Scheme of Teaching and Examination for B.E (CS&E)

SEMESTER: III

Sl. No.	Subject Code	Course Title	Teaching Department	Credits				Contact Hours	Marks			Exam Duration in hrs
				L	T	P	TOTAL		CIE	SEE	Total	
1	MA310	Mathematics III	Mathematics	4	0	0	4	4	50	50	100	03
2	CS310	Digital System Design	CSE	4	0	1	5	6	50	50	100	03
3	CS320	Discrete Mathematical Structures and Combinatorics	CSE	4	0	0	4	4	50	50	100	03
4	CS330	Computer Organization	CSE	4	0	0	4	4	50	50	100	03
5	CS340	Data Structures	CSE	4	0	1	5	6	50	50	100	03
6	CS350	Object Oriented Programming with C++	CSE	4	0	1	5	6	50	50	100	03
		Total		**Total Credits**			**27**		**Total Marks**		600	

Educate Elevate Enlighten

JSS Mahavidyapeetha

JSS Science And Technology University

(Established Under JSS Science and Technology University Act No. 43 of 2013)

(Formerly Known as SJCE)

JSS SCIENCE AND TECHNOLOGY UNIVERSITY MYSURU

Scheme of Teaching and Examination for B.E (CS&E)

SEMESTER: IV

Sl. No.	Subject Code	Course Title	Teaching Department	Credits				Contact Hours	Marks			Exam Duration in hrs
				L	T	P	TOTAL		CIE	SEE	Total	
1	MA410	Probability, Statistics and Queuing	Mathematics	4	0	0	4	4	50	50	100	03
2	CS410	Operating Systems	CSE	4	0	1	5	6	50	50	100	03
3	CS420	Design and Analysis of Algorithms	CSE	4	0	1	5	6	50	50	100	03
4	CS430	Theory of Computation	CSE	4	0	0	4	4	50	50	100	03
5	CS440	Microprocessors	CSE	4	0	1	5	6	50	50	100	03
6	CS450	Data Communication	CSE	4	0	0	4	4	50	50	100	03
		Total		**Total Credits**			**27**		**Total Marks**		**600**	

Scheme of Teaching and Examination for B.E (CS&E)

SEMESTER: V

Sl. No.	Subject Code	Course Title	Teaching Department	Credits				Contact Hours	Marks			Exam Duration in hrs
				L	T	P	TOTAL		CIE	SEE	Total	
1	MA510	Linear Algebra	Mathematics	4	0	0	4	4	50	50	100	03
2	CS510	Database Systems	CSE	4	0	1	5	6	50	50	100	03
3	CS520	Unix System Programming	CSE	4	1	0	5	6	50	50	100	03
4	CS530	Software Engineering	CSE	4	0	0	4	4	50	50	100	03
5	CS540	Computer Network	CSE	4	0	1	5	6	50	50	100	03
6	CS550	Language Processor	CSE	4	1	0	5	6	50	50	100	03
		Total		**Total Credits**			**28**		**Total Marks**		**600**	

Scheme of Teaching and Examination for B.E (CS&E)

SEMESTER: VI

Sl. No.	Subject Code	Course Title	Teaching Department	Credits				Contact Hours	Marks			Exam Duration in hrs
				L	T	P	TOTAL		CIE	SEE	Total	
1	CS610	Data warehouse and Data Mining	CSE	4	1	0	5	6	50	50	100	03
2	CS620	Neural Networks and Fuzzy Logic	CSE	4	0	0	4	4	50	50	100	03
3	CS630	File Structures	CSE	4	0	1	5	6	50	50	100	03
4	CS640	Software Project Management	CSE	4	0	0	4	4	50	50	100	03
5	CS650	Embedded Systems	CSE	4	0	1	5	6	50	50	100	03
6	CS66X	Elective-I	CSE	4	0	0	4	4	50	50	100	03
		Total		**Total Credits**			**27**		**Total Marks**		**600**	

Sl. No.	Code	Elective-I
1	CS 661	Green Computing
2	CS 662	Digital Image Processing
3	CS 663	Java and J2EE
4	CS 664	Mobile Application Development
5	CS 665	System Simulation and Modeling

Scheme of Teaching and Examination for B.E (CS&E)

SEMESTER: VII

Sl. No.	Subject Code	Course Title	Teaching Department	Credits				Contact Hours	Marks			Exam Duration in hrs
				L	T	P	TOTAL		CIE	SEE	Total	
1	CS710	Computer Architecture	CSE	4	1	0	5	6	50	50	100	03
2	CS720	Agile Software Engineering	CSE	4	0	1	5	6	50	50	100	03
3	CS73X	Elective-II	CSE	4	0	0	4	4	50	50	100	03
4	CS74X	Elective-III	CSE	4	0	0	4	4	50	50	100	03
5	CS750	Seminar	CSE	0	0	2	2	-	50	--	50	--
		Total		**Total Credits**			**20**		**Total Marks**		**450**	

Sl. No.	Code	Elective-II
1	CS731	Internet of Things
2	CS732	Big Data Analytics
3	CS733	Distributed Computing Systems
4	CS734	Multimedia Communication
5	CS735	Web Technologies

Sl. No.	Code	Elective-III
1	CS741	Optimization Techniques
2	CS742	Human Computer Interaction
3	CS743	Cryptography and Network Security
4	CS744	Data Compression
5	CS745	Software Architecture

Educate Elevate Enlighten

JSS Mahavidyapeetha

JSS Science And Technology University

(Established Under JSS Science and Technology University Act No. 43 of 2013)

(Formerly Known as SJCE)

JSS SCIENCE AND TECHNOLOGY UNIVERSITY MYSURU

Scheme of Teaching and Examination for B.E (CS&E)

SEMESTER: VIII

Sl. No.	Subject Code	Course Title	Teaching Department	Credits				Contact Hours	Marks			Exam Duration in hrs
				L	T	P	TOTAL		CIE	SEE	Total	
1	CS810	Enterprise Resource Planning		4	0	0	4	4	50	50	100	03
2	CS82X	Elective-IV		4	0	0	4	4	50	50	100	03
3	CS83X	Elective-V		4	0	0	4	4	50	50	100	03
4	CS840	Project Work		0	0	8	8	-	100	100	200	03
5		Foreign language		2	0	0	2	2	25	25	50	1.5
		Total		**Total Credits**			**22**		**Total Marks**		**550**	

Sl. No.	Code	Elective-IV
1	CS821	Pattern Classification
2	CS822	Cloud Computing
3	CS823	Storage Area Network
4	CS824	Advanced Web technologies
5	CS825	Machine Intelligence & Expert Systems

Sl. No.	Code	Elective-V
1	CS831	Web Mining
2	CS832	Wireless networks and Mobile Computing
3	CS833	Adhoc Networks
4	CS834	Ubiquitous Computing
5	CS835	Game Theory

Semester–III

Department: Computer Science and Engineering	
Course title: Digital System Design	***Course Code:CS310***
Credits(L:T:P): 4:0:1	***Core/Elective: Core***
Type of Course: Lecture, Practical	***Total Contact Hours:52:0:26***
CIE Marks : 50	***SEE Marks: 100***

Pre-requisite: **Nil**

Course Outcomes: After completing this course, students should be able to:

CO1: Comprehend the fundamental concepts of Boolean algebra, Boolean theorems, K- MAP & Quine-McCluskey algorithm to simplify Boolean functions, basic combinational and sequential logic components used in the typical data path.

CO2: Analyse and design combinational systems using standard gates, MSI devices and minimization methods.

CO3: Analyze and design sequential systems composed of standard sequential modules, such as counters and registers.

Unit No.	Course Content	No. of Hours
1.	**Digital Logic**: The Basic Gates, Universal Logic Gates, AND-OR invert gates, Positive and Negative Logic, Introduction to HDL. Combinational Logic Circuits: Boolean laws and Theorems , Sum-of-Products Method, Truth Table to Karnaugh Map, Pairs, Quads, and Octets, Karnaugh Simplifications, Don't-care Conditions, Product-of-sums Method, Product-of-sums simplifications, Simplification by Quine-McCluskyMethod, Hazards and Hazard covers, HDL Implementation Models.	10

2.	**Data Processing Circuits:** Multiplexers, Demultiplexers, 1-of-16 Decoder, BCD to Decimal Decoders, Seven Segment Decoders, Encoders, Parity Generators and Checkers, Magnitude Comparator, ROM, Programmable Array Logic, Programmable Logic Arrays, Troubleshooting with a logic probe, HDL Implementation of Data Processing Circuits. Arithmetic Building Blocks, Arithmetic Logic Unit.	10
3.	**Flip-Flops**: RS Flip-Flops, Gated Flip-Flops, Edge-triggered RS FLIP-FLOP, Edge-triggered D FLIP-FLOPs, Edge-triggered JK FLIP-FLOPs., Timing, JK Master-slave FLIP-FLOP, Switch Contact Bounce Circuits, Various Representation of FLIP-FLOPs, Analysis of Sequential Circuits, Conversion of Flip-Flops, HDL Implementation of FLIP-FLOP.	10
4.	**Registers:** Types of Registers, Serial In - Serial Out, Serial In - Parallel out, Parallel In - Serial Out, Parallel In - Parallel Out, Universal Shift Register, Applications of Shift Registers, Register implementation in HDL. Counters: Asynchronous Counters, Decoding Gates, Synchronous Counters, Changing the Counter Modulus. Decade Counters, Pre settable Counters, Counter Design as a Synthesis problem, A Digital Clock, Counter Design using HDL.	10
5.	**Design of Synchronous and Asynchronous Sequential Circuits**: Model Selection, State Transition Diagram, State Synthesis table, Design equations and Circuit diagram, Algorithmic State machine, State reduction Technique. Asynchronous Sequential Circuits: Analysis of Asynchronous Sequential Circuits, Problems with Asynchronous Sequential Circuits, Design of Asynchronous Sequential Circuits, FSM Implementation in HDL.	12

Text Book:

1. Donald P Leach, Albert Paul Malvino & GoutamSaha: Digital Principles and Applications, 7th Edition, Tata McGraw Hill, 2014

Reference Book:

1. Logic and Computer Design Fundamentals, Morris Mano, & Kime, Charles Prentice Hall, 2001, II Edition.

Note:

Students are informed to visit NPTEL website (nptel.ac.in/courses/117105080/19) for additional information on the course.

Department: Computer Science and Engineering	
Course title: Discrete Mathematical Structures and Combinatorics	***Course Code:CS320***
Credits(L:T:P): 4:0:0	***Core/Elective: Core***
Type of Course: Lecture	***Total Contact Hours:52***
CIE Marks : 50	***SEE Marks: 100***

Pre-requisite: Previous basic mathematics

Course Outcomes: After completing this course, students should be able to:

CO1**:** Express the notations of mathematical thinking, mathematical proofs, algorithmic thinking and relations to model problems.

CO2: Construct problems using graphs and demonstrate different traversal methods of trees and graphs.

CO3: Solving various combinatory problems and using recurrence relations, ability to analyze and solve problems in data structures.

