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SEMESTER-III						
Paper Code	**Course Code**	**Course Title**	**C**	**L**	**T**	**P**
CEL101	CEL101	Environmental Science	2	2		
HUL201	HUL201	General Studies	2	2		
3CSDC01	CSL201	Discrete Mathematic Structure	4	3	1	
3CSDC02	CSL202	Data Structures and Algorithms	4	3		2
3CSDC03	CSL203	Object Oriented Programming	4	3		2
3CSDC04	CSL204	Microprocessor & Microcontroller	4	3		2
3CSDC05	CSL205	Software Engineering	4	3		2
3CSDC06	CSL206	Computer Networks	3	3		
TPN102	TPN102	Soft Skill Development-1				2
SAA100	SAA100	SODECA (Anandam)	0.5			
		Total Credits	**27.5**	**22**	**1**	**10**

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SEMESTER-IV						
Paper Code	**Course Code**	**Course Title**	**C**	**L**	**T**	**P**
MTL102	MTL102	Statistics and Probability Theory	4	3	1	
HUL202	HUL202	Economics and Financial Management	3	3		
4CSDC07	CSL207	Big Data Analysis	4	3		2
4CSDC08	CSL208	Artificial Intelligence	3	3		
4CSDC09	CSL209	Internet of Things	4	3		2
4CSDC10	CSL210	Database Management System	4	3		2
4CSDEXX	CSLXX	Department Elective Group-1*	*			
XXXXXX	XXXXX	Open Elective #	#			
TPN103	TPN103	Soft Skill Development-2				2
SAA100	SAA100	SODECA (Anandam)	0.5			
		Sub Total (excluding OC and DE)	**22.5**	**18**	**1**	**8**

*** Every student has to earn minimum 20 credits by clearing department elective courses over the complete duration of the B.Tech programme.**

 # Every student has to earn minimum 10 credits by clearing open elective courses over the complete duration of the B.Tech programme. The student may opt for open elective courses floated by other department before the commencement of semester.

Department Elective (Group-1)							
S. No	**Paper Code**	**Course Code**	**Course Title**	**C**	**L**	**T**	**P**
1.	4CSDE23	CSL223	Advanced Data Structures	3	3		
2.	4CSDE24	CSL224	Software Tools (Scilab, LaTex, R)	3	1		4
3	4CSDE25	CSL225	Human Computer Interface	3	3		

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SEMESTER-V						
Paper Code	**Course Code**	**Course Title**	**C**	**L**	**T**	**P**
HUL203	HUL203	Indian Constitution	2			
5CSDC11	CSL311	Design and Analysis of Algorithm	3	3		
5CSDC12	CSL312	Recent Topics	3	3		
5CSDC13	CSL313	Operating System	3	3		
5CSDC14	CSP314	Linux Shell and Network Programming	2			4
5CSDC15	CSL315	Theory of Computation	3	3		
CST301	CST301	Industrial Training (45 days)	2			
CSN201	CSN201	Seminar-1				
5CSDEXX	CSLXXX	Department Elective Group-2*	*			
XXXXX	XXXXX	Open Elective #	#			
SAA100	SAA100	SODECA (Anandam)	0.5			
		Sub Total (excluding OC and DE)	**18.5**	**12**		**4**

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 # Every student has to earn minimum 10 credits by clearing open elective courses over the complete duration of the B.Tech programme. The student may opt for open elective courses floated by other department before the commencement of semester.

Department Elective (Group-2)							
S. No	**Paper Code**	**Course Code**	**Course Title**	**C**	**L**	**T**	**P**
1.	5CSDE26	CSL326	Cyber Security Management	3	3		
2.	5CSDE27	CSL327	Software Project Management	3	3		
3.	5CSDE28	CSL328	Social Network Analysis	3	3		

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SEMESTER-VI						
Paper Code	**Course Code**	**Course Title**	**C**	**L**	**T**	**P**
6CSDC16	CSL316	Compiler Design	3	3		
6CSDC17	CSL317	Computer Graphics	4	3		2
6CSDC18	CSL318	Computer Architecture and Organization	3	3		
6CSDC19	CSL319	Distributed System	3	3		
6CSDC20	CSP320	Emerging Technology Lab	2			4
CSN202	CSN202	Seminar-2				2
6CSDEXX	CSLXXX	Department Elective Group-3*	*			
6CSDEXX	CSLXXX	Department Elective Group-4*	*			
XXXXX	XXXXX	Open Elective #	#			
SAA100	SAA100	SODECA (Anandam)	0.5			
		Sub Total (excluding OC and DE)	**15.5**	**12**		**8**

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 # Every student has to earn minimum 10 credits by clearing open elective courses over the complete duration of the B.Tech programme. The student may opt for open elective courses floated by other department before the commencement of semester.

Department Elective (Group-3)							
S. No	**Course Code**	**Course Title**	**Course Title**	**C**	**L**	**T**	**P**
1.	6CSDE29	CSL329	Digital Image Processing	4	3		2
2.	6CSDE30	CSL330	Nature Inspired Algorithms	4	3		2
3.	6CSDE31	CSL331	Software Testing and Quality Assurance	4	3		2
Department Elective (Group-4)							
S. No	**Course Code**	**Course Title**	**Course Title**	**C**	**L**	**T**	**P**
1.	6CSDE32	CSL332	Data Mining And Business Intelligence	3	3		
2.	6CSDE33	CSL333	Data Compression Techniques	3	3		
3.	6CSDE34	CSL334	Software Defined Network	3	3		

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SEMESTER-VII						
Paper Code	**Course Code**	**Course Title**	**C**	**L**	**T**	**P**
7CSDC21	CSL421	Cloud Computing	3	3		
7CSDC22	CSL422	Information System Security	3	3		
CST302	CST302	Industrial Training (60 days)	3			
CSD411	CSD411	Project Part-1	4			8
7CSDEXX	CSLXXX	Department Elective Group-5*	*			
7CSDEXX	CSLXXX	Department Elective Group-6*	*			
XXXXX	XXXXX	Open Elective#	#			
XXXXX	XXXXX	Open Elective#	#			
SAA100	SAA100	SODECA (Anandam)	0.5			
		Sub Total (excluding OC and DE)	**13.5**	**6**		**8**

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Departmental Elective (Group-5)							
S. No	**Course Code**	**Course Title**	**Course Title**	**C**	**L**	**T**	**P**
1.	7CSDE35	CSL435	Real Time System	3	3		
2.	7CSDE36	CSL436	Virtual Reality	3	3		
3.	7CSDE37	CSL437	Soft Computing	3	3		

Departmental Elective (Group-6)							
S. No	**Course Code**	**Course Title**	**Course Title**	**C**	**L**	**T**	**P**
1.	7CSDE38	CSL438	Graph Theory	4	3	1	
2.	7CSDE39	CSL439	Intelligent Robotics	4	3		2
3.	7CSDE40	CSL440	Computer Vision	4	3		2

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SEMESTER-VIII						
Paper Code	**Course Code**	**Course Title**	**C**	**L**	**T**	**P**
HUL204	HUL204	Innovation & Entrepreneurship	3	3		
CSD412	CSD412	Project Part-2	4			8
8CSDEXX	CSLXXX	Department Elective Group-6*	*			
8CSDEXX	CSLXXX	Department Elective Group-7*	*			
XXXXX	XXXXX	Open Elective#	#			
XXXXX	XXXXX	Open Elective#	#			
SAA100	SAA100	SODECA (Anandam)	0.5			
		Sub Total (excluding OC and DE)	**7.5**	**3**		**8**

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 # Every student has to earn minimum 10 credits by clearing open elective courses over the complete duration of the B.Tech programme. The student may opt for open elective courses floated by other department before the commencement of semester.

Departmental Elective (Group-6)							
S. No	**Course Code**	**Course Title**	**Course Title**	**C**	**L**	**T**	**P**
1.	8CSDE41	CSL441	Mobile Computing	3	3		
2.	8CSDE42	CSL442	Advanced DBMS	3	3		
3.	8CSDE43	CSL443	Pattern Recognition	3	3		

Departmental Elective (Group-7)							
S. No	**Course Code**	**Course Title**	**Course Title**	**C**	**L**	**T**	**P**
1.	8CSDE44	CSL444	Digital Forensic	3	3		
2.	8CSDE45	CSL445	Agile Software Development	3	3		
3.	8CSDE46	CSL446	Multi Core Architecture	3	3		

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List of Open Electives for ODD Semester

S. No	Paper Code	Course Code	Course Title	C	L	T	P
1.	71OCO	CSL271	Data Structures	4	3		2
2.	72OCO	CSL272	Concepts of Object Oriented Programming	4	3		2
3.	73OCO	CSL273	Fundamental of Computer Networks	3	3		
4.	74OCO	CSL274	Operating System Concepts	3	3		
5.	75OCO	CSL275	Cloud Computing and Applications	3	3		
6.	76OCO	CSL276	Cyber Security	3			
7.	77OCO	CSL277	Robotics	4			
8.	78OCO	CSL278	Basics of Soft Computing Techniques	4			

List of Open Electives for EVEN Semester

S. No	Paper Code	Course Code	Course Title	C	L	T	P
1.	81OCE	CSL281	Basics of Big Data Analysis	4	3		2
2.	82OCE	CSL282	Artificial Intelligence and Applications	3	3		
3.	83OCE	CSL283	Internet of Things Concepts	4	3		2
4.	84OCE	CSL284	Fundamental of DBMS	3	3		
5.	85OCE	CSL285	Software Tools and Techniques	3	1		2
6.	86OCE	CSL286	Fundamental of Digital Image Processing	4			
7.	87OCE	CSL287	Nature Inspired Algorithms and Applications	4			

SYLLABUS

Semester	**III**
Branch	**CSE**
Admission Year	**2020-21**
Academic Year	**2021-22**

Scheme Code	Paper Code	Course Code	Course Title (Departmental Core)	C	L	T	P
CSE2020	3CSDC01	CSL201	Discrete Mathematic Structure	4	3	1	
Pre-requisites/Exposure							

Course Objectives:

To Check the validity of predicates in Propositional and Quantified Propositional Logic using truth tables, deductive reasoning and inference theory on Propositional Logic. To demonstrate an understanding of sets, relations and functions and be able to determine their properties.

To illustrate an application for Partially Ordered Sets , Lattices and Theorem Proving Techniques in Computer Science. To illustrate the abstract algebraic systems - Semigroups, Monoids, Groups, Homomorphism and Isomorphism of Monoids and Groups. To demonstrate different aspect of graph theory technique and methods.

UNIT - I:

Fundamentals of Logic: Proposition, First order logic, Basic logical operation, truth tables, tautologies, Contradictions, Algebra of Proposition, logical implications, logical equivalence, predicates, Normal Forms, Rules of Inference ,Universal and existential quantifiers. **[T1,T2][No. of hrs. 8]**

UNIT - II:

Set Theory , Relations and Functions: Set Theory: Definition and types, Set operations, Partition of set, Cardinality (Inclusion-Exclusion & Addition Principles). Relations: Definition, Binary Relation, Matrix of Relation, Digraph of Relation, Properties of Relations, Equivalence relations and partition, Equivalence Class, The Connectivity Relations, Operations on Relations, Closures of Relation, Transitive Closure-Warshall's Algorithm. Functions: Concept, Some Special Functions (Characteristic, Floor & Ceiling Functions), Properties of Functions, The Pigeonhole &Generalized Pigeonhole Principles, Composition of Functions. **[T1,T2,T3][No. of hrs. 10]**

UNIT - III:

Partially ordered Set , Lattices and Theorem Proving Techniques Partially ordered Set: Introduction, ordered set, Hasse Diagram, Maximal-Minimal Element, Least upper bound (lub), Greatest Lower bound(glb) Lattice: Lattice, Dual Lattice , Sub lattice , Properties of glb and lub , Properties of Lattice , Special Lattice , Complete Lattice, Bounded Lattice, Completed Lattice , Distributive Lattice. Theorem proving Techniques: Mathematical induction, Proof by contradiction. **[T1,T2,T3][No. of hrs. 8]**

UNIT - IV:

Algebraic Structures: Definition, Properties, types: Semi Groups, Monoid, Groups, Abelian group, properties of groups, Subgroup, cyclic groups, Cosets, factor group, Permutation groups, Normal subgroup, Homomorphism and isomorphism of Groups, example and standard results, Rings and Fields. **[T1,T2,T3][No. of hrs. 6]**

UNIT - V:

Graph: Graphs- Directed, Undirected, Basic Terminologies, Degree of Vertex, Adjacency & Incidence, The Handshaking Theorem, Representing Graphs, Types of Graphs(Null graph, Complete graph, Regular graph, Cycles, Wheels and N-cube) , Subgraph, Bipartite & Complete Bipartite Graph, Weighed Graph, Isomorphic Graphs, Operations of Graphs(Union, Intersection, Sum of two graphs, Ring sum, Product of graphs, Composition and Complement), Walk, Path, Cycles & Circuits Euclerian & Hamiltonian Graphs. Planar Graphs, Graph Coloring. Trees: Definition, Rooted Tree, Spanning Trees, Minimal Spanning Trees, Prim's Algo, Kruskal'sAlgo. **[T1,T2,T3][No. of hrs. 8]**

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Text Books:

1. Discrete Mathematical Analysis, Kolman et al., Pearson
2. Discrete Mathematics and its Applications, Kenneth H. Rosen, MGH
3. Trembley, J.P & Manohar; "Discrete Mathematical Structure with Application CS", McGraw Hill.

Reference Books:

1. C.L.Liu, "Elements of Discrete Mathematics" Tata Mc Graw-Hill Edition.
2. Lipschutz, "Discrete mathematics (Schaum)",TMH.

COURSE OUTCOMES:

Course Code	Course Name	Course Outcome	Details
CSL201	Discrete Mathematics Structure	CO1	Check the validity of predicates in Propositional and Quantified Propositional Logic using truth tables, deductive reasoning and inference theory on Propositional Logic
		CO2	Demonstrate an understanding of sets, relations and functions and be able to determine their properties.
		CO3	Illustrate an application for Partially Ordered Sets , Lattices and Theorem Proving Techniques in Computer Science
		CO4	Illustrate the abstract algebraic systems - Semigroups, Monois, Groups, Homomorphism and Isomorphism of Monoids and Groups.
		CO5	Demonstrate different aspect of graph theory technique and methods.

CO-PO MAPPING:

SUBJECT	Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
Discrete Mathematic Structure	CO1	2	3	3	3		2			1			2
	CO2	2	3	2	2		1			1			2
	CO3	2	3	2	3		1			1			1
	CO4	2	3	2	2		1			1			1
	CO5	2	3	3	2		1			1			2

3: Strongly **2: Moderate** **1: Weak**

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Scheme Code	Paper Code	Course Code	Course Title (Departmental Core)	C	L	T	P
CSE2020	3CSDC02	CSL202	Data Structures and Algorithms	4	3		2
Pre-requisites/Exposure			Programming for Problem Solving- CSL100				

Course Objectives:

To understand and examine asymptotic analysis of any algorithm. To evaluate and analyse the implementation and application of various ADTs such as Stack, Queue etc. To find the solution of a computational problem by Apply an appropriate data structure (binary tree/graph) to represent a data item to be processed. To apply an appropriate Hash Function to enable efficient access of data in the given set. To select and analyze appropriate sorting or searching algorithms to be used in specific circumstances.

UNIT - I:
Basic Concepts: Introduction of Algorithms, Analysis of algorithms: Space Complexity, Time Complexity, Asymptotic notations: Big-Oh, theta, Omega- Definitions and examples.**[T1,T4][No. of hrs. 4]**

UNIT - II:
Linear Data Structures: Arrays, Sparse matrix, Stacks, Queues-Circular Queues, Priority Queues, Double Ended Queues, Evaluation of Expressions and conversions. Searching: Linear Search and Binary Search. **[T1,T2][No. of hrs. 10]**

UNIT - III:
Linked List : Self Referential Structures, Dynamic Memory Allocation, List, Dynamic List, Singly Linked List-Operations on Linked List. Doubly Linked List, Circular Linked List, Stacks and Queues using Linked List, Polynomial representation using Linked List.**[T3,T4][No. of hrs. 8]**

UNIT - IV:
Sorting: Bubble Sort, Selection Sort, Insertion Sort, Quick Sort, Merge Sort and Heap Sort. Hashing: Hashing Techniques, Collision Resolution, Overflow handling, Hashing functions: Mid square, Division, Folding, Digit Analysis. **[T1, T2, T3, T4] [No. of hrs. 10]**

UNIT - V:
Trees :Trees, Binary Trees and its types, Binary Tree Representation, Tree Traversals, Binary Search Trees, Binary Search Tree Operations, B-Tree , B+ Tree, AVL tree, Threaded Binary Tree. Graphs: Graphs, Representation of graphs, Depth First Search and Breadth First Search on graphs, Applications of graphs, Spanning tree, Single source single destination shortest path algorithms. **[T1, T2, T3, T4][No. of hrs. 10]**

Text Books:

1. Ellis Horowitz, Sartaj Sahni and Susan Anderson-Freed, Universities Press,
2. Fundamentals of Data Structures in C
3. Data Structures in C/C++, Tanenbaum, Pearson
4. An introduction to data structures with applications By Jean-Paul Tremblay, P. G. Sorenson,TMH

Reference Books:

1. Aho A. V., J. E. Hopcroft and J. D. Ullman, Data Structures and Algorithms, Pearson Publication.
2. Lipschuts S., Theory and Problems of Data Structures, Schaum's Series.

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Scheme Code	Paper Code	Course Code	Course Title (LAB) (Departmental Core)	C	L	T	P
CSE2020	3CSDC02	CSL202	Data Structures and Algorithms	4	3		2
Pre-requisites/Exposure			Programming for Problem Solving- CSL100				

List of Experiments :

1 Write a program to read two polynomials and store them in an array. Calculate the sum of the two polynomials and display the first polynomial, second polynomial and the resultant polynomial.

2. Implement a Stack using arrays with the operations:
   2.1.Pushing elements to the Stack.
   2.2.Popping elements from the Stack
   2.3.Display the contents of the Stack after each operation.

3. Using stack convert an infix expression to a postfix expression and evaluate the postfix expression.
4. Write a program to convert an infix expression to a prefix expression using stacks.
5. Convert an infix expression to a postfix expression without using a stack
6. Implement a Queue using arrays with the operations:
   6.1.Insert elements to the Queue.
   6.2.Delete elements from the Queue.
   6.3.Display the contents of the Queue after each operation.
7. Implement a circular queue using arrays with the operations:
   7.1.Insert an element to the queue.
   7.2.Delete an elements from the queue.
   7.3.Display the contents of the queue after each operation.
8. Implement a Priority Queue using arrays with the operations:
   8.1.Insert elements to the Priority Queue.
   8.2.Delete elements from the Priority Queue.
   8.3.Display the contents of the Priority Queue after each operation.
9. Implement a Double-Ended Queue (DEQUEUE) with the operations:
   9.1.Insert elements to the Front of the queue.
   9.2.Insert elements to the Rear of the queue
   9.3.Delete elements from the Front of the queue.
   9.4.Delete elements from the Rear of the queue.
   9.5.Display the queue after each operation.
10. Write a menu driven program for performing the following operations on a Linked List:
    10.1.Display
    10.2.Insert at Beginning
    10.3.Insert at End
    10.4.Insert at a specified Position
    10.5.Delete from Beginning
    10.6.Delete from End
    10.7.Delete from a specified Position
11. Implement a stack using linked list with the operations:
    11.1.Push elements to the queue.
    11.2.Pop elements from the queue.
    11.3.Display the queue after each operation.
12. Implement a Queue using linked list with the operations:
    12.1.Insert an elements to the queue.
    12.2.Delete an elements from the queue.

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12.3.Display the queue after each operation.

13. Write a program to read two polynomials and store them using linked list. Calculate the sum of the two polynomials and display the first polynomial, second polynomial and the resultant polynomial.

14. Write a program to reverse the content of queue using stack

15. Create a Doubly Linked List from a string taking each character from the string. Check if the given string is palindrome in an efficient method.

16. Create a binary search tree with the following operations:
    16.1.Insert a new node .
    16.2.Inorder traversal.
    16.3.Preorder traversal.
    16.4.Postorder traversal.
    16.5.Delete a node.

17. Represent any given graph and
    17.1.Perform a depth first search .
    17.2.Perform a breadth first search

18. Create a text file containing the name, height, weight of the students in a class. Perform Quick sort and Merge sort on this data and store the resultant data in two separate files. Also write the time taken by the two sorting methods into the respective files.

    Eg.

a. Sony Mathew 5.5 60
b. Arun Sajeev 5.7 58
c. Rajesh Kumar 6.1 70

19. Write a program to sort a set of numbers using Heap sort and find a particular number from the sorted set using Binary Search.

20. Implement a Hash table using Chaining method. Let the size of hash table be 10 so that the index varies from 0 to 9.

21. Implement a Hash table that uses Linear Probing for collision resolution

COURSE OUTCOMES:

Course Code	Course Name	Course Outcome	Details
CSL202	Data Structures and Algorithms	CO1	Understand and examine asymptotic analysis of any algorithm.
		CO2	Evaluate and Analyse the implementation and application of various ADTs such as Stack, Queue etc.
		CO3	Find the solution of a computational problem by Apply an appropriate data structure (binary tree/graph) to represent a data item to be processed
		CO4	Apply an appropriate Hash Function to enable efficient access of data in the given set
		CO5	Select and Analyze appropriate sorting or searching algorithms to be used in specific circumstances

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CO-PO MAPPING:

SUBJECT	Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
Data Structures and Algorithms	CO1	3	2	2	3		1			1			2
	CO2	3	3	3	2		2	1		1			2
	CO3	3	3	3	2		2	1		1			2
	CO4	3	2	3	2		2	1		1			2
	CO5	3	3	3	2		2	2		1			2

3: Strongly **2: Moderate** **1: Weak**

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Scheme Code	Paper Code	Course Code	Course Title (Departmental Core)	C	L	T	P
CSE2020	3CSDC03	CSL203	Object Oriented Programming	4	3		2
Pre-requisites/Exposure							

Course Objectives:

To understand the key features of Object-Oriented Programming and Methodology like objects, methods, instance, message passing, encapsulation, polymorphism, data hiding, abstract data and inheritance.

UNIT – I:

Introduction to Object Oriented Thinking & Object-Oriented Programming: Comparison with Procedural Programming, features of Object oriented paradigm– Merits and demerits of OO methodology; Object model; Elements of OOPS, IO processing, different OOP language. **[T1][No. of hrs. 9]**

UNIT – II:

Encapsulation and Data Abstraction- Concept of Objects: State, Behavior & Identity of an object; Classes: identifying classes and candidates for Classes Attributes and Services, Access modifiers, Static members of a Class, Instances, Message passing, and Construction and destruction of Objects, life cycle of objects. **[T1,T2][No. of hrs. 9]**

UNIT – III:

Relationships – Inheritance: purpose and its types, 'is a' relationship; Association, Aggregation. Concept of interfaces and Abstract classes **[T1,T2][No. of hrs. 8]**

UNIT – IV:

Polymorphism: Introduction, Method Overriding & Overloading, static and run time Polymorphism. **[T1,T2][No. of hrs. 6]**

UNIT – V:

Strings, File Handling, Exceptional handling, Introduction of Multi-threading and Data collections. Case study like: ATM, Library management system **[T1,R1][No. of hrs. 8]**

Text Books:

[T1] Timothy Budd, "An Introduction to Object-Oriented Programming", Addison Wesley Publication, 3rd Edition..
[T2] G. Booch, "Object Oriented Analysis& Design", Addison Wesley

Reference Books:

[R1] Cay S. Horstmann and Gary Cornell, "Core Java: Volume I, Fundamentals", Prentice Hall publication
[R2] James Martin, "Principles of Object Oriented Analysis and Design", Prentice Hall/PTR.

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Scheme Code	Paper Code	Course Code	Course Title (LAB) (Departmental Core)	C	L	T	P
CSE2020	3CSDC03	CSL203	Object Oriented Programming	4	3		2
Pre-requisites/Exposure							

List of Experiments:

1. Write the programs to demonstrate the concept of classes, objects, member functions, constructors, destructor and different OOP features.
2. Write the programs to demonstrate the concept of different type of Inheritance.
3. Write the programs to demonstrate the different concept of Polymorphism.
4. Write the programs to demonstrate the concept of File handling.
5. Write the programs to demonstrate the concept of Exception handling.
6. Write the programs to demonstrate the concept of Multithreading.
7. To build software development skills using object oriented programming for real-world applications.

COURSE OUTCOMES:

Course Code	Course Name	Course Outcome	Details
CSL203	Object Oriented Programming	CO1	To understand the basic principles of different programming paradigm and its structure.
		CO2	Gain knowledge of Object Oriented Programming and Methodology like objects, methods, instance, message passing, encapsulation etc.
		CO3	Classify Inheritance and Polymorphism with design solution
		CO4	To design solution of file handling and exception handling

CO-PO MAPPING:

SUBJECT	Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
OBJECT ORIENTED PROGRAMMING	CO1	2	1		3	1					1		
	CO2	3	3	1	3	1					1		
	CO3	3	2	1	3	1					1		
	CO4	3	3	1	3	1					1		

3: Strongly **2: Moderate** **1: Weak**

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Scheme Code	Paper Code	Course Code	Course Title (Departmental Core)	C	L	T	P
CSE2020	3CSDC04	CSL204	Microprocessor & Microcontroller	4	3		2
Pre-requisites/Exposure							

Course Objectives:

To understand the architecture and instruction set of typical 8-bit microprocessor and a brief introduction of microcontroller. It also deals with Assembly Language Programming, input-output techniques and important programmable support chips used in microprocessor-based systems.

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UNIT – 1:

Introduction to Microprocessors, microcontroller; 8085 Microprocessor Architecture, pin description, Bus concept and organization; concept of multiplexing and demultiplexing of buses; concept of static and dynamic RAM, type of ROM, memory map. **[T1,T2][No. of hrs. 8]**

UNIT – II:

Software architecture registers and signals, Classification of instruction, Instruction set, addressing modes, Assembly Language Programming and Debugging, Programming Technique, instruction Format and timing. **[T1,T2][No. of hrs. 10]**

UNIT – III:

Advance Assembly Language Programming, Counter and time delay; types of Interrupt and their uses, RST instructions and their uses, 8259 programmable interrupt controller; Macros, subroutine; Stack- implementation and uses with examples; Memory interfacing.**[T1,T2][No. of hrs. 10]**

UNIT – IV:

8085 Microprocessor interfacing:, 8255 Programmable Peripheral Interface, 8254 programmable interval timer, interfacing of Input/output device, 8279 Keyboard/Display interface. **[T1,T2] [No. of hrs. 8]**

UNIT – V:

Microprocessor Application: Interfacing scanned multiplexed display and liquid crystal display, Interfacing and Matrix Keyboard, MPU Design; USART 8251, RS232C and RS422A, Parallel interface- Centronics and IEEE 488. **[T1,T2] [No. of hrs. 8]**

Text Books:

[T1] Ramesh S. Gaonkar, "Microprocessor architecture, programming, and applications with the 8085", 4th Edition, Penram International.

[T2] Aditya P. Mathur, "Introduction to Microprocessor", 3rd Edition, Tata McGraw-Hill Education.

Reference Books:

[R1] Douglas V. Hall, S S S P Rao, "Microprocessor & Interfacing", 3rd Edition, Tata McGraw-Hill Education

[R2] A.K.Ray, K M Bhurchandi, "Microprocessor & Peripheral", 2nd Edition, Tata McGraw-Hill Education.

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Scheme Code	Paper Code	Course Code	Course Title (LAB) (Departmental Core)	C	L	T	P
CSE2020	3CSDC04	CSL204	Microprocessor & Microcontroller	4	3		2
Pre-requisites/Exposure							

List of Experiments :

1. Write an introduction to 8085 Microprocessor, an 8085 kit and an 8085 simulator.
2. Add the 8 bit contents of memory locations XX00 H and XX01 H and place the result in memory location XX02 H.
3. Add two 16 bit numbers stored at different memory locations and store the result in another memory location.
4. Transfer a block of data which is stored at addresses starting from XX00 to another memory location starting from YY00 in forward and reverse order. *Note: Size of data block should be minimum of five.*
5. Write an assembly program to swap two blocks of data stored at different memory locations.
6. Write an assembly program to find the square of an integer number.
7. Write an assembly program to find largest and smallest number from a given array.
8. Write an assembly program to sort an array in ascending and descending order.
9. Write an assembly program to multiply two 8 bit numbers whose result is of 16 bits.
10. Write an assembly program to perform division of two 8 bit numbers. *Note: One of the operand should be read from any specific port number.*
11. Write an assembly program to find 2's complement of a 16 bit number.
12. Write an assembly program to implement a Digital Clock.
13. Write an assembly program which contains a main program and a conversion subroutine to convert a binary number to its equivalent BCD.
14. Write an assembly program to implement Hexadecimal up counter.

Note: While writing output specify the contents of Flag Register for the experiments which include Arithmetic and (or) Logical Instruction(s).

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COURSE OUTCOMES:

Course Code	Course Name	Course Outcome	Details
CSL204	Microprocessor & Microcontroller	CO1	Explain the architecture of 8085 microprocessor and 8051 microcontroller and their features.
		CO2	Associate the organization of registers and memory in microprocessors.
		CO3	Discuss interrupts of 8085 and 8259 programmable interrupt controller.
		CO4	Use sequence of instructions to solve mathematical and other real world problems with assembly language programming.
		CO5	Illustrate electrical circuitry to the Microprocessor I/O ports in order to interface the processor to peripheral devices.

CO-PO MAPPING:

Subject	Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
Microprocessor & Microcontroller	CO1	1		2		2							
	CO2	2		2		2							
	CO3	1	2		2								
	CO4	1		3		2							
	CO5		2	2	2	3							

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Scheme Code	Paper Code	Course Code	Course Title (Departmental Core)	C	L	T	P
CSE2020	3CSDC05	CSL205	Software Engineering	4	3		2
Pre-requisites/Exposure							

Course Objective:

To comprehend software development life cycle, prepare SRS document, apply software design and development techniques and implement testing methods.

UNIT – 1:

Introduction - Evolving role of software, Software a crisis on the Horizon, Software Myths Software engineering layered technology. Software process & Software process models. The linear sequential model, The prototyping model, The RAID model, Evolutionary models, Component based development, The formal methods model, Fourth generation techniques **[T1][No. of hrs. 10]**

UNIT – 2:

Project management concepts, Software Process and project metrics, Software project planning, Software project estimation, Risk management, RMMM plans. Project scheduling and tracking, Software quality assurance, Software configuration management **[T1][No. of hrs. 10]**

UNIT – 3:

Requirement analysis-software prototyping-Specification Review Analysis modeling, Data modeling-functional modeling. Behavioral modeling- Data dictionary Design concepts and principles, Effective modular design, design heuristics, Design model, Documentation. **[T1][T2][No. of hrs. 9]**

UNIT – 4:

Software design-Software architecture, Data designing, Architectural styles, Transform mapping, Transaction mapping, Refining architectural design User interface design, Component level design. **[T1][No. of hrs. 8]**

UNIT – 5:

Software testing techniques-White box and black box testing, Unit testing, integrating testing, validation technique, System testing – debugging. **[T1][No. of hrs. 5]**

TEXT BOOKS

[T1] Software Engineering By Roger S. Pressman, TMH
[T2] Rajib Mall, Fundamentals of software Engineering, Prentice Hall of India.

REFERENCE BOOKS

[R1] Software Engineering By Ian Sommerville
[R2] Pankaj Jalote, Software Engineering – A Precise Approach Wiley
[R3] Software Engineering Fundamental By Ali Behforooz, Frederick J Hudson, Oxford University Press
[R4] Software Engineering Concepts By Richard E. Fairley (Mcgraw-Hill)

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Scheme Code	Paper Code	Course Code	Course Title (LAB) (Departmental Core)	C	L	T	P
CSE2020	3CSDC05	CSL205	Software Engineering	4	3		2
Pre-requisites/Exposure							

List of Experiments:

Draw standard UML diagrams using an UML modeling tool for a given case study

1. Identify a software system that needs to be developed.
2. Document the Software Requirements Specification (SRS) for the identified system.
3. Identify use cases and develop the Use Case model.
4. Identify the conceptual classes and develop a Domain Model and also derive a Class Diagram from that.
5. Using the identified scenarios, find the interaction between objects and represent them using UML Sequence and Collaboration Diagrams
6. Draw relevant State Chart and Activity Diagrams for the same system.
7. Implement the system as per the detailed design
8. Test the software system for all the scenarios identified as per the usecase diagram
9. Improve the reusability and maintainability of the software system by applying appropriate design patterns.
10. Implement the modified system and test it for various scenarios

SUGGESTED DOMAINS FOR MINI-PROJECT:

1. Passport automation system.
2. Book bank
3. Exam registration
4. Stock maintenance system.
5. Online course reservation system
6. Airline/Railway reservation system
7. Software personnel management system
8. Credit card processing
9. e-book management system
10. Recruitment system
11. Foreign trading system
12. Conference management system
13. BPO management system
14. Library management system
15. Student information system

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COURSE OUTCOMES:

Course Code	Course Name	Course Outcome	Details
CSL205	Software Engineering	CO1	Understand the basic implementation model SDLC and its types
		CO2	Recognize how to ensure the quality of software product, different quality standards and software review techniques.
		CO3	Apply the concept of Functional Oriented and Object-Oriented Approach for Software Design.
		CO4	Demonstrate the different architectural design
		CO5	Capable to apply implementation process of validation and verification methods in software project.

CO-PO MAPPING:

SUBJECT	Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
SOFTWARE ENGINEERING	CO1		2	3			2	2	3	2	3	3	3
	CO2	3	3	3	2	3	2	2		2	3	3	3
	CO3		2	3		3	2	2	3	2	3	3	3
	CO4	3	3	3	2	3	2	2	3	2	3	3	3
	CO5	3	3	3	2	3	2	2	3	2	3	3	3

3: Strongly **2: Moderate** **1: Weak**

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Scheme Code	Paper Code	Course Code	Course Title (Departmental Core)	C	L	T	P
CSE2020	3CSDC06	CSL206	Computer Networks	3	3		
Pre-requisites/Exposure							

Course Objectives:

To make students learn architecture of data communication networks. Recognize the different internetworking devices and their functions. Analyze the services and features of the various layers of data networks.

UNIT – 1:

Introduction: Organization of the Internet, ISP, Network criteria, Categories of networks, Network performance and Transmission Impairments. Network Devices, OSI Model, TCP/IP Protocol Suite, Layering principles. Local Area Networks: LAN topologies: Bus topology, Ring topology, Token passing rings, FDDI, Star topologies, Asynchronous transfer mode, Ethernet, IEEE standards 802.3, 802.5. Wireless LANs: IEEE 802.11 and Bluetooth. **[T1,T2][No. of hrs. 6]**

UNIT – II:

Data Link Layer: Function and design issues. Reliable Data Delivery: Error Control: Error Detection and correction techniques, Flow Control: Flow control in lossless and lossy channels using stop-and-wait, sliding window protocols. Performance of protocols used for flow control. MAC sub layer: MAC Addressing, Binary Exponential Back-off (BEB) Algorithm, Channel Allocation Problem, Pure and slotted Aloha, CSMA, CSMA/CD, collision free multiple access, Throughput analysis of pure and slotted Aloha, High Speed LAN. **[T1,T2][No. of hrs. 10]**

UNIT – III:

Network layer-design issue. Routing and Forwarding: Routing versus forwarding, Static and dynamic routing, Unicast and Multicast Routing. Distance-Vector, Link-State, Shortest path computation, Dijkstra's algorithm, Network Layer Protocols (IP: IP header format, ICMP), IPv4 classful and classless addressing, sub netting, comparative study of IPv4 & IPv6. **[T1,T2][No. of hrs. 10]**

UNIT – IV:

Process-to-Process Delivery: Transport Layer in the Internet: Introduction to TCP, TCP service Model, TCP Header and segment structure, TCP connection establishment and release, transmission policy, timer management, UDP : Design issue and header format, Multiplexing with TCP and UDP, Congestion Control :Principles of congestion control, Congestion Control Algorithms, Prevention Policies. Quality of service, Techniques to improve QoS. **[T1,T2] [No. of hrs. 10]**

UNIT – V

Session layer: Authentication, Authorization, Session layer protocol. Presentation layer: Data conversion, Character code translation, Compression, Encryption and Decryption. Presentation layer protocol, Application Layer: DNS, SMTP, WWW, HTTP, FTP. **[T1,T2] [No. of hrs. 6]**

Text Books:

[T1] Forouzan, B.A., Data communication and Networking, McGraw Hill (2006).
[T2] Tanenbaum , A.S., Computer Networks, Prentice Hall (2010)..

Reference Books:

[R1] Kurose and Ross, Computer Networking: A Top Down Approach, Addison-Wesley, (2012).
[R2] Stallings, W., Computer Networking with Internet Protocols and Tech, Prentice Hall of India (2010).

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COURSE OUTCOMES:

Course Code	Course Name	Course Outcome	Details
CSL206	Computer Networks	CO1	Describe the functions of each layer in OSI and TCP/IP model.
		CO2	Describe the functions of data link layer and protocols used in MAC sub layer.
		CO3	Building the skills of IP addressing, Routing Mechanisms and Congestion Control technique.
		CO4	Identify the essential principles of a transport layer protocol and session layer protocol.
		CO5	Illustrate the features and operations of various application layer protocols such as HTTP, DNS, SMTP, etc.

CO PO MAPPING

SUBJECT	Course Outcome	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO 12
COMPUTER NETWORKS	CO1	2	2	3	2	-	1	-	-	2	3	2	1
	CO2	3	3	2	3	1	-	-	-	1	2		2
	CO3	3	3	3	3	2	2	2		2	2	1	1
	CO4	3	3	3	1	1		-	-	1	2	-	2
	CO5	2	2	2	2	2	2	-	-	2	2	-	2

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SYLLABUS

Semester	**IV**
Branch	**CSE**
Admission Year	**2020-21**
Academic Year	**2021-22**

Scheme Code	Paper Code	Course Code	Course Title (Departmental Core)	C	L	T	P
CSE2020	4CSDC07	CSL207	Big Data Analysis	4	3		2
Pre-requisites/Exposure							

Course Objectives:
To understand the Big Data Platform and the fundamental concepts of HDFS. Also, to Provide an overview of Apache Hadoop and Apply analytics on Structured, Unstructured.

UNIT – 1:
INTRODUCTION TO BIG DATA AND HADOOP
Types of Digital Data, Introduction to Big Data, Big Data Analytics, History of Hadoop, Apache Hadoop, Analysing Data with Unix tools, Analysing Data with Hadoop, Hadoop Streaming, Hadoop Echo System, IBM Big Data Strategy. **[T1,T2][No. of hrs. 4]**

UNIT – II:
HDFS(Hadoop Distributed File System)
The Design of HDFS, HDFS Concepts, Command Line Interface, Hadoop file system interfaces, Data flow, Data Ingest with Flume and Scoop and Hadoop archives, Hadoop I/O: Compression, Serialization, Avro and File-Based Data structures. **[T1,T2][No. of hrs. 10]**

UNIT – III:
Map Reduce
Anatomy of a Map Reduce Job Run, Failures, Job Scheduling, Shuffle and Sort, Task Execution, Map Reduce Types and Formats, Map Reduce Features. **[T1,T2][No. of hrs. 8]**

UNIT – IV:
Hadoop Eco System
Pig : Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User Defined Functions, Data Processing operators.
Hive : Hive Shell, Hive Services, Hive Metastore, Comparison with Traditional Databases, HiveQL, Tables, Querying Data and User Defined Functions.
Hbase : HBasics, Concepts, Clients, Example, Hbase Versus RDBMS.
Big SQL : Introduction. **[T1,T2] [No. of hrs. 12]**

UNIT – V
Data Analytics with R / Python
Machine Learning : Introduction, Supervised Learning, Unsupervised Learning, Collaborative Filtering. Big Data Analytics with R or Python. **[T1,T2] [No. of hrs. 6]**

Text Books:
[T1] Michael Mineli, Michele Chambers, Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley Publications, 2013.
[T2] Tom White " Hadoop: The Definitive Guide" Third Edit on, O'reily Media, 2012.
Reference Books:
[R1] Glen J. Myat, "Making Sense of Data", John Wiley & Sons, 2007
[R2] Jay Liebowitz, "Big Data and Business Analytics" Auerbach Publications, CRC press (2013)
[R3] Tom Plunkett, Mark Hornick, "Using R to Unlock the Value of Big Data: Big Data Analytics with Oracle R Enterprise and Oracle R Connector for Hadoop", McGraw-Hill/Osborne Media (2013), Oracle press.

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Scheme Code	Paper Code	Course Code	Course Title (LAB) (Departmental Core)	C	L	T	P
CSE2020	4CSDC07	CSL207	Big Data Analysis	4	3		2
Pre-requisites/Exposure			1. Programming for Problem Solving- CSL100 2. Data Structures and Algorithms- CSL202				

List of Experiments :

1. Implement the following Data structures in Java

a)Linked Lists b) Stacks c) Queues d) Set e) Map

2. Perform setting up and Installing Hadoop in its three operating modes: Standalone, Pseudo distributed, Fully distributed

3. Use web based tools to monitor your Hadoop setup

4. Implement the following file management tasks in Hadoop:

· Adding files and directories · Retrieving files · Deleting files

Hint: A typical Hadoop workflow creates data files (such as log files) elsewhere and copies them into HDFS using one of the above command line utilities.

5. Run a basic Word Count Map Reduce program to understand Map Reduce Paradigm.

6. Write a Map Reduce program that mines weather data. Weather sensors collecting data every hour at many locations across the globe gather a large volume of log data, which is a good candidate for analysis with MapReduce, since it is semi structured and record-oriented.

7. Implement Matrix Multiplication with Hadoop Map Reduce

8. Install and Run Pig then write Pig Latin scripts to sort, group, join, project, and filter your data.

9. Install and Run Hive then use Hive to create, alter, and drop databases, tables, views, functions, and indexes

10. Practicing pig commands from grunt shell.

11. Using Hive to perform CRUD operations-Databases,Tables,Views,Functions and Indexes

12. Working with sqoop commands to import and export data between HDFS and RDBMS

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COURSE OUTCOMES:

Course Code	Course Name	Course Outcome	Details
CSL207	Big Data Analysis	CO1	Describe about the sources of Big Data and Analyzing Tools.
		CO2	Create cluster in Hadoop distributed file system
		CO3	Apply Map Reduction in HDFS.
		CO4	Interpret mapping statistical methods to analyze huge data.
		CO5	Apply the other frameworks in Distributed File Systems.

CO-PO MAPPING:

SUBJECT	Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
Big Data Analysis	CO1	-	2	2	-	-	1	1	1	-	-	-	-
	CO2	3	3	2	2	-	1	-	1	-	-	-	-
	CO3	-	2	2	-	-	1	1	1	-	-	2	-
	CO4	3	3	3	2	2	2	1	1	-	-	-	2
	CO5	3	3	3	2	2		2	2	-	-	2	2

3: Strongly **2: Moderate** **1: Weak**

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Scheme Code	Paper Code	Course Code	Course Title (Departmental Core)	C	L	T	P
CSE2020	4CSDC08	CSL208	Artificial Intelligence	3	3		
Pre-requisites/Exposure							

Course Objectives:

AI is an introductory course in Artificial Intelligence. The goal is to acquire knowledge on intelligent systems and agents, formalization of knowledge, reasoning with and without uncertainty, machine learning and applications at a basic level. The basic skill that the student is expected to acquire after the successful completion of

UNIT – 1: Introduction to AI and Intelligent agent, Different Approach of AI Problem Solving: Solving Problems by Searching, Uninformed search, BFS, DFS, Iterative deepening, Bi directional search, Informed search techniques: heuristic, Greedy search, A* search, AO* search, Hill climbing, constraint satisfaction problems.
[T1][No. of hrs. 10]

UNIT – II: Game Playing: minimax, alpha-beta pruning, tic-tac-toi, jug problem, chess problem, tiles problem. **[T1][No. of hrs. 06]**

UNIT – III: Knowledge representation and Reasoning: Building a Knowledge Base: Propositional logic, first order logic, Theorem Proving in First Order Logic, Resolution, refutation, deduction, Frame, Semantic network script, Knowledge bases and inference. Monotonic and nonmonotonic reasoning. Planning, partial order planning. **[T1,T2][No. of hrs. 08]**

UNIT – IV:
Learning: Overview of different forms of learning, Supervised base learning: Decision Trees, Naive Bayes, Unsupervised based learning. Neural Networks, Fuzzy logic. **[T1,T2] [No. of hrs. 10]**

UNIT – V:
Introduction to Natural Language Processing, Different issue involved in NLP, Expert System, Computer Vision. **[T1] [No. of hrs. 06]**

Text Books:

[T1] Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, Prentice-Hall.

[T2] Nils J. Nilsson, Artificial Intelligence: A New Sythesis, Morgan-Kaufmann.

Reference Books:

[R1] Artificial Intelligence for Humans by Jeff Heaton

[R2] Machine Learning. Tom Mitchell. First Edition, McGraw- Hill, 2013.

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COURSE OUTCOMES:

Course Code	Course Name	Course Outcome	Details
CSL208	Artificial Intelligence	CO 1	Define different AI branches i.e. problem solving, natural language, learning, knowledge representation, perception, common sense.
		CO 2	Explain searching technique, KRR, learning method, and language processing.
		CO 3	Solving a gaming problem, searching problem and learning problem with uncertain information.
		CO 4	Illustrate Searching, fuzzy system, expert system and neural network.
		CO 5	Compare a small intelligent system using learning method for a specific problem.

CO-PO mapping

Subject	Course Outcomes	PO 1	PO 2	PO 3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Artificial Intelligence	CO 1	3											
	CO 2	3	1										
	CO 3	3	3	3	2		2						
	CO 4	3	2	2	2			3					
	CO5	3	2	2	2	3	2			2			3

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Scheme Code	Paper Code	Course Code	Course Title (Departmental Core)	C	L	T	P
CSE2020	4CSDC09	CSL209	Internet of Things	4	3		2
Pre-requisites/Exposure			1. Computer Networks-CSL206				

Course Objective:
Assess the genesis and impact of IoT applications, architectures in real world.

UNIT – 1:
What is IoT, Genesis of IoT, IoT and Digitization, IoT Impact, Convergence of IT and IoT, IoT Challenges, IoT Network Architecture and Design, Drivers Behind New Network Architectures, Comparing IoT Architectures, A Simplified IoT Architecture, The Core IoT Functional Stack, IoT Data Management and Compute Stack. IOT. **[T1][No. of hrs. 9]**

UNIT – II:
Smart Objects: The "Things" in IoT, Sensors, Actuators, and Smart Objects, Sensor Networks, Connecting Smart Objects, Communications Criteria, IoT Access Technologies. **[T1][No. of hrs. 8]**

UNIT – III:
IP as the IoT Network Layer, The Business Case for IP, The need for Optimization, Optimizing IP for IoT, Profiles and Compliances, Application Protocols for IoT, The Transport Layer, IoT Application Transport Methods. **[T1][No. of hrs. 10]**

UNIT – IV:
IoT Physical Devices and Endpoints - Arduino UNO: Introduction to Arduino, Arduino UNO, Installing the Software, Fundamentals of Arduino Programming. IoT Physical Devices and Endpoints - RaspberryPi: Introduction to RaspberryPi, About the RaspberryPi Board: Hardware Layout, Operating Systems on RaspberryPi, Configuring RaspberryPi, Programming RaspberryPi with Python, Wireless Temperature Monitoring System Using Pi, DS18B20 Temperature Sensor, Connecting Raspberry Pi via SSH, Accessing Temperature from DS18B20 sensors, Remote access to RaspberryPi. **[T2] [No. of hrs. 12]**

UNIT – V:
Smart and Connected Cities, An IoT Strategy for Smarter Cities, Smart City IoT Architecture, Smart City Security Architecture, Smart City Use-Case Examples. **[T1] [No. of hrs. 3]**

Text Books:
[T1] David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry,"IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", 1st Edition, Pearson Education (Cisco Press Indian Reprint). (ISBN: 978- 9386873743)
[T2] Srinivasa K G, "Internet of Things",CENGAGE Leaning India, 2017

Reference Books:
[R1] Vijay Madisetti and ArshdeepBahga, "Internet of Things (A Hands-on-Approach)",1st Edition, VPT, 2014
[R2] Raj Kamal, "Internet of Things: Architecture and Design Principles", 1st Edition, McGraw Hill Education, 2017. (ISBN: 978-9352605224)

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Scheme Code	Paper Code	Course Code	Course Title (LAB) (Departmental Core)	C	L	T	P
CSE2020	4CSDC09	CSL209	Internet of Things	4	3		2
Pre-requisites/Exposure			1. Computer Networks-CSL206				

List of Experiments:

1. Familiarization with Arduino/Raspberry Pi and perform necessary software installation.
2. To interface LED/Buzzer with Arduino/Raspberry Pi and write a program to turn ON LED for 1 sec after every 2 seconds.
3. To interface Push button/Digital sensor (IR/LDR) with Arduino/Raspberry Pi and write a program to turn ON LED when push button is pressed or at sensor detection.
4. To interface DHT11 sensor with Arduino/Raspberry Pi and write a program to print temperature and humidity readings.
5. To interface motor using relay with Arduino/Raspberry Pi and write a program to turn ON motor when push button is pressed.
6. To interface OLED with Arduino/Raspberry Pi and write a program to print temperature and humidity readings on it.
7. To interface Bluetooth with Arduino/Raspberry Pi and write a program to send sensor data to smartphone using Bluetooth.
8. To interface Bluetooth with Arduino/Raspberry Pi and write a program to turn LED ON/OFF when „1"/"0" is received from smartphone using Bluetooth.
9. Write a program on Arduino/Raspberry Pi to upload temperature and humidity data to thingspeak cloud.
10. Write a program on Arduino/Raspberry Pi to retrieve temperature and humidity data from thingspeak cloud.
11. To install MySQL database on Raspberry Pi and perform basic SQL queries.
12. Write a program on Arduino/Raspberry Pi to publish temperature data to MQTT broker.
13. Write a program on Arduino/Raspberry Pi to subscribe to MQTT broker for temperature data and print it.
14. Write a program to create TCP server on Arduino/Raspberry Pi and respond with humidity data to TCP client when requested.
15. Write a program to create UDP server on Arduino/Raspberry Pi and respond with humidity data to UDP client when requested.

NOTE:- At least 8 Experiments out of the list must be done in the semester.

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COURSE OUTCOMES:

Course Code	Course Name	Course Outcome	Details
CSL209	Internet of Things	CO1	Interpret the impact and challenges posed by IoT networks leading to new architectural models
		CO2	Compare and contrast the deployment of smart objects and the technologies to connect them to network.
		CO3	Appraise the role of IoT protocols for efficient network communication.
		CO4	Elaborate the need for Data Analytics and Security in IoT
		CO5	Illustrate different sensor technologies for sensing real world entities and identify the applications of IoT in Industry.

CO-PO MAPPING:

SUBJECT	Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
Internet of Things	CO1	2	3	2	3		1	1	1				
	CO2	2	3	2	3		1		1				
	CO3	2	3	3	3		1	1	1				
	CO4	2	3	3	3	2	2	1	1				
	CO5	2	3	3	3	2		2	2				2

3: Strongly **2: Moderate** **1: Weak**

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Scheme Code	Paper Code	Course Code	Course Title (Departmental Core)	C	L	T	P
CSE2020	4CSDC10	CSL210	Database Management System	4	3		2
Pre-requisites/Exposure			1. Data Structures and Algorithms- CSL202 2. Discrete Mathematics Structures- CSL201				

Course Objectives:

To provide concept and need of Database System. To cover the concepts of ER-data model and Relational data model. Demonstrate the features of indexing and hashing in database applications. To make students design database with the help of E-R model or Normalization. To know the fundamental concepts of transaction processing- concurrency control techniques and recovery procedure.

UNIT - I:

Introduction & Entity Relationship (ER) Model

Introduction: Overview of DBMS, File system vs DBMS, Advantages of database systems, Database System architecture, Data models, Schemas and instances, Data independence, Functions of DBA. ER model: Entities and attributes, Entity types, Key attributes, Relationships, Constraints on E-R diagram, Defining the E-R diagram of database, Concept of Generalization, Aggregation and Specialization. **[T1,T2][No. of hrs. 8]**

UNIT - II:

Relational Data models: Domains, Tuples, Attributes, Relations, Characteristics of relations, Keys, Key attributes of relation, Relational database, Schemas, Integrity constraints. Referential integrity, Relationship Algebra, Selection, Projection, Set Operations, Renaming, Joins, Division, Relation Calculus, Expressive Power of Algebra and Calculus. Transforming ER diagram into Relations.**[T1,T3][No. of hrs. 10]**

UNIT - III:

Physical Data Organization: Review of terms: physical and logical records, blocking factor, pinned and unpinned organization. Heap files, Indexing, Singe level indices, numerical examples, Multi-level-indices, numerical examples, B-Trees & B+-Trees (structure only, algorithms not required), Extendible Hashing, Indexing on multiple keys – grid files. **[T1,T2][No. of hrs. 6]**

UNIT - IV:

Schema refinement and Normal forms: Different anomalies in designing a database, The idea of normalization, Functional dependency,

Armstrong's Axioms (proofs not required), Closures and their computation, Equivalence of Functional Dependencies (FD), Minimal Cover (proofs not required). First Normal Form (1NF),

Second Normal Form (2NF), Third Normal Form (3NF), Boyce Codd Normal Form (BCNF), Lossless join and dependency preserving decomposition, Algorithms for checking Lossless Join (LJ) and Dependency Preserving (DP) properties. **[T1,T2,T3][No. of hrs. 8]**

UNIT - V:

Transactions, Concurrency and Recovery:Transaction Processing Concepts - overview of concurrency control, Transaction Model, Significance of concurrency Control & Recovery, Transaction States, System Log, Desirable Properties of transactions. Serial schedules, Concurrent and Serializable Schedules, Conflict equivalence and conflict serializability, Recoverable and cascade-less schedules, Locking, Two-phase locking and its variations. Log-based recovery, Deferred database modification, check-pointing. [T1,T3][No. of hrs. 10] **[T1,T3][No. of hrs. 10]**

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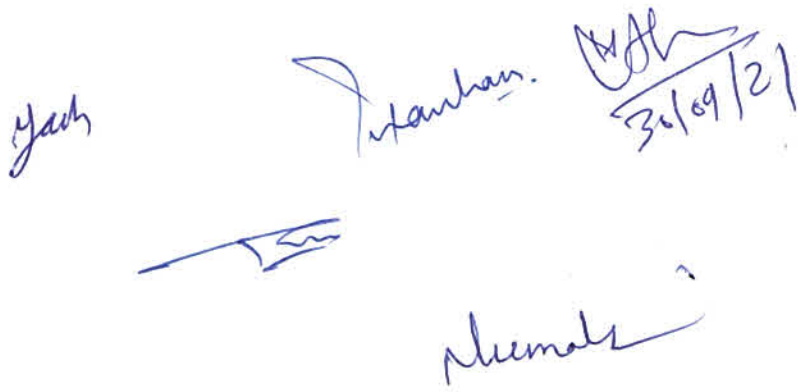
Text Books:

1. Elmasi, R. and Navathe, S.B., "Fundamentals of Database Systems", 4th Ed., 2005, Pearson Education.
2. A Silberschatz, H Korth, S Sudarshan, "Database System and Concepts", fifth Edition McGraw-Hill , 2005
3. Ramakrishnan, R. and Gekhre, J., "Database Management Systems", 3rd Ed., 2003, McGraw-Hill.

Reference Books:

1. Databases Illuminated 3nd Ed., Catherine Ricardo and Susan Urban, Jones and Bartlett, 2017
2. Date, C. J., "Introduction to Database Systems", 2002, Pearson Education.



Scheme Code	Paper Code	Course Code	Course Title (LAB) (Departmental Core)	C	L	T	P
CSE2020	4CSDC10	CSL210	Database Management System	4	3		2
Pre-requisites/Exposure			1. Data Structures and Algorithms- CSL202 2. Discrete Mathematics Structures- CSL201				

List of Experiments

Part A

1. Design a Database and create required tables. For e.g. Employee , Department, College Database.
2. Apply the constraints like Primary Key , Foreign key, NOT NULL to the tables.
3. Write a SQL statement for implementing ALTER,UPDATE and DELETE.
4. Write the queries to implement the joins.
5. Write the query for implementing the following functions: MAX(),MIN(),AVG() and COUNT().
6. Write the query to implement the concept of Integrity constraints.
7. Write the query to create the views.
8. Perform the queries for triggers.
9. Perform the following operation for demonstrating the insertion , updation and deletion using referential integrity constraints.
10. Write the query for creating the users and their role.

Part B

Project 1: Consider the following set of requirements for a UNIVERSITY database that is used to keep track of students' transcripts.

Description

a) The university keeps track of each student's name, student number, Social Security number, current address and phone number, permanent address and phone number, birth date, sex, class (freshman, sophomore, ..., graduate), major department, minor department (if any), and degree program (B.A., B.S., ..., Ph.D.). Some user applications need to refer to the city, state, and ZIP Code of the student's permanent address and to the student's last name. Both Social Security number and student number have unique values for each student.

b) Each department is described by a name, department code, office number, office phone number, and college. Both name and code have unique values for each department.

c) Each course has a course name, description, course number, number of semester hours, level, and offering department. The value of the course number is unique for each course.

d) Each section has an instructor, semester, year, course, and section number. The section number distinguishes sections of the same course that are taught during the same semester/year; its values are 1, 2, 3, ..., up to the number of sections taught during each semester.

e) A grade report has a student, section, letter grade, and numeric grade (0, 1, 2, 3,or 4).

1- Draw an ER diagram for the schema (**Make sure to use correct notation for specifying cardinality ratios, total/partial participations, key constraints.**)
2- Design the relational schema for this application.
3-Create tables in SQL for all the relations along with constraints.

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Project 2: Consider a MAIL_ORDER database in which employees take orders for parts from customers.

Description

The data requirements are summarized as follows:

a) The mail order company has employees, each identified by a unique employee number, first and last name, and Zip Code.

b) Each customer of the company is identified by a unique customer number, first and last name, and Zip Code.

c) Each part sold by the company is identified by a unique part number, a part name, price, and quantity in stock.

d) Each order placed by a customer is taken by an employee and is given a unique order number. Each order contains specified quantities of one or more parts. Each order has a date of receipt as well as an expected ship date. The actual ship date is also recorded.

1- Draw an ER diagram for the schema (**Make sure to use correct notation for specifying cardinality ratios, total/partial participations, key constraints.**)

2- Design the relational schema for this application.

3-Create tables in SQL for all the relations along with constraints.

COURSE OUTCOMES:

Course Code	Course Name	Course Outcome	Details
CSL210	Database Management System	CO1	escribe data models and schemas in DBMS.
		CO2	Apply logical database design principles, including E-R diagrams and database normalization.
		CO3	Construct simple and moderately advanced database queries using relational Algebra.
		CO4	Demonstrate the features of indexing and hashing in database applications
		CO5	To understand the concept of Transaction, Concurrency Control, Failure and Recovery.

CO-PO MAPPING:

SUBJECT	Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
Database Management System	CO1	3	1	2	1		2	1		1	2		2
	CO2	3	3	3	3		2	2		3	2	2	2
	CO3	3	3	3	3	2	1	2		1			2
	CO4	3	2	3	3		1	2		1			2
	CO5	3	2	2	1	3	3	2		1			2

3: Strongly **2: Moderate** **1: Weak**

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Scheme Code	Paper Code	Course Code	Course Title (Departmental Elective)	C	L	T	P
CSE2020	4CSDE23	CSL223	**Advanced Data Structures**	3	3		
Pre-requisites/Exposure			Data Structures and Algorithms- CSL202				

Course Objectives:

To extend the students' knowledge of algorithms and data structures. To learn a variety of useful algorithms and techniques. To ensure that the student evolves into a competent programmer capable of designing and analyzing implementations of algorithms and data structures for different kinds of problems.

UNIT - I:

Review of Time and Space complexity of algorithms, asymptotic analysis. File structures- Basic file operations, File organization –Sequential file organization, Indexed sequential file organization, Direct file organization. External merge sort, Multiway Merge sort, Tournament Tree ,Replacement Selection. **[T1,T2][No. of hrs. 8]**

UNIT - II:

Optimal Binary search trees, B-Trees: Definition of B-trees,2-3 tree, Basic operations on B-trees and Deleting a key from a B-tree. Binomial Heaps: Binomial trees and binomial heaps and Operations on binomial heaps Fibonacci Heaps: Structure of Fibonacci heaps, Mergeable-heap operations, Decreasing a key and deleting a node and Bounding the maximum degree **[T1,T2][No. of hrs. 9]**

UNIT - III:

Amortized Analysis: Aggregate analysis, The accounting method, The potential method, Dynamic tables
Disjoint Sets: Disjoint-set operations, Linked-list representation of disjoint sets, Disjoint-set forests and Analysis of union by rank with path compression. Dictionary: Abstract data type, array and tree based implementations. **[T1,T2][No. of hrs. 8]**

UNIT - IV:

Red-Black Trees: Properties of red-black trees, Rotations, Insertion, Deletion. Splay Trees: Splay Trees, Properties of Splay Trees and Operation on splay tree. Augmenting Data Structures: Dynamic order statistics, How to augment a data structure, Interval trees. **[T1,T2][No. of hrs. 9]**

UNIT - V:

Randomized Algorithms- Las Vegas algorithms, Monte Carlo algorithms, randomized algorithm for Min-Cut, randomized algorithm for 2- SAT. **[T3][No. of hrs. 6]**

Text Books:

[T1] T. H. Cormen, C. E. Leiserson, R. L. Rivest, and C. Stein, Introduction to Algorithms, MIT Press.
[T2] S. Sahni and E. Horowitz, "Data Structures", Galgotia Publications.
[T3] Randomized algorithms, R.Motwani and P. Raghavan

Reference Books:

[R1] Trembley and Sorenson , "Data Structures", TMH Publications
[R2] A. M. Tenenbaum, Y. Langsam, and M. J. Augenstein, Data Structures Using C and C++, Prentice Hall.

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COURSE OUTCOMES:

Course Code	Course Name	Course Outcome	Details
CSL223	Advanced Data Structures	CO 1	Identify different parameters to analyze the performance of an algorithm.
		CO 2	Describe the File structures ,Disjoint Sets and Augmenting Data Structures.
		CO 3	Explain the significance of balanced search trees.
		CO 4	Illustrate various technique to for Heap.
		CO 5	Apply to randomization as a tool for developing algorithms.

CO-PO MAPPING:

SUBJECT	Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
Advanced Data Structures	CO 1	3	2	2	1		1	2		1			2
	CO 2	3	3	2	2		1	2		1			2
	CO 3	3	3	2	2		1	2		1			2
	CO 4	3	3	2	2		1	2		1			2
	CO 5	3	3	2	2	2	1	1		1			2

3: Strongly **2: Moderate** **1: Weak**

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Scheme Code	Paper Code	Course Code	Course Title (Departmental Elective)	C	L	T	P
CSE2020	4CSDE24	CSL224	Software Tools (Scilab, LaTex, R)	3	1		4
Pre-requisites/Exposure							

Course Objectives:

This course will introduce you to basic concepts of scientific programming using Scilab, R and LaTex. The course will help you explore the world of programming. You will understand how cool it is to do programming in Scilab, R and LaTex. By the end of this course, you will be in a position to write a simple scientific program on your own in Scilab and R.

UNIT - I:

INTRODUCTION TO SIMULATION SOFTWARE in in SciLab:

About SCILAB/MATLAB, SCILAB/MATLAB System, Starting and Quitting SCILAB/MATLAB, Entering Matrices sum and transpose, subscripts, colon Operator, magic function, variables numbers, operators functions, expressions, If, else, and else if, switch and case, for, while, continue, break try - catch, return.

[T1,T2][No. of hrs. 4]

UNIT - II:

GRAPHICS, SCRIPTS & FUNCTIONS in SciLab:

Plotting Process, Editing Process, Preparing Graphs, Basic Plotting Functions, Mesh & Surface Plot, and Image Reading & Writing, Printing graphics, Scripts, functions, Global Variables, Passing String Arguments to Functions, eval Function, Function Handles, Vectorization , Pre allocation.

[T1,T2][No. of hrs. 5]

UNIT - III:

INTRODUCTION TO R language:

R Data Structures, help functions in R, vectors, scalars, declarations, recycling, common vector operations,– vectorized operations, filtering, vectorised if-then else, vector equality and element name, Creating matrices Matrix operations, Applying Functions to Matrix Rows and Columns, Vector/Matrix Distinction, lists, Creating lists, General list operations, Accessing list components and values, applying functions to lists, recursive lists.

[T3,T4][No. of hrs. 4]

UNIT - IV:

Data Frames in R:

Creating Data Frames, Matrix-like operations in frames, Merging Data Frames, Applying functions to Data frames , Factors and Tables, factors and levels, Common functions used with factors, Working with tables, Other factors and table related functions, Control statements, Arithmetic and Boolean operators and values, Default values for arguments, Returning Boolean values, functions are objects, Environment and Scope issues, Writing Upstairs, Recursion, Replacement functions, Tools for composing function code, Math and Simulations in R

[T3,T4][No. of hrs. 5]

UNIT - V:

INTRODUCTION TO LaTex:

Installation of the software LaTeX, Understanding Latex compilation Basic Syntex, Writing equations, Matrix, Tables, Page Layout, Packages, Classes, Applications to: Writing Resume Writing question paper Writing articles/ research papers Presentation using beamer.

[T5][No. of hrs. 3

Text Books:

[T1] Introduction to SCILAB by Rachna Verma and Arvind Verma.
[T2] SCILAB—A Beginner's Approach by Anil Kumar Verma.

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[T3] R for Everyone: Advanced Analytics and Graphics by Jared P. Lander
[T4] Beginning R – The Statistical Programming Language by Mark Gardener
[T5] Latex Beginner's Guide: Create High-Quality and Professional-Looking Texts, Articles, and Books for business and science using LaTex Book by Stefan Kottwitz

Reference Books:

[R1] MATLAB & Its Applications in Engineering By: Raj Kumar Bansal, Ashok Kumar Goel, Manoj Kumar Sharma
[R2] The Art of R Programming: A Tour of Statistical Software Design by Norman Matloff

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Scheme Code	Paper Code	Course Code	Course Title (Departmental Elective)	C	L	T	P
CSE2020	4CSDE24	CSL224	Software Tools (Scilab, LaTex, R)	3	1		4
Pre-requisites/Exposure							

List of Experiments

1. To write and execute programs that demonstrate on Control Structures (If-Else, If-elseif –else, Select) in SCILAB.
2. To Design on basic Matrix Constructors and Operations in SCILAB.
3. To Design on basic graphics -- 2D and 3D Plots and function in SCILAB.
4. To write and execute programs that demonstrate on Control Structures (for, while, break and continue) in SCILAB.
5. Write a R program to extract first 10 English letter in lower case and last 10 letters in upper case and extract letters between 22nd to 24th letters in upper case.
6. Write a R program to create an array of two 3x3 matrices each with 3 rows and 3 columns from two given two vectors. Print the second row of the second matrix of the array and the element in the 3rd row and 3rd column of the 1st matrix.
7. Write a R program to compare two data frames to find the row(s) in first data frame that are not present in second data frame.
8. Write a R program to find Sum, Mean and Product of a Vector, ignore element like NA or NaN.
9. Write a R program to create a list containing a vector, a matrix and a list and remove the second element.
10. Write a resume and research paper in LaTeX.

COURSE OUTCOMES:

Course Code	Course Name	Course Outcome	Details
CSL230	Software Tools	CO 1	Apply the basics of SCILAB software and its data class & control statement.
		CO 2	Design the Graph and function in SCILAB.
		CO 3	Understand the basics in R programming in terms of constructs, control statements, string functions
		CO 4	Apply the R programming from a statistical perspective
		CO 5	Write a various application program in LaTeX

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CO-PO MAPPING:

SUBJECT	Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
Software Tools	CO 1	3	2	3		3		2					
	CO 2	3	3	3	3	3		2		3			3
	CO 3	3	3	3	2	3							3
	CO 4	3	3	3	3	3				3			3
	CO 5	3				3	3		3		3		

3: Strongly **2: Moderate** **1: Weak**

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Scheme Code	Paper Code	Course Code	Course Title (Departmental Elective)	C	L	T	P
CSE2020	4CSDE25	CSL225	Human Computer Interface	3	3		
Pre-requisites/Exposure							

Course Objective:

This course provides basic understanding of how a system/device interacts with its users is what differentiates a product that is technically sound from a usable one. HCI is the science that explores these interactions. HCI is at the intersection of many disciplines including cognitive psychology, linguistics, design and engineering. HCI considerations are increasingly cited as key factors in product design. In this course we will explore the science behind HCI and we will put parts of it into practice.

UNIT – I:

The Human: input-output channels, Human memory, thinking, emotions, individual differences, psychology and the design of interactive systems. The computer: Text entry devices with focus on the design of key boards, positioning, pointing and drawing, display devices. The Interaction: Models of interaction, ergonomics, interaction styles, elements of WIMP interfaces, interactivity, experience, engagement and fun. Paradigms for Interaction. **[T1,T2][No. of hrs. 7]**

UNIT – II:

Design Process: The process of design, user focus, scenarios, navigation design screen design and layout, Iteration & prototyping. Usability Engineering.
Design rules: Principles to support usability, standards, guidelines, rules and heuristics, HCI patterns. **[T1,T2][No. of hrs. 8]**

UNIT – III:

Evaluation Techniques: Definition and goals of evaluation, evaluation through expert analysis and user participation, choosing an evaluation method.
User support, requirement, approaches, adaptive help systems, designing user support systems **[T1,T2][No. of hrs. 8]**

UNIT – IV:

Cognitive methods: Goals and task hierarchies, linguistic models, challenges of display-based systems, physical and device models, cognitive architectures. **[T1,T2] [No. of hrs. 6]**

UNIT – V:

Communications and collaborations models: Face to Face communication, conversations, Text based communication, group working.
Task Analysis: Differences between task analysis and other techniques, task decomposition, knowledge-based analysis, ER based analysis, sources of information and data collection, use of task analysis **[T1,T2] [No. of hrs. 6]**

Text Books:

[T1] "Human-Computer Interaction 3/E", Dix, Prentice Hall.

[T2] "Design of Everyday Things", Donald Norman.

Reference Books:

[R1] S. Sahni "Smart Things: Ubiquitous Computing User Experience Design, Mike Kuniavsky".

[R2] "The UX Book: Process and Guidelines for Ensuring a Quality User Experience", Rex Harston and Pardha Pyla.

[R3] "Designing for the Digital Age: How to Create Human-Centered Products and Services", Kim Goodwin and Alan Cooper.

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[R4] "Human-Computer Interaction Handbook: Fundamentals, Evolving Technologies, and Emerging Applications", Third Edition, Julie Jacko

COURSE OUTCOMES:

Course Code	Course Name	Course Outcome	Details
CSL225	Human Computer Interaction	CO 1	Describe typical human–computer interaction (HCI) models, styles, and various historic HCI paradigms.
		CO 2	Understand capabilities of both humans and computers from the viewpoint of human information processing.
		CO 3	Examine HCI design principles, standards and guidelines.
		CO 4	Design and analyze HCI systems for real world problems.
		CO 5	Illustrate HCI issues in groupware, ubiquitous computing, virtual reality, multimedia, and Word Wide Web-related environments

CO-PO MAPPING:

SUBJECT	Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
Human computer Interaction	CO 1	2	2	2			2		3				3
	CO 2	3	3		3		3						2
	CO 3	3	3	3	2	3	3		2				2
	CO 4	3	3	3	2	3	3		2	2		2	2
	CO 5	2	2		2	3	2		2	2			

3: Strongly **2: Moderate** **1: Weak**

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SYLLABUS

Semester	V
Branch	CSE
Admission Year	2020-21
Academic Year	2022-23

Scheme Code	Paper Code	Course Code	Course Title (Departmental Core)	C	L	T	P
CSE2020	5CSDC11	CSL311	Design and Analysis of Algorithm	3	3		
Pre-requisites/Exposure			1. Data Structures and Algorithms- CSL202 2. Discrete Mathematics Structures- CSL201				

Course Objectives:

To understand various complexity order notations. To study mathematical background for algorithm analysis and implementation of various strategies like divide and conquer, Greedy method, Dynamic programming, Branch and bound, Backtracking and number theoretic algorithm. To study different pattern matching algorithms. To study various problem classes like P, NP, NP- Hard etc.

UNIT - I:

BACKGROUND: Introduction of Algorithms, Analysis of Algorithms: Space Complexity, Time Complexity, Asymptotic Notation, Recurrence Relation and Master theorem. DIVIDE AND CONQUER METHOD: Binary Search, Merge Sort, Quick sort and Strassen's matrix multiplication algorithms. [T1,T2]**[No. of hrs. 6]**

UNIT - II:

GREEDY METHOD: Knapsack Problem, Job Sequencing, Optimal Merge Patterns, Huffman codes, Minimal Spanning Trees. DYNAMIC PROGRAMMING: Matrix Chain Multiplication. Longest Common Subsequence, 0/1 Knapsack Problem and All Pairs Shortest Path.**[T1,T2][No. of hrs. 10]**

UNIT - III:

ASSIGNMENT PROBLEMS: Formulation of Assignment and Quadratic Assignment Problem. BRANCH AND BOUND: Traveling Salesman Problem and Lower Bound Theory. BACKTRACKING: The 8-Queens Problem and Sum Of Subset Problem. **[T1,T2,T3][No. of hrs. 8]**

UNIT - IV:

NUMBER THEORITIC ALGORITHM: Number theoretic notions, Division theorem, GCD, recursion, Modular arithmetic, Solving Modular Linear equation, Chinese Remainder Theorem, power of an element, Computation of Discrete Logarithms, primality testing and integer factorization. PATTERN MATCHING ALGORITHMS: Naïve and Rabin Karp string matching algorithms, KMP Matcher and Boyer Moore Algorithms. **[T1,T2][No. of hrs. 10]**

UNIT - V:

PROBLEM CLASSES NP, NP-HARD AND NP-COMPLETE: Definitions of P, NP-Hard and NP-Complete Problems. Decision problems. Cook's theorem. Proving NP-Complete Problems - Satisfiability problem and vertex Cover Problem. Approximation algorithms for vertex cover and set cover problem.**[T1,T2,T3][No. of hrs. 8]**

Text Books:

1. Cormen, Leiserson, Rivest: Introduction to Algorithms, Prentice Hall of India.
2. Ellis horowitz ,sartajSahni , s. Rajsekaran. "Fundamentals of computer algorithms"University Press.
3. Aho A.V , J.D Ulman: Design and analysis of Algorithms, Addison Wesle

Reference Books:

1. Michael Gooddrich& Roberto Tammassia, "Algorithm design foundation, analysis and internet examples", Secondedition ,wiley student edition.

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COURSE OUTCOMES:

Course Code	Course Name	Course Outcome	Details
CSL311	Design and Analysis of Algorithm	CO1	Analyze worst-case running times of algorithms using asymptotic analysis.
		CO2	Describe the divide-and-conquer paradigm and explain when an algorithmic design situation calls for it.
		CO3	Describe the Greedy Method and Dynamic Programming paradigm and explain when an algorithmic design situation calls for it.
		CO4	Describe the Assignment Problems, Branch and Bound And Backtracking Programming paradigm and explain when an algorithmic design situation calls for it.
		CO5	Students will be able to identify a proper pattern matching algorithm and identify the computational issues of problem solving in computing.

CO-PO MAPPING:

SUBJECT	Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
Design and Analysis of Algorithm	CO1	3	2	1	1		2	2		1			2
	CO2	3	3	3	2		3	1		1			2
	CO3	3	3	3	2		3	1		1			2
	CO4	3	3	3	2		3	1		1			2
	CO5	3	3	3	2		3	2		1			2

3: Strongly **2: Moderate** **1: Weak**

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Scheme Code	Paper Code	Course Code	Course Title	C	L	T	P
CSE2020	5CSDC12	CSL312	Recent Topics	3	3		
Pre-requisites/Exposure							

Note- As per the availability of industrial expert.

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Scheme Code	Paper Code	Course Code	Course Title (Departmental Core)	C	L	T	P
CSE2020	5CSDC13	CSL313	**Operating System**	3	3		
Pre-requisites/Exposure							

Course Objectives:

The goal of this course is to provide an introduction to the internal operation of modern operating systems. The course will cover processes and threads, mutual exclusion, CPU scheduling, deadlock, memory management, and file systems.

UNIT I

Introduction: What is an Operating System, Simple Batch Systems, Multiprogrammed Batches systems, Time-Sharing Systems, Personal-computer systems, Parallel systems, Distributed Systems, Real-Time Systems, OS – A Resource Manager. **[T1] [T2] [No. of hrs. 6]**

UNIT II

Memory Organization & Management: Memory Organization, Memory Hierarchy, Memory Management Strategies, Contiguous versus non- Contiguous memory allocation, Partition Management Techniques, Logical versus Physical Address space, swapping, Paging, Segmentation, Segmentation with Paging

Virtual Memory: Demand Paging, Page Replacement, Page-replacement Algorithms, Performance of Demand Paging, Thrashing, Demand Segmentation, and Overlay Concepts. **[T1] [T2][R2][R3] [No. of hrs. 9]**

UNIT III

Processes: Introduction, Process states, process management, Interrupts, Interprocess Communication

Threads: Introduction, Thread states, Thread Operation, Threading Models. Processor Scheduling: Scheduling levels, pre emptive vs no pre emptive scheduling, priorities, scheduling objective, scheduling criteria, scheduling algorithms, demand scheduling, real time scheduling.

Process Synchronization: Mutual exclusion, software solution to Mutual exclusion problem, hardware solution to Mutual exclusion problem, semaphores, Critical section problems. Case study on Dining philosopher problem, Barber shop problem etc. **[T1][T2][[R3] [No. of hrs. 10]**

UNIT IV

Deadlocks: examples of deadlock, resource concepts, necessary conditions for deadlock, deadlock solution, deadlock prevention, deadlock avoidance with Bankers algorithms, deadlock detection, deadlock recovery.

Device Management: Disk Scheduling Strategies, Rotational Optimization, System Consideration, Caching and Buffering.**[T1][T2][R1] [No. of hrs. 8]**

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UNIT V

File System: Introduction, File Organization, Logical File System, Physical File System , File Allocation strategy, Free Space Management, File Access Control, Data Access Techniques, Data Integrity Protection, Case study on file system viz FAT32, NTFS, Ext2/Ext3 etc. **[T1] [T2][R4][R5] [No. of hrs. 7]**

Text Books:

[T1] Deitel & Dietel, "Operating System", Pearson, 3rd Ed., 2011

[T2] Silbersachatz and Galvin, "Operating System Concepts", Pearson, 5th Ed., 2001

[T3] Madnick & Donovan, "Operating System", TMH, 1st Ed., 2001

Reference Books:

[R1] Tannenbaum, "Operating Systems", PHI, 4th Edition, 2000

[R2] Godbole, "Operating Systems", Tata McGraw Hill, 3rd edition, 2014

[R3] Chauhan, "Principles of Operating Systems", Oxford Uni. Press, 2014

[R4] Dhamdhere, "Operating Systems", Tata McGraw Hill, 3rd edition, 2012

[R5] Loomis, "Data Management & File Structure", PHI, 2nd Ed.

COURSE OUTCOMES:

Course Code	Course Name	Course Outcome	Details
CSL313	Operating System	CO 1	To identify the basics of Operating Systems, Services, Functions provided.
		CO 2	Analyze the various types of process scheduling.
		CO 3	Describe the concepts of Process Management and Memory management
		CO 4	To analyse the concept of deadlock and Discuss File systems and other Input-Output subsystems
		CO 5	To generalise the concept of Interprocess communication

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CO-PO MAPPING:

SUBJECT	Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
Operating System	CO 1	3	3		2								2
	CO 2	3	3	2	2	3							
	CO 3	3	3			3							2
	CO 4	3	3		2	2							
	CO 5	3	3		3	3							2

3: Strongly **2: Moderate** **1: Weak**

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Scheme Code	Paper Code	Course Code	Course Title (LAB) (Departmental Core)	C	L	T	P
CSE2020	5CSDC14	CSP314	Linux shell and Network Programming	2			4
Pre-requisites/Exposure			1 Programming for problem solving-CSL101 2 Computer Networks-CSL206				

1. Use of Basic Unix Shell Commands: ls, mkdir, rmdir, cd, cat, banner, touch, file, wc, sort, cut, grep, dd, dfspace, du, ulimit.
2. Execute commands related to inode, I/O redirection and piping, process control commands, mails.
3. Shell Programming: Shell script exercises based on following

i.Interactive shell scripts
ii.Positional parameters
iii.Arithmetic
iv.if-then-fi, if-then-else-fi, nested if-else
v.Logical operators
vi.else + if equals elif, case structure
vii.while, until, for loops, use of break
viii.Meta-characters
ix.System administration: disk management and daily administration

4. Write shell script for-

i.Showing the count of users logged in
ii.Printing Column list of files in your home directory
iii.Listing your job with below normal priority
iv.Continue running your job after logging out.

5. Write a shell script to change data format. Show the time taken in execution of this script
6. Write a shell script to print files names in a directory showing date of creation & serial number of the file.
7. Write a shell script to count lines, words and characters in its input (do not use wc).
8. Write two programs in C: hello_client and hello_server
   (a)The server listens for, and accepts, a single TCP connection; it reads all the data it can from that connection, and prints it to the screen; then it closes the connection
   (b)The client connects to the server, sends the string "Hello, world!", then closes the Connection
9. Write an Echo_Client and Echo_server using TCP to estimate the round trip time from client to the server. The server should be such that it can accept multiple connections at any given time.
10. Repeat Exercises 8 & 9 for UDP.
11. Study and run basic network command and Network configuration commands.
12. Configure Host IP, Subnet Mask and Default Gateway in a System in LAN (TCP/IP Configuration).
13. Configure Internet connection and use IPCONFIG, PING / Tracer and Net stat utilities to debug the network issues.
14. Simulation of Wired topology of 4 Node
15. Network Topology - Star, Bus, Ring
16. Interpret Ping and Traceroute Output
17. Connect the computers in Local Area Network.
18. Configure Host IP, Subnet Mask and Default Gateway in a System in LAN (TCP/IP Configuration).
19. Transfer files between systems in LAN using FTP Configuration.
20. Study of Network Devices in Detail.

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COURSE OUTCOMES:

Course Code	Course Name	Course Outcome	Details
CSL314	Linux shell and Network Programming	CO1	Understanding the installation procedure of the Linux operating system, hands on with simple commands and Installation of Linux packages into the operating system.
		CO2	Able to apply the concepts of file handling, and regular expression using shell programming.
		CO3	Capable to apply and implement grep, awk script.
		CO4	Ability to develop and evaluate shell script program that handle processes.
		CO5	Able to implement various networking commands, Execute socket programming and configuration of IP.

CO-PO Mapping:

Subject	Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
Linux shell and Network Programming Lab	CO 1	1				3				1			
	CO 2	2	1	3									
	CO 3	2	1	3									
	CO 4	2	3	3	2								
	CO 5	3	2	1		1				1			3

3. Strong **2. Moderate** **1. Weak**

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Scheme Code	Paper Code	Course Code	Course Title (Departmental Core)	C	L	T	P
CSE2020	5CSDC15	CSL315	Theory of Computation	3	3		
Pre-requisites/Exposure			1.Discrete Mathematic Structure-CSL201				

Course Objectives:

To be able to construct finite state machines and the equivalent regular expressions and to prove the equivalence of languages described by finite state machines and regular expressions. Design context free grammars to generate strings from a context free language and convert them into normal forms. To be able to construct pushdown automata and the equivalent context free grammars and to able to prove the equivalence of languages described by pushdown automata and context free grammars. To be able to construct Turing machines and to prove the equivalence of languages described by Turing machines and Post machines. Distinguish between computability and non-computability and Decidability and un decidability.

UNIT - I:

Introduction to Automata Theory: Finite Automata & Basic machine, Alphabet, words, Finite state machine, Transition graph, Transition matrix, Deterministic and non-deterministic finite automation, Equivalence of DFA and NDFA, Minimization of finite automata, Mealy & Moore machines, Conversion of Mealy and Moore.
.[T1,T2][No. of hrs. 8]

UNIT - II:

Regular Expression Regular Grammar, Regular Expressions, Equivalence of regular, expressions and NFA with epsilon transitions. Converting Regular Expressions to NFA with epsilon transitions Equivalence of DFA and regular expressions, converting DFA to Regular Expressions.
Pumping Lemma for Regular Languages, Applications of Pumping Lemma. Closure Properties of Regular sets (Proofs not required), Decision Problems. **[T1,T2][No. of hrs. 08]**

UNIT - III:

Grammars and CFL: Types of grammar, Regular Grammar, Context Free Grammars (CFG), Derivations and Languages, Relationship between derivation and derivation trees, leftmost and rightmost derivation, sentential forms, parsing and ambiguity, simplification of CFG, conversion of grammar to automata machine and vice versa, Normal forms, Greibach and Chomsky Normal form , Problems related to CNF and GNF including membership problem.
[T1,T2][No. of hrs. 8]

UNIT - IV:

Push down Automata: Nondeterministic PDA, Definitions, PDA and CFL, CFG for PDA, Deterministic PDA, and Deterministic PDA and Deterministic CFL , The pumping lemma for CFL's, Closure Properties and Decision properties for CFL, Deciding properties of CFL
[T1, T3][No. of hrs. 8]

UNIT - V:

Turing Machines: Turing Machines: Introduction, Definition of Turing Machine, TM as language Acceptors and Transducers, Computable Languages and functions, Techniques for construction of Turing Machine, Universal TM & Other modification, multiple tracks Turing Machine.
Hierarchy of Formal languages: Recursive & recursively enumerable languages, Properties of RL and REL, The Chomsky Hierarchy.
Tractable and Untractable Problems: P, NP, NP complete and NP hard problems, Undecidability, examples of these problems like vertex cover problem, Hamiltonian path problem, traveling sales man problem.
[T1, T3][No. of hrs. 7]

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Text Books:

1. An introduction to Formal Languages and Automata, Peter Linz
2. Aho, Hopcroft and Ullman, Introduction to Automata Theory, Formal Languages and Computation, Narosa
3. Cohen, Introduction to Computer Theory, Addison Wesley.

Reference Books:

1. Aho A. V., J. E. Hopcroft and J. D. Ullman, Data Structures and Algorithms, Pearson Publication.

COURSE OUTCOMES:

Course Code	Course Name	Course Outcome	Details
CSL315	Theory of Computation	CO 1	Explain the knowledge of System Software such as Translators, Assemblers, and understand different phases of compilers.
		CO 2	To be able to evaluate lexical, semantic rules and grammars for a programming language.
		CO 3	To determine the principles, algorithms, and data structures involved in the design and construction of compilers and parsers by using theory of computation.
		CO 4	To be able to understand the requirement of heap and stack memory allocation system in programming.
		CO 5	To be able to apply optimization while doing simple programming.

CO-PO Mapping:

SUBJECT	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Theory Of Computation	CO 1	2	2	3	1								
	CO 2	2	2	3	1								
	CO 3	2	2	3	1								
	CO 4	2	3	3	1	2							
	CO 5	3	3	2	2								

3. Strong **2. Moderate** **1. Weak**

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Scheme Code	Paper Code	Course Code	Course Title (Departmental Elective)	C	L	T	P
CSE2020	5CSDE26	CSL326	Cyber Security Management	3	3		
Pre-requisites/Exposure							

Course Objectives:
Introduce details of cyber security, cyber-crime to learn how to avoid becoming victims of cyber-crimes. To understand about security attack, services and mechanism. To gain a fundamental understanding of cyber-crime and law. To acquire knowledge of vulnerability, security tools and method.

UNIT – I:
Introduction of Cyber Crime, Challenges of cyber-crime, Classifications of Cybercrimes: E-Mail Spoofing/Security, Spamming, Internet Time Theft, Salami attack/Technique, Risk in Social Networking. **[T1,T2][No. of hrs. 7]**

UNIT – II:
Web jacking, Online Frauds, Software Piracy, Computer Network Intrusions, Password Sniffing, Identity Theft, cyber terrorism, Virtual Crime, Perception of cyber criminals: hackers, insurgents and extremist group etc. Web servers hacking, session hijacking. **[T1,T2][No. of hrs. 8]**

UNIT – III:
Cyber Crime and Criminal justice: Concept of Cyber Crime and the IT Act 2000, Hacking, Teenage Web Vandals, Cyber Fraud and Cheating, Defamation, Harassment and E-mail Abuse, Other IT Act Offences, Monetary Penalties, jurisdiction and Cyber Crimes, Nature of Criminality, Strategies to tackle Cyber Crime and Trends, Digital Forensics. **[T1,T3][No. of hrs. 8]**

UNIT – IV:
Overview of vulnerability scanning: OpenSSL, DVWA, Webgoat, Metasploit. Network Sniffers and Injection Tools:Tcpdump and Windump,Wireshark. Network Address Translation (NAT) and Port Forwarding, Network Defense tools: Firewalls, Use of Firewall, VPN, DNS, NMAP. **[T1,T2][No. of hrs. 9]**

UNIT – V:
Proxy Servers and Anonymizers, Password Cracking, Key loggers and Spyware, virus and worms, Trojan Horses, Backdoors, Ransomware, DoS and DDoS Attacks , Buffer and Overflow, Attack on Wireless Networks, Phishing : Method of Phishing, Phishing Techniques, Cyber Insurance, Crytocurrencies, Introduction to Blockchain. Case Study: 1. Banking Related Frauds, Credit Card Related Frauds 2.Cyber defamation: A Young Couple Impacted. **[T1,T2][No. of hrs. 8]**

Text Books:
[T1] Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Nina Godbole and S Belpure, Publication Wiley.
[T2] Anti Hacker Tool Kit (Indian Edition) by Mike Shema, Publication McGraw Hill.
[T3]Cyber Law Simplified, VivekSood, Pub: TMH

Reference Books:
[R1] Principles of Cybercrime, Jonathan Clough Cambridge University Press.
[R2] Information Warfare: Corporate attack and defense in digital world, William Hutchinson, Mathew Warren, Elsevier.

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COURSE OUTCOMES:

Course Code	Course Name	Course Outcome	Details
CSL326	Cyber Security Management	CO 1	Gain a fundamental knowledge of what Cyber Security is and Apply knowledge of computer science to provide security.
		CO 2	Classify different type of attack and how to identify and prevent.
		CO 3	Identify issues to protect digital assets in compliance with cyber laws.
		CO 4	Determine the vulnerability to detects and classifies system weaknesses in networks, application and predicts the effectiveness of countermeasures
		CO 5	Acquire knowledge about network security tools and authentication applications and apply legal and ethical aspects to manage and audit digital assets.

CO-PO MAPPING:

SUBJECT	Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CYBER SECURITY MANAGEMENT	CO 1	3	3	2	2	1	2		2			1	2
	CO 2	2	2	3	3	3	1			1			
	CO 3	1	1	2			3	2	3				2
	CO 4	2	2	2	3	3				2			
	CO 5	2	1	1	3	3				2			

3: Strongly **2: Moderate** **1: Weak**

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Scheme Code	Paper Code	Course Code	Course Title (Departmental Elective)	C	L	T	P
CSE2020	5CSDE27	CSL327	Software Project Management	3	3		
Pre-requisites/Exposure							

Course Objectives:

To understand the fundamental principles of Software Project management & will also have a good knowledge of responsibilities of project manager and how to handle these. Be familiar with the different methods and techniques used for project management.

UNIT – 1:

Importance of Software Project Management Activities Methodologies Categorization of Software Projects Setting Objectives Management Principles Management Control Project portfolio Management Cost-benefit evaluation technology Risk evaluation Strategic program Management Stepwise Project Planning. **[T1,T2,T3][No. of hrs. 6]**

UNIT – II:

Software process and Process Models Choice of Process models - mental delivery Rapid Application development Agile methods Extreme Programming SCRUM Managing interactive processes Basics of Software estimation Effort and Cost estimation techniques COSMIC Full function points - COCOMO II A Parametric Productivity Model - Staffing Pattern.**[T1,T2,T3][No. of hrs. 6]**

UNIT – III:

Objectives of Activity planning Project schedules Activities Sequencing and scheduling Network Planning models Forward Pass & Backward Pass techniques Critical path (CRM) method Risk identification Assessment Monitoring PERT technique Monte Carlo simulation Resource Allocation Creation of critical patterns Cost schedules. **[T1,T2,T3][No. of hrs. 7]**

UNIT – IV:

Framework for Management and control Collection of data Project termination Visualizing progress Cost monitoring Earned Value Analysis- Project tracking Change control- Software Configuration Management Managing Contracts Contract Management. **[T1,T2,T3] [No. of hrs. 6]**

UNIT – V

Project organization and planning: work breakdown structures, planning guidelines, the cost and schedule estimating process, the iteration planning process, pragmatic planning, line-of-business organizations, project organizations, evolution of organizations; process automation - automation building blocks, the project environment. **[T1,T2,T3] [No. of hrs. 6]**

Text Books:

[T1] Software Project Management, Walker Royce, Pearson, 2005
[T2] Project Management and Tools & Technologies – An overview Shailesh Mehta, SPD, 1st edition 2017
[T3] Bob Hughes, Mike Cotterell and Rajib Mall: Software Project Management Fifth Edition, Tata McGraw Hill, New Delhi, 2012.

Reference Books:

[R1] Kieron Conway, "Software Project Management", Dreamtech Press, 2001
[R2] Ramesh, "Managing Global software Projects", Tata McGraw Hill, 2001
[R3] Roger S. Pressman , "Software Engineering – A Practitioner's approach", Tata McGraw Hill, 2009

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COURSE OUTCOMES:

Course Code	Course Name	Course Outcome	Details
CSL327	Software Project Management	CO 1	Identify the different project contexts and suggest an appropriate management strategy.
		CO 2	Evaluate and decide the software project management.
		CO 3	Classify the project life cycle and estimate the effort of Agile methods.
		CO 4	Formulate the project activity plan and project risk management.
		CO 5	Organize and manage the project.

CO-PO MAPPING:

SUBJECT	Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
Software Project Management	CO 1	2	3	2	1	1				1	1	3	2
	CO 2	2	2	2	2	1					1	3	1
	CO 3	3	3	2	2	1					1	2	2
	CO 4	3	3	2	2	1			2	1	1	3	2
	CO 5	2	3	2	1	1			2	2	2	3	1

3: Strongly **2: Moderate** **1: Weak**

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Scheme Code	Paper Code	Course Code	Course Title (Departmental)	C	L	T	P
CSE2020	5CSDE28	CSL328	Social Network Analysis	3	3		
Pre-requisites/Exposure							

Course Objectives:

To understand the concept of semantic web and related applications.To learn knowledge representation using ontology.To understand human behaviour in social web and related communities. To learn visualization of social networks.

UNIT - I

INTRODUCTION: Introduction to Semantic Web: Limitations of current Web – Development of Semantic Web – Emergence of the Social Web – Social Network analysis: Development of Social Network Analysis – Key concepts and measures in network analysis – Electronic sources for network analysis: Electronic discussion networks, Blogs and online communities – Web-based networks – Applications of Social Network Analysis. **[T1][T2][R2][Hrs. 7]**

UNIT - II

Modelling, Aggregating and Knowledge Representation Ontology and their role in the Semantic Web: Ontology-based knowledge Representation –Ontology languages for the Semantic Web: Resource Description Framework – Web Ontology Language – Modeling and aggregating social network data: State-of-the-art in network data representation – Ontological representation of social individuals – Ontological representation of social relationships – Aggregating and reasoning with social network data –Advanced representations. **[T1][T2][R2][Hrs. 8]**

UNIT - III

Extraction and Mining Communities in Web Social Networks: Extracting evolution of Web Community from a Series of Web Archive – Detecting communities in social networks – Definition of community – Evaluating communities – Methods for community detection and mining – Applications of community mining algorithms – Tools for detecting communities social network infrastructures and communities – Decentralized online social networks – Multi-Relational characterization of dynamic social network communities. **[T1][T2][R2][Hrs. 8]**

UNIT - IV

Predicting Human Behaviour and Privacy Issues:Understanding and predicting human behaviour for social communities – User data management – Inference and Distribution – Enabling new human experiences – Reality mining – Context – Awareness – Privacy in online social networks – Trust in online environment – Trust models based on subjective logic – Trust network analysis – Trust transitivity analysis – Combining trust and reputation – Trust derivation based on trust comparisons – Attack spectrum and countermeasures. **[T1][T2][R2][Hrs. 9]**

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UNIT-V

Visualization and Applications of Social Networks: Graph theory – Centrality – Clustering – Node-Edge Diagrams – Matrix representation –Visualizing online social networks, Visualizing social networks with matrix-based representations – Matrix and Node-Link Diagrams – Hybrid representations – Applications – Cover networks – Community welfare – Collaboration networks – Co-Citation networks. **[T1][T2][R2][Hrs. 8]**

TEXT BOOKS:

[T1] Peter Mika, —Social Networks and the Semantic Web, First Edition, Springer 2007.

[T2] Borko Furht, —Handbook of Social Network Technologies and Applications, 1st Edition, Springer, 2010.

REFERENCES:

[R1] Guandong Xu, Yanchun Zhang and Lin Li, Web Mining and Social Networking –Techniques and applications, First Edition, Springer, 2011.

[R2] Dion Goh and Schubert Foo - Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively, IGI Global Snippet, 2008.

[R3] Max Chevalier, Christine Julien and Chantal Soulé-Dupuy, Collaborative and Social Information Retrieval and Access: Techniques for Improved user Modelling, IGI Global Snippet, 2009.

[R4] John G. Breslin, Alexander Passant and Stefan Decker, -The Social Semantic Web, Springer, 2009.

COURSE OUTCOMES:

Course Code	Course Name	Course Outcome	Details
CSL 328	Social Network Analysis	CO 1	Develop semantic web related applications
		CO 2	Represent knowledge using ontology
		CO 3	Predict human behaviour in social web and related communities
		CO 4	Visualize social networks
		CO 5	Applications of Social Network

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CO-PO MAPPING:

SUBJECT	Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
Social Network Analysis	CO 6	3	3		2			1					2
	CO 7	2	3	2	2	3			1				
	CO 8	3	3			3							2
	CO 9	2	3		2	2			1				
	CO 10	3	3		3	3				1			2

3: Strongly **2: Moderate** **1: Weak**

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SYLLABUS

Semester	**VI**
Branch	**CSE**
Admission Year	**2020-21**
Academic Year	**2022-23**

Scheme Code	Paper Code	Course Code	Course Title (Departmental Core)	C	L	T	P
CSE2020	6CSDC16	CSL316	Compiler Design	3	3		
Pre-requisites/Exposure			1 Programming for Problem solving – CSL 101				

Course Objectives:

To provide a thorough understanding of the internals of Compiler Design and to extend the knowledge of parser by parsing LL parser and LR parser.To apply the code generation algorithms to get the machine code for the optimized code and Understand design/implementation issues involved with storage allocation and binding, control flow, parameter passing, symbol table. To understand the machine dependent code and to apply the optimization techniques to have a better code for code generation.

UNIT - I:

Compiler, Translator, Interpreter definition, Phase of compiler, Bootstrapping, Review of Finite automata lexical analyzer, lexems, Input, Recognition of tokens, Idea about LEX: A lexical analyzer generator, Error handling.
.[T1,T2][No. of hrs. 5]

UNIT - II:

Review of CFG Ambiguity of grammars, Syntax Analysis, Introduction to parsing. Top down parsing, LL grammars & passers error handling of LL parser, Recursive descent parsing predictive parsers, Bottom up parsing, Shift reduce parsing, LR parsers, Construction of SLR, Conical LR & LALR parsing tables, parsing with ambiguous grammar. Operator precedence parsing, Introduction of automatic parser generator: YACC error handling in LR parsers.
[T1,T2][No. of hrs. 12]

UNIT - III:

Semantic Analysis, Syntax directed definitions; Construction of syntax trees, S-Attributed Definition, L-attributed definitions, Top down translation.
Type checking: type system, specification of simple type checker. Storage organization, Storage allocation, Strategies, Activation records, Accessing local and non-local names in a block structured language, Parameters passing, Symbol table organization, Data structures used in symbol tables.
[T1,T2][No. of hrs. 8]

UNIT - IV:

Intermediate code forms using postfix notation, DAG, Three address code, TAC for various control structures, Representing TAC using triples and quadruples, Boolean expression and control structures. Definition of basic block control flow graphs, DAG representation of basic block, Advantages of DAG.
[T1, T3][No. of hrs. 8]

UNIT - V:

Introduction to Code optimization: Sources of optimization, Loop optimization, Idea about global data flow analysis, Loop invariant computation, Peephole optimization, Issues in design of code generator, A simple code generator, Code generation from DAG. constant propagation, liveness analysis, common subexpression elimination.
[T1, T3][No. of hrs. 7]

Text Books:

1. Aho, Ullman and Sethi: Compilers, Addison Wesley
2. Holub, Compiler Design in C, PHI
3. Louden. Compiler Construction: Principles and Practice, Cengage Learning

Reference Books:

1. Aho A. V., J. E. Hopcroft and J. D. Ullman, Data Structures and Algorithms, Pearson Publication.

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Scheme Code	Paper Code	Course Code	Course Title (LAB) (Departmental Core)	C	L	T	P
CSE2020	6CSDC16	CSL316	Compiler Design	3	3		
Pre-requisites/Exposure			1 Programming for Problem Solving-CSL 101				

List of Experiments :

1. To identify whether given string is keyword or not?
2. Count total no. of keywords in a file. [Taking file from user]
3. Count total no of operators in a file. [Taking file from user]
4. Count total occurrence of each character in a given file. [Taking file from user]
5. Write a C program to insert, delete and display the entries in Symbol Table.
6. Write a LEX program to identify:
    1. Valid mobile number
    2. Valid url
    3. Valid identifier
    4. Valid date (dd/mm/yyyy)
    5. Valid time (hh:mm:ss)
7. Write a lex program to count blank spaces,words,lines in a given file.
8. Write a lex program to count the no. of vowels and consonants in a C file.
9. Write a YACC program to recognize strings aaab,abbb using a^nb^n, where b>=0.
10. Write a YACC program to evaluate an arithmetic expression involving operators +,-,* and /.
11. Write a YACC program to check validity of a strings abcd, aabbcd using grammar a^nb^nc^md^m, where n , m>0
12. Write a C program to find first of any grammar.

COURSE OUTCOMES:

Course Code	Course Name	Course Outcome	Details
CSL316	Compiler Design	CO 1	Explain the knowledge of System Software such as Translators, Assemblers, and understand different phases of compilers.(K3)
		CO 2	To be able to evaluate and implement lexical, semantic rules and grammars for a programming language.(K4)
		CO 3	To determine the principles, algorithms, and data structures involved in the design and construction of compilers and parsers by using theory of computation.(K4)
		CO 4	To be able to understand the requirement of heap and stack memory allocation system in programming.(K2)
		CO 5	To be able to apply optimization while doing simple programming.(K4)

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CO-PO Mapping:

SUBJECT	Course Outcomes	PO 1	PO 2	PO 3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO 12
Compiler Design	CO 1	3		2	1	1							2
	CO 2	3	2	2	2	1							
	CO 3	2	3	2	2								
	CO 4	2	2										
	CO 5	3	2	3	2		1		1				

3. Strong **2. Moderate** **1. Weak**

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Scheme Code	Paper Code	Course Code	Course Title (Departmental Core)	C	L	T	P
CSE2020	6CSDC17	CSL317	Computer Graphics	4	3		2
Pre-requisites/Exposure							

Course Objective:
The course introduces the basic concepts of computer graphics. It provides the necessary theoretical background and demonstrates the application of computer science to graphics.

UNIT – 1

Introduction and Line Generation: Types of computer graphics, Graphic Displays, Random scan displays, Raster scan displays, Frame buffer and video controller, Scan Conversion of Point, Line, Circle, Ellipse and Polygon, Introduction to Aliasing and Anti Aliasing technique. **[T1,T2][No. of hrs. 10]**

UNIT – II
Transformations: Basic transformation, Matrix representations and homogeneous coordinates, Composite transformations, Reflections and shearing. Windowing and Clipping: Viewing pipeline, Viewing transformations, 2-D Point Clipping; 2-D Line clipping: Cohen Sutherland, Liang Barsky and Cyrus–Beck line clipping algorithm; 2-D Polygon clipping: Sutherland Hodgeman, Weiler and Atherton polygon clipping **[T1,T2][No. of hrs. 10]**

UNIT – III:
3-D Geometric Primitives, 3-D Object representation, 3-D Transformation, 3-D viewing, projections. **[T1,T2][No. of hrs. 8]**

UNIT – IV:
Hidden Lines & Surfaces: Back Face Detection algorithm, Depth buffer method, A- buffer method, Scan line method, Curves and Splines: Parametric and Non parametric Representations, Bezier curve, Spline Curves. **[T1,T2] [No. of hrs. 6]**

UNIT – V:
Rendering: Basic illumination model, Diffuse reflection, Specular reflection, Phong shading, Gourand shading, Ray tracing, Color models like RGB, YIQ, CMY, HSV. **[T1,T2] [No. of hrs. 6]**

Text Books:

[T1] "Human- D. Hearn and M. Pauline Baker, Computer Graphics (C Version), Pearson Education, 2nd Edition, 2004.

[T2] Foley, A. Van Dam, S. Feiner, J. Hughes: Computer Graphics- Principles and Practice, Pearson

Reference Books:
[R1] D. F. Rogers and J. A. Adams, Mathematical Elements for Computer Graphics, 2ndEdition, McGraw-Hill International Edition, 1990

[R2] Curves and Surfaces for Computer Aided Geometric Design by G Farin, Academic Press

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Scheme Code	Paper Code	Course Code	Course Title (LAB) (Departmental Core)	C	L	T	P
CSE2020	6CSDC17	CSL317	Computer Graphics	4	3		2
Pre-requisites/Exposure							

List of Experiments:-

1. WAP to draw Line, Circle, ellipse, other curves and also fill the colours using inbuilt function. Using inbuilt function draw the given fig. 1

fig. 1

2. WAP to implement Digital Differential Analyzer Algorithm(DDA) and Bresenham's Line Drawing Algorithm. Using These algorithms draw a bar graph . Input to the program is to include the data points and the labelling required for the x and y axes. The data points are to be scaled by the program so that the graph is displayed across the full screen area.

3. WAP to implement Midpoint Circle Generation Algorithm. Using this algorithm display a pie chart with appropriate labeling. Input to the routine is to include a data set giving the distribution of the data over some set of intervals, the name of the pie chart, and the names of the intervals. Each section label is to be displayed outside the boundary of the pie chart near the corresponding pie section.

4. WAP to implement the midpoint ellipse algorithm assuming the start position is (rx, 0) and points are to be generated along the curve path in counter clockwise order.

5. Perform 2D geometric transformations- Translation, Rotation, Scaling, Reflection, shearing on fig-1 which is implemented in Experiment 1.

6. Draw a polygon using any line drawing algorithm and perform line clipping using Cyrus-Beck, Cohen-Sutherland and Liang-Barsky algorithms against a selected window.

7. Write a program to implement Boundary Fill algorithm and Flood Fill algorithm. Using these fill the colour in fig-1 which is implemented in Experiment 1.

In this experiment you should work on your old interface (fig-1) to add more features, you should create a menu and a submenu, the main menu should have the following Entries (Background color, add teams, add a Ball), each submenu have the following entries:

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1. Background colour: Red, White, Brown, Grey.
2. Add Teams: Team 1 (Left): this choice will add 11 players on the left field and you can select any shapes to represent the player for example you can use a circle but don't forget to color the players in the same team with the same colour. Team 2 (right): this choice will add 11 players on the Right field and you can select any shapes to represent the player for example you can use a circle but don't forget to color the players in the same team with the same color " .
3. Add a ball: Centre, left Penalty point, right Penalty point, corners (the corners should be numbered 1,2,3,4 and give the user a choice to select any one of them).

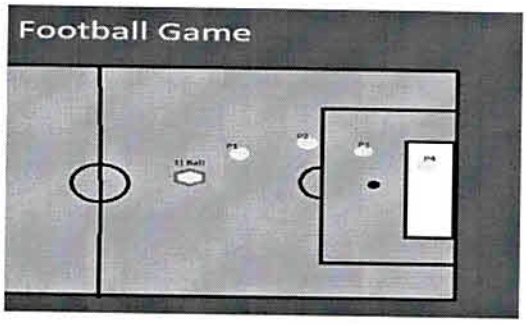
Your new interface should be more advanced by adding audience and Strips.

8. .Perform 3D geometric transformations- Translation, Rotation, Scaling, Reflection, shearing on fig-1 which is implemented in Experiment 1.

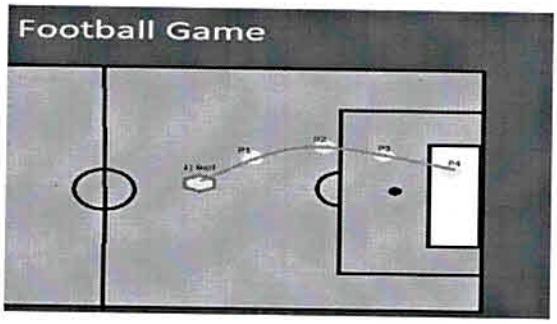
9. In this experiment you should work on your old interface to add the following features:

1. Using mouse Function you should let the user to choose where to put the ball (once the user clicks the mouse anywhere inside the playground you should draw a ball there).
2. Let the user draw the Kick curve then the ball should go through this curve (Note here you should define the starting and end points).

   To Draw the kicking curve you will wait until the user specify the path of the curve using mouse click (note here that you will wait for 4 points i.e 4 clicks from the user), see the following figure.



- The first click to specify where to draw the Ball.
- Clicks from 2 to 5 to specify the path of the curve (P1, P2, P3 and P4).
- Once completed, your program should draw the kicking curves passes through the specified points (Ball ,P1,P2,P3 and P4) as the following figure :



- Now your curve is ready and your program should have a menu with the following items:

1. Kick the ball (fast mode): your ball moves on the kicking curve quickly.
2. Kick the ball (Medium speed mode): your ball moves on the kicking with Medium speed.
3. Kick the ball (slow mode): your ball moves on the kicking with low speed.

Hint : use the Timer Function to control the move speed .

Your interface should be implemented in 3D environment.

COURSE OUTCOMES:

Course Code	Course Name	Course Outcome	Details
CSL317	COMPUTER GRAPHICS	CO 1	Understand the basics of computer graphics, different graphics systems and applications of computer graphics.
		CO 2	Discuss various algorithms for scan conversion and filling of basic objects and their comparative analysis.
		CO 3	Use of geometric transformations, viewing and clipping algorithms for 2D and 3D graphics objects.
		CO 4	Determine projections and visible surface detection techniques for display of 3D scene on 2D screen.
		CO 5	Render projected objects to naturalize the scene in 2D view and use of illumination models for this.

CO-PO MAPPING:

Subject	Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12
Computer Graphics	CO1	2	3	2									1
	CO2	3	3	2	2								
	CO3	3	3	2	2								
	CO4	3	2	2	2								
	CO5	3	3	3	3	1	2			2	2		2

3: Strongly **2: Moderate** **1: Weak**

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Scheme Code	Paper Code	Course Code	Course Title (Departmental Core)	C	L	T	P
CSE2020	6CSDC18	CSL318	Computer Architecture and Organization	3	3		
Pre-requisites/Exposure							

Course Objective:
To understand the structure, function and characteristics of computer systems. To understand the design of the various functional units and components of computers. To identify the elements of modern instructions sets and their impact on processor design.

UNIT – 1:
Introduction: Objective, scope and outcome of the course. Computer Data Representation: Basic computer data types, Complements, Fixed point representation, Register Transfer and Micro-operations: Floating point representation, Register Transfer language, Register Transfer, Bus and Memory Transfers (Tree-State Bus Buffers, Memory Transfer), Arithmetic Micro-Operations, Logic Micro-Operations, Shift Micro-Operations, Arithmetic logical shift unit.. **[T1,T2][No. of hrs. 06]**

UNIT – II:
Basic Computer Organization and Design Instruction codes, Computer registers, computer instructions, Timing and Control, Instruction cycle, Memory-Reference Instructions, Input-output and interrupt, Complete computer description, Design of Basic computer, design of Accumulator Unit Micro programmed Control: Control Memory, Address sequencing, Micro program Example, Design of control Unit.. **[T1,T2][No. of hrs. 06]**

UNIT – III:
Central Processing Unit: Introduction, General Register Organization, Stack Organization, Instruction format, Addressing Modes, Data Transfer and Manipulation, Program Control, Reduced Instruction Set Computer (RISC), Pipeline And Vector Processing, Flynn's taxonomy, Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, RISC Pipeline, Vector Processing, Array Processors. **[T1,T2][No. of hrs. 07]**

UNIT – IV:
Computer Arithmetic: Introduction, Addition and subtraction, Multiplication Algorithms (Booth Multiplication Algorithm), Division Algorithms, Floating Point Arithmetic operations, Decimal Arithmetic Unit. Input-Output Organization, Input-Output Interface, Asynchronous Data Transfer, Modes Of Transfer, Priority Interrupt, DMA, Input-Output Processor (IOP), CPUIOP Communication, Serial communication. **[T1,T2] [No. of hrs. 07]**

UNIT – V
Memory Organization: Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Virtual Memory. Multi-pre-processors: Characteristics of Multiprocessors, Interconnection Structures, Inter-processor Arbitration, Inter- processor Communication and Synchronization, Cache Coherence, Shared Memory Multiprocessors. **[T1,T2][No. of hrs. 05]**

Text Books:
[T1] Title : Computer System Architecture, Author: M. Morris Mano, Publisher: Prentice Hall of India Pvt Ltd
[T2]. Title: Computer Architecture and Organization, Author:J .P. Hayes, Publisher:McGraw-Hill

Reference Books:
[R1] Title: Computer Organization and Design - The Hardware/Software Interface, Author: D. A. Patterson and J. L. Hennessy, Publisher: Morgan Kaufmann
[R2].Title:Computer Organization and Architecture - Designing for Performance, Author:W. Stallings, Publisher: Prentice Hall of India

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[R3] Title: Computer Organization, Author: C. Hamacher, Z. Vranesic and S. Zaky, Publisher: McGrawHill

COURSE OUTCOMES:

Course Code	Course Name	Course Outcome	Details
CSL318	Computer Architecture and Organization	CO 1	Describe classification of Computer Architecture and Micro Operations
		CO 2	Categorize memory organization and explain the function of each element of a memory hierarchy
		CO 3	To Use addressing modes, instruction format and pipelining structure
		CO 4	Demonstrate computer Arithmetic. Identify and compare different methods for computer I/O mechanisms

CO-PO MAPPING:

SUBJECT	Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	O 12
Computer Architecture and Organization	CO1	2	2	2	1	2							
	CO2	3	2	3	2	1							
	CO3	3	1	2		1							
	CO4	3	3	3	1	2							

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Scheme Code	Paper Code	Course Code	Course Title (Departmental Core)	C	L	T	P
CSE2020	6CSDC19	CSL319	Distributed System	3	3		
Pre-requisites/Exposure			Operating Systems-CSL313				

Course Objectives:

This course provides an introduction to the fundamentals of distributed computer systems, assuming the availability of facilities for data transmission.

UNIT-I

Distributed Systems: Features of distributed systems, nodes of a distributed system, Distributed computation paradigms, Model of distributed systems, Types of Operating systems: Operating System, Network Operating Systems, Distributed Operating Systems, and Cooperative Autonomous Systems, design issues in distributed operating systems. Systems Concepts and Architectures: Goals, Transparency, Services, Architecture Models, Distributed Computing Environment (DCE). **[T1] [No. of hrs. 7]**

UNIT-II

Theoretical issues in distributed systems: Notions of time and state, states and events in a distributed system, time, clocks and event precedence, recording the state of distributed systems. Concurrent Processes and Programming: Processes and Threads, Graph Models for Process Representation, Client/Server Model, Time Services, Language Mechanisms for Synchronization. Inter-process Communication and Coordination: Message Passing, Request/Reply and Transaction Communication, Name and Directory services, RPC and RMI case studies. **[T1,T2] [No. of hrs. 7]**

UNIT-II

Distributed Process Scheduling: A System Performance Model, Static Process Scheduling with Communication, Dynamic Load Sharing and Balancing, Distributed Process Implementation. Distributed File Systems: Transparencies and Characteristics of DFS, DFS Design and implementation, Data and File Replication.
Case studies: Sun network file systems, General Parallel File System and Window's file systems. Andrew and Coda File Systems. **[T1] [No. of hrs. 6]**

UNIT-IV

Distributed Shared Memory: Non-Uniform Memory Access Architectures, Memory Consistency Models, Multiprocessor Cache Systems, Distributed Shared Memory, Implementation of DSM systems. Models of Distributed Computation: Preliminaries, Causality, Distributed Snapshots, Modelling. Distributed Computation, Failures in a Distributed System. **[T1, T2] [No. of hrs. 6]**

UNIT-V

Distributed Agreement: Concept of Faults, failure, and recovery, Byzantine Faults, Adversaries, Byzantine Agreement, Impossibility of Consensus and Randomized Distributed Agreement. CORBA case study: Introduction, Architecture, CORBA RMI, CORBA Services. **[T2] [No. of hrs. 6]**

Text Books:

[T1] Distributed operating systems and algorithm analysis by Randy Chow and T. Johnson, Pearson
[T2] Operating Systems A concept-based approach by DM Dhamdhere, TMH

Reference Books:

[R1] Pradeep K Sinha, "Distributed Operating Systems: Concepts and Design", Prentice Hall of India, 2007.
[R2] Mukesh Singhal and Niranjan G. Shivaratri. Advanced concepts in operating sys. McGraw-Hill, Inc., 1994.
[R3] Tanenbaum A.S., Van Steen M., —Distributed Systems: Principles and Paradigmsl, Pearson Education, 2007.
[R4] Liu M.L., Distributed Computing, Principles and Applicationsl, Pearson Education, 2004.
[R5] Nancy A Lynch, —Distributed Algorithmsl, Morgan Kaufman Publishers, USA, 2003.

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Course Outcome:

Course Code	Course Name	Course Outcome	Details
CSL319	Distributed System	CO1	Understand basic concept, principles and techniques behind distributed system model.
		CO2	Describe software components of distributed computing systems, communication and interconnection architecture of computer systems.
		CO3	Differentiate design issues related to a centralized system and a distributed system.
		CO4	Summarize security issues and development of fault tolerant distributed system.
		CO5	Analyze different distributed file systems(Case Study).

CO-PO Mapping:

SUBJECT	Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
Distributed System	CO1		2	2			2	1	1				
	CO2	3	2	3	3		2		1	2		2	2
	CO3	1	2	2	2		2	2	2	2			3
	CO4	3	3	3	2	2	2	3	2			2	
	CO5	3	3	3	2	1		2	2			2	1

3: Strongly **2: Moderate** **1: Weak**

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Scheme Code	Paper Code	Course Code	Course Title (Departmental Core)	C	L	T	P
CSE2020	6CSDC20	CSP320	Emerging Technology Lab	2			4

Note: As per availability of the industrial expert.

Scheme Code	Paper Code	Course Code	Course Title (Departmental Elective)	C	L	T	P
CSE2020	6CSDE29	CSL329	Digital Image Processing	4	3		2
Pre-requisites/Exposure							

Course Objectives:

To introduce the concepts of image processing and basic analytical methods to be used in image processing. To familiarize students with image enhancement and restoration techniques, To explain different image compression techniques. To introduce segmentation and morphological processing techniques.

UNIT- I :

Introduction and Digital Image Fundamentals: The origins of Digital Image Processing, Examples of Fields that Use Digital Image Processing, Fundamentals Steps in Image Processing, Elements of Digital Image Processing Systems, Image Sampling and Quantization, Some basic relationships like Neighbors, Connectivity, Distance Measures between pixels, Linear and Non Linear Operations. Image Enhancement in the Spatial Domain: Some basic Gray Level Transformations, Histogram Processing, Enhancement Using Arithmetic and Logic operations, Basics of Spatial Filters, Smoothening and Sharpening Spatial Filters, Combining Spatial Enhancement Methods.
[T1, T2][No. of Hrs: 10]

UNIT- II:

Filtering in the Frequency Domain: Introduction to Fourier Transform and the frequency Domain, Smoothing and Sharpening Frequency Domain Filters. Image Restoration: A model of The Image Degradation / Restoration Process, Noise Models, Restoration in the presence of Noise Only Spatial Filtering, Periodic Noise Reduction by Frequency Domain Filtering, Estimation of Degradation Function, Inverse filtering, Wiener filtering, Constrained Least Square Filtering, Geometric Mean Filter, Geometric Transformations.
[T1, T2][No. of Hrs. 12]

UNIT- III:

Image Compression: fundamentals of compression, coding redundancy, Lossy and lossless compression, Spatial and temporal redundancy, Image compression models. Some basic compression methods. Image Segmentation: Detection of Discontinuities, Edge linking and boundary detection, Region Oriented Segmentation, Motion based segmentation.
[T1, T2][No. of Hrs. 12]

UNIT- IV:

Representation and Description: Representation, Boundary Descriptors, Regional Descriptors, Use of Principal Components for Description, Introduction to Morphology, Some basic Morphological Algorithms. Object Recognition: Patterns and Pattern Classes, Decision-Theoretic Methods, Structural Methods.
[T1, T2][No. of Hrs: 10]

Text Books:

[T1] Rafael C. Gonzalez & Richard E. Woods, "Digital Image Processing", 3Rd edition, Pearson, 2002.
[T2] A.K. Jain, "Fundamental of Digital Image Processing", PHI, 1989.

Reference Books:

[R1] Bernd Jahne, "Digital Image Processing", 5th Ed., Springer, 2002.
[R2] William K Pratt, "Digital Image Processing: Piks Inside", John Wiley & Sons, 2001.

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Scheme Code	Paper Code	Course Code	Course Title (LAB) (Departmental Elective)	C	L	T	P
CSE2020	6CSDE29	CSL329	Digital Image Processing	4	3		2
Pre-requisites/Exposure							

List of Experiments:

Software Experiments:

1. Generation of basic signals sine, cosine, ramp, step, impulse and exponential in continuous and discrete domains using user defined functions.
2. Write a program to find convolution (linear/circular) and correlation of two discrete signals.
3. Perform linear convolution using circular convolution and vice versa.
4. Write a program to
   i. Find 8 point DFT, its magnitude and phase plot and inverse DFT.
   ii. Find 16 point DFT, its magnitude and phase plot and inverse DFT.
5. Perform the following properties of DFT.
   i. Circular shift of a sequence.
   ii. Circular fold of a sequence.
6. Write a program to design FIR Low pass filter using
   i. Rectangular window
   ii. Hanning window
   iii. Hamming window
   iv. Bartlett window
7. Write a program to
   i. Implement a Low pass / High pass / Band pass / Band stop IIR Filter using Butterworth Approximation.
   ii. Implement a Low pass / High pass / Band pass / Band stop IIR Filter using Chebyshev Approximation.

Hardware Experiments using Texas Instruments Kits-DSK 6713:

8. Introduction to Code composer Studio.
9. Write a program to generate a sine wave and see the output on CRO
10. Write a Program to Generate ECHO to give audio file.
11. Write a program to demonstrate Band Stop filter by FIR.

Additional Experiments:

12. Write a program to generate a cos wave and see the output on CRO
13. Write a program to blink the LED
14. Write a program to display a string on LCD.

NOTE:- At least 8 Experiments out of the list must be done in the semester.

Course Outcome:

Course Code	Course Name	Course Outcome	Details
CSL329	Digital Image Processing	CO 1	Compare different methods for image acquisition, storage and representation in digital devices and computers
		CO 2	A role of image transforms in representing, highlighting, and modifying image features
		CO 3	Interpret the mathematical principles in digital image enhancement and apply them in spatial domain and frequency domain
		CO 4	Apply various methods for segmenting image and identifying image components
		CO 5	Summarize different reshaping operations on the image and their practical applications
		CO 6	Identify image representation techniques that enable encoding and decoding images.

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CO-PO Mapping:

SUBJECT	Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
Digital Image Processing	CO 1	2											
	CO 2	2			2								
	CO 3				2								
	CO 4	2											
	CO 5	3											
	CO 6	2		3									

3: Strongly **2: Moderate** **1: Weak**

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Scheme Code	Paper Code	Course Code	Course Title (Departmental Elective)	C	L	T	P
CSE2020	6CSDE30	CSL330	Nature Inspired Algorithms	4	3		2
Pre-requisites/Exposure							

Course Objectives: To understand the various concepts of nature inspired algorithms. Detailed understanding of the Evolutionary Algorithms. Knowledge enhancement on the swarm intelligence based algorithms. Practical knowledge of the Discrete Nature Inspired Algorithms and Local Search Techniques. Implementation and Applications of the NIA for engineering optimization problem.

Syllabus:

Introduction to Nature Inspired Algorithms:

Overview of Computational Intelligence, Biologically inspired computing: nature as source of inspiration for the design of algorithms; Overview of the Nature Inspired Algorithms, Evolutionary Computation, Swarm Intelligence based algorithms.

Evolutionary Computation Theory and Paradigms:

History, overview, Genetic Algorithm, Differential Algorithm, Evolutionary Programming, Evolutionary Strategies. An overview of Evolutionary Algorithms, etc.

Swarm Intelligence Based Algorithms

Basic Particle Swarm Optimization, Global Best PSO, Local Best PSO, gbest versus, lbest PSO, Basic PSO Parameters, Artificial Bee Colony Algorithms, ANT Colony Optimization, Spider Monkey Optimization Algorithm, Gravitational Search Algorithm, Bio-Geography Based Optimization etc.

Discrete Nature Inspired Algorithms and Local Search Techniques: Discrete versions of the PSO, ABC, BBO, SMO Local Search Algorithms, Performance Evaluation of memetic algorithms, Parameterization and Balancing Local and Global Search, Memetic Algorithms in Discrete Optimization, Memetic Algorithms in Constrained Optimization, Multiobjective: Memetic Algorithms.

Step by step procedure of the Nature Inspired Algorithms, Applications and implementation of Nature Inspired Algorithms to solve engineering optimization problems for example Knapsack Problem, Quadratic Assignment Problem, Robot Path Planning Problem, Job Shop Scheduling Problem etc.

TEXT BOOKS:

1. Engelbrecht, Andries P. Computational intelligence: an introduction. John Wiley & Sons, 2007.
2. Smolinski, Tomasz G., Mariofanna G. Milanova, and Aboul-Ella Hassanien, eds. *Applications of computational intelligence in biology: current trends and open problems*. Vol. 122. Springer, 2008.
3. Clerc, Maurice. *Particle swarm optimization*. Vol. 93. John Wiley & Sons, 2010.
4. Hariri, S., and M. Parashar. "Handbook of bioinspired algorithms and applications, chapter the foundations.

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COURSE OUTCOMES:

Course Code	Course Name	Course Outcome	Details
CSL330	NATURE INSPIRED ALGORITHMS	CO1	Define the basic concept of natural phenomenon for developing the optimization algorithms
		CO2	Classify the evolutionary algorithms as per the optimization problem
		CO3	Apply the swarm intelligence based algorithms to solve the engineering optimization problems
		CO4	Analyze the discrete variants of the nature inspired algorithms
		CO5	Develop the step by step learning mechanism of the nature inspired algorithms

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Scheme Code	Paper Code	Course Code	Course Title (Departmental Elective)	C	L	T	P
CSE2020	6CSDE31	CSL331	Software Testing and Quality Assurance	4	3		2
Pre-requisites/Exposure							

Course Objectives:

To understand test management strategies and tools for testing. Learn to apply the testing strategies and methodologies in projects. To learn in detail about various quality assurance models.

UNIT – 1:

Faults, Errors, and Failures, Basics of software testing, Testing objectives, Principles of testing, Requirements, behavior and correctness, Testing and debugging, Test metrics and measurements, Verification, Validation and Testing, Types of testing, Software Quality and Reliability, Software defect tracking. **[T1,T2,T3][No. of hrs. 6]**

UNIT – II:

Using White Box Approach to Test design - Static Testing Vs. Structural Testing, Code Functional Testing, Coverage and Control Flow Graphs, Using Black Box Approaches to Test Case Design, Random Testing, Requirements based testing, Decision tables, State-based testing, Cause-effect graphing, Error guessing, Compatibility testing, Levels of Testing -Unit Testing, Integration Testing, Defect Bash Elimination. System Testing - Usability and Accessibility Testing, Configuration Testing, Compatibility Testing.**[T1,T2,T3][No. of hrs. 6]**

UNIT – III:

Software Test Automation, Skills needed for Automation, Scope of Automation, Design and Architecture for Automation, Requirements for a Test Tool, Challenges in Automation Tracking the Bug, Debugging. Testing Software System Security - Six-Sigma, TQM - Complexity Metrics and Models, Quality Management Metrics, Availability Metrics, Defect Removal Effectiveness, FMEA, Quality Function Deployment, Taguchi Quality Loss Function, Cost of Quality. **[T1,T2,T3][No. of hrs. 7]**

UNIT – IV:

SQA basics, Components of the Software Quality Assurance System, software quality in business context, planning for software quality assurance, product quality and process quality, software process models, 7 QC Tools and Modern Tools. **[T1,T2,T3] [No. of hrs. 6]**

UNIT – V:

Models for Quality Assurance, ISO-9000 series, CMM, CMMI, Test Maturity Models, SPICE, Malcolm Baldrige Model- P-CMM. Software Process- PSP and TSP, OO Methodology, Clean-room software engineering, Defect Injection and prevention, Internal Auditing and Assessments, Inspections & Walkthroughs, Case Tools and their Effect on Software Quality **[T1,T2,T3] [No. of hrs. 6]**

Text Books:

[T1] Srinivasan Desikan, Gopalaswamy Ramesh,Software Testing: Principles and Practices Pearson.
[T2] Daniel Galin, Software Quality Assurance: From Theory to Implementation, Pearson Addison Wesley.
[T3] Aditya P. Mathur, Foundations of Software Testing, Pearson

Reference Books:

[R1] Gordon G Schulmeyer, "Handbook of Software Quality Assurance", Third Edition, Artech House Publishers 2007
[R2] Nina S Godbole, "Software Quality Assurance: Principles and Practice", Alpha Science International, Ltd, 2004

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COURSE OUTCOMES:

Course Code	Course Name	Course Outcome	Details
CSL331	Software Test and Quality Assurance	CO1	Knowledge of quantitative, technical, practical methods that software engineers and developers can use to test their software
		CO2	Test the software by applying testing techniques to deliver a product free from bugs.
		CO3	Understand test management strategies and tools for testing.
		CO4	To explain quality assurance and various tools used in quality management.
		CO5	Apply quality tools and techniques in their projects.

CO-PO MAPPING:

SUBJECT	Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
Software Test and Quality Assurance	CO1	3	3	2	3	3				1	1		2
	CO2	3	3	2	3	3		2	2	1	2	2	3
	CO3	3	3	2	2	3		2		1	2	1	1
	CO4	3	3	2	2	3				1	1	2	1
	CO5	3	3	2	2	3			2	1	1	2	2

3: Strongly **2: Moderate** **1: Weak**

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Scheme Code	Paper Code	Course Code	Course Title (Departmental Core)	C	L	T	P
CSE2020	6CSDE32	CSL332	Data Mining And Business Intelligence	3	3		
Pre-requisites/Exposure			Data Analysis & AI Using Python -CSL101				

Course Objectives:

This course is designed to introduce students to business intelligence concepts and provide students with an understanding of data warehousing and data mining along with associated techniques and their benefits to organizations of all sizes.

UNIT-I:

Introduction: Evolution and importance of Data Mining-Types of Data and Patterns mined Technologies-Applications-Major issues in Data Mining. . **[T1][No. of hrs. 5]**

UNIT-II:

Knowing about Data- Data Preprocessing: Cleaning– Integration–Reduction–Data transformation and Discretization. **[T1][No. of hrs. 6]**

UNIT-III:

Data Warehousing: Basic Concepts-Data Warehouse Modeling- OLAP and OLTP systems - Data Cube and OLAP operations–Data Warehouse Design and Usage-Business Analysis Framework for Data Warehouse Design- OLAP to Multidimensional Data Mining. **[T1][No. of hrs. 8]**

UNIT-IV:

Mining Frequent Patterns: Basic Concept – Frequent Item Set Mining Methods – Mining Association Rules – Association to Correlation Analysis. Classification and Predication: Issues - Decision Tree Induction - Bayesian Classification – Rule Based Classification – k-Nearest mining Classification. Prediction –Accuracy and Error measures. Clustering: Overview of Clustering – Types of Data in Cluster Analysis – Major Clustering Methods. **[T1][No. of hrs. 12]**

UNIT-V:

Introduction to BI -BI definitions and concepts- BI Frame work-Basics of Data integration Introduction to Business Metrics and KPI - Concept of dash board and balance score card. Tool for BI: Microsoft SQL server: Introduction to Data Analysis using SSAS tools Introduction to data Analysis using SSIS tools- Introduction to Reporting Services using SSRS tools- Data Mining Implementation Methods. **[T2][No. of hrs. 9]**

Text Books:

[T1] Jiawei Han, Micheline Kamber and Jian Pei, "Data Mining Concepts and Techniques", Third Edition, Elsevier Publisher, 2006.

[T2] Loshin D, "Business Intelligence", First Edition, Elsevier Science, 2003.

Reference Books:

[R1] K.P.Soman, Shyam Diwakar and V.Ajay, "Insight into Data Mining Theory and Practice", PHI of India, 2006.

[R2] Darren Herbold, Siva Kumar Harinath, Matt Carroll, Sethu Meenakshisundaram, Robert Zare and Denny Guang-Yeu Lee, "Professional Microsoft SQL Server Analysis Services 2008 with MDX", Wrox, 2008.

[R3] T .H . Cormen, C . E . Leiserson, R .L . Rivest "Introduction to Algorithms", PHI/Pearson.

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COURSE OUTCOMES:

Course Code	Course Name	Course Outcome	Details
CSL332	Data Mining and Business Intelligence	CO1	Understand the functionality of the various data mining components.
		CO2	Appreciate the strengths and limitations of various data mining models.
		CO3	Compare and contrast the various clustering methods and classifiers.
		C04	Examine CRM concepts and solutions.
		CO5	Describe and utilize a range of techniques for designing data warehousing and data mining systems for real-world applications.

CO-PO MAPPING:

SUBJECT	Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
Data Mining And Business Intelligence	CO1	1	2	2			2	2	2				
	CO2	3	3	2	2		1		1			1	
	CO3		2	3	3		2	2	2				
	C04	3	3	3	2	2	2	1	1			3	
	CO5	3	3	3	2	2		2	2			3	3

3: Strongly **2: Moderate** **1: Weak**

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Scheme Code	Paper Code	Course Code	Course Title (Departmental Elective)	C	L	T	P
CSE2020	6CSDE33	CSL333	Data Compression Techniques	3	3		
Pre-requisites/Exposure							

Course Objectives:
The objective of the course is to familiarize students with basic Data compression techniques.

UNIT 1
Compression Techniques: Lossless, lossy, measure of performance, modelling & coding.

Lossless compression: Derivation of average information, data models, uniquely decodable codes with tests, prefix codes, Kraft-Mc Millan inequality.
Huffman coding: Algorithms, minimum variance Huffman codes, optimality, length extended codes, adaptive coding, Rice codes, using Huffman codes for lossless image compression. **[T1,T2][No. of hrs. 8]**

UNIT 2
Arithmetic coding with application to lossless compression.

Dictionary Techniques: LZ77, LZ78, LZW.

Predictive coding: Burrows-Wheeler Transform and move-to-front coding, JPEG-LS.

Facsimile Encoding: Run length, T.4 and T.6 **[T1,T2][No. of hrs. 8]**

UNIT 3
Lossy coding- Mathematical preliminaries: Distortion criteria, conditional entropy, average mutual information, differential entropy, rate distortion theory, probability and linear system models.

Scalar quantization: The quantization problem, uniform quantizer, Forward adaptive quantization, non uniform quantization, formal adopting quantization, companded quantization

Vector quantization: Introduction, advantages, The Linde-Ruzo-Grey algorithm, lattice vector quantization.
[T1,T2][No. of hrs. 8]
UNIT 4

Differential encoding – Introduction, Basic algorithm, Adaptive DPCM, Delta modulation, speech and image coding using delta modulation.

Sampling in frequency and time domain, z-transform, DCT, DST, DWHT, quantization and coding of transform coefficient. **[T1,T2][No. of hrs. 8]**

UNIT 5

Sub band coding: Introduction, Filters, Basic algorithm, Design of Filter banks, G.722, MPEG.

Wavelet based compression: Introduction, wavelets multi-resolution analysis and the scaling function implementation using filters. **[T1,T2][No. of hrs. 8]**

.Text Books:

[T1] Sayood, K, Data Compression, Morgan Kauffman, 2006.

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[T2] Saloman, Handbook of Data Compression

Reference Books:

[R1] Drew & Li, Fundamentals of Multimedia, PHI, 2006
[R2] Halsall, Multimedia Communications, Pearson Edu Asia, 2004
[R3] Parekh Ranjan, Principles of Multimedia, TMH, 2006

COURSE OUTCOMES:

Course Code	Course Name	Course Outcome	Details
CSL333	Data Compression Techniques	CO1	Explain the evolution and fundamental concepts of Data Compression and Coding techniques.
		CO2	Apply various coding techniques for compression of any raw data.
		CO3	Differentiate between Lossy and Lossless compression.
		C04	Understand the scalar quantization and vector quantization
		CO5	Determine Differential, Sub band Coding and Wavelet based Compression.

CO-PO MAPPING:

Subject	Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
Data Compression Techniques	CO1	2	2	2	1								
	CO2	3	2		2								
	CO3	2	3		2								
	CO4	3	2	2	2								
	CO5	3	3	2	2								

3: Strongly **2: Moderate** **1: Weak**

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Scheme Code	Paper Code	Course Code	Course Title (Departmental Elective)	C	L	T	P
CSE2020	6CSDE34	CSL334	Software Defined Network	3	3		
Pre-requisites/Exposure							

Course Objectives:

To learn the fundamentals of software defined networks. To understand the separation of the data plane and the control plane. To study about the SDN Programming. To study about the various applications of SDN.

UNIT – I

SDN Origins and Evolution, Centralized and Distributed Control and Data Planes, SDN APIs, Virtualization of Network Functions (VNF) and NFV, Open Virtual Networking (OVN), Open Network Operating Systems (ONOS). **[T1,T2][No. of hrs. 9]**

UNIT – II

SDN ABSTRACTIONS- How SDN Works, The Open flow Protocol, Big picture and other protocols, Controller Platforms, SDN Software Stack(s). **[T1,T2][No. of hrs. 8]**

UNIT – III

PROGRAMMING SDN- Northbound Application Programming Interface, Current Languages and Tools, Composition of SDNs, Mininet Environment and Implementation. **[T1,T2][No. of hrs. 8]**

UNIT – VI

SDN APPLICATIONS IN SECURITY- Switching and Load Balancers, Firewall and Access Control, Use cases in Legacy Networks security. **[T1,T2][No. of hrs. 7]**

UNIT – V

Multitenant and Virtualized Multitenant Data Center – SDN Solutions for the Data Center Network – VLANs – EVPN – VxLAN – NVGRE. **[T1,T2][No. of hrs. 8]**

Text Books:

[T1] SDN: Software Defined Networks, An Authoritative Review of Network Programmability Technologies, By Thomas D. Nadeau, Ken Gray Publisher: O'Reilly Media
[T2] Network Innovation through OpenFlow and SDN: Principles and Design, Edited by Fei Hu, CRC Press

Reference Books:

[R1]Software Defined Networking with OpenFlow By Siamak Azodolmolky, Packt Publishing
[R2]Foundations of Modern Networking: SDN, NFV, QoE, IoT, and Cloud" - William Stallings

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COURSE OUTCOMES:

Course Code	Course Name	Course Outcome	Details
CSL334	Software Defined Network	CO1	Differentiate between traditional networks and software defined networks
		CO2	Understand advanced and emerging networking technologies
		CO3	Explain the use of SDN in the current networking scenario
		CO4	Learn how to use software programs to perform varying and complex networking tasks
		CO5	Expand upon the knowledge learned and apply it to solve real world problems

CO-PO MAPPING:

SUBJECT	Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
SOFTWARE DEFINED NETWORK	CO1	3		3	1								
	CO2	2				3					3		
	CO3	3		1		3	2		2			2	
	CO4	2	2	3				2			2		
	CO5	3	2	3	2						2		2

3: Strongly **2: Moderate** **1: Weak**

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SYLLABUS

Semester	**VII**
Branch	**CSE**
Admission Year	**2020-21**
Academic Year	**2023-24**

Scheme Code	Paper Code	Course Code	Course Title (Departmental Core)	C	L	T	P
CSE2020	7CSDC21	CSL421	Cloud Computing	3	3		0

Course Objectives:

To understand the concept of cloud and utility computing. To understand the various issues in cloud computing. To familiarize themselves with the lead players in cloud. To appreciate the emergence of cloud as the next generation computing paradigm. To be able to set up a private cloud.

UNIT - I:
Introduction: Historical Development Cloud Computing Architecture, The Cloud Reference Model, Cloud Characteristics Cloud Deployment Models: Public, Private, Community, Hybrid Clouds Cloud Delivery Models: IaaS, PaaS, SaaS Open-Source Private Cloud Software: Eucalyptus, Open Nebula, Open Stack. . **[T1,T4][No. of hrs. 8]**

UNIT - II:
Data Center Technology Virtualization: Characteristics of Virtualized Environments Taxonomy of Virtualization Techniques Virtualization and Cloud Computing Pros and Cons of Virtualization Implementation Levels of Virtualization Tools and Mechanisms, VMWare, Microsoft Hyper-V, KVM, Virtual Box . **[T1, T2] [No. of hrs. 10]**

UNIT - III:
Cloud Infrastructure Mechanism: Cloud Storage, Cloud Usage Monitor, Resource Replication Specialized Cloud Mechanism: Load Balancer, SLA Monitor, Pay-per-use Monitor, Audit Monitor, Failover System, Hypervisor, Resource Cluster, Multi Device Broker, State Management Database Cloud Management Mechanism: Remote Administration System, Resource Management System, SLA Management System, Billing Management System. **[T1, T2, T3, T4] [No. of hrs. 10]**

UNIT - IV:
Apache Hadoop: HadoopMap Reduce, Hadoop Distributed File System, Hadoop I/O- Developing a MapReduce Application, MapReduce Types and Formats MapReduce Features, Hadoop Cluster Setup Administering Hadoop. **[T5] [No. of hrs. 10]**

UNIT - V:
Basic Terms and Concepts, Threat Agents, Cloud Security Threats, Cloud Security Mechanism: Encryption, Hashing, Digital Signature, Public Key Infrastructure, Identity and Access Management, Single Sign-on, Cloud Based Security Groups, Hardened Virtual Server Images. **[T1, T2, T3, T4] [No. of hrs. 10]**

TEXT BOOKS:

1. Thomas Erl, Zaigham Mahood, Ricardo Puttini, "Cloud Computing, Concept, Technology & Architecture", Prentice Hall, 2013.
2. Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, "Mastering Cloud Computing", Tata McGraw-Hill, 2013.
3. Toby Velte, Anthony Velte, Robert C. Elsenpeter, "Cloud Computing, A Practical Approach",Tata McGraw-Hill Edition, 2010.
4. Arshdeep Bahga, Vijay Madisetti, "Cloud Computing: A Hands-On Approach", Universities Press(India) Private Limited, 2014.
5. Tom White, "Hadoop: The Definitive Guide", O'Reilly Media, 4th Edition, 2015.

REFERENCE BOOKS:

1. James E Smith and Ravi Nair, "Virtual Machines", Elsevier, 2005.
2. John Ritting house& James Ransome, "Cloud Computing, Implementation, Management and Strategy", CRC Press, 2010.

COURSE OUTCOMES:

Course Code	Course Name	Course Outcome	Details
CSL421	CLOUD COMPUTING	CO1	Articulate the main concepts, key technologies, strengths and limitations of cloud computing.
		CO2	Identify the architecture, infrastructure and delivery models of cloud computing.
		CO3	Explain the core issues of cloud computing such as security, privacy and interoperability.
		CO4	Choose the appropriate technologies, algorithms and approaches for the related issues.
		CO5	Facilitate Service Level Agreements (SLA).

CO-PO MAPPING:

SUBJECT	Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CLOUD COMPUTING	CO1	3		2	3					3		2	
	CO2	3		3	2			1		3		2	
	CO3	3		3	2			1		3		2	
	CO4	3		3	2		2	1		3		2	
	CO5	3		3	2		2	2		3		2	

3: Strongly **2: Moderate** **1: Weak**

Scheme Code	Paper Code	Course Code	Course Title	C	L	T	P
CSE2020	7CSDC22	CSL422	Information System Security	3	3		
Pre-requisites/Exposure			Discrete Mathematic Structure-CSL201				

Course Objectives:

To provide an understanding of principal concepts, major issues, technologies and basic approaches in information security. Gain familiarity with prevalent network and distributed system attacks, defenses against them and forensics to investigate the aftermath. To develop a basic understanding of cryptography, how it has evolved and some key encryption techniques used today.

Syllabus:

Unit 1: Introduction to security attacks: services and mechanism, classical encryption techniques- substitution ciphers and transposition ciphers, cryptanalysis, stream and block ciphers. Modern block ciphers: Block Cipher structure, Data Encryption standard (DES) with example, strength of DES, Design principles of block cipher, AES with structure, its transformation functions, key expansion, example and implementation. **[T1, T2][No. of hrs. 8]**

Unit 2: Multiple encryption and triple DES, Electronic Code Book, Cipher Block Chaining Mode, Cipher Feedback mode, Output Feedback mode, Counter mode. **[T1, T2][No. of hrs. 8]**

Unit 3: Public Key Cryptosystems with Applications: Requirements and Cryptanalysis, RSA cryptosystem, Rabin cryptosystem, Elgamal cryptosystem, Elliptic curve cryptosystem. Cryptographic Hash Functions, their applications: Simple hash functions, its requirements and security, Hash functions based on Cipher Block Chaining, Secure Hash Algorithm (SHA). **[T1, T2][No. of hrs. 8]**

Unit 4: Message Authentication Codes, its requirements and security, MACs based on Hash Functions, Macs based on Block Ciphers. Digital Signature, its properties, requirements and security, various digital signature schemes (Elgamal and Schnorr), NIST digital Signature algorithm. **[T1, T2][No. of hrs. 8]**

Unit 5: Key management and distribution: symmetric key distribution using symmetric and asymmetric encryptions, distribution of public keys, X.509 certificates, Public key infrastructure. Remote user authentication with symmetric and asymmetric encryption, Kerberos Web Security threats and approaches, SSL architecture and protocol, Transport layer security, HTTPS and SSH. **[T1, T2][No. of hrs. 8]**

TEXTBOOKS:

[T1] Stalling Williams: Cryptography and Network Security: Principles and Practices, 4th Edition, Pearson Education, 2006.
[T2] Kaufman Charlie et.al; Network Security: Private Communication in a Public World, 2ndEd., PHI/Pearson

REFERENCE BOOKS:

[R1] Pieprzyk Josef and et.al; Fundamentals of Computer Security, Springer-Verlag, 2008.
[R2] Trappe & Washington, Introduction to Cryptography, 2nd Ed. Pearson.

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COURSE OUTCOMES:

Course Code	Course Name	Course Outcome	Details
CSL422	INFORMATION SYSTEM SECURITY	CO1	Describe major issues, basic approaches in information security and Identify common network security attacks.
		CO2	Illustrate various Public Key Cryptosystems.
		CO3	Understand different Authentication requirements and Mechanisms.
		CO4	To Explain IP Security and summarize its Architecture.

CO-PO MAPPING:

SUBJECT	Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
INFORMATION SYSTEM SECURITY	CO1	3	3	2	2								
	CO2	3	3	2	2	2							
	CO3	3	2	2	2								
	CO4	3	3	3	3								

3: Strongly **2: Moderate** **1: Weak**

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Scheme Code	Paper Code	Course Code	Course Title (Departmental Elective)	C	L	T	P
CSE2020	7CSDE35	CSL435	Real Time System	3	3		
Pre-requisites/Exposure			1. Operating system- CSL313				

Course Objectives:

To introduce students to the fundamental problems, concepts, and approaches in the design and analysis of real-time systems. To study issues related to the design and analysis of systems with real-time constraints.

UNIT-1

Introduction: Definition, Typical Real Time Applications, concept of tasks, types of tasks and real time systems, block diagram of RTS, and tasks parameters -Release Times, execution time, period, Deadlines, and Timing Constraints etc. RTS requirements. **[T1,T2][No. of hrs. 4]**

UNIT-2

Reference Models for Real Time Systems: processors and Resources, Temporal Parameters of Real-Time Workload, Periodic and Aperiodic Task Model, Precedence Constrains and Data Dependency, Other Types of Dependencies, Functional Parameters, Resource Parameters

Real Time Scheduling: classification of Real Time Scheduling, scheduling criteria, performance metrics, schedulability analysis, Introduction to Clock Driven scheduling, Weighted Round Robin Approach and Priority Driven Approach. Dynamic Versus Static systems, Offline Versus Online Scheduling. **[T1,T2][No. of hrs. 8]**

UNIT-3

Periodic tasks scheduling: Clock Driven Scheduling – definition, notations and assumption, scheduler concepts, general scheduling structure, cyclic executives. Priority Driven Scheduling; notations and assumption, fixed priority verses dynamic priority, fixed priority scheduling algorithms (RM and DM) and their schedulability analysis, concept of schedulability tests – Inexact and exact schedulability tests for RM and DM, Optimality of the RM and DM algorithms, practical factors. **[T1,T2][No. of hrs. 8]**

UNIT-4

Aperiodic task scheduling; assumption and approaches, server based and non-server based fixed priority scheduling algorithms – polling server, deferrable server , simple sporadic server,priority exchange, extended priority exchange, slack stealing. Introduction to scheduling offlexible computations –flexible applications, imprecise computation model and firm deadline model. **[T1,T2][No. of hrs. 8]**

UNIT-5

Resources Access Control: Assumptions on Resources and their usage, Effect of Resource Contention and Resource Access Control (RAC), Non-preemptive Critical Sections, priority inversion problem, need of new resource synchronization primitives/protocols for RTS, Basic Priority-Inheritance and Priority-Ceiling Protocols, Stack Based Priority-Ceiling Protocol, Use of Priority- Ceiling Protocol in Dynamic Priority Systems, Preemption Ceiling Protocol, Access Control in Multiple Unit Resources, Controlling Concurrent Accesses to Data Objects. **[T1,T2][No. of hrs. 8].**

Text Books:

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[T1] J.W.S.Liu: Real-Time Systems, Pearson Education Asia

[T2] P.D.Laurence, K.Mauch: Real-time Microcomputer System Design, An Introduction, McGraw Hill

Reference Books:

[R1] C.M. Krisna & K. G. Shim- Real time systems- TMH

Course Code	Course Name	Course Outcome	Details
CSL435	Real Time System	CO 1	To identify the basics of Real Time Systems.
		CO 2	Generalize the Periodic and Aperiodic task scheduling.
		CO 3	To recognize certain concepts of Resource Access Control.(K1)
		CO 4	To memorize the parameters, constraints and dependencies of several task models.
		CO 5	To analyze several types of scheduling.

CO-PO MAPPING:

Subject	Course Outcome	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
Real Time System	CO 1	3	3	1	2								
	CO 2	3	3	2	2	3							
	CO 3	3	3	1	2	1							
	CO 4	3	2	2	2	1							
	CO 5	3	3	1	2	2							

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Scheme Code	Paper Code	Course Code	Course Title (Departmental Core)	C	L	T	P
CSE2020	7CSDE36	CSL436	Virtual Reality	3	3		
Pre-requisites/Exposure			1. Computer Graphics - CSL319				

Course Objectives:
The objective of this course is to provide a general introduction about Virtual Reality and build a foundation for those who are interested in creating Virtual Reality applications and to provide students a of Virtual and Augmented Environments followed by an analysis of features, requirement and issues in real-life applications.

UNIT-1 Introduction: What is Virtual Reality?, Virtual Reality as an Immersive Technology, Reality-Virtuality Continuum, Working Principle, Uses and Benefits, History of Virtual Reality, Application Domains.
.[T1,T2][No. of hrs. 5]

UNIT-2 Virtual Reality Hardware and Software
Introduction: Field of View, Degrees of Freedom, Stereoscopy
Hardware: Input Devices, Output Devices, Virtual Reality Displays, Tracking - Magnetic, Electromagnetic, Ultrasonic and Inertial, and Optical
Software: Platforms – Development and Deployment, VR Scripting, VRML, X3D, WebVR
[T1,T2][No. of hrs. 8]

UNIT-3 Creating a Virtual Reality Experience – Design
Illusions of Presence, Perceptual Modalities: Sight, Hearing, Touch, Proprioception, Balance and Physical Motion, Smell and Taste, Multimodal Perceptions, Perception of Space and Time, Perceptual Stability, Attention, and Action
Health Effect: Motion Sickness, Eye Strain, Seizures, After-effects, Factors Affecting Health
Design Guidelines: Hardware, System Calibration, Latency Reduction, General Design, Motion Design, Interaction Design, Usage, Measuring Sickness.
[T1][No. of hrs. 10]

UNIT-4 Creating a Virtual Reality Experience – Implementation

Rendering: Virtual Environments, Object Modeling, Geometric Transformation, Perspective Views, 3D Clipping, Stereoscopic Vision, Rendering, Texture Mapping, 360 degree Images and Videos
Navigation: Navigation in Virtual Reality Environment, Navigation Characteristics, Locomotion Techniques – Physical and Virtual, Wayfinding – Landmark, Signs and Maps
Interaction: Interacting with Virtual Objects, Direct and Indirect Interactions, Modes of Interactions, Multi-modal Interaction, Selection, Manipulation, Collaborative Virtual Reality..
[T2][No. of hrs. 9]

UNIT-5 Putting Everything Together – Case Study
Case Study – Billiards Board, Unity Game Engine: Introduction, Basic Workflow Environment Creation, Object Modeling, Incorporating Navigation and Interaction, Deploy Application.
[T2][R1][No. of hrs. 8]

Text Books:

1. The VR Book: Human-Centered Design for Virtual Reality Book by Jason Jerald
2. Learning Virtual Reality: Developing Immersive Experiences and Applications for Desktop, Web, and Mobile

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Reference:

[R1] Virtual, Augmented and Mixed Reality. Applications and Case Studies: 11th International Conference, VAMR 2019, Held as Part of the 21st HCI ... II (Lecture Notes in Computer Science, 11575) 1st ed. 2019 Edition.

COURSE OUTCOMES:

Course Code	Course Name	Course Outcome	Details
CSL436	Virtual Reality	CO1	Appreciate the potential of Virtual Reality
		CO2	Comprehensive understanding of VR Hardware and Software
		CO3	In-depth knowledge of the design process for VR including human factors that influence the design.
		CO4	In-depth knowledge on the core components of VR system implementation.
		CO5	Ability to create and deploy an interactive VR system

CO-PO MAPPING:

SUBJECT	Course Outcomes	PO 1	PO 2	PO 3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO 12
Virtual Reality	CO1	2	2	3	1								
	CO2	2	2	3	1								
	CO3	2	2	3	1								
	CO4	2	3	3	1	2							
	CO5	3	3	2	2								

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Scheme Code	Paper Code	Course Code	Course Title (Departmental Elective)	C	L	T	P
CSE2020	7CSDE37	CSL437	Soft Computing	3	3		
Pre-requisites/Exposure							

Course Objectives:

Develop the skills to gain a basic understanding of neural network theory, rough set and fuzzy logic theory and . introduce students to artificial neural networks and optimization from an engineering perspective.

UNIT – I: Introduction to Neuro, Fuzzy and Soft Computing, Fuzzy Sets : Basic Definition and Terminology, Set-theoretic Operations, Member Function Formulation and Parameterization, Fuzzy Rules and Fuzzy Reasoning, Extension Principle and Fuzzy Relations, Fuzzy If-Then Rules, Fuzzy Reasoning , Fuzzy Inference Systems, Mamdani Fuzzy Models, Sugeno Fuzzy Models, Tsukamoto Fuzzy Models, Input Space Partitioning and Fuzzy Modeling..
[T1,T2][No. of hrs. 10]

UNIT – II: Rough Set, Set Approximation, Rough set operation, Decision Tables. **[T1,T2][No. of hrs. 06]**

UNIT – III: Neural networks: Single layer networks, Perceptron: Adaline, Multilayer Perceptron Supervised Learning, Back-propagation, LM Method, Radial Basis Function Networks, Unsupervised Learning Neural Networks, Competitive Learning Networks, Kohonen Self-Organizing Networks, Learning Vector Quantization, Hebbian Learning. Recurrent neural networks,. Adaptive neuro-fuzzy information; systems (ANFIS), Hybrid Learning Algorithm, Applications to control and pattern recognition. **[T1,T2][No. of hrs. 12]**

UNIT – IV:
Derivative-free Optimization Genetic algorithms: Basic concepts, encoding, fitness function, reproduction. Differences of GA and traditional optimization methods. Basic genetic programming concepts Applications. **[T1,T2] [No. of hrs. 10]**

UNIT – V:
Evolutionary Computing, Simulated Annealing, Random Search, Downhill Simplex Search, Swarm optimization. **[T1,T2] [No. of hrs. 06]**

Text Books:

[T1] J.S.R.Jang, C.T.Sun and E.Mizutani, "Neuro-Fuzzy and Soft Computing", PHI, 2004, Pearson Education 2004.

[T2] S. Rajasekaran & GA Vijayalakshmi Pai "Neural Networks, Fuzzy Logic, and Genetic Algorithms synthesis and application", PHI

Reference Books:

[R1] Timothy J.Ross, "Fuzzy Logic with Engineering Applications", McGraw-Hill, International Editions, Electrical Engineering Series, Singapore, 1997

[R2] Davis E.Goldberg, "Genetic Algorithms: Search, Optimization and Machine Learning", Addison Wesley, N.Y., 1989.

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COURSE OUTCOMES:

Course Code	Course Name	Course Outcome	Details
CSL437	Soft Computing	CO 1	Know different method and application of Soft Computing.
		CO 2	Explain the concepts of fuzzy logic, Rough set, Artificial neural network, Evaluation method and Hybrid method.
		CO 3	Solving specific problem using different soft computing method.
		CO 4	Illustrate different soft computing method.
		CO 5	Design a small intelligent system using soft computing method.

CO-PO mapping

Subject	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Soft Computing	CO 1	3											
	CO 2	3	2										
	CO 3	3	3	3	2		2						
	CO 4	3	2	2	2			3					
	CO5	3	2	2	2	3	2			2			3

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Scheme Code	Paper Code	Course Code	Course Title (Departmental Elective)	C	L	T	P
CSE2020	7CSDE38	CSL438	Graph Theory	4	3	1	
Pre-requisites/Exposure							

Course Objectives:

The objective of this course is to be familiar with fundamental concepts in Graph theory. To apply models of Graph theory to solve problems of connectivity and uncertainty. To analyzing graphs and random phenomena occurring in real life situations using Graph theory. To interpret the models of Graph theory for real life and engineering problems.

UNIT – I:

Introduction :Finite and Infinite graphs, Incidence and Degree, Isolated Vertex, Pendant Vertex and Null Graph, Isomorphism, Subgraphs, Walk,Path, and Circuits, Connected Graphs, Disconnected Graphs and Components, Euler Graphs, Operation on Graphs, Hamiltonian Paths and Circuits..**[T1,T2][No. of hrs. 8]**

UNIT – II:

Cuts-sets and Cut- Vertices:Cut-Sets, Properties of Cut-sets, Cut-Sets in a Graph, Connecivity and Separability, Network Fows, 1- Isomorphism, 2- Isomorphism. Planar and Dual Graph: Combinatorial Vs Geometric Graphs, Planar Graphs, Different representation of Planar Graphs, Detection of Planarity, Thickness and Crossing,Kuratowski's Theorem, Wagner's Theorem. **[T1,T2][No. of hrs. 10]**

UNIT – III:

Matrix Representation of Graphs: Incidence Matrix, Submatrics of A(G), Circuit Matrix, Cut-Set Matrix,Path Matrix, Adjacency Matrix.Coloring, Covering and Partitioning: Chromatic Number, Chromatic Partitioning, Chromatic Polynomial, Matching, Covering. Maximum Matching,Hall's matching condition,Min-Max theorms, Independent sets and Covers.**[T1,T2][No. of hrs. 8]**

UNIT – IV:

Connectivity and Paths: Cuts and Connectivity, k-Connected Graphs, Network Flow Ford-Fulkerson Labeling Algorithm, Max-Flow Min-cut Theorem, Menger's Proof using Max-Flow Min-Cut Theorem. **[T1,T2][No. of hrs. 8]**

UNIT – V:

Perfect Graph:The Perfect graph theorem, Classes of perfect graph. Matroid: Properties of Matroid, The dual of Matroid,Matroid Minors and Planer graph,Matroid Intersection and Union **[T1,T2][No. of hrs. 6]**

Text Books:

1. N. Deo: Graph Theory with Application to Engineering and Computer Science, PHI.
2. D.B. West, Introduction to Graph Theory, Prentice Hall.

Reference Books:

1. J.A.Bondy and U.S.R.Murty: Graph Theory, Springer.
2. R.Diestel: Graph Theory, Springer(low price edition).

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COURSE OUTCOMES:

Course Code	Course Name	Course Outcome	Details
CSL438	Graph Theory	CO1	Demonstrate the knowledge of fundamental concepts in Graph theory.
		CO2	Apply models of Graph theory to solve problems of connectivity and uncertainty.
		CO3	Analyzing graphs and random phenomena occurring in real life situations using Graph theory.
		CO4	Interpret the models of Graph theory for real life and engineering problems.

CO-PO MAPPING:

SUBJECT	Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
Graph Theory	CO1	3	1	2	1		1			1	1		2
	CO2	3	2	3	2		2	1		1	2		2
	CO3	3	3	3	3		2	1		1	2		3
	CO4	3	3	3	3		2	1		1	2		3

3: Strongly **2: Moderate** **1: Weak**

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Scheme Code	Paper Code	Course Code	Course Title (Departmental Core)	C	L	T	P
CSE2020	7CSDE39	CSL439	Intelligent Robotics	4	3		2
Pre-requisites/Exposure							

Course Objectives:

The objective of this course is to impart knowledge about basic mathematics related to industrial robots for their control, design and application in robotics & automation Industries.

UNIT - I:

Introduction to Robotics: Types and components of a robot, Classification of robots, Kinematics systems; Definition of mechanisms and manipulators, Degrees of Freedom

UNIT - II:

Robot Kinematics and Dynamics Kinematic Modelling: Translation and Rotation Representation, Coordinate transformation, DH parameters, Forward and inverse kinematics, Jacobian, Singularity, and Statics Dynamic Modelling: Forward and inverse dynamics, Equations of motion using Euler-Lagrange formulation, Newton Euler Formulation

UNIT - III:

Sensors, Sensor: Contact and Proximity, Position, Velocity, Force, Tactile etc., Introduction to Cameras, Camera calibration, Geometry of Image formation, Euclidean/Similarity/Affine/Projective Transformations, Vision applications in robotics.

UNIT - IV:

Robot Actuation Systems, Actuators: Electric, Hydraulic and Pneumatic; Transmission: Gears, Timing Belts and Bearings, Parameters for selection of actuators.
RobotControl, Basics of control: open loop- closed loop, Transfer functions, Control laws: P, PD, PID Linear and Non-linear controls

UNIT - V:

Control Hardware and Interfacing, Embedded systems : Microcontroller Architecture and integration with sensors, actuators, components, Programming, Applications for Industrial robot - programming in – VAL II,
AI in Robotics : Applications in unmanned systems, defense, medical, industries, etc.
Robotics and Automation for Industry 4.0
Robot safety and social robotics.

Text Books:

1. Introduction to Robotics : J. Craig , Pearson
2. Robot Dynamics and Control, Spong & Vidyasagar, Mc Graw Hill
3. Robotics Engineering : R. Klafter, PHI

Reference Books:

1. Robotics : Subir K Saha , Mc GrawHill
2. Industrial Robotics : M. P. Groover, Ashish Dutta , McGraw Hill

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COURSE OUTCOMES:

Course Code	Course Name	Course Outcome	Details
CSL439	Introduction to Robotics	CO 1	Perform kinematic and dynamic analyses with simulation.
		CO 2	Design control laws for a simple robot.
		CO 3	Integrate mechanical and electrical hardware for a real prototype of robotic device.
		CO 4	Select a robotic system for given industrial application.

SUBJECT	Course Outcomes	PO 1	PO 2	PO 3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO 12
Introduction to Robotics	CO 1	3		2	1	1							
	CO 2	3	2	2	2								
	CO 3	2	3	2	2	2							
	CO 4	2	2			2							

3: Strongly **2: Moderate** **1: Weak**

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Scheme Code	Paper Code	Course Code	Course Title (Departmental Elective)	C	L	T	P
CSE2020	7CSDE40	CSL440	Computer Vision	4	3		2
Pre-requisites/Exposure			Computer Graphics-CSL317				

Course Objectives:

Computer Vision focuses on development of algorithms and techniques to analyze and interpret the visible world around us. understanding of the fundamental concepts related to multi-dimensional signal processing, feature extraction, pattern analysis, visual geometric modeling, stochastic optimization etc.

UNIT – 1:

Image Formation Models: Monocular imaging system, Orthographic & Perspective Projection, Cameras – lenses, projections, sensors, Representation – color spaces, Camera model and Camera calibration, Binocular imaging systems, Sources, Shadows and Shading. **[T1,T2][No. of hrs. 6]**

UNIT – II:

2D/3D Vision: Filters, Binary Images, Features, Edge Detection, Texture, Shape, Segmentation, Clustering, Model Fitting, Probabilistic Models, 3D Vision: Multi view geometry, Stereo, Shape from X, 3D data. **[T1,T2][No. of hrs. 6]**

UNIT – III:

Image Processing and Feature Extraction: Image representations (continuous and discrete), Linear Filters, Texture, Edge detection. Motion Estimation: Regularization theory, Optical computation, Stereo Vision, Motion estimation, Structure from motion. **[T1,T2][No. of hrs. 6]**

UNIT – IV:

Shape Representation and Segmentation: Deformable curves and surfaces, Snakes and active contours, Level set representations, Fourier and wavelet descriptors, Medial representations, Multi-resolution analysis. Object recognition: Hough transforms and other simple object recognition methods, Shape correspondence and shape matching, Principal Component analysis. Shape priors for recognition **[T1,T2] [No. of hrs. 8]**

UNIT – V

Latest trends in computer vision: Computer Vision Interaction for People with Severe Movement Restrictions, DARWIN: A Framework for Machine Learning and Computer Vision Research and Development, Computer Vision Face Tracking for Use in a Perceptual User Interface. **[T1,T2] [No. of hrs. 8]**

Text Books:

[T1] Richard Szeliski, Computer Vision: Algorithms and Applications, Springer-Verlag London Limited 2011.
[T2] Computer Vision: A Modern Approach, D. A. Forsyth, J. Ponce, Pearson Education, 2003.
[T] Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision, Second Edition, Cambridge University Press, March 2004.

Reference Books:

[R1] Haralick& Shapiro, "Computer and Robot Vision", Vol II
[R2] GerardMedioni and Sing Bing Kang "Emerging topics in computer vision".
[R3] Olivier Faugeras, "Three-Dimensional Computer Vision", The MIT Press, 1993.

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COURSE OUTCOMES:

Course Code	Course Name	Course Outcome	Details
CSL440	Computer Vision	CO1	Identify basic concepts, terminology, theories, models and methods in the field of computer vision.
		CO2	Able to demonstrate knowledge and understanding of Human and computer vision systems.
		CO3	Understand current approaches to image formation and image modeling.
		CO4	Analyze and design a range of algorithms for image processing and computer vision.

CO-PO MAPPING:

Subject	Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12
Computer Vision	CO1	2	2	2									
	CO2	2	3	2	2								
	CO3	3	3	2	2								
	CO4	3	2	2	2								

3: Strongly **2: Moderate** **1: Weak**

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SYLLABUS

Semester	**VIII**
Branch	**CSE**
Admission Year	**2020-21**
Academic Year	**2023-24**

Scheme Code	Paper Code	Course Code	Course Title (Departmental Elective)	C	L	T	P
CSE2020	8CSDE41	CSL441	Mobile Computing	3	3		
Pre-requisites/Exposure							

Course Objectives:

To understand basics of mobile communication. To be familiar with the Network, Transport and application layers in Mobile Networks. To understand issues in mobile computing.

Unit 1: Introduction of Mobile Communication Systems: Generations of Mobile Communication Technologies- Multiplexing – Spread spectrum -MAC Protocols –SDMA- TDMA- FDMA- CDMA. Introduction to Cellular Systems: GSM – Services & Architecture, GSM Protocol Stack, Connection Establishment, Frequency Allocation and Reuse, Localization, Handover , Security, HSCSD and GPRS. **[T1,T2,T3][No. of hrs. 8]**

Unit 2: Network, Transport and application layers in Mobile Networks, Challenges posed by Mobility in Data Communication Networks, Mobile IP, Mobile TCP, TCP over 3G and 4G Networks, Architecture of WAP, WDP, WTLS, WTP, WSP, WAE, WTA, WML. **[T1,T2,T3][No. of hrs. 8]**

Unit 3: Introduction to Mobile Computing: Specific requirements of Mobile Computing, Adaptability, Mechanisms for Adaptation, Incorporating adaptation in Applications, Case Studies: Odyssey and Rover. Registration area based Mobility Management, PCS Location management System. . **[T1,T2,T3][No. of hrs. 8]**

Unit 4: Data Dissemination: Challenges, Data Dissemination –Bandwidth allocation, Broadcast disk scheduling, Mobile data caching, mobile cache management schemes, mobile web caching. Context Aware Computing: Types of Context, Context Aware Computing and Applications, Middleware Support. **[T1,T2,T3][No. of hrs. 8]**

Unit 5: Middleware for Application Development, Adaptation spectrum, Resource monitoring, Characterizing adaptation strategies, Odyssey as adaptation middleware, Mobile Agents, Finding Needed Services: Introduction to Jini, UPnP, Salutation Architecture, SLP. Services- UUID, Standardization, Textual Descriptions, Using Interfaces for Standardization. Unicast and Multicast Discovery, Advertisement, Service Catalogues. Garbage Collection, Eventing. **[T1,T2,T3][No. of hrs. 8]**

Text Books:

[T1] Schiller Jochen, Mobile Communications, 2nd Edition, 2004, Pearson
[T2] Adelstein F., Gupta Sandeep K.S., Richard Golden G. III, Schwiebert Loren, Fundamentals of Mobile and Pervasive Computing, McGrawhill, 2017
[T3] Murthy, Manoj; Adhoc Wireless Networks, Pearson, 2008

COURSE OUTCOMES:

Course Code	Course Name	Course Outcome	Details
CSL441	Mobile Computing	CO1	Explain the basics of mobile Computing
		CO2	Describe the functionality of Mobile IP and Transport Layer
		CO3	Classify different types of mobile telecommunication systems
		CO4	Make use of mobile operating systems in developing mobile applications

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CO-PO MAPPING:

SUBJECT	Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
Mobile Computing	CO1	3	3	2	2								
	CO2	3	3	2	2								
	CO3	3	2	2	2								
	CO4	3	3	3	3	3	3	2	3	3	2	3	3

3: Strongly **2: Moderate** **1: Weak**

Yes

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Scheme Code	Paper Code	Course Code	Course Title (Departmental Elective)	C	L	T	P
CSE2020	8CSDE42	CSL442	Advanced DBMS	3	3		
Pre-requisites/Exposure			1. Database Management System-CSL210 2. Computer Networks- CSL206				

Course Objectives:

To understand the concept of Distributed Database Systems (DDBMS), including the architecture and design of DDBMS. To apply various fragmentation techniques for a given problem. To understand the steps of query processing and how optimization techniques are applies to Distributed Database. To understand Transaction Management & Compare various approaches to concurrency control in Distributed database. To understand the concept of NOSQL

UNIT - I:

Distributed Databases: An Overview

Distributed Data Processing, What is a Distributed Database System, Features of Distributed versus Centralized Databases, Why Distributed Databases, Distributed Database Management Systems, Design Issues, Distributed DBMS Architecture. **[T1,T2][No. of hrs. 5]**

UNIT - II:

Distributed Database Design

Top-Down Design Process, Distribution Design Issues: Reasons for Fragmentation, Fragmentation Alternatives, Degree of Fragmentation, Correctness Rules of Fragmentation, Allocation Alternatives, Fragmentation: Horizontal Fragmentation, Vertical Fragmentation, Hybrid Fragmentation, Allocation of Resources, Data Directory.**[T1,T2,T3,T4][No. of hrs. 9]**

UNIT - III:

Query Processing

Query Processing Problem, Objectives of Query Processing ,Complexity of Relational Algebra Operations, Characterization of Query Processors, Layers of Query Processing, Query Decomposition, Localization of Distributed Data, Optimization of Distributed Queries: Query Optimization, Centralized Query Optimization, Join Ordering in Distributed Queries, Distributed Query Optimization. **[T1,T2,T3,T4][No. of hrs. 10]**

UNIT - IV:

Distributed Concurrency Control

Serializability Theory, Taxonomy of Concurrency Control Mechanisms, Locking-Based Concurrency Control Algorithms, Timestamp-Based Concurrency Control Algorithms, Optimistic Concurrency Control Algorithms, Deadlock Management. **[T1,T2,T3,T4][No. of hrs. 9]**

UNIT - V:

Cassandra(NoSQL)

Introduction to Cassandra, Problems in the RDBMS, NoSQL, Cassandra, Cassandra Data Model, Cassandra architecture, Components of Cassandra, Reading and Writing Data. **[T5][No. of hrs. 7]**

Text Books:

[T1] M. Tamer Özsu; and Patrick Valduriez," Principles of Distributed Database Systems",3 Ed, 2011, Springer

[T2] Giuseppe Pelagatti and Stefano Ceri," Distributed Databases: Principles and Systems"1 Ed,2008, McGraw Hill Education.

[T3] Elmasi, R. and Navathe, S.B., "Fundamentals of Database Systems", 4th Ed., 2005, Pearson Education.

[T4] A Silberschatz, H Korth, S Sudarshan, "Database System and Concepts", 5 Ed, 2005, McGraw-Hill.

[T5] Eben Hewitt," Cassandra: The Definitive Guide",2011, O'Reilly.

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Reference Books:

[R1] Saeed K. Rahimi and Frank S. Haug," Distributed Database Management Systems: A Practical Approach",2010, Wiley-IEEE Press.

[R2] Nishant Neeraj," Mastering Apache Cassandra", 2013, Packt Publishing.

COURSE OUTCOMES:

Course Code	Course Name	Course Outcome	Details
CSL442	Advanced DBMS	CO1	Learn the concept, architecture and design of DDBMS
		CO2	Apply various fragmentation techniques for a given problem
		CO3	Apply query processing and optimization techniques for a Distributed Database
		CO4	Analysis various approaches to concurrency control in Distributed database
		CO5	Create and analysis of NOSQL database using Cassandra

CO-PO MAPPING:

SUBJECT	Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
Advanced DBMS	CO1	3	2	2	1					1	1		1
	CO2	3	3	3	3	2	2	2		2	1		2
	CO3	3	3	3	3	2	2	2		1	2	1	2
	CO4	3	3	3	3	2	2	2		2	2	1	2
	CO5	3	3	3	2	3	1	1		1	1		3

3: Strongly **2: Moderate** **1: Weak**

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Scheme Code	Paper Code	Course Code	Course Title (Departmental Elective)	C	L	T	P
CSE2020	8CSDE43	CSL443	Pattern Recognition	3	3		
Pre-requisites/Exposure							

Course Objectives:

To understand the basics of pattern recognition and application in real world problems in order to get better solutions.

UNIT-1

Pattern Classifier: Overview of Pattern recognition; Discriminant functions; Supervised learning; Parametric estimation; Maximum Likelihood Estimation; Bayesian parameter Estimation; Problems with Bayes approach; Pattern classification by distance functions; Minimum distance pattern classifier. **[T1,T2][No. of hrs. 10]**

UNIT-2

Clustering: Basics of Clustering; Clustering vs. Classification; Supervised vs. unsupervised; similarity / dissimilarity measures; clustering criteria; Different distance functions and similarity measures; Minimum within cluster distance criterion; K-means algorithm; Hierarchical clustering, K Mediods, DBSCAN. **[T1,T2][No. of hrs. 10]**

UNIT-3

Feature Extraction and Structural Pattern Recognition: Principle component analysis, Independent component analysis, Linear discriminant analysis, Feature selection through functional approximation. **[T1,T2][No. of hrs. 10]**

UNIT-4

Hidden Markov Models and Support Vector Machine: State Machines; Hidden Markov Models: Training, Classification; Support Vector Machine; Feature Selection.

Recent Advances: Structural Pattern Recognition; Fuzzy Pattern Classifiers; Pattern Classification using Genetic Algorithms. **[T1,T2][No. of hrs. 10]**

Text Books:

[T1] C M Bishop, Pattern Recognition and Machine Learning,Springer

[T2] R O Duda, P.E. Hart and D.G. Stork, Pattern Classification and scene analysis, John Wiley.

Reference Books:

[R1] Morton Nadier and Eric Smith P., Pattern Recognition Engineering, John Wiley & Sons, New York, 1993.

[R2] Robert J. Schalkoff, Pattern Recognition : Statistical, Structural and Neural Approaches, John Wiley & Sons Inc., New York, 2007

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COURSE OUTCOMES:

Course Code	Course Name	Course Outcome	Details
CSL443	Pattern Recognition	CO1	Describe the basics of Pattern recognition and its applications in different fields.
		CO2	Identify the strengths and weaknesses of different type of pattern classifier and clustering techniques.
		CO3	Apply various dimensionality reduction methods whether through feature selection or feature extraction.
		CO4	Compare different pattern recognition techniques for practical problems.

CO-PO Mapping:

SUBJECT	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
PATTERN RECOGNITION	CO 1	3	3		2	1							1
	CO 2	2	3	2	1								
	CO 3	2	2	2	1								
	CO 4	1	3	3	2								1

3: Strongly **2: Moderate** **1: Weak**

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Scheme Code	Paper Code	Course Code	Course Title (Departmental Core)	C	L	T	P
CSE2020	8CSDE44	CSL444	Digital Forensic	3	3		
Pre-requisites/Exposure			1. Computer Networks - CSL206 2. Cyber Security - CSL332				

Course Objectives:

To understand the basic digital forensics and techniques for conducting the forensic examination on different digital devices and how to examine digital evidences such as the data acquisition, identification analysis.

UNIT - I:

Digital Forensics Science: Forensics science, computer forensics, digital forensics and uses.
Computer Crime: Criminal Investigation, Intelligence, Criminalistics as it relates to the investigative process, analysis of cyber-criminalistics area, Locard's exchange principal, holistic approach to cyber-forensics, various societies. computer forensics evidence and courts, legal concerns and private issues.
[T1,T2][No. of hrs. 5]

UNIT - II:

Cyber Crime Scene Analysis: Understanding Computing Investigations – Procedure for corporate High-Tech investigations, understanding data recovery work station and software, conducting and investigations, retrieved and un-retrieved communications, Discuss the importance of understanding what court documents would be required for a criminal investigation.. **[T1,T2][No. of hrs. 12]**

UNIT - III:

Evidence Management & Presentation: Create and manage shared folders using operating system, importance of the forensic mindset, define the workload of law enforcement, explain what the normal case would look like, define who should be notified of a crime, parts of gathering evidence, Define and apply probable cause.
Procedure for corporate High-Tech investigations, understanding data recovery work station and software, conducting and investigations. **[T1,T2][No. of hrs. 8]**

UNIT - IV:

Computer Forensics: Processing crimes and incident scenes, securing a computer incident or crime, seizing digital evidence at scene, storing digital evidence, obtaining digital hash, reviewing case. Prepare a case, begin an investigation, understand computer forensics workstations and software, conduct an investigation, Critique a case.
Network Forensics: open-source security tools for network forensic analysis, requirements for preservation of network data. **[T1, T3][No. of hrs. 8]**

UNIT - V:

Mobile Forensics: mobile forensics techniques and tools. Legal Aspects of Digital Forensics: IT Act 2000, amendment of IT Act 2008.
Recent Trends: Recent Trends in forensic technique and methods to search and seizure
electronic evidence. Current computer forensics tools- software, hardware tools, validating and testing forensic software, addressing data-hiding techniques, performing remote acquisitions, E-Mail investigations- investigating email crime and violations, understanding E-Mail servers, specialized E-Mail forensics tool.
[T1, T3][No. of hrs. 7]

Text Books:

1. John Sammons, The Basics of Digital Forensics, Elsevier
2. John Vacca, Computer Forensics: Computer Crime Scene Investigation, Laxmi Publications
3. Warren G. Kruse II and Jay G. Heiser, "Computer Forensics: Incident Response Essentials", Addison Wesley, 2002
4. A Practical Guide to Digital Forensics Investigations Darren R. Hayes

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Reference Books:

1. Digital Forensics and Incident Response Incident response techniques and procedures to respond to modern cyber threats, 2nd Edition Gerard Johansen.
2. Nelson, B, Phillips, A, Enfinger, F, Stuart, C., "Guide to Computer Forensics and Investigations, 2nd ed., Thomson Course Technology, 2006, ISBN: 0-619-21706-5

COURSE OUTCOMES:

Course Code	Course Name	Course Outcome	Details
CSL444	Digital Forensic	CO1	Define computer forensics and describe how to conduct an investigation using various tools and methods.
		CO2	Identify the process in taking digital evidence.
		CO3	Know how to apply forensic analysis tools to recover important evidence for identifying computer crime.
		CO4	Assess and examine the different forensics tools.
		CO5	To be well-trained as next-generation computer crime investigators.

CO-PO Mapping:

SUBJECT	Course Outcomes	PO 1	PO 2	PO 3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO 12
Digital Forensics	CO1	2	2	3	1								
	CO2	2	2	3	1								
	CO3	2	2	3	1								
	CO4	2	3	3	1	2							
	CO5	3	3	2	2								

3: Strongly **2: Moderate** **1: Weak**

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Scheme Code	Paper Code	Course Code	Course Title (Departmental Elective)	C	L	T	P
CSE2020	8CSDE45	CSL445	Agile Software Development	3	3		
Pre-requisites/Exposure			Software Engineering- CSL205				

Course Objectives:

This course makes student learn the fundamental principles and practices associated with each of the agile development methods. T

UNIT-I:

Agile Methodology: Theories for Agile Management, Agile Software Development, Traditional Model vs. Agile Model, Classification of Agile Methods, Agile Manifesto and Principles, Agile Project Management, Agile Team Interactions, Ethics in Agile Teams, Agility in Design, Testing, Agile Documentations, Agile Drivers, Capabilities and Values. **[T1, T2] [No. of hrs. 7]**

UNIT-II:

Agile Processes: Lean Production, SCRUM, Crystal, Feature Driven Development, Adaptive Software Development, Extreme Programming: Method Overview, Lifecycle, Work Products, Roles and Practices. **[T1, T2] [No. of hrs. 6]**

UNIT- III:

Agility And Knowledge Management: Agile Information Systems, Agile Decision Making, Earl's Schools of KM, Institutional Knowledge Evolution Cycle, Development, Acquisition, Refinement, Distribution, Deployment. Leveraging, KM in Software Engineering, Managing Software Knowledge, Challenges of
Migrating to Agile Methodologies, Agile Knowledge Sharing, Role of Story-Cards, Story-Card Maturity Model (SMM). **[T1, T2] [No. of hrs. 7]**

UNIT- IV:

Agility And Requirements Engineering: Impact of Agile Processes in RE, Current Agile Practices, Variance, Overview of RE Using Agile, Managing Unstable Requirements, Requirements Elicitation, Agile Requirements Abstraction Model, Requirements Management in Agile Environment, Agile Requirements
Prioritization, Agile Requirements Modeling and Generation, Concurrency in Agile Requirements Generation. **[T1, T2] [No. of hrs. 6]**

UNIT-V:

Agility And Quality Assurance: Agile Product Development, Agile Metrics, Feature Driven Development (FDD), Financial and Production Metrics in FDD, Agile Approach to Quality Assurance, Test Driven Development. Agile Approach in Global Software Development. **[T1, T2] [No. of hrs. 6]**

Text Books:

[T1] Craig Larman, "Agile and Iterative Development – A Manager's Guide",Pearson Education – 2004.
[T2] Elisabeth Hendrickson Quality Tree Software Inc, "Agile Testing" 2008.

Reference Books:

[R1] Agile Software Development with Scrum By Ken Schawber, Mike Beedle, Pearson.
[R2] Agile Software Development, Principles, Patterns and Practices By Robert C. Martin, Prentice Hall.
[R3] Agile Testing: A Practical Guide for Testers and Agile Teams By Lisa Crispin, Janet Gregory, Addison Wesley.
[R4] Agile Software Development: The Cooperative Game By Alistair Cockburn, Addison Wesley.

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Course Code	Course Name	Course Outcome	Details
CSL445	Agile Software Development	CO1	Understand the basic concepts of Agile Software Development.
		CO2	Acquire knowledge in the area of various Agile Methodologies.
		CO3	Analyze the impact of Agile Processes in RE
		CO4	Understand the principles of Agile Approach in Global Software Development.

CO-PO Mapping:

SUBJECT	Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
Agile Software Development	CO1	2	2	2									
	CO2	3								2		2	2
	CO3	1								2			
	CO4	3	2	2	2	2						2	

3: Strongly **2: Moderate** **1: Weak**

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Scheme Code	Paper Code	Course Code	Course Title (Departmental Elective)	C	L	T	P
CSE2020	8CSDE46	CSL446	Multi Core Architecture	3	3		
Pre-requisites/Exposure							

Course Objectives:

The student should be made to Understand the challenges in parallel and multi-threaded programming and Learn about the various parallel programming paradigms, and solutions.

UNIT-I:
MULTI-CORE PROCESSORS: Single core to Multi-core architectures – SIMD and MIMD systems – Interconnection networks - Symmetric and Distributed Shared Memory Architectures – Cache coherence - Performance Issues – Parallel program design. **[T1] [No. of hrs. 7]**

UNIT-II:
PARALLEL PROGRAM CHALLENGES: Performance– Scalability– Synchronization and data sharing – Data races – Synchronization primitives (mutexes, locks, semaphores, barriers) – deadlocks and livelocks – communication between threads (condition variables, signals, message queues and pipes). **[T1] [No. of hrs. 6]**

UNIT- III:
SHARED MEMORY PROGRAMMING WITH OpenMP: OpenMP Execution Model – Memory Model – OpenMP Directives – Work-sharing Constructs - Library functions – Handling Data and Functional Parallelism – Handling Loops - Performance Considerations. **[T2] [No. of hrs. 7]**

UNIT- IV:
DISTRIBUTED MEMORY PROGRAMMING WITH MPI: MPI program execution – MPI constructs – libraries – MPI send and receive – Point-to-point and Collective communication – MPI derived datatypes – Performance evaluation **[T2] [No. of hrs. 6]**

UNIT-V:
PARALLEL PROGRAM DEVELOPMENT: Case studies - n-Body solvers – Tree Search – OpenMP and MPI implementations and comparison. **[T2] [No. of hrs. 6]**

Text Books:

[T1] Advanced Computer Architecture: Parallelism, Scalability, Programmability (Mcgraw Hill Series In Electrical And Computer Engineering) Hardcover – Import, 31 May 1993 by Kai Hwang (Author)
[T2] Peter S. Pacheco, —An Introduction to Parallel Programmingl, Morgan-Kauffman/Elsevier, 2011.
[T3] Darryl Gove, —Multicore Application Programming for Windows, Linux, and Oracle Solaris Pearson, 2011

Reference Books:

[R1] Michael J Quinn, —Parallel programming in C with MPI and OpenMP, Tata McGraw Hill,2003.
[R2] Victor Alessandrini, Shared Memory Application Programming, 1st Edition, Concepts and Strategies in Multicore Application Programming, Morgan Kaufmann, 2015.
[R3] Yan Solihin, Fundamentals of Parallel Multicore Architecture, CRC Press, 2015.

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Course Code	Course Name	Course Outcome	Details
CSL446	Multi Core Architecture	CO1	Able to describe multicore architectures and identify their characteristics and challenges.
		CO2	Able to identify the issues in programming Parallel Processors.
		CO3	Able to write programs using OpenMP and MPI.
		CO4	Able to design parallel programming solutions to common problems.
		CO5	Able to compare and contrast programming for serial processors and programming for parallel processors.

CO-PO Mapping:

SUBJECT	Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
Multi Core Architecture	CO1	3	3	3	3	3	-	-	-	2	-	3	2
	CO2	3	3	3	3	3	-	-	-	2	-	3	2
	CO3	3	1	2	1	3	-	-	-	2	-	3	-
	CO4	3	1	1	-	3	-	-	-	1	-	3	-
	CO5	3	1	1		3	-	-	-	1	-	3	-

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