliver different components of advanced and distributed computing system.
2	To provide knowledge of issues involved in synchronization, resource and process management.
3	To induce steps involved in designing, simulating and implementing various operating systems.

Course Outcomes (CO) with Bloom's Taxonomy Level		
At the end of the course, the students will be able to,		
CO1	Analyze the advances in operating systems and characteristics of environment in which they are used	Analyze
CO2	Apply the communication techniques in distributed operating systems implementations and analyze the distributed file systems.	Apply
CO3	Design and implement the different algorithms in synchronization, resource and process management and build real time operating system kernel for different applications.	Evaluate

Module	**Module Contents**	**Hours**
I	**Real Time Operating Systems** Overview, System characteristics, Features of real time kernels, implementing real time operating systems, real time CPU scheduling. Case study of different RTOS and mobile operating System - Android, Windows Phone	7
II	**Distributed Operating System** Architectures, Issues in Distributed operating systems, Limitations of Distributed Systems, Lamport's logical clock, Global states, Chandy-Lampert's global state recording algorithm, Basic concepts of Distributed Mutual Exclusion, Lamport's Algorithm, Ricart-Agrawala Algorithm; Basic concepts of Distributed deadlock detection	7
III	**Distributed File system and Architecture** Design issues, SUN Network File system Basic concepts of Distributed shared memory, Basic concepts of Distributed Scheduling, Load balancing, Load sharing	6
IV	**Multiprocessor System** Motivation, Classification, Multiprocessor Interconnections, Types, Multiprocessor OS functions & requirements; Design & Implementation Issue; Introduction to parallel programming; Multiprocessor Synchronization.	6
V	**Analytic Modeling** Introductions, Queuing Theory, Markov Process	5

VI	**Security & Protection** Security-threats & goals, Penetration attempts, Security Policies & mechanisms, Authentication, Protections & access control Formal models of protection, Cryptography, worms & viruses. **Case Study of any two real time OS** ClickOS, Drawbridge,GUK11, MiniOS, OSv or any latest cloud OS	8

Text Books	
1	P. K. Sinha, "Distributed Operating Systems Concepts and Design", PHI.
2	Silberschatz, Galvin, Gagne "Operating System Concepts", John Wiley, 8th Edition.2011
References	
1	S. Tanenbaum ,"Modern Operating Systems", Pearson/PH 3rd Edition 2009.
2	S. Tanenbaum ,"Distributed Operating Systems", Pearson, 5th Impression 2008.
3	
Useful Links	
1	
2	

CO-PO Mapping						
	Programme Outcomes (PO)					
	1	**2**	**3**	**4**	**5**	**6**
CO1	2			3		2
CO2				1	1	
CO3	2			3	1	
The strength of mapping is to be written as 1,2,3; Here, 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		**T1**	**T2**	**ESE**	**Total**
1	Remember				
2	Understand				
3	Apply	05	05	20	**30**
4	Analyze	10	10	20	**40**
5	Evaluate	05	05	25	**30**
6	Create				
Total		**20**	**20**	**20**	**60**

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Course Information

Programme	M. Tech. (Computer Science and Engineering)
Class, Semester	First Year M. Tech., Sem II
Course Code	7CO521
Course Name	Advanced Computer Algorithms
Desired Requisites:	Design and Analysis of Algorithms Basics

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

Course Objectives

1	To introduce students to the advanced methods of designing and analysing algorithms.
2	To allow students choose appropriate algorithm and use it for a specific problem.
3	To impart knowledge of different classes of problems along with recent developments in the area of algorithmic design.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO1	apply algorithms involving different strategies for problem solving	Apply
CO2	analyze algorithm for given problem at hand	Analyze
CO3	evaluate the complexity of the algorithm	Evaluate

Module	**Module Contents**	**Hours**
I	**Elementary Algorithms** **Sorting:** Review of various sorting algorithms **Graph:** Topological sorting, Definitions and Elementary Algorithms: Shortest path by BFS, shortest path in edge-weighted case (Dijkstra's), depth-first search and computation of strongly connected components, emphasis on correctness proof of the algorithm and time/space analysis, example of amortized analysis.	8
II	**Graph Algorithms** **Matroids:** Introduction to greedy paradigm, algorithm to compute a maximum weight maximal independent set. Application to Minimum Spanning Tree. **Shortest Path in Graphs:** Floyd-Warshall algorithm and introduction to dynamic programming paradigm. More examples of dynamic programming.	6
III	**Parallel Algorithms** Introduction, Data and Temporal parallelism, RAM and PRAM Model, Shared Memory and Message Passing Models, PRAM Algorithms: Prefix Sum, List Ranking, Merging two sorted lists, Matrix multiplication, Analysis of PRAM Algorithms.	7

IV	**Modulo Representation and DFT** **Modulo Representation of integers/polynomials**: Chinese Remainder Theorem, Conversion between base-representation and modulo- representation, Powers of an element, The RSA public-key cryptosystem. **Discrete Fourier Transform (DFT):** In complex field, DFT in modulo ring. Fast Fourier Transform algorithm.	7
V	**NP-completeness:** Basic concepts of complexity classes- P, NP, NP-Hard, NP Complete, Examples, Proof of NP-hardness and NP-completeness. **One or more of the following topics based on interest-** Approximation algorithms, Randomized Algorithms, Interior Point Method, Advanced Number Theoretic Algorithm	6
VI	**Recent Trends** Recent Trends in problem solving paradigms using recent searching and sorting techniques by applying recently proposed data structures.	5

Text Books	
1	C. R. Kothari, Research Methodology, New Age international
2	Deepak Chopra and Neena Sondhi, Research Methodology : Concepts and cases, Vikas Publishing House, New Delhi

References	
1	Kleinberg and Tardos, *Algorithm Design*, Pearson Education Limited
2	Robert Sedgewick, "*Algorithms in C++*", Addison-Wesley Professional, Third Edition

Useful Links	
1	NPTEL Videos of '*Data Structures and Algorithms*' Course: Link

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1				2											
CO2	2			3											
CO3	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 Plan based on Bloom's Taxonomy Level (Marks) (For lab Courses)

Bloom's Taxonomy Level	**ISE**	**MSE**	**ESE**	**Total**
Remember				
Understand	5	5	10	**20**
Apply	5	10	20	**35**
Analyze	5	10	10	**25**
Evaluate	5	5	10	**20**
Create				
Total Marks	**20**	**30**	**50**	**100**

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Course Information

Programme	M.Tech. (Computer science and engineering)
Class, Semester	First Year M. Tech., Sem II
Course Code	**7CO522**
Course Name	**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	-	Nil			
Interaction	-	**Credits: 3**			

Course Objectives

1	To foster student's abilities to implement soft computing-based solutions for real-world problems
2	To impart knowledge of non-traditional technologies and fundamentals of artificial neural networks, fuzzy sets, fuzzy logic, genetic algorithms
3	To discuss 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	analyze soft computing techniques and their roles in building intelligent machines	Analyze
CO2	evaluate fuzzy logic and neural networks techniques to solve various engineering problems	Evaluate
CO3	build prototyping applications using genetic algorithms and hybrid approaches	Create

Module	**Module Contents**	**Hours**
I	**Introduction:** Evolution of Computing: Soft Computing Constituents, From Conventional AI to Computational Intelligence, Characteristics of Neuro Computing and Soft Computing, Difference between Hard Computing and Soft Computing, Concepts of Learning and Adaptation	6
II	**Fuzzy Logic:** Fuzzy Sets, Operations on Fuzzy Sets, Fuzzy Relations, Membership Functions: Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems, Fuzzy Expert Systems, Fuzzy Decision Making	7
III	**Neural Networks:** Machine Learning Using Neural Network, Adaptive Networks, Feed forward Networks, Supervised Learning Neural Networks, Radial Basis Function Networks : Reinforcement Learning, Unsupervised Learning Neural Networks, Adaptive Resonance Architectures, Advances in Neural Networks	7

IV	**Genetic Algorithms:** Introduction to Genetic Algorithms (GA), Applications of GA in Machine Learning : Machine Learning Approach to Knowledge Acquisition	7
V	**Hybrid Systems:** Introduction to Hybrid Systems, Adaptive Neuro Fuzzy Inference System(ANFIS)	6
VI	**Deep Learning:** Spark auto encoder, Convolutional neural networks, Recurrent neural networks, Deep belief networks	7

Text Books	
1	Rajasekaran S., Vijayalakshmi Pai G.A., "Neural Networks, Fuzzy Logic and Genetic Algorithms", PHI, 2003
2	Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press e- book

References	
1	Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani, "Neuro-Fuzzy and Soft Computing", PHI, 2003
2	George J. Klir and Bo Yuan, "Fuzzy Sets and Fuzzy Logic: Theory and Applications", PHI, 1995

CO-PO Mapping

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

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 Plan based on Bloom's Taxonomy Level (Marks) (For lab Courses)

Bloom's Taxonomy Level	**ISE**	**MSE**	**ESE**	**Total**
Remember				
Understand				
Apply				
Analyze	20	10	20	**50**
Evaluate		10	20	**30**
Create			20	**20**
Remember				
Total	**20**	**20**	**60**	**100**

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Course Information

Programme	M. Tech. (Computer Science and Engineering)
Class, Semester	First Year M. Tech., Sem II
Course Code	7CO523
Course Name	Information Security
Desired Requisites:	Basics of security

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

Course Objectives

1	Develop a strong foundational understanding of information security concepts, principles, and terminology.
2	Gain expertise in cryptographic techniques, including encryption, decryption, digital signatures, and certificates, and understand how they contribute to secure communication and data protection.
3	Develop skills in identifying vulnerabilities, conducting vulnerability assessments, and performing penetration testing to uncover security weaknesses.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO1	Exhibit a clear grasp of information security principles, concepts, and terminology, including the security goals of confidentiality, integrity, and availability.	Apply
CO2	Design and implement network security measures, including the use of secure communication protocols and mechanisms for preventing and mitigating network attacks.	Analyze
CO3	Apply best practices for securing web applications, including identifying and addressing common web application vulnerabilities.	Evaluate

Module	**Module Contents**	**Hours**
I	**Module 1: Introduction to Information Security** Overview of information security concepts Security goals: confidentiality, integrity, availability Threats, vulnerabilities, and risks Security models: Bell-LaPadula, Biba, Clark-Wilson	8
II	Module 2: Cryptography and Network Security Principles of encryption and decryption Symmetric and asymmetric cryptography Public key infrastructure (PKI) Digital signatures and certificates Network security protocols: SSL/TLS, IPsec	6

III	Module 3: Access Control and Authentication Access control models: DAC, MAC, RBAC Authentication mechanisms: passwords, biometrics, tokens Multifactor authentication and single sign-on Identity management and federation	7
IV	Module 4: Security in Operating Systems and Software Secure software development lifecycle Buffer overflows and input validation Malware types: viruses, worms, Trojans Operating system security mechanisms Security patches and updates	7
V	Module 5: Threats and Vulnerability Management Common network attacks: DoS, DDoS, phishing Intrusion detection and prevention systems Vulnerability assessment and penetration testing Security incident response and handling	6
VI	Module 6: Secure Network Communication and Web Security Secure email communication and PGP VPNs and tunneling protocols Web security principles: XSS, CSRF, SQL injection Web application firewalls and secure coding practices	5

Text Books	
1	"Computer Security: Principles and Practice" by William Stallings and Lawrie Brown
2	"Cryptography and Network Security: Principles and Practice" by William Stallings

References	
1	"Security Engineering: A Guide to Building Dependable Distributed Systems" by Ross J. Anderson
2	"Network Security Essentials: Applications and Standards" by William Stallings

Useful Links	
1	NPTEL Videos

CO-PO Mapping

	Programme Outcomes (PO)														
	1	2	3	4	5	6									
CO1				2											
CO2	2			3											
CO3	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 Plan based on Bloom's Taxonomy Level (Marks) (For lab Courses)				
Bloom's Taxonomy Level	**ISE**	**MSE**	**ESE**	**Total**

Remember				
Understand	10	5	10	**25**
Apply	10	10	20	**40**
Analyze		10	10	**20**
Evaluate		5	10	**15**
Create				
Total Marks	**20**	**30**	**50**	**100**

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Course Information	
Programme	M.Tech. (Computer science and engineering)
Class, Semester	First Year M. Tech., Sem II
Course Code	**7CO572**
Course Name	**Soft Computing Lab**
Desired Requisites:	Programming knowledge

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

Course Objectives	
1	To demonstrate knowledge of implementation of artificial neural networks, fuzzy sets, fuzzy logic, genetic algorithms and hybrid systems
2	To evaluate soft computing based solutions of real-world problems

Course Outcomes (CO) with Bloom's Taxonomy Level		
At the end of the course, the students will be able to,		
CO1	Apply appropriate soft computing technique for creating prototyping applications	Apply
CO2	Evaluate soft computing techniques in building intelligent machines	Evaluate

Module Contents

Course Contents:

Assignments

1. Create a perceptron with appropriate number of inputs and outputs. Train it using fixed increment learning algorithm until no change in weights is required. Output the final weights Write a program to implement artificial neural network without back propagation.
2. Write a program to implement artificial neural network with back propagation.
3. Implement Union, Intersection, Complement and Difference operations on fuzzy sets. Also create fuzzy relation by Cartesian product of any two fuzzy sets and perform max-min composition on any two fuzzy relations.
4. Implement travelling sales person problem (tsp) using genetic algorithms.
5. Plot the correlation plot on dataset and visualize giving an overview of relationships among data on soya bins data. Analysis of covariance: variance (ANOVA), if data have categorical variables on iris data.
6. Implement linear regression and multi-regression for a set of data points
7. Implement crisp partitions for real-life iris dataset
8. Write a program to implement Hebb's rule Write a program to implement Delta rule.
9. Write a program to implement logic gates.
10. Implement svm classification by fuzzy concepts.

Text Books	
1	Rajasekaran S., Vijayalakshmi Pai G.A., "Neural Networks, Fuzzy Logic and Genetic Algorithms", PHI, 2003
2	Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press e-book

References	
1	Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani, "Neuro-Fuzzy and Soft Computing", PHI, 2003
2	George J. Klir and Bo Yuan, "Fuzzy Sets and Fuzzy Logic: Theory and Applications", PHI, 1995

Useful Links	
1	NPTEL LECTURES

CO-PO Mapping

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

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.

Assessment Plan based on Bloom's Taxonomy Level (Marks) (For lab Courses)

Bloom's Taxonomy Level	LA1	LA2	ESE	Total
Remember				
Understand				
Apply	20	10	20	50
Analyze				
Evaluate	10	20	20	50
Create				
Total Marks	**30**	**30**	**40**	**100**

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Course Information

Programme	M.Tech. (Computer science and engineering)
Class, Semester	First Year M. Tech., Sem II
Course Code	7CO545
Course Name	Pre-dissertation work and seminar
Desired Requisites:	Programming knowledge

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

Course Objectives

1	to find a high-quality research topic
2	to develop a convincing research proposal
3	to craft a high-quality introduction and literature review
4	to choose a suitable methodology and present your results
5	to polish your dissertation or thesis for the highest marks

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO1	Developing research based knowledge	Apply
CO2	Creating research based work	Create

Module Contents

Course Contents:

Module I: Introduction.
Module II: Review of Literature.
Module III: Methodology (Research Design & Methods)
Module IV: Presentation of Research (Results)
Module V: Summary, Implications, Conclusions (Discussion)
This second course of a two-semester sequence is designed to assist students in developing a dissertation proposal consisting of three chapters. This includes working to develop a clearly defined research idea, introduction, literature review, theoretical/conceptual framework, and research design. The Dissertation Seminar sequence will also provide networking opportunities with students in a similar place in their graduate studies as well as professional development designed to help students complete the dissertation after finishing the course sequence.

Assignments

1. Review paper publication

Text Books	
1	Rajasekaran S., Vijayalakshmi Pai G.A., "Neural Networks, Fuzzy Logic and Genetic Algorithms", PHI, 2003
2	Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press e-book

References	
1	Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani, "Neuro-Fuzzy and Soft Computing", PHI, 2003
2	George J. Klir and Bo Yuan, "Fuzzy Sets and Fuzzy Logic: Theory and Applications", PHI, 1995

Useful Links	
1	NPTEL LECTURES

CO-PO Mapping

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

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.

Assessment Plan based on Bloom's Taxonomy Level (Marks) (For lab Courses)

Bloom's Taxonomy Level	LA1	LA2	ESE	Total
Remember				
Understand				
Apply	20	10	20	50
Analyze				
Evaluate	10	20	20	50
Create				
Total Marks	**30**	**30**	**40**	**100**

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Course Information	
Programme	M. Tech. (Computer Science and Engineering)
Class, Semester	First Year M. Tech., Sem II
Course Code	7CO531
Course Name	Data Science
Desired Requisites:	Basics of mathematics , and strong programming skills

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

Course Objectives	
1	Develop a clear understanding of the fundamental concepts, principles, and terminology of data science.
2	Acquire skills to collect, scrape, and retrieve data from various sources, and apply preprocessing techniques to clean and prepare data for analysis.
3	Apply exploratory data analysis techniques to gain insights from data, and create meaningful visualizations to effectively communicate findings.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO1	Acquire, clean, preprocess, and manipulate diverse datasets from various sources, ensuring data quality and usability.	Apply
CO2	Apply statistical and visualization techniques to explore and summarize data, extracting meaningful insights and patterns.	Analyze
CO3	Apply a range of machine learning algorithms for solving classification, regression, clustering, and recommendation problems.	Evaluate

Module	**Module Contents**	**Hours**
I	Module 1: Introduction to Data Science Understanding data science concepts and its importance Role of data scientists and their skills Overview of the data science process and lifecycle	6
II	Module 2: Data Collection and Preprocessing Data sources and acquisition techniques Data scraping, APIs, and web data collection Data preprocessing, cleaning, and handling missing values	8
III	Module 3: Exploratory Data Analysis and Visualization Exploring and summarizing data using statistical measures Data visualization techniques and best practices Creating visualizations using libraries (e.g., Matplotlib, Seaborn)	7

IV	Module 4: Machine Learning Fundamentals Introduction to machine learning concepts Supervised, unsupervised, and semi-supervised learning Feature engineering and selection	7
V	Module 5: Supervised and Unsupervised Learning Regression analysis and linear models Classification algorithms (e.g., decision trees, random forests) Clustering techniques and dimensionality reduction	6
VI	Module 6: Advanced Topics in Data Science Natural Language Processing (NLP) fundamentals Introduction to deep learning and neural networks Introduction to big data concepts and tools Ethical considerations and bias in data science	5

Text Books	
1	"Python for Data Analysis" by Wes McKinney
2	"Introduction to Machine Learning with Python" by Andreas C. Müller and Sarah Guido

References	
1	"Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow" by Aurélien Géron
2	"Python Machine Learning" by Sebastian Raschka and Vahid Mirjalili

Useful Links	
1	NPTEL Videos

CO-PO Mapping

	Programme Outcomes (PO)														
	1	2	3	4	5	6									
CO1				2											
CO2	2			3											
CO3	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 Plan based on Bloom's Taxonomy Level (Marks) (For lab Courses)

Bloom's Taxonomy Level	**ISE**	**MSE**	**ESE**	**Total**
Remember				
Understand	10	5	10	**25**
Apply	10	10	20	**40**
Analyze		10	15	**25**
Evaluate		5	5	**10**
Create				
Total Marks	**20**	**30**	**50**	**100**

Walchand College of Engineering, Sangli
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AY 2023-24

Course Information

Programme	M.Tech. (Computer science and engineering)
Class, Semester	First Year M.Tech., Sem II
Course Code	**7CO532**
Course Name	**Data Encryption and Compression**
Desired Requisites:	

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

Course Objectives

1	To develop a research orientation among the students and to acquaint them with fundamentals of research methods.
2	To develop understanding of the basic framework of research process and techniques
3	To identify various sources of information for literature review and data collection.
4	To develop an understanding of the ethical dimensions of conducting applied research.
5	To develop understanding about patent process.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO1	**Classify** various methods to solve research problem.	Apply
CO2	**Construct** a research problem in respective engineering domain.	Apply
CO3	**Investigate** various data analysis techniques for a research problem.	Analyze
CO4	**Identify** various Intellectual Property Rights procedures	Apply

Module	**Module Contents**	**Hours**
I	Introduction to Data Compression Data Compression : Modelling and Coding, Statstical Modelling, Dictionary Schemes, LZ, Lossy CompressionShannon – Fano Algorithm, Huffman Algorithm, Adaptive Huffman CodingDifficulties in Huffman Coding, Arithmetic Coding – Decoding, Dictionary Based Compression	4
II	Video and Audio Compression Analog Video, Digital Video, MPEG – 2, H – 261 Encoder and Decoder Sound, Digital Audio, g-Law and A-Law Companding, MPEG – 1 Audio Layer	5
III	Data Security Security Goals, Cryptographic Attacks, Techniques, Symmetric Key: Substitution Cipher, Transposition Cipher , Stream and Block Cipher, DES, AES	5

IV	Network Security Email, PGP, S/MIME, Intrusion Detection System Web Security Considerations, SSL Architecture, SSL Message Formats, TLS, Secure Electronic Transactions Kerberos, X.509 Authentication Service, Public Key Infrastructure	4
V	**Compression Techniques** Loss less compression, Lossy Compression, Measures of performance, Modeling and coding, Mathematical Preliminaries for Loss-less compression: A brief introduction to information theory, Models: Physical models, Probability models, Markov models, com-posite source model, Coding: uniquely decodable codes, Prefix codes.	5
VI	**The Huffman coding algorithm** Minimum variance Huffman codes, Adaptive Huffman coding: Update procedure, Encoding procedure, Decoding procedure. Golomb codes, Rice codes, Tunstall codes, Applications of Hoffman coding: Loss less image compression, Text compression, Audio Compression.	4

Text Books	
1	Improvement of A5/1 encryption algorithm based on filtration technique Zainab H Jassim, Sattar B Sadkhan
2	

References	
1	International Data Encryption Algorithm Second Edition Gerard Blokdyk
2	

Useful Links	
1	NPTEL Lectures

CO-PO Mapping

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

Assessment Plan based on Bloom's Taxonomy Level (Marks) (For lab Courses)				
Bloom's Taxonomy Level	**ISE**	**MSE**	**ESE**	**Total**
Remember				
Understand				

Apply	15			**15**
Analyze	15	10		**25**
Evaluate		10	20	**30**
Create		10	20	**30**
Total Marks	**30**	**30**	**40**	**100**

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Course Information

Programme	M. Tech. (Computer Science and Engineering)
Class, Semester	First Year M. Tech., Sem II
Course Code	7CO533
Course Name	Blockchain Technology
Desired Requisites:	Basics of mathematics , and security algorithms

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

Course Objectives

1	Understand the fundamental concepts of blockchain technology, including decentralization, transparency, and immutability
2	Gain insights into the cryptographic techniques used in blockchain, such as hashing and digital signatures.
3	Examine real-world applications of blockchain across industries, including finance, supply chain, and healthcare.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO1	Describe cryptographic techniques like hashing and digital signatures used in blockchain security.	Understand
CO2	Develop and deploy basic smart contracts using Solidity on the Ethereum Virtual Machine.	Apply
CO3	Analyze and compare features of blockchain platforms like Ethereum and Hyperledger for different use cases	Analyze

Module	**Module Contents**	**Hours**
I	**Module 1: Introduction to Blockchain** **Overview of blockchain technology and its core principles** **Types of blockchains: public, private, and consortium** **Basics of decentralization, consensus, and immutability**	8
II	Module 2: Cryptography and Security Cryptographic techniques in blockchain: hashing, digital signatures Consensus mechanisms: Proof of Work (PoW), Proof of Stake (PoS) Security considerations and vulnerabilities in blockchain	8
III	Module 3: Smart Contracts and DApps Introduction to smart contracts and their benefits Ethereum Virtual Machine (EVM) and Solidity programming language Design principles and development of decentralized applications (DApps)	7

IV	Module 4: Blockchain Platforms and Frameworks In-depth exploration of blockchain platforms: Ethereum, Hyperledger Setting up a development environment for Ethereum or Hyperledger	7
V	Module 5: Blockchain Applications and Use Cases Real-world applications of blockchain in finance, supply chain, etc. Case studies of successful blockchain implementations Challenges and limitations of blockchain technology	7
VI	Module 6: Blockchain Development and Capstone Project Hands-on lab sessions for developing smart contracts Building a simple decentralized application (DApp) Students work on a blockchain-related project as a capstone	6

Text Books	
1	"Mastering Bitcoin: Unlocking Digital Cryptocurrencies" by Andreas M. Antonopoulos
2	"Blockchain Basics: A Non-Technical Introduction in 25 Steps" by Daniel Drescher
References	
1	"Blockchain Applications: A Hands-On Approach" by Arshdeep Bahga and Vijay Madisetti
2	"Blockchain Basics: A Practical Approach" by Pete Harris
Useful Links	
1	NPTEL Videos

CO-PO Mapping

	Programme Outcomes (PO)														
	1	2	3	4	5	6									
CO1				2											
CO2	2			3											
CO3	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 Plan based on Bloom's Taxonomy Level (Marks) (For lab Courses)

Bloom's Taxonomy Level	ISE	MSE	ESE	Total
Remember				
Understand	10	5	10	**25**
Apply	10	15	25	**50**
Analyze		10	15	**25**
Evaluate				
Create				
Total Marks	**20**	**30**	**50**	**100**

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Course Information

Programme	M.Tech. (Computer science and engineering)
Class, Semester	First Year M. Tech., Sem II
Course Code	7CO534
Course Name	Theory and Applications of 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	-	Nil			
Interaction	-	**Credits: 3**			

Course Objectives

1	To impart knowledge of the fundamentals of Remote Sensing (RS) and geographical information systems (GIS)
2	To make students familiar with Data and Data Products in RS and GIS.
3	To acquaint students advantages and 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,

CO1	Understand and summarize fundamental concepts in RS and GIS	Understand
CO2	Interpret and Apply various satellite RS data and demonstrate GIS data and GIS database management system	Apply
CO3	Compare and examine data and data Products of RS and GIS	Analyse
CO4	Select and Verify 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, Broad Classifications of Sensors and Platform, Earth Observation Satellite and Sensors, Data Reception, Transmission and Processing, Remote Sensing Data and Data Products.	4
II	**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, Spatial Filtering, Image Transformation, Image Classification and Analysis.	5
III	**Applications of Remote Sensing** Land use Land Cover Mapping, Crop Inventory, Ground Water Mapping, Urban Growth, Flood Plain Mapping, Disaster Management.	5

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, GPS	4
V	**GIS Data** GIS Data types and Data Representation, Data Acquisition, Georeferencing of GIS Data, Raster and Vector data, Raster to Vector conversion, Remote Sensing Data in GIS, GIS Database and Database Management System	5
VI	**GIS Spatial Data Analysis and Applications** Measurements in GIS-Lengths, Perimeters, and Areas, Queries, Reclassification, Buffering and Neighborhood Functions, Map Overlay, Spatial Interpolation, Analysis of Surfaces, Network Analysis, GIS Applications	4

Text Books	
1	Chandra, A.M. and Gosh, 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", John Wiley and Sons, 6th Edition. 2012
2	Chang, K, "Introduction to Geographical Systems", Tata McGraw-Hill, 4th Edition. 2010

Useful Links	
1	NPTEL: https://nptel.ac.in/noc/courses/noc19/SEM1/noc19-ce08 https://nptel.ac.in/noc/courses/noc18/SEM1/noc18-ce10

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1			2												
CO2			2												
CO3	2			2											
CO4	3			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 Plan based on Bloom's Taxonomy Level (Marks) (For lab Courses)

Bloom's Taxonomy Level	**ISE**	**MSE**	**ESE**	**Total**
Remember				
Understand	10	5	15	**30**
Apply	5	5	20	**30**
Analyze	5	5	15	**25**
Evaluate		5	10	**15**
Create				
Total Marks	**20**	**20**	**60**	**100**

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Course Information

Programme	M.Tech. (Computer science and engineering)
Class, Semester	First Year M.Tech., Sem III
Course Code	**7CO535**
Course Name	**Deep Learning**
Desired Requisites:	Working knowledge of Linear Algebra, Statistics and Probability Theory

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

Course Objectives

1	To explain the fundamentals of neural networks, recurrent neural networks (RNN), long short term memory cells and convolutional neural networks (CNN).
2	To demonstrate various learning models for practical application.
3	To discuss optimization approach and distribution techniques for Deep Learnin model
4	
5	

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO1	Illustrate fundamentals of deep learning using foundation of mathematics terminology	Understanding
CO2	Compare various deep learning models by hyper tuning various parameters	Analyze
CO3	Demonstrate various case studies of deep learning.	Apply
CO4	Design and deploy deep learning models on various frameworks and platform.	Create

Module	**Module Contents**	**Hours**
I	**Introduction to Deep Learning**	6

	Neural network fundamentals: General Introduction to Deep Learning, Perceptron algorithm, Back propagation and Multi-layer Networks. Image fundamentals: Pixels, Image coordinate, scaling and aspect ratios	
II	**Parameterized Learning and Optimization Methods** parameterized Learning: Introduction to linear classification, Four components of parameterized learning, role of loss function. Optimization Methods: Optimization Methods: Gradient descent, stochastic gradient descent (SGD) and extensions to SGD, regularization	7
III	**Convolutional Neural Networks (CNN)** Understanding Convolutions: Convolutions versus Cross-correlation, The “Big Matrix” and “Tiny Matrix" Analogy, Kernels, A Hand Computation Example of Convolution The Role of Convolutions in **Deep Learning.** CNN Building blocks: Layer Types, Convolutional Layers, Activation Layers, Pooling Layers, Fully-connected Layers, Batch Normalization, Dropout, ShallowNEt, LeNet, MiniVGGNET	7
IV	**Deep learning-based object detection** Fundamentals of Object detection, Family of R-CNN, Single shot detectors (SSD), You only look once (YOLO)	6

V	**Sequence Models** Recurrent Neural Networks, Vanishing gradients, Gated Recurrent Units (GRU), Long-short-term-memories (LSTMs) .	6
VI	**Optimization techniques & Distributed Training for DL model** Fundamentals of optimization techniques, Optimize TensorFlow Models For Deployment with TensorRT, Custom and Distributed Training.	6

Text Books	
1	Ian Goodfellow, Yoshua Bengio and Aaron Courville Deep Learning, MIT Press, 2016
2	Aurelien Geron, " Hands-On Machine Learning with Scikit-Learn & TensorFlow", O'REILLY, Dec 2017
References	
1	Neural Networks: A Systematic Introduction, Raúl Rojas, 1996
2	Pattern Recognition and Machine Learning, Christopher Bishop, 2007
3	Prof. Mitesh M. Khapra, "Deep Learning", course on NPTEL, July 2018
4	Andrew Ng, "Deep Learning Specialization", Coursera online course
Useful Links	
1	https://nptel.ac.in/courses/106/106/106106184/
2	https://www.coursera.org/specializations/deep-learning

CO-PO Mapping															
	Programme Outcomes (PO)														
	1	2	3	4	5	6									
CO1	1														
CO2	2		2												
CO3			2	1											
CO4		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.															

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.				

Assessment Plan based on Bloom's Taxonomy Level (Marks) (For lab Courses)				
Bloom's Taxonomy Level	**ISE**	**MSE**	**ESE**	**Total**
Remember				
Understand	10			**10**
Apply	10			**10**
Analyze	10	10		**20**
Evaluate		10	20	**30**
Create		10	20	**30**
Total Marks	**30**	**30**	**40**	**100**

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Course Information	
Programme	M.Tech. (Computer science and engineering)
Class, Semester	First Year M. Tech., Sem II
Course Code	7CO536
Course Name	Cyber Security
Desired Requisites:	Fundamentals of security

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

Course Objectives	
1	Identify various types of cyber threats, including malware, hacking, and social engineering.
2	Examine and implement network security protocols such as IPsec, SSL/TLS, and VPNs.
3	Develop a comprehensive understanding of incident response planning and methodologies.

Course Outcomes (CO) with Bloom's Taxonomy Level		
At the end of the course, the students will be able to,		
CO1	Summarize the concepts of information security and the CIA triad.	Understand
CO2	Apply network security measures to mitigate risks and protect against common vulnerabilities	Apply
CO3	Analyze and categorize common web vulnerabilities, proposing appropriate solutions.	Analyze
CO4	Evaluate the security considerations of cloud computing environments and identify potential risks.	Evaluate

Module	**Module Contents**	**Hours**
I	**Module 1: Introduction to Cyber Security** **Overview of cyber security importance, challenges, and threats** **Information security concepts: confidentiality, integrity, availability (CIA triad)** **Types of cyber threats: malware, hacking, social engineering**	8
II	Module 2: Network Security and Cryptography Network vulnerabilities and attacks Network security protocols: IPsec, SSL/TLS, VPNs Cryptography basics: encryption, decryption, hashing Secure communication and data protection techniques	9

III	Module 3: Web and Application Security Common web vulnerabilities: SQL injection, XSS, CSRF Secure coding practices and application security testing Securing web applications: input validation, output encoding	8
IV	Module 4: Incident Response and Threat Intelligence Incident response planning and methodologies Threat intelligence sources, feeds, and analysis Handling security incidents: investigation, containment, recovery	7
V	Module 5: Cloud and IoT Security Cloud security considerations: data privacy, compliance Securing IoT devices and communication Identity and Access Management (IAM) in the cloud	6
VI	Module 6: Ethical Hacking and Penetration Testing Introduction to ethical hacking: goals and legal considerations Penetration testing methodologies and tools Reporting vulnerabilities and risk assessment	7

Text Books	
1	"Principles of Computer Security: CompTIA Security+ and Beyond" by Wm. Arthur Conklin, Gregory White, Dwayne Williams, Chuck Cothren, Roger L. Davis
2	"Cybersecurity: A Business Solution" by Rob Arnold

References	
1	"Hacking: The Art of Exploitation" by Jon Erickson
2	"Cybersecurity and Cyberwar: What Everyone Needs to Know" by P.W. Singer and Allan Friedman

Useful Links	
1	NPTEL:

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1			2												
CO2			2												
CO3	2			2											
CO4	3			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 Plan based on Bloom's Taxonomy Level (Marks) (For lab Courses)				
Bloom's Taxonomy Level	**ISE**	**MSE**	**ESE**	**Total**
Remember				
Understand	10	5	15	**30**

Apply	5	5	20	**30**
Analyze	5	5	15	**25**
Evaluate		5	10	**15**
Create				
Total Marks	**20**	**20**	**60**	**100**

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Course Information

Programme	M.Tech. (Computer science and engineering)
Class, Semester	First Year M. Tech., Sem II
Course Code	7CO537
Course Name	Advanced Database Management Systems
Desired Requisites:	DBMS

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

Course Objectives

1	Evaluate the use of inheritance, aggregation, and encapsulation in database design.
2	Explore modern indexing techniques and their role in optimizing query performance.
3	Compare transaction isolation levels and their trade-offs in multi-user environments.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO1	Understand mapping strategies between object-oriented models and relational databases.	Understand
CO2	Apply advanced query optimization techniques to enhance complex query performance	Apply
CO3	Analyze the impact of modern indexing techniques on query execution	Analyze
CO4	Evaluate the consistency models based on the CAP theorem in distributed databases.	Evaluate

Module	**Module Contents**	**Hours**
I	Module 1: Advanced Database Design Review of relational database concepts Object-oriented and object-relational database design Mapping between object-oriented models and relational databases Inheritance, aggregation, and encapsulation in database design	8
II	Module 2: Advanced Query Optimization and Execution Query optimization techniques: cost-based and rule-based optimization Join algorithms: nested loop, hash join, merge join Parallel query processing and optimization Introduction to modern indexing techniques: bitmap indexing, R-tree, etc.	8

III	Module 3: Advanced Transaction Management Concurrency control techniques: multiversion concurrency control (MVCC), timestamp ordering, two-phase locking Distributed transaction management and protocols Transaction isolation levels and their trade-offs Deadlock detection and prevention strategies	7
IV	Module 4: Data Warehousing and Data Mining Introduction to data warehousing concepts and architecture ETL (Extract, Transform, Load) processes in data warehousing Data mining techniques: classification, clustering, association rule mining Integration of data mining algorithms with databases	7
V	Module 5: NoSQL and Big Data Introduction to NoSQL databases: key-value, document, column-family, graph databases CAP theorem and consistency models in distributed databases Overview of big data technologies: Hadoop, Spark, and their integration with databases Challenges and solutions in managing and querying big data	6
VI	Module 6: Emerging Trends in Database Systems NewSQL databases: overview and comparison with traditional databases In-memory databases: benefits, architecture, and use cases Blockchain and databases: integration, benefits, and challenges Overview of database-as-a-service (DBaaS) and serverless databases	7

Text Books	
1	"Database System Concepts" by Abraham Silberschatz, Henry F. Korth, S. Sudarshan
2	"Modern Database Management" by Jeffrey A. Hoffer, V. Ramesh, Heikki Topi
References	
1	"Database Management Systems" by Raghu Ramakrishnan, Johannes Gehrke
2	"Transaction Processing: Concepts and Techniques" by Jim Gray, Andreas Reuter
Useful Links	
1	NPTEL videos

CO-PO Mapping

	Programme Outcomes (PO)												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1			2												
CO2			2												
CO3	2			2											
CO4	3			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 Plan based on Bloom's Taxonomy Level (Marks) (For lab Courses)				
Bloom's Taxonomy Level	**ISE**	**MSE**	**ESE**	**Total**
Remember				
Understand	10	5	15	**30**
Apply	5	5	20	**30**
Analyze	5	5	15	**25**
Evaluate		5	10	**15**
Create				
Total Marks	**20**	**20**	**60**	**100**

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Course Information	
Programme	M.Tech.
Class, Semester	First Year M. Tech.CSE Sem II
Course Code	7OE509
Course Name	Machine Learning in practice
Desired Requisites:	Basic mathematics and python programming

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 python and mathematical concepts required for machine learning
2	To prepare data for machine learning
3	To implement supervised and unsupervised learning algorithm

Course Outcomes (CO) with Bloom's Taxonomy Level		
CO1	Apply different data pre-processing techniques required for data preparation.	Apply
CO2	Identify and implement different machine learning algorithms to solve real life problems.	Analyze
CO3	Evaluate and compare performance of the machine learning algorithms.	Evaluate

Module	**Module Contents**	**Hours**
I	**Introduction to Machine Learning** Introduction, Types of machine learning, Applications of Machine Learning, Python basics: basic constructs of python, pandas, NumPy, Matplotlib for data visualization	6
II	**Data pre-processing** Data Cleaning: handling missing values, removing noise from data, handling categorical features, Feature selection and reduction, Data normalization, Train/test split, cross-validation	6
III	**Supervised Learning-I** Linear regression, multiple regression, MSE, RMSE Classification using Naïve Bayes classifier, Decision tree classifier, KNN, logistic regression	8
IV	**Supervised Learning-II** Ensemble models: tree-based algorithms, Bagging, Boosting, Stacking **Model Performance** Confusion matrices, accuracy, precision, recall, F1 score, Hyperparameter tuning, deployment	8
V	**Unsupervised Learning** Clustering- K means clustering, HDBSCAN, Dimensionality reduction using PCA.	5
VI	**Reinforcement learning and Case study** Introduction to reinforcement learning, Types, elements and applications of	6

	Reinforcement learning, Case studies based on various applications of machine learning algorithms in real life.	
Text Books		
1	Machine Learning. Tom Mitchell. First Edition, McGraw- Hill, 1997.	
2		
3		
References		
1	Introduction to Machine Learning Edition 2, by Ethem Alpaydin.	
2		
3		
Useful Links		
1	NPTEL 'Introduction to Machine learning' -Link	
2		

CO-PO Mapping						
	Programme Outcomes (PO)					
	1	2	3	4	5	6
CO1	2	2				
CO2				3		
CO3	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 (for Theory Course)
The assessment is based on 1 in-semester examinations in the form of ISE of 20 marks and MSE of 30 Marks. Also, there is End-Sem examination (ESE) of 50 marks. MSE shall be typically on modules 1 2 and 3, ISE based typically on all the modules and ESE shall be on all modules with nearly 30% weightage on first 3 modules and 70% weightage on modules 4, 5, 6.

Assessment Plan based on Bloom's Taxonomy Level (Marks) For Theory Course					
Bloom's Taxonomy Level		**ISE**	**MSE**	**ESE**	**Total**
1	Remember				
2	Understand				
3	Apply		15	20	35
4	Analyse		15	20	35
5	Evaluate	20		10	30
6	Create				
Total		**20**	**30**	**50**	**100**