Unit No.	**Course Content**	**No. of Hours**
1.	**Fundamental of Logic:** Basic Connectives and Truth Tables, Logical Equivalence: The Laws of Logic, Logical Implication: Rules of Inference, The Use of Quantifiers, Quantifiers, Definitions and the Proofs of Theorems.	08
2.	**Relations:** Properties of relations, Computer Recognition: Zeros- One Matrices and Directed Graphs, Partial; orders:Hasse diagrams , Equivalence Relations and Partitions , Lattices.	12
3	Elements of coding theory and Hamming Metric, generation of codes using Parity check and Generator matrices.	08

4.	**Graph theory:** Definitions and Examples, Subgraphs, Complements, and Graph Isomorphism, Vertex degree, Euler trail and circuits, Planar Graphs, Hamiltonian Paths and cycles. Trees: Definitions, Properties and Examples, Rooted trees, trees and sorting weighted trees and prefix Codes.	12
5.	The principle of Inclusion and Exclusion, Generalizations of principle, Derangements: - Nothing is in its Right place, Rook Polynomials. Generating Function : Introductory Examples, Definition and examples – Calculation techniques, Partition of Integers, The Exponential Generating Function, and the Summation Operator, Recurrence relations.	12

Text Book:

1. Ralph.P.Grimaldi, B.V.Ramana, "Discrete and Combinatorial Mathematics", 5th Edition, Pearson Education -2009.

Reference Books:

1. Kenneth. H.Rosen, "Discrete Mathematical Structures Theory and Application", V Edition, PHI/Pearson, Education, 2004.
2. Kolman, Busby and Ross, "Discrete Mathematical Structures", Fourth Edition, Prentice –Hall of India Pvt Ltd-2009.

Note: Students are informed to visit NPTEL website (http://nptel.ac.in) for additional information on the course.

Department: Computer Science and Engineering	
Course Title: Computer Organization	***Course Code:CS330***
Credits(L:T:P): 4:0:0	***Core/Elective: Core***
Type of Course: Lecture	***Total Contact Hours:52***
CIE Marks : 50	***SEE Marks: 100***

Pre-requisite: NIL

Course Outcomes: After completing this course, students should be able to:

CO1: Understand the basic principles of computer's working

CO2: Analyse and understand the design and performance of the computers

CO3: Solve and understand the issues affecting modern processors (primary, secondary, caches, TLB etc.) with the various architecture RTN representations.

Unit No.	Course Content	No. of Hours
1.	**Basic Structures of Computers, Machine Instructions & Programs:** Basic Operational Concepts, Bus Structures, Performance, Multiprocessors and Multicomputers. **Machine Instructions and Programs:** Arithmetic operations and characters, Memory Location and Addresses, Memory Operations, Instructions and Instruction Sequencing, Addressing Modes, Assembly Language, Basic Input/output Operations, Stacks and Queues, Subroutines, Additional Instructions, Encoding of Machine Instruction.	12

2.	**Input/Output Organization:** Accessing I/O Devices, Interrupts – Interrupt Hardware, Enabling and Disabling Interrupts, Handling Multiple Devices, Controlling Device Requests, Exceptions, Direct Memory Access, Buses, Interface Circuits.	10
3	**The Memory System:** Basic Concepts, Semiconductor RAM Memories, Read Only Memories, Speed, Size, and Cost, Cache Memories – Mapping Functions, Replacement Algorithms, Performance Considerations, Virtual Memories, Secondary Storage.	10
4.	**Arithmetic Operations:** Addition and Subtraction of Signed Numbers, Design of Fast Adders, Multiplication of Positive Numbers, Signed Operand Multiplication, Fast Multiplication, Integer Division, Floating-point Numbers and Operations.	10
5.	**Basic Processing Unit:** Some Fundamental Concepts, Execution of a Complete Instruction, Multiple Bus Organization, Hard-wired Control and Micro programmed Control.	10

Text Book:

1 Computer Organization – Carl Hamacher, Zvonks Vranesic, V Edition, McGraw Hill.

Reference Books:

1 Computer Systems Architecture – M.Moris Mano, III Edition, Pearson/PHI.

2 V Heuring & H Jordan, Computer System Design & Architecture, Addison-Wesley, FirstEdition, 1999.

3 Structured Computer Organization – Andrew S. Tanenbaum, IV Edition PHI/Pearson

Additional Reference:

1. https://www.youtube.com/watch?v = leWKvuZVUE8&list = P LQObLu nIEgaQ 7Drxp8yCmsJqidgSsTqlw

Note: Students are informed to visit NPTEL website(http://nptel.ac.in) and Swayam Online Courses website (https://swayam.gov.in) for additional information on the course.

Educate Elevate Enlighten

JSS Mahavidyapeetha

JSS Science And Technology University

(Established Under JSS Science and Technology University Act No. 43 of 2013)

(Formerly Known as SJCE)

JSS SCIENCE AND TECHNOLOGY UNIVERSITY MYSURU

Department: Computer Science and Engineering	
Course Title: Data Structures	***Course Code: CS340***
Credits(L:T:P): 4:0:1	***Core/Elective: Core***
Type of Course: Lecture, Practical	***Total Contact Hours: 52:0:26***
CIE Marks : 50	***SEE Marks: 100***

Pre-requisite: Students should have basic knowledge of C programming and should be able to write simple C programs.

Course Outcomes: After completing this course, students should be able to:

CO1: Interpret and associate various data structures and their applications essential for problem solving.

CO2: Apply and analyze applications of stacks, queues, linked lists, trees and graphs data structures

CO3: Design and implement various applications using linear or non-linear data structures.

Unit No.	Course Content	No. of Hours
1.	**Introduction to Data structures:** The Abstract Data Type, Atomic and Composite Data, **Pointers Revisited**: Pointers to variables, arrays, structures and functions. Data Structure, Model for an Abstract Data Type, ADT Implementations. **Array Operation**s: Traversing, inserting, deleting, Searching, and sorting. Dynamically allocated arrays, Polynomial ADT, Sparse matrix ADT.	10
2.	**Linear List:** Array vs Linked storage representation. Representation of linked lists in Memory, Memory allocation and Garbage Collection. List ADT: Linked list operations: Traversing, Searching, Insertion, updation and Deletion. Circular linked lists, Doubly Linked lists, header linked lists. Applications of Linked lists – Representation of Polynomials, Sparse matrix and Long positive numbers.	12
3	**Stacks and Queues**: Stack ADT , Array Representation of Stacks, Stacks using Dynamic Arrays, Multiple Stacks, Linked Stacks .Stack Applications:	10

	Conversions of expressions, evaluation of expressions, Recursion. **Queues**: Queue ADT, Array Representation, Circular Queues, queues using Dynamic arrays, Dequeues, Priority Queues, Multiple Queues, Linked Queues Queue Applications.	
4.	**Trees:** Basic tree concepts**,** General trees and their representations. Binary Trees, Array and linked Representation of Binary Trees, Binary tree ADT: Binary Tree Traversals. Additional Binary tree operations: Insertion, deletion, searching. Binary Search Trees – Definition, Insertion, Deletion, Traversal and Searching. Binary expression trees: Construction of expression trees for different notations, Evaluation of Expression. Threaded binary trees.	10
5.	**Priority Queues and Graphs:** Priority queue implementation using binary heap, Different types of heaps. **Graphs:** Basic concepts, Graph storage structures, Graph ADT, Traversal methods: Depth first search and Breadth first search, Applications of DFS and BFS.	10

Text Book:

1. Fundamentals of Data Structures in C - Ellis Horowitz and Sartaj Sahni, 2nd edition, Universities Press,2014

2. Richard F.Gilberg and Behronz A. Forouzan, "Data structures, A Pseudo code Approach with C", 2nd edition, Cengage learning 2005.

Reference Books:

1. Data Structures - Seymour Lipschutz, Schaum's Outlines, Revised 1stedition, McGraw Hill.

2. Yedidyah, Augenstein, Tannenbaum: Data Structures Using C, Pearson Education, 2003.

URL:

https://www.youtube.com/watch?v=zWg7U0OEAoE&list=PLB3CD0BBB95C1BF09

Note: Students are informed to visit NPTEL website(http://nptel.ac.in) and Swayam Online Courses website (https://swayam.gov.in) for additional information on the course.

Department: Computer Science and Engineering	
Course Title: Object Oriented Programming with C++	***Course Code: CS350***
Credits(L:T:P): 4:0:1	***Core/Elective: Core***
Type of Course: Lecture, Practical	***Total Contact Hours: 52:0:26***
CIE Marks : 50	***SEE Marks: 100***

Pre-requisite: C Programming

Course Outcomes: After completing this course, students should be able to:

CO1: Interpret and associate the concepts of object oriented programming and their applications essential for problem solving.

CO2: Apply and analyze the effects of various concepts of object oriented programming in problem solving.

CO3: Design and implement real world applications incorporating object oriented programming concepts.

Unit No.	Course Content	No. of Hours
1	**Introduction to C++** Introduction: Procedure-oriented programming vs. object-oriented programming, concepts of object-oriented programming. Overview of C++, Sample C++ program, Different data types, operators, expressions, and statements, arrays and strings, pointers & user-defined types Function Components, argument passing, inline functions, function overloading, recursive functions.	10
2	**Classes, Objects and Polymorphism** Class Specification, Class Objects, Scope resolution operator, Access members, Defining member functions, Data hiding, Constructors, Destructors, Static data members and functions. Constant data members and functions, mutable data members.	12

	Friend functions, Passing objects as arguments, Returning objects, Arrays of objects, Dynamic objects, Pointers to objects, Generic functions and classes, Operator overloading and their applicationssuch as +, - , pre-increment, post-increment, [ ] etc.	
3	**Inheritance** Introduction to Inheritance, Different types of Inheritances, Inheritance and protected members, Protected base class inheritance, Constructors and Destructors in Inheritance, Granting access, Virtual base classes.	10
4	**Run-time polymorphism and Exception handling** Virtual functions and Polymorphism: Introduction to Virtual functions, calling a Virtual function through a base class reference, Inheritance of virtual attributes, Hierarchy of virtual functions, Pure virtual functions and Abstract classes, Early and late binding. **Exception Handling:** Exception handling fundamentals, Catching Class Types, Using Multiple catch Statements, Handling Derived-Class Exceptions, Exception handling options: Catching All Exceptions, Restricting Exceptions & Re-throwing an Exception, user defined exceptions, Applying Exception Handling.	10
5	**I/O System Basics and Standard template library** I/O System Basics: The C++ I/O system basics: C++ stream classes, Formatted I/O, I/O manipulators; C++ file I/O: fstream and the File classes, File operations. STL: An overview, the container classes, general theory of operations, vectors, lists, maps.	10

Text Books:

1. Herbert Schildt: The Complete Reference C++, 4th Edition, Tata McGraw Hill, 2003.
2. Stanley B.Lippmann, JoseeLajore: C++ Primer, 4th Edition, Pearson Education, 2005.
3. E Balagurusamy: Object Oriented Programming With C++, 6th Edition, Tata Mcgraw Hill Education

Reference Books:

1. Paul J Deitel, Harvey M Deitel: C++ for Programmers, Pearson Education, 2009.
2. K R Venugopal, RajkumarBuyya, T Ravi Shankar: Mastering C++, Tata McGraw Hill, 1999

3. Yashavant P. Kanetkar: Let Us C++, 2nd Edition, BPB Publications

Note: Students are informed to visit NPTEL website for additional information on the course.

NPTEL Online Courses:
Programming in C++ (NPTEL-NOC)
https://www.youtube.com/playlist?list=PL0gIV7t6l2iIsR55zsSgeiOw9Bd_IUTbY

Additional Video Lectures:

OBJECT ORIENTED PROGRAMMING USING C++ by University Academy- Formerly-IP University CSE/IT. https://www.youtube.com/playlist?list=PLG9aCp4uE-s36Iya992WTs5-5BSTLqaYQ

Semester–IV

Department: Computer Science and Engineering	
Course title: Operating Systems	***Course Code:CS410***
Credits(L:T:P): 4:0:1	***Core/Elective: Core***
Type of Course: Lecture, Practical	***Total Contact Hours:52:0:26***
CIE Marks : 50	***SEE Marks: 100***

Pre-requisite: Computer Organization and Architecture, Data Structures.

Course Outcomes: After completing this course, students should be able to:

CO1: Interpret various activities of process, thread, memory, file and secondary storage components of an Operating System

CO2: Apply and analyze various scheduling algorithms of process, memory and secondary storage components.

CO3: Design and implement various applications using the concepts of inter process communication, deadlocks, memory allocation strategies, page replacement algorithms.

Unit No.	Course Content	No. of Hours
1	**Introduction to Operating Systems and System structures:** What operating systems do; Computer System organization; Computer System architecture; Operating System structure; OS operations; Process management; Memory management; Storage management; Protection and security; Distributed system; Special-purpose systems; Computing environments, services System structure: User - Operating System interface; System calls and its types ; System programs; OS design and implementation; OS structure; Virtual machines; OS generation; System boot.	10
2	**Process Management and Synchronization:**	12

	Process concept; Process scheduling; Operations on processes; Inter-process communication. Multi-Threaded Programming: Overview; Multithreading models; Thread Libraries; Threading issues. Process Scheduling: Basic concepts; Scheduling criteria; Scheduling algorithms; Multiple-Processor scheduling; Thread scheduling. Synchronization: The Critical section problem; Peterson's solution; Synchronization hardware; Semaphores; Classical problems of synchronization; Monitors.	
3	**Deadlocks and Memory Management:** Deadlocks: System model; Deadlock characterization; Methods for handling deadlocks; Deadlock prevention; Deadlock avoidance; Deadlock detection and recovery from deadlock. Memory Management Strategies: Background; Swapping; Contiguous memory allocation; Paging; Structure of page table; Segmentation. Virtual Memory Management: Background; Demand paging; Copy-on-write; Page replacement; Allocation of frames; Thrashing.	10
4	**File System and Secondary Storage Structures**: File System: File concept; Access methods; Directory structure; File system mounting; File sharing; Protection. Implementing File System: File system structure; File system implementation; Directory implementation; Allocation methods; Free space management, Secondary storage Structure: Mass storage structures; Disk structure; Disk attachment; Disk scheduling; Disk management;	10
5	**Protection and Case Study:** Protection: Goals of protection, Principles of protection, Domain of protection, Access matrix, Implementation of access matrix, Access control, Revocation of access rights Case Study: Linux history; Design principles; Kernel modules; Process management; Scheduling; Memory management; File systems, Input and output; Inter-process communication.	10

Text Books:

4. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne: Operating System Principles, 8th Edition, Wiley India.

Reference Books:

1. D.M Dhamdhere: Operating systems - A concept based Approach, 2nd Edition, Tata McGraw- Hill, 2002.
2. P.C.P. Bhatt: Introduction to Operating Systems: Concepts and Practice, 2nd Edition, PHI, 2008.
3. Harvey M Deital: Operating systems, 3rd Edition, Pearson Education

Note: Students are informed to visit NPTEL website for additional information on the course.

NPTEL Online Courses:
Operating Systems by Sampat Ghosh, NPTEL IITD
https://www.youtube.com/playlist?list=PLsylUObW5M3CAGT6OdubyH6FztKfJCcFB

Introduction to Operating Systems by NPTEL Online Courses
https://www.youtube.com/playlist?list=PL3-wYxbt4yCjpcfUDz-TgD_ainZ2K3MUZ

Operating Systems by P.K.Biswas, IIT Kharagpur
https://www.youtube.com/playlist?list=PLLDC70psjvq5hIT0kfr1sirNuees0NIbG

Additional Video Lectures:
Operating Systems Gate Lectures by Ravindrababu Ravula
https://www.youtube.com/playlist?list=PLEbnTDJUr_If_BnzJkkN_J0Tl3iXTL8vq

Operating Systems by - Easy Engineering Classes
https://www.youtube.com/playlist?list=PLV8vIYTIdSnZ67NQObdXE0gFjrzPrNKHp

Department: Computer Science and Engineering	
Course title: Design and Analysis of Algorithms	***Course Code:CS420***
Credits(L:T:P): 4:0:1	***Core/Elective: Core***
Type of Course: Lecture, Practical	***Total Contact Hours:52:0:26***
CIE Marks : 50	***SEE Marks: 100***

Pre-requisite: Data Structures

Course Outcomes: After completing this course, students should be able to:

CO1: Interpret and appreciate various algorithm design techniques and their applications essential for problem solving.
CO2: Design efficient algorithms choosing appropriate design techniques and data structures in solving the given problem.
CO3: Apply mathematical models to analyze the best case, worst case and average case efficiencies of various algorithms.

Unit No.	Course Content	No. of Hours
1	**Introduction and Brute Force Technique** Introduction: Notion of Algorithms, Fundamentals of Algorithmic approach to problem Solving, Important Problem Types, Fundamental data Structures. Analysis Framework, Asymptotic Notations and Basic efficiency classes, Mathematical analysis of Recursive and Non recursive algorithms, Examples.	10
2	**Brute force, Divide, Decrease and Conquer Techniques** Brute Force Approaches: Introduction, Selection Sort and Bubble Sort, Sequential Search and Brute Force String Matching, Exhaustive search. Divide and conquer: General Divide and Conquer, Masters theorem, Recurrence relations, Binary Search, Merge Sort, Quick Sort and its performance, Multiplication of large integers and Strassen's Matrices. Decrease-and-Conquer Approaches: Introduction, Insertion Sort, Depth First	12

	Search and Breadth First Search, Topological Sorting	
3	**Transform and Conquer and Space-Time Tradeoffs** Transform-and-Conquer: Presorting, Balanced Search Trees, Heaps and Heapsort. Space-Time Tradeoffs: Introduction, Sorting by Counting, Input Enhancement in String Matching, Hashing.	10
4	**Greedy and Dynamic Programming** The greedy method: The General Method, Knapsack Problem, Minimum-Cost Spanning Trees: Prim's Algorithm, Kruskal's Algorithm Dijkstra's Algorithm, Huffman Trees. Dynamic programming: The General Method, Computing a binomial coefficient, Warshall's and Floyd's Algorithms, the Knapsack Problem and Memory Functions.	12
5	**Limitations of Algorithmic Power:** Lower-Bound Arguments, Decision Trees, P, NP, and NP-Complete Problems. Coping With Limitations of Algorithmic Power: Backtracking, Branch-and-Bound, Approximation Algorithm for NP-Hard problems.	8

Text Books:

1. Anany Levitin: Introduction to The Design & Analysis of Algorithms, 2nd Edition, Pearson Education, 2007.

2. Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran: Fundamentals of Computer Algorithms, 2nd Edition, Universities Press, 2007.

Reference Books:

1. Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein: Introduction to Algorithms, 3rd Edition, PHI.

2. R.C.T. Lee, S.S. Tseng, R.C. Chang & Y.T.Tsai: Introduction to the Design and analysis of Algorithms A Strategic Approach, Tata McGraw Hill, 2005.

Note: Students are informed to visit NPTEL website (www.nptelvideos.in/2012/11/design-analysis-of-algorithms.htm) for additional information on the course.

Department: Computer Science and Engineering	
Course title: Theory of Computation	***Course Code:CS430***
Credits(L:T:P): 4:0:0	***Core/Elective: Core***
Type of Course: Lecture	***Total Contact Hours:52***
CIE Marks : 50	***SEE Marks: 100***

Pre-requisite: Discrete mathematical structure

Course Outcomes: After completing this course, students should be able to:

CO1: Examine the fundamental concepts of finite automata and formal languages.

CO2: Analyze and appreciate the correlation between the formal language and automata.

CO3: Design automata for the evaluation of formal languages.

Unit No.	Course Content	No. of Hours
1.	**Introduction to Finite Automata:** The central concepts of Automata theory; Deterministic finite automata; Nondeterministic finite automata; An application of finite automata; Finite automata with Epsilon-transitions; Equivalence and minimization of automata.	10
2.	**Regular Expressions and Properties of Regular Languages:** Regular expressions; Finite Automata and Regular Expressions; Applications of Regular Expressions; Proving languages not to be regular languages; Closure properties of regular Languages; Decision properties of regular languages;	12
3	**Context-Free Grammars and Languages:** Context-Free Grammars; Parse trees; Applications of Context-Free Grammars; Ambiguity in Grammars and	12

	Languages; Normal forms for CFGs;	
4.	**Pushdown Automata and Properties of Context-Free Languages:** Definition of the Pushdown Automata; The languages of a PDA; Equivalence of PDA's and CFG's; Deterministic Pushdown Automata; The pumping lemma for CFGs; Closure properties of CFLs.	10
5.	**Introduction to Turing Machine:** Problems that Computers cannot solve; The Turing machine; Programming techniques for Turing Machines; Extensions to the basic Turing Machines; Restricted Turing Machines; Turing Machine and Computers.	08

Text Books:

1. John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman: Introduction to Automata Theory, Languages and Computation, 3rd Edition, Pearson education, 2007.

2. Peter Linz, Finite Automata & Formal Languages, 4th edition, Narosa Publication, 2001.

Reference Books:

1. John C Martin: Introduction to Languages and Automata Theory, 3rd Edition, Tata McGraw- Hill, 2007.

2. Daniel I.A. Cohen: Introduction to Computer Theory, 2nd Edition, John Wiley & Sons, 2004.
3. Thomas A. Sudkamp: An Introduction to the Theory of Computer Science, Languages and Machines, 3rd Edition, Pearson Education, 2006.

3. http://www.nptel.ac.in/courses/111103016/
4. http://www.nptelvideos.com/course.php?id=451

Note:
Students are informed to visit NPTEL website (http://nptel.ac.in) for additional information on the course.

Department: Computer Science and Engineering	
Course title: Microprocessors	***Course Code: CS440***
Credits(L:T:P): 4:0:1	***Core/Elective: Core***
Type of Course: Lecture, Practical	***Total Contact Hours:52:0:26***
CIE Marks : 50	***SEE Marks: 100***

Pre-requisite: Computer Organization and Architecture

Course Outcomes: After completing this course, students should be able to:

CO1: Comprehend the fundamental concepts of advanced microprocessors and their architectures.

CO2: Analyse, design and develop programs in assembly language of the 8086 family of microprocessors.

CO3: Design and develop microprocessor based systems by the techniques of interfacing between the processors, memory and peripheral devices.

Unit No.	Course Content	No. of Hours
1.	**The Processors: 8086-Architecture, Pin Diagrams and Timing Diagrams:** 8086 Microprocessor Family – An Overview, Register Organization of 8086, Architecture, Signal Descriptions of 8086, Physical Memory Organization, General Bus Operation, I/O Address Capability, Special Processor Activities, Minimum and Maximum Mode 8086 System and Timings.	10
2.	**8086 Instruction Descriptions and Assembler Directives:** Instruction formats, Addressing modes, Instruction Set of 8086, Assembler Directives and operators.	10

3	**The art of Assembly Language Programming with 8086:** A few machine level Programs, Machine coding the Programs, Programming with an Assembler, Assembly Language Example Programs. Interrupts and Interrupt service routines, Interrupt cycle of 8086, NMI, Maskable Interrupt (INTR), BIOS (Basic Input/Output System) and DOS (Disk Operating System) function calls.	10
4.	**Interfacing:** Semiconductor Memory interfacing, Interfacing I/O Ports, PIO 82C55 (Programmable Input – Output Port)	10
5.	**Microprocessors versus Microcontrollers:** ARM Embedded Systems: The RISC design philosophy, The ARM Design Philosophy, Embedded System Hardware, Embedded System Software. ARM Processor Fundamentals: Registers, Current Program Status Register, Pipeline, Exceptions, Interrupts, and the Vector Table. Introduction to the ARM Instruction Set : Data Processing Instructions, Branch Instructions, Load & Store instructions, Software Interrupt Instructions, Simple programming exercises.	12

Text Books:

4 K M Bhurchandi, A K Ray: Advanced Microprocessors and Peripherals, 3 Edition, TMH, 2006.

5 ARM system developers guide, Andrew N Sloss, Dominic Symes and Chris Wright,Elsevier,Morgan Kaufman publishers, 2008.

Reference Books:

1. Barry B Brey: The Intel Microprocessors, 8th Edition, Pearson Education, 2009.

2. K. Udaya Kumar & B.S. Umashankar : Advanced Microprocessors & IBM-PC Assembly Language Programming, TMH 2003.

Note:

Students are informed to visit website (https://www.youtube.com/watch?v=DmwOSdwzZ3E) for additional information on the course.

Educate Elevate Enlighten

JSS Mahavidyapeetha

JSS Science And Technology University

(Established Under JSS Science and Technology University Act No. 43 of 2013)

(Formerly Known as SJCE)

JSS SCIENCE AND TECHNOLOGY UNIVERSITY MYSURU

Department: Computer Science and Engineering	
Course title: Data Communication	***Course Code:CS450***
Credits(L:T:P): 4:0:0	***Core/Elective: Core***
Type of Course: Lecture	***Total Contact Hours:52***
CIE Marks : 50	***SEE Marks: 100***

Pre-requisite: Nil

Course Outcome: After completing this course, students should be able to:

CO1: Comprehend the evolution of communication technologies, digital transmission Techniques, services, applications and protocols

CO2: Acquire the knowledge and analyze different Transmission and switching techniques.

CO3: Analyze different physical and data link layer protocols of OSI, TCP/IP.

Unit No.	Content	No. of Hours
1.	**Communication Networks & Services, Applications & Layered Architectures** Evolution of Network Architecture and Services; Future network architectures and their services; Key factors in communication network evolution. Examples of Protocols, Services, and Layering; The OSI Reference Model; Overview of TCP/IP Architecture; Application Layer Protocols and TCP/IP Utilities.	08
2.	**Digital Transmission** Digital Representation of Information: Block-Oriented Information, Stream Information; Why Digital Communications? Comparison of Analog and Digital Transmission, Basic properties of Digital Transmission Systems; Digital Representation of Analog Signals: Bandwidth of Analog Signals, Sampling of an Analog Signal, Digital Transmission of Analog Signals; Characterization of	14

	Communication Channels: Frequency Domain Characterization, Time Domain Characterization; Fundamental Limits in Digital Transmission: The Nyquist Signaling Rate, The Shannon Channel Capacity; Line Coding. Modems and Digital Modulation: Binary Phase Modulation, QAM and Signal Constellations, Telephone Modem Standards; Properties of Media and Digital Transmission Systems: Twisted Pair, Coaxial Cable, Optical Fiber, Radio Transmission, Infrared Light; Error Detection and Correction: Error Detection, Two Dimensional Parity Checks, Internet Checksum, Polynomial Codes, Standardized Polynomial Codes, Error Detecting Capability of a Polynomial Code.	
3.	**Circuit Switching Networks** Multiplexing: Frequency Division Multiplexing, Time Division Multiplexing, Wavelength-Division Multiplexing; SONET: SONET Multiplexing, SONET Frame Structure; Transport Networks: SONET Networks, Optical Transport networks; Circuit Switches: Space Division Switches, Time Division Switches; The Telephone Network: Transmission Facilities, End to End Digital Services; Cellular telephone networks.	08
4.	**Peer-to-Peer Protocols and Data Link Layer** Peer-to-Peer Protocols and Service Models: Service models, Examples of services, End to end versus hop by hop; ARQ Protocols and Reliable Data Transfer Service: Stop-and-Wait ARQ, Go-Back-N ARQ, Selective Repeat ARQ; Other Peer-to-Peer Protocols: Sliding-window flow control, Timing recovery for synchronous services, Data Link Controls: Framing; Point to Point Protocol; HDLC Data link Control: Data link services, HDLC configuration and transfer modes, HDLC frame format, Typical frame exchanges; Link Sharing using Packet Multiplexers: Statistical Multiplexing, Speech Interpolation and the Multiplexing of Packetized Speech.	12
5.	**Medium Access Control Protocols and Local Area Networks** The Medium Access Control Protocols: Multiple Access Communications; Random Access: ALOHA, Slotted ALOHA, CSMA, CSMA-CD; Scheduling Approaches to Medium Access Control: Reservation Systems, Polling, Token-Passing Rings, Channelization: FDMA, TDMA, CDMA. LAN Protocols: LAN Structure , The Medium Access Control Sublayer, The Logical Link Control Sublayer; Ethernet and IEEE 802.3 LAN Standard: Ethernet Protocol, Frame structure, Physical Layers, Fast Ethernet ,Gigabit Ethernet, 10 Gigabit Ethernet; Token Ring and IEEE 802.5 LAN Standard: Token-Ring Protocol, Frame structure; FDDI; Wireless LANs and IEEE 802.11 Standard: Ad hoc and Infrastructure Networks, LAN Bridges and Ethernet Switches: Transparent Bridges, Source Routing Bridges, Mixed-Media Bridges, Virtual LANs.	10

Text Books:

1. Alberto Leon-Garcia and Indra Widjaja: Communication Networks –Fundamental Concepts and Key architectures, 2nd Edition Tata McGraw-Hill, 2004.

Reference Books:

1. Behrouz A. Forouzan: Data Communications and Networking, 4th Edition, Tata McGraw-Hill, 2006.
2. William Stallings: Data and Computer Communication, 8th Edition, Pearson Education, 2007.
3. Larry L. Peterson and Bruce S. David: Computer Networks – A Systems Approach, 4th Edition, Elsevier, 2007.
4. Wayne Tomasi: Introduction to Data Communications and Networking, First edition, Pearson Education, 2005.
5. Nader F. Mir: Computer and Communication Networks, First edition, Pearson Education, 2007.

Note:

Students are informed to visit NPTEL website (http://nptel.ac.in) for additional information on the course.

Semester–V

Department: Computer Science and Engineering	
Course Title: Database Systems	***Course Code: CS510***
Credits(L:T:P): 4:0:1	***Core/Elective: Core***
Type of Course: Lecture, Practical	***Total Lecture Hours: 52:0:26***
CIE Marks: 50	***SEE Marks: 100***

Pre-requisite: Nil

Course Outcomes: After completing this course, students should be able to:

CO1: Interpret and associate different data models, relational operators and normalization techniques used in database systems

CO2: Apply and analyze the effects of relational operators, inference rules and normalization techniques on different database schema

CO3: Design and develop real world applications involving relational databases.

Unit No.	Course Content	No.of Hours
1.	**Introduction to Database Concepts and Architecture .** Introduction; An example; Characteristics of Database approach; Database users, Advantages of using DBMS approach, Data models, schema and instances, Three-schema architecture and data independence; Database languages and interfaces; The database system environment; Centralized and client-server architectures; Classification of DBMS.	10
2.	**Data Modeling Using the Entity-Relationship (ER) Model :** Using High-Level Conceptual Data Models for Database Design, A Sample Database Application, Entity Types, Entity Sets, Attributes, and Keys, Relationship Types, Relationship Sets, Roles,	10

	and Structural Constraints, Weak Entity Types, Refining the ER Design for the COMPANY Database, ER Diagrams, Naming Conventions, and Design Issues, Relationship Types of Degree Higher than Two, Relational Database Design Using ER-to-Relational Mapping **The Relational Data Model and Relational Database Constraints** : Relational Model Concepts, Relational Model Constraints and Relational Database Schemas, Update Operations, Transactions, and Dealing with Constraint Violations,	
3.	**The Relational Algebra :** Unary Relational Operations: SELECT and PROJECT, Relational Algebra Operations from Set Theory, Binary Relational Operations: JOIN and DIVISION, Additional Relational Operations : Generalized Projection, Aggregate Functions and Grouping, OUTER JOIN Operations, Examples of Queries in Relational Algebra **Basic SQL:** SQL Data Definition and Data Types, Specifying Constraints in SQL, Basic Retrieval Queries in SQL, INSERT, DELETE, and UPDATE Statements in SQL, More Complex SQL retrieval Queries, Specifying Constraints as Assertions and Actions as Triggers, Views (Virtual Tables) in SQL	12
4.	**Database Design Theory and Normalization** Informal Design Guidelines for Relation Schemas; Functional Dependencies; Normal Forms Based on Primary Keys; General Definitions of Second and Third Normal Forms; Boyce-Codd Normal Form, Further Topics in Functional Dependencies: Inference Rules, Equivalence, and Minimal Cover, Properties of Relational Decompositions,	10
5.	**Transaction Processing, Concurrency Control, and Recovery** Introduction to Transaction Processing, Transactions, Database Items, Read and Write Operations and DBMS Buffers, Why Concurrency Control is Needed, Why Recovery Is Needed, Desirable Properties of Transactions, Characterizing Schedules Based on Serializability, Two-Phase Locking Techniques for Concurrency Control,	10

1. Elmasri and Navathe: Fundamentals of Database Systems, 7th Edition, Pearson Education, 2016.
2. Raghu Ramakrishnan and Johannes Gehrke: Database Management Systems, 3rd Edition, McGraw-Hill, 2014.

1. Silberschatz, Korth and Sudharshan: Data base System Concepts, 6th Edition, Mc-GrawHill, 2010.
2. C.J. Date, A. Kannan, S. Swamynatham: An Introduction to Database Systems, 8th Edition, Pearson Education, 2006.

URL

1. NPTEL: http://nptel.ac.in/courses/106106093/

Note: Students are informed to visit NPTEL website(http://nptel.ac.in) and Swayam Online Courses website (https://swayam.gov.in) for additional information on the course.

Department: Computer Science and Engineering	
Course title: Unix System Programming	***Course Code: CS520***
Credits(L:T:P): 4:1:0	***Core/Elective: Core***
Type of Course: Lecture, Tutorial	***Total Contact Hours: 52:26:0***
CIE Marks: 50	***SEE Marks: 100***

Pre-requisite: Object Oriented Programming with C++ and Operating Systems

Course Out comes: After completing this course, students should be able to :

CO1: Understand unix environment, process environment, signals and various IPC techniques.

CO2: Design and develop programs using system calls.

CO3: Analyze and apply various types of APIs, signals and IPC mechanisms for better solutions.

Unit No.	Course Content	No.of Hours

1.	**UNIX and ANSI Standards:** The ANSI C Standard, The ANSI/ISO C++ Standards, Difference between ANSI C and C++, The POSIX Standards, The POSIX.1 FIPS Standard, The X/Open Standards. UNIX and POSIX APIs: The POSIX APIs, The UNIX and POSIX Development Environment, API Common Characteristics. **UNIX Files :** File Types, The UNIX and POSIX File System, The UNIX and POSIX File Attributes, Inodes in UNIX System V, Application Program Interface to Files, UNIX Kernel Support for Files, Relationship of C Stream Pointers and File Descriptors, Directory Files, Hard and Symbolic Links.	10
2.	**UNIX File APIs:** General File APIs, File and Record Locking, Directory File APIs, Device File APIs, FIFO File APIs, Symbolic Link File APIs, General File Class, regfile Class for Regular Files, dirfile Class for Directory Files, FIFO File Class, Device File Class, Symbolic Link File Class, File Listing Program. **UNIX Processes :** The Environment of a UNIX Process: Introduction, main function, Process Termination, Command-Line Arguments, Environment List, Memory Layout of a C Program, Shared Libraries, Memory Allocation, Environment Variables, setjmp and longjmp Functions, getrlimit, setrlimit Functions, UNIX Kernel Support for Processes.	10
3.	**Process Control** : Introduction, Process Identifiers, fork, vfork, exit, wait, waitpid, wait3, wait4 Functions, Race Conditions, exec Functions, Changing User IDs and Group IDs, Interpreter Files, system Function, Process Accounting, User Identification, Process Times, I/O Redirection. **Process Relationships:** Introduction, Terminal Logins, Network Logins, Process Groups, Sessions, Controlling Terminal, tcgetpgrp and tcsetpgrp Functions, Job Control, Shell Execution of Programs, Orphaned Process Groups. Minishell example in c++.	10
4.	**Signals, Daemon Processes :**Signals: The UNIX Kernel Support for Signals, signal, Signal Mask, sigaction, The SIGCHLD Signal and the waitpid Function, The sigsetjmp and siglongjmp Functions, Kill, Alarm, Interval Timers, POSIX.lb Timers, Timer class. **Daemon Processes**: Daemon Characteristics, Coding Rules, Error Logging, Error Logging, Client-Server Model.	10

5.	**Interprocess Communication** : Overview of IPC methods, Pipes, Popen and Pclose functions, Coprocesses; FIFOs, system V IPC, Message Queues; Semaphores, Shared memory, Client server properties, Stream pipes, Passing file descriptors, An open server (version 1),client –server connection functions , An open server (version 2), POSIX.1b semaphores, memory mapped I/O, POSIX.1b shared memory, Programming example in C and C++.	12

1. Terrence Chan, "Unix System Programming Using C++", Prentice Hall India, 2012.
2. Richard Stevens, "Advanced Programming in the UNIX Environment", Addison-Wesley, 2008.

Reference books:

1. Behrouz A. Forouzan and Richard F.Gilberg, "Unix and Shell Programming - A Text book", Thomson, Edition-2003.
2. Kenneth Rosen, Douglas Host, James Farber and Richard Rosinski, "The Complete Reference UNIX", Tata McGraw- Hill, Edition 2000.
3. Sumitabha Das, "UNIX Concepts and Applications", 4th edition, Tata McGraw Hill, 2015.

URL

1. NPTEL Video link: https://www.youtube.com/watch?v=lcRqHwIn5Dk

Note: Students are informed to visit NPTEL website(http://nptel.ac.in) and Swayam Online Courses website (https://swayam.gov.in) for additional information on the course.

Department: Computer Science and Engineering	
Course title: Software Engineering	***Course Code: CS530***
Credits(L:T:P): 4:0:0	***Core/Elective: Core***
Type of Course: Lecture	***Total Contact Hours: 52***
CIE Marks: 50	***SEE Marks:100***

Pre-requisite: Nil

Course Out comes: After completing this course, students should be able to:

CO1: Realize the concepts of software development process.

CO2: Analyze and apply different software development methodologies.

CO3: Design and develop software systems using software engineering concepts.

Unit No.	Course Content	Hours
1.	**Software Process** The Nature of Software , The Changing Nature of Software, Defining the Discipline, Defining the Discipline, The Essence of Practice, Software Development Myths, A Generic Process Model, Defining a Framework Activity, Identifying a Task Set, Process Patterns ,Process Assessment and Improvement, Prescriptive Process Models, Specialized Process Models, The Unified Process, Personal and Team Process Models, Process Technology, Product and Process, What Is Agility?, Agility and the Cost of Change, What Is an Agile Process?.	10
2.	**Software Analysis** Software Engineering Knowledge, Core Principles, Principles That Guide Each Framework Activity, Work Practices, Requirements Engineering, Establishing	12

	the Groundwork, Eliciting Requirements, Developing Use Cases, Building the Analysis Model, Negotiating Requirements, Requirements Monitoring, Validating Requirements, Requirements Analysis, Scenario-Based Modeling, Identifying Analysis Classes, Specifying Attributes , Defining Operations, Class-Responsibility-Collaborator Modeling ,Associations and Dependencies.	
3.	**Software Design** Design within the Context of Software Engineering, The Design Process, Design Concepts, The Design Model, Software Architecture, Architectural Genres, Architectural Styles, Architectural Considerations, Architectural Decisions, Architectural Design, Assessing Alternative Architectural Designs, What Is a Component?, Designing Class-Based Components, Conducting Component-Level Design, Designing Traditional Components, The Golden Rules, User Interface Analysis and Design.	12
4.	**Software Testing** What Is Quality?, Software Quality, The Software Quality Dilemma, Achieving Software Quality, A Strategic Approach to Software Testing, Strategic Issues, Test Strategies for Conventional Software, Test Strategies for Object-Oriented Software, Test Strategies for Web Apps, Test Strategies for Mobile Apps, Validation Testing, System Testing, The Art of Debugging, Software Testing Fundamentals, Internal and External Views of Testing, White-Box Testing, Basis Path Testing, Control Structure Testing, Black-Box Testing, Model-Based Testing, Testing Documentation and Help Facilities, Testing for Real-Time Systems, Patterns for Software Testing.	10
5.	**Software Maintenance and Improvement** Software Maintenance, Software Supportability, Reengineering, Business Process Reengineering, Software Reengineering, Restructuring, Forward Engineering, What Is SPI?, The SPI Process,T he CMM, The People CMM.	08

Text Books:

1. Roger S Pressman: Software Engineering-A Practitioners approach, 8th edition, McGraw-Hill Publication, 2015.

Reference Books:

1. Pankaj Jalote: An Integrated Approach to Software Engineering, 3rd edition, 2014 Reprint, Narosa Publications.
2. Ian Sommerville : Software Engineering, 10th edition, Person Education Ltd, 2015.

URL

1. http://nptel.ac.in/courses/106101061

Note: Students are informed to visit NPTEL website(http://nptel.ac.in) and Swayam Online Courses website (https://swayam.gov.in) for additional information on the course.

Department: Computer Science and Engineering	
Course title: Computer Network	***Course Code: CS540***
Credits(L:T:P): 4:0:1	***Core/Elective: Core***
Type of Course: Lecture, Practical	***Total Lecture Hours:52:0:26***
CIEMarks:50	***SEEMarks:100***

Pre-requisite: Data Communication

Course Out comes: After completing this course, students should be able to:

CO1: Describe and identify Network and Transport layer protocols

CO2: Express Network, Transport and Application layer processes.

CO3: Implement different algorithms related to Layer 2 and above of the protocol stack

Unit No.	Course Content	Hours
1.	**Network layer:** Network layer design issues: Store-and-Forward Packet Switching, Services provided to the Transport Layer, Implementation of Connectionless Service, Implementation of Connection-Oriented Service, Comparison of Virtual-Circuit and Datagram Subnets. Routing Algorithms: The Optimality Principle, Shortest path Routing, Flooding, Distance vector Routing, Link State Routing, Hierarchical Routing, Broadcast Routing, Multicast Routing, Routing for Mobile Hosts, Routing in Ad Hoc Networks, Node Lookup in Peer-to-Peer Networks.	12
2.	**Network layer:** Congestion control algorithms: General Principles of Congestion Control, Congestion Prevention Policies, Congestion Control in Virtual-Circuit Subnets, Congestion Control in Datagram Subnets, Load Shedding, Jitter Control.	10

	Quality of service: Requirements, Techniques for Achieving Good Quality of Service, Integrated Services, Differentiated Services, Label Switching and MPLS, Internetworking: How Network differs, Tunneling, Internetwork Routing, Fragmentation The network Layer in the Internet: IP protocol, IP address, Internet Control protocols, OSPF, BGP, Internet Multicasting, Mobile IP and IPV6.	
3.	**Transport Layer:** The Transport Service: Services provided to the upper layers, transport Service Primitives. Elements of Transport Protocols: Addressing, Connection establishment, Connection release, Flow control and Buffering, Multiplexing and Crash recovery. Internet Transport Protocols: UDP, Remote Procedure Call, Real-Time Transport Protocol, TCP, TCP service Model, TCP Protocol, TCP segment Header, TCP connection establishment, TCP connection release, Modeling TCP connection management, transmission policy, TCP congestion control, TCP timer management, Wireless TCP and UDP, Transactional TCP. Performance Problems in Computer Networks: Network Performance Measurement, System design for better performance, Fast TPDU processing and protocols for Gigabit Networks	10
4.	**The Application Layer**: DNS: The DNS Name Space, Resource Records, Name Servers, Electronic Mail: Architecture and Services, The User agent, message formats, message transfer, final delivery; WWW: Architectural overview, static web documents, dynamic web documents, HTTP, Performance enhancements, The wireless web. Multimedia: Introduction to Digital Audio, Streaming audio, Internet radio, Voice over IP, Video on Demand	10
5.	**Network Management:** Configuration Management, Fault Management, Performance Management, Security Management, Accounting Management, Simple Network Management Protocol concepts, Structure of Management Information, Management Information Base, ATM Networks: Why ATM?, BISDN Reference model, ATM Layer, ATM cell header, ATM Adaptation Layer, ATM Signaling, PNNI Routing, Classical IP over ATM	10

Text Books:

1. Andrew S Tanenbaum, Computer Networks, Fifth Edition, PHI/Pearson Publication, 2002.
2. Alberto Leon-Garcia and Indra Widjaja: Communication Networks –Fundamental Concepts and Key architectures, 2nd Edition Tata McGraw-Hill, 2014.

Reference Books:

1. Behrouz A Forouzan, Data Communications and Networking, Tata McGraw Hill, fifth edition.
2. William Stallings, Data and Computer Communication, 8th edition, PHI
3. Computer Networking: A Top-Down approach, by Ames Kurose, Keith Ross
4. Computer Networks: A Systems Approach by Bruce S Davie and Larry L Peterson

URL

1. https://www.youtube.com/watch?v=UXMIxCYZu8o
2. https://www.youtube.com/watch?v=hffYt7RDrgk
3. https://www.youtube.com/watch?v=3QWrq5gN8VY
4. https://www.youtube.com/watch?v=IPuLZSOye4c&list=PLCB46B39EBE51B674&index=24

Note: Students are informed to visit NPTEL website(http://nptel.ac.in) and Swayam Online Courses website (https://swayam.gov.in) for additional information on the course.

Department: Computer Science and Engineering	
Course title: Language Processor	***Course Code: CS550***
Credits(L:T:P): 4:1:0	***Core/Elective:Core***
Type of Course: Lecture, Tutorial	***Total Contact Hours: 52:26:0***
CIE Marks: 50	***SEE Marks: 100***

Prerequisites: Theory of Computation

Course Outcomes: After completing this course, students should be able to:

CO1: Examine the fundamental working principles of compiler.

CO2: Analyse the given CFG and construct the syntax tree using different parsing approaches.

CO3: Generate various forms of intermediate code and assembly code for the given language constructs.

Unit No.	Course Content	Hours
1.	**Introduction, Lexical Analysis**: Language processors, The structure of Compilers, Lexical analysis: The role of Lexical Analyzer, Input Buffering, Specifications of Tokens, recognition of Tokens.	8
2.	**Syntax analysis-I:** Introduction, Writing a Grammar, Top-down Parsing, Bottom-up Parsing, Introduction to LR Parsing: Simple LR parser.	12
3.	**Syntax analysis-II:** More powerful LR Parsers: Canonical parser, LALR parser. **Syntax-Directed Definitions:** Evaluation order for SDDs, Applications of Syntax-directed translation, Syntax-directed translation schemes.	12
4.	**Intermediate Code Generation**: Variants of syntax trees, Three-address code, Types and declarations, Translation of expressions, Type checking, Control flow, Back patching, Switch statements, Intermediate code for procedures.	10
5.	**Code Generation**: Issues in the design of Code Generator, The Target language, Addresses in the target code, Basic blocks and Flow graphs,	10

	Optimization of basic blocks, A Simple Code Generator.	

Text Book:

1. Alfred V Aho, Monica S. Lam, Ravi Sethi, Jeffrey D Ullman: Compilers- Principles, Techniques and Tools, 2nd Edition, Pearson education, 2014.

Reference Books:

1. Kenneth C Louden: Compiler Construction - Principles & Practice, First Edition, Brooks/Cole, CENGAGE learning, 1997.
2. Andrew W Appel: Modern Compiler Implementation in C, First Edition, Cambridge University Press, 2010.

URL

1. http://nptel.iitm.ac.in
   NPTEL video lectures of Compiler Design course of Computer Science & Engineering by Prof.Y.N.Srikanth, IISc Bangalore
2. http://nptel.ac.in/courses/106104123/
   NPTEL video lectures of Compiler Design course of Computer Science & Engineering by Sanjeev Aggarwal, IIT Kanpur

Note: Students are informed to visit NPTEL website(http://nptel.ac.in) and Swayam Online Courses website (https://swayam.gov.in) for additional information on the course.

Semester–VI

Department: Computer Science and Engineering	
Course Title: Data Ware house & Data Mining	***Course Code: CS610***
Credits(L:T:P): 4:1:0	***Core/Elective: Core***
Type of Course: Lecture, Tutorial	***Total Lecture Hours:52:26:0***
CIE Marks: 50	***SEE Marks: 100***

Pre-requisite: Nil

Course Outcomes: After completing this course, students should be able to:

CO1: Interpret and associate the process and methodologies used in modelling the data warehouse architecture,

CO2: Apply and analyse the results of different data mining techniques

CO3: Design and develop real world applications which uses data mining

Unit No.	Course Content	Hours
1.	**Introduction to Data Warehousing** Data Warehouse: Basic Concepts, Data warehouse Modeling : Data cube and OLAP: Data Cube , Stars, Snowflakes, and Fact Constellations, Typical OLAP Operations, Data Warehouse Design and Usage, Data Warehouse Implementation:	12
2.	**Introduction to Data Mining** Importance of Data Mining, Kinds of data that can be Mined, What Kinds of patterns can be Mined, Which Technologies are used, Which types of Applications are Targeted, Major issues in Data Mining. Data Objects and Attribute Types, Basic Statistical Description of Data, Data Visualization, Measuring Data Similarity and Dissimilarity.	10

3.	**Data Understanding and Preparation** An Overview, Major Tasks in Data Preprocessing**,** Data Cleaning: Missing Values, Noisy Data, Data Integration: Entity Identification Problem, Tuple Duplication, Data Value Conflict Detection and Resolution**,** Overview of Data Reduction Strategies, Principal Components Analysis, Attribute Subset Selection, Histograms, Clustering, Sampling, Data Transformation Strategies Overview, Data Transformation by Normalization.	10
4.	**Association Rules** Mining Frequent Patterns, Associations, and Correlations: Market Basket Analysis, Apriori Algorithm : Finding Frequent Itemsets by Confined Candidate Generation, A Pattern- Growth Approach For Mining Frequent Itemsets.	8
5.	**Classification and Cluster Analysis** Basic Concepts, General Approach to Classification, Decision Tree Induction : Attribute Selection Measures, Tree Pruning, Bayes Classification Methods: Bayes' Theorem, Nai've Bayesian Classification, Rule-Based Classification: Using IF-THEN Rules for Classification, Rule Extraction from a Decision Tree, Model Evaluation and Selection: Metrics for Evaluating Classifier Performance Basic Concepts and Methods, Overview of Basic Clustering Methods, Partitional Methods: *k*-Means: A Centroid-Based Technique, Hierarchical Methods: Agglomerative versus Divisive Hierarchical Clustering	12

Text Books:

1. Jiawei Han and Micheline Kamber: Data Mining - Concepts and Techniques, 3rd Edition, Morgan Kaufmann Publisher, 2014.

Reference Books:

1. Alex Berson and Stephen J. Smith, " Data Warehousing, Data Mining & OLAP", TataMcGraw – Hill Edition, Tenth Reprint 2007
2. Pang Ning Tan, Michael Steinbach and Vipin kumar : Introduction to Data Mining, Pearson, 2006.
3. G. K. Gupta: Introduction to Data Mining with Case Studies, 3rd Edition, PHI, New Delhi, 2009.

URL

1. NPTEL : http://nptel.ac.in/courses/106106093/35

Note: Students are informed to visit NPTEL website(http://nptel.ac.in) and Swayam Online Courses website (https://swayam.gov.in) for additional information on the course.

Educate Elevate Enlighten

JSS Mahavidyapeetha

JSS Science And Technology University

(Established Under JSS Science and Technology University Act No. 43 of 2013)

(Formerly Known as SJCE)

JSS SCIENCE AND TECHNOLOGY UNIVERSITY MYSURU

Department: Computer Science and Engineering	
Course Title: Neural Networks and Fuzzy Logic	***Course Code: CS620***
Credits(L:T:P): 4:0:0	***Core/Elective: Core***
Type of Course: Lecture	***Total Contact Hours: 52***
CIE Marks: 50	***SEE Marks: 100***

Pre-requisite: Engineering Mathematics

Course Outcomes: After completing this course, students should be able to:

CO1: Understand and comprehend the fundamentals of Neural Network architectures and Fuzzy Logic sets and relations.

CO2: Analysis and design of Neural Network architectures and Fuzzy Logic systems.

CO3: Apply Neuro-Fuzzy hybrid systems for real world problems.

Unit No.	Course Content	Hours
1.	**Introduction:** Neural Networks, Application Scope of Neural Networks, Fuzzy Logic, Genetic Algorithm, Hybrid Systems, Soft Computing **Artificial Neural Networks:** **An Introduction** Fundamental Concepts, Evolution of Neural Networks, Basic Models Of Artificial Neural Networks, Important Terminologies of ANNs, McCulloch-Pitts Neuron, Linear Separability, Hebb Network	12
2.	**Supervised Learning Network** Introduction, Perception Network-Architecture, Adaptive Linear Neuron(Adeline), Multiple adaptive Linear Neurons, Back-Propagation Network, Architecture Radial Basis Function Network Architecture, Time Delay Neural Network, Function Link Networks, Tree Delay Neural Network, Wavelet Neural Networks	12
3	**Associative Memory Networks**	10

	Introduction, Training Algorithms for Pattern Association, Auto associative Memory Network, Hetero associative Memory Network, Bidirectional Associative Memory(BAM), Hopefield Networks, Iterative Auto associative Memory Networks, Temporal Associative Memory Network	
4.	**Introduction to Fuzzy Logic, Classical Sets and Fuzzy Sets:** Introduction to Fuzzy Logic, Classical Sets(Crisp Sets),Fuzzy Sets. **Classical Relations and Fuzzy Relations** Introduction, Cartesian Product of Relation, Classical Relation, Fuzzy Relations, Tolerance and Equivalence Relations, Non interactive Fuzzy Sets **Membership Functions** Introduction, Features of the Membership Functions, Fuzzification, Methods of Membership Value Assignments **Defuzzification** Introduction, Lambda-Cuts for Fuzzy Sets(Alpha-Cuts), Lambda-Cuts for Fuzzy Relations, Defuzzification Methods	10
5.	**Fuzzy Arithmetic and Fuzzy Measures** Introduction, Fuzzy Arithmetic, Extension Principle, Fuzzy Measures, Measures of Fuzziness, Fuzzy Integrals **Fuzzy Rule Base and Approximate Reasoning** Introduction, Truth Values and Tables in Fuzzy Logic, Fuzzy Propositions, Formation of Rules, Decomposition of Rules(Compound Rules), Aggregation of Fuzzy Rules, Fuzzy Reasoning (Approximate Reasoning), Fuzzy Interface Systems (FIS), Overview of Fuzzy Expert Systems	8

Text Books:

1. S.N Sivanandam, S.N Deepa Wiley India, Principles of Soft Computing, Second Edition 2011.

Reference Books:

1. Simon Haykin, ”Neural Networks: A Comprehensive Foundation”, Pearson Education (Asia) Pvt.Ltd. 2007.
2. J.S.R. Jang, C.T. Sun, and E. Mizutani, “Neuro-Fuzzy and Soft Computing”, PHI Learning, 2009.

URL

1. http://nptel.ac.in/courses/117105084/
2. http://www.nptelvideos.in/2012/11/neuralnetwork-and-applications.

3. https://videoken.com/search-results

Note: Students are informed to visit NPTEL website(http://nptel.ac.in) and Swayam Online Courses website (https://swayam.gov.in) for additional information on the course.

Department: Computer Science and Engineering	
Course title: File Structures	***Course Code: CS630***
Credits(L:T:P): 4:0:1	***Core/Elective: Core***
Type of Course :Lecture, Practical	***Total Contact Hours: 52:0:26***
CIEMarks:50	***SEE Marks: 100***

Pre-requisite: Computer Programming, Data Structures and Design and analysis of Algorithms

Course Outcomes: After completing this course, students should be able to:

CO1: Identify, associate and select different types of file, indexing, hashing and distribution techniques of databases.

CO2: Apply and analyse the result of different types of file, indexing, hashing and distribution techniques of databases.

CO3: Design and develop real world applications used for storing, retrieving, updating and optimizing query execution in secured distributed databases.

Unit No.	Course Content	Hours
1.	**Disk Storage, Basic File Structures and Hashing:** Introduction, Secondary storage devices, Buffering of blocks, Placing file records on Disks, Operation on Files, Files of Unordered Records(Heap files),Files of Ordered Records(Sorted Files), Hashing Techniques other primary file organizations, Parallelizing Disk Access using RAID Technology.	10
2.	**Indexing Structures for Files:** Types of single-level Ordered indexes, Multilevel indexes, Dynamic multilevel indexes using B-Trees and B+ trees, Indexes on multiple keys, other types of indexes, some general issues concerning indexing.	10
3	**Algorithms for Query Processing and Optimization :** Translating SQL Queries into Relational Algebra , Algorithms for External Sorting ,Algorithms for SELECT and JOIN Operations, Algorithms for	12

	PROJECT and Set Operations, Implementing Aggregate Operations and OUTER JOINs, Combining Operations Using Pipelining , Using Heuristics in Query Optimization, Using Selectivity and Cost Estimates in Query Optimization , Overview of Query Optimization in Oracle, Semantic Query Optimization. **Physical Database Design and Tuning:** Physical Database Design in Relational Databases, An Overview of Database Tuning in Relational Systems.	
4.	**Database Security:** Introduction to Database Security Issues , Discretionary Access Control Based on Granting and Revoking Privileges, Mandatory Access Control and Role-Based Access Control for Multilevel Security, SQL Injection , Introduction to Statistical Database Security, Introduction to Flow Control, Encryption and Public Key Infrastructures , Privacy Issues and Preservation ,Challenges of Database Security, Oracle Label-Based Security.	10
5.	**Distributed Databases:** Distributed Database Concepts, Types of Distributed Database Systems, Distributed Database Architectures, Data Fragmentation, Replication, and Allocation Techniques for Distributed Database Design, Query Processing and Optimization in Distributed Databases ,Overview of Transaction Management in Distributed Databases, Overview of Concurrency Control and Recovery in Distributed Databases, Distributed Catalog Management, Current Trends in Distributed Databases, Distributed Databases in Oracle.	10

Text Book:

1. Ramez Elmasri and Shamkant B. Navathe *" Fundamentals of Database Systems"* , 7th Edition, Pearson Publishers, 2017

Reference Books:

1. Raghu Ramakrishan and Johannes Gehrke: Database Management Systems, 3rd Edition, McGraw Hill, 2003.
2. K.R. Venugopal, K.G. Srinivas, P.M. Krishnaraj: File Structures Using C++, Tata McGraw-Hill, 2008.
3. Michael J.Folk, University of Illinois Bill Zoellick, CAP ventures, Greg Riccardi, Florida State University, File Structures: An Object Oriented Approach with *C*++, 3/e Pearson Publishers, 1998

URL

1. https://www.youtube.com/watch?v=nPS7yH-QyPg

Note: Students are informed to visit NPTEL website (http://nptel.ac.in) and Swayam Online Courses website (https://swayam.gov.in) for additional information on the course.

Educate Elevate Enlighten

JSS Mahavidyapeetha

JSS Science And Technology University

(Established Under JSS Science and Technology University Act No. 43 of 2013)

(Formerly Known as SJCE)

JSS SCIENCE AND TECHNOLOGY UNIVERSITY MYSURU

Department : Computer Science and Engineering	
Course title: Software Project Management	***Course Code: CS640***
Credits(L:T:P): 4:0:0	***Core/Elective: Core***
Type of Course: Lecture	***Total Contact Hours:52***
CIE Marks: 50	***SEE Marks: 100***

Pre-requisite: Software Engineering

Course Outcomes: After completing this course, students should be able to:

CO1: Understand the concepts of Conventional software project management.

CO2: Identity and explore appropriate software project management techniques.

CO3: Illustrate software project management practice on project models.

Unit No.	Course Content	Hours
1.	**Project Management Concepts:** The management spectrum: The People- Stake Holders, Team leaders, Software team, agile teams, Coordination and Communication Issues , The Product- Software Scope, Problem Decomposition, The Process- Melding the Product and the Process, Process Decomposition, The Project- The W5HH principle, critical practices.	10
2.	**Process and Project Metrics:** Metrics in the process and project domains, Process Metrics and Software Process Improvement, Project Metrics, Software Measurement, Size-Oriented Metrics, Function-Oriented Metrics, Reconciling LOC and FP Metrics, Object-Oriented Metrics- Number of scenario scripts, Number of key classes, Number of support classes, Average number of support classes per key class, Number of subsystems**,** Use Case-Oriented Metrics, Web App Project Metrics, Metrics for Software Quality- Measuring Quality, Defect Removal Efficiency, Integrating metrics within the software process, Arguments for Software Metrics, Establishing a Baseline**,** Metrics Collection,	10

	Computation, and Evaluation, Metrics for small organizations, Establishing a software metrics program.	
3	**Estimation for Software Projects:** Observations on estimation, the project planning process, Software scope and feasibility, Resources- Human Resources, Reusable Software Resources, Environmental Resources, Software Project Estimation, Decomposition techniques- Software sizing, Problem based estimation, An Example of LOC-Based Estimation, An Example of FP-Based Estimation, Process-Based Estimation, An Example of Process-Based Estimation, Estimation with Use Cases, An Example of Estimation Using Use Case Points, Reconciling Estimates, Empirical Estimation Models, The Structure of Estimation Models, The COCOMO II Model, The Software Equation, Estimation for Object-Oriented Projects, Specialized Estimation Techniques- Estimation for Agile Development, Estimation for WebApp Projects, The Make/Buy Decision, Creating a Decision Tree, Outsourcing.	10
4.	**Project Scheduling:** Basic Concepts, Project Scheduling, Basic Principles, The Relationship between People and Effort, Effort Distribution, Defining a task for the software project, A Task Set Example, Refinement of Major Tasks, Defining a task network, scheduling, Time-Line Charts, Tracking the Schedule, Tracking Progress for an OO Project, Scheduling for Web App and Mobile Projects, Earned Value Analysis.	10
5.	**Risk Management, Maintenance and Reengineering :** Reactive versus Proactive Risk Strategies, Software Risks, Risk Identification- Assessing Overall Project Risk, Risk Components and Drivers, Risk Projection- Developing a Risk Table, Assessing Risk Impact, Risk Refinement, Risk Mitigation, Monitoring and Management, The RMMM Plan; Maintenance and Reengineering: Software Maintenance, Software Supportability, Reengineering, Business Process Reengineering- Business Processes, A BPR Model, Software Reengineering- A Software Reengineering Process Model, Software Reengineering Activities, Reverse Engineering, Reverse Engineering to Understand Data, Reverse Engineering User Interfaces, Restructuring- Code Restructuring, Data Restructuring, Forward Reengineering- Forward Engineering for Client-Server Architectures, Forward Engineering for Object-Oriented Architectures, The Economics of Reengineering.	12

Text Book:

1. Roger S Pressman and Bruce R. Maxim; Software Engineering: A PRACTITIONER'S APPROACH; Mc Graw Hill Education, Eighth Edition, 2015 reprint.

Reference Books:

1. Bob Hughes, Mike Cotterell and Rajib Mall ; Software Project Management McGraw Hill Education; 6th edition.
2. Ian Summerville, Software Engineering; 10th edition, Pearson Education Publication.

URL

1. http://nptel.ac.in/courses/106101061/29.

Note: Students are informed to visit NPTEL website(http://nptel.ac.in) and Swayam Online Courses website (https://swayam.gov.in) for additional information on the course.

Department: Computer Science and Engineering	
Course title: Embedded Systems	***Course Code: CS650***
Credits(L:T:P): 4:0:1	***Core/Elective: Core***
Type of Course: Lecture, Practical	***Total Lecture Hours: 52:0:26***
CIE Marks: 50	***SEE Marks: 100***

Pre-requisite: Computer Organization and Architecture, Microprocessors

Course Outcomes: After completing this course, students should be able to:

CO1: Examine the significance of embedded applications in contrast with general purpose applications to cater to the needs of Real time applications

CO2: Explore and analyze the specialties of hardware and system software configurations of embedded systems

CO3: Apply the various programming strategies to develop embedded applications using the features and facilities provided by the embedded systems IDE

Unit No.	Course Content	Hours
1.	**Embedded Computing, Instruction Sets:** Introduction, Complex Systems and Microprocessors, Embedded Systems Design Process, Formalism for System design, Design Example: Model Train Controller. Preliminaries, ARM Processor.	09
2.	**CPUs, Bus-Based Computer Systems:** Programming Input and Output, Supervisor mode, Exceptions, Traps, Coprocessors, Memory Systems Mechanisms, CPU Performance, CPU Power Consumption. Design Example: Data Compressor. Basic Computing Platforms, CPU Bus, Memory Devices and systems, Designing with computing platforms, Consumer Electronic architecture, Platform level performance analysis, Design Example: Alarm Clock.	12

3	**Program Design and Analysis:** Components for embedded programs, Models of programs, Assembly, Linking and Loading, Compilation Techniques, Program level performance analysis, Software performance optimization, Program-Level energy and power analysis and optimization, Analysis and optimization of program size, Program validation and testing. Design Example: Software modem.	10
4.	**Real Time Operating System (RTOS) Based Design:** Basics of OS, Kernel, types of OSs, tasks, processes, Threads, Multitasking and Multiprocessing, Context switching, Scheduling Policies, Task Communication, Task Synchronization. Inter process Communication mechanisms, Evaluating OS performance, Choice of RTOS, Power Optimization. Design Example: Telephone Answering machine	12
5.	**Embedded Systems Development Environment: The** Integrated Development Environment, Types of File generated on Cross Compilation, Dis-assembler/Decompiler, Simulators, Emulators, and Debugging, Target Hardware Debugging.	09

Text Books:

1. Marilyn Wolf: Computers as Components, Principles of Embedded Computing Systems Design, 3rd Edition, Elsevier, 2012.
2. Shibu K V: Introduction to Embedded Systems, Tata McGraw Hill, 2009

Reference Book:

1. James K. Peckol: Embedded Systems, A Contemporary Design Tool, Wiley India, 2008.

URL

1. http://nptel.ac.in/courses/108102045
2. http://swayam.gov.in/course/3573-embedded-systems-design&hl=en-IN
3. https://www.coursera.org/learn/introduction-embedded-systems

Note: Students are informed to visit NPTEL website(http://nptel.ac.in) and Swayam Online Courses website (https://swayam.gov.in) for additional information on the course.

Department: Computer Science and Engineering	
Course title: Green Computing	***Course Code:CS661***
Credits(L:T:P): 4:0:0	***Core/Elective: Elective***
Type of Course: Lecture	***Total Contact Hours:52***
CIE Marks : 50	***SEE Marks: 100***

Pre-requisite: **Nil**

Course Out comes: After completing this course, students should be able to :

CO1: Understand the principles and practices of green computing.

CO2: Interpret business process models by adopting environmental intelligence.

CO3: Participate in green movement and contribute to society.

Unit No.	Course Content	No. of Hours
1.	**FUNDAMENTALS** Green IT Fundamentals: Business, IT, and the Environment;, Green computing: carbon foot print, scoop on power ,Green IT Strategies: Drivers, Dimensions, and Goals, Environmentally Responsible Business: Policies, Practices, and Metrics.	10
2.	**GREEN ASSETS AND MODELING** Green Assets: Buildings, Data Centers, Networks, and Devices ; Green Business Process Management: Modeling, Optimization, and Collaboration ;Green Enterprise Architecture ;Environmental Intelligence; Green Supply Chains; Green Information Systems: Design and Development Models	12
3.	**GRID FRAMEWORK** Virtualizing of IT systems; Role of electric utilities, Telecommuting, teleconferencing and teleporting; Materials recycling; Best ways for Green PC ;	10

	Green Data center ; Green Grid framework.	
4.	**GREEN COMPLIANCE** Socio-cultural aspects of Green IT; Green Enterprise Transformation Roadmap; Green Compliance: Protocols, Standards, and Audits; Emergent Carbon Issues: Technologies and Future.	10
5.	**CASE STUDIES** The Environmentally Responsible Business Strategies (ERBS); Case Study Scenarios for Trial Runs; Case Studies: Applying Green IT Strategies and Applications to a Home, Hospital, Packaging Industry and Telecom Sector.	10

Text Book:

1. Bhuvan Unhelkar, Green IT Strategies and Applications-Using Environmental Intelligence, CRC Press, June 2011

References:

1. Woody Leonhard, Katherrine Murray, ―Green Home computing for dummies‖, August 2009.
2. San Murugesan, G. R. Gangadharan: Harnessing Green IT,WILEY 1st Edition-2013

URL

1. www.youtube.com/watch?v=T265ByyQk3A

Department: Computer Science and Engineering	
Course title: Digital Image Processing	***Course Code: CS662***
Credits(L:T:P): 4:0:0	***Core/Elective: Elective***
Type of Course: Lecture	***Total Contact Hours: 52***
CIE Marks:50	***SEE Marks: 100***

Pre-requisite: Engineering Mathematics, Knowledge of programming language

Course Outcomes: After completing this course, students should be able to:

CO1: Infer and associate various fundamental operations of digital image processing.

CO2: Apply and analyse the effects of fundamental operations on digital images.

CO3: Design and develop real world applications which uses digital images.

Unit No.	Course Content	Hours
1.	**Introduction:** Digital Image Processing, The Origins of Digital Image Processing, Examples of Fields that Use Digital Image Processing, Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Image Sampling and Quantization, Some Basic Relationships Between Pixels, Mathematical tools used in digital image processing.	10
2.	**Image Enhancement in the Spatial Domain:** Basic Gray Level Transformations: Image negatives, Log transformations, Powerl-Law transformations, Piecewise linear transformations, Histogram Processing: Histogram Equalization, Histogram Specification/Matching, Local Histogram processing, Histogram statistics for image enhancement, Fundamentals of of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters, Combining Spatial Enhancement Methods.	12
3	**Color Image Processing:** Color fundamentals, Color models:RGB, CMY, CMYK, HIS, Pseudocolor Image Processing, Full color Image processing,	10

	color Transformations, Color image smoothing and sharpening, noise in color images.	
4.	**Morphological Image Processing and Image Segmentation:** Erosion and Dilation, opening and closing, Hit-or-Miss transformations, Basic morphological algorithms: Boundary extraction, Hole filling, Extraction of connected components, Convex Hull, Thinning, Thickenning, Skeletons, Pruning. **Image Segmatation:** Point, Line and Edge detection, Detection of discontinues, edge linking and boundary detection, Gradient operators in edge detection,thresh holding, region –based segmentation.	12
5.	**Representation and Descriptors:** Representation, Boundary Descriptors, Regional Descriptors, Use of Principal Components for Description.	08

Text Book:

1. Rafael C Gonzalez and Richard E Woods, Digital Image Processing, Pearson Education, 4th edition , 2017

Reference Books:

1. Anil K Jain, Fundamental of Digital Image Processing, Prentice Hall of India, 2004.
2. William K Pratt, Digital Image Processing PIKS Scientific Inside, 4th Edition
3. WileyVipul Singh, Digital Image Processing With Matlab & LabView, Reed Elsevier India Pvt Ltd, 2013.

URL

1. http://nptel.ac.in/courses/117105079/

Note: Students are informed to visit NPTEL website(http://nptel.ac.in) and Swayam Online Courses website (https://swayam.gov.in) for additional information on the course.

Department: Computer Science and Engineering	
Course title: Java and J2EE	***Course Code: CS663***
Credits(L:T:P): 4:0:0	***Core/Elective: Elective***
Type of Course: Lecture	***Total Contact Hours: 52***
CIE Marks: 50	***SEE Marks: 100***

Pre-requisite: Object oriented Programming with C++, Database Systems.

Course Outcomes: After completing this course, students should be able to:

CO1: Associate the concepts of object oriented programming, exception handling, multithreading, event-handling, JDBC process and RMI in problem solving.

CO2: Apply event handling mechanism to design user interfaces for various applications.

CO3: Incorporate the aspects of Java based development for web applications.

Unit No.	Course Content	Hours
1.	**Introduction to Java:** How java changed the internet; Java Buzz words, Byte Code; Object oriented programming; First Simple Java program, Introducing Classes: Classes Fundamentals; Declaring Objects, Assigning Object Reference Variable; Introducing Methods; Inheritance Basics- using super; Creating Multilevel Hierarchy, When constructors are called, method Overriding, Dynamic Method Dispatch, Abstract classes, final with inheritance **Interfaces, Exception handling Multi Threaded Programming:** The java tread model, The main thread, Creating thread, creating multiple threads, Using isAlive() and join()Thread priorities; Synchronization; Suspending , resuming and stopping threads;	12
2.	**Applets and Event Handling:** The Applet Class: Two types of Applets; Applet basics; Applet Architecture; An Applet skeleton; Simple Applet display methods; Requesting repainting; Using the Status Window; The	12

	HTMLAPPLET tag; Passing parameters to Applets; getDocumentbase() and getCodebase(); ApletContext and showDocument() ; The AudioClipInterface ; The Applet Stub Interface; Output to the Console. Producer-consumer problems. **Event Handling**: Two event handling mechanisms; The delegation event model; Event classes; Sources of events; Event listener interfaces; Using the delegation event model; Adapter classes; Inner classes;	
3	**Swings and Java 2 Enterprise Edition Overview :** Swings: The origins of Swing; Two key Swing features; Components and Containers; The Swing Packages; A simple Swing Application; Create a Swing Applet; Jlabel and ImageIcon; JTextField; The Swing Buttons; JTabbedpane; JScrollPane ; JList; JComboBox; JTable.: Overview of J2EE and J2SE.	10
4.	**Database Access**, **Servlets :** The Concept of JDBC; JDBC Driver Types; JDBC Packages; A Brief Overview of the JDBC process; Database Connection; Associating the JDBC/ODBC Bridge with the Database; Statement Objects; ResultSet; Transaction Processing; Metadata, Data type ,Exceptions s,; Servlets: Background; The Life Cycle of a Servlet; Using Tomcat for Servlet Development; A simple Servlet; The Servlet API; The Javax.Servlet Package; Reading Servlet Parameter; The Javax.servlet.http package; Handling HTTP Requests and Responses; Using Cookies; Session Tracking;	10
5.	**JSP and RMI** Java Server Pages (JSP): JSP, JSP Tags, Tomcat, Request String, User Sessions, Cookies, Session Objects. Java Remote Method Invocation.	08

Text Books:

1. Herbert Schildt, "Java - The Complete Reference", 7th Edition, Tata McGraw Hill.
2. Jim Keogh, "J2EE - The Complete Reference" Tata McGraw Hill.

Reference Books:

5. Y. Daniel Liang, "Introduction to JAVA Programming", 6th Edition, Pearson Education.
6. Stephanie Bodoff et al , "The J2EE Tutorial", 2nd Edition, Pearson Education.
7. "Head First Java", O'Reilly Publication

URL

1. https://nptel.ac.in/courses/106105084
2. https://www.youtube.com/watch?v=OEPaNB-X99Y

Note: Students are informed to visit NPTEL website(http://nptel.ac.in) and Swayam Online Courses website (https://swayam.gov.in) for additional information on the course.

Department: Computer Science and Engineering	
Course title: Mobile Application Development	***Course Code: CS664***
Credits(L:T:P): 4:0:0	***Core/Elective: Elective***
Type of Course: Lecture	***Total Contact Hours: 52***
CIE Marks: 50	***SEE Marks: 100***

Pre-requisite: Object Oriented programming Language, DBMS

Course Outcomes: After completing this course, students should be able to:

CO1: Understand the discipline of Mobile Application Development using J2ME Technology.

CO2: Design and Develop small computing Application with J2ME Architecture

CO3: Implement User Interface for a J2ME application that interact with DBMS

Unit No.	Course Content	Hours
1.	**J2ME Overview** Java 2 Micro Edition and the World of Java, Inside J2ME, J2ME and Wireless Devices. Small Computing Technology: Wireless Technology, Radio Data Networks, Microwave Technology, Mobile Radio Networks, Messaging, Personal Digital Assistants.	08
2.	**J2ME Architecture and Development Environment** J2ME Architecture, Small Computing Device Requirements, Run Time Environment, MIDlet Programming, Java Language for J2ME, J2ME Software Development Kits, Hello World J2ME Style, Multiple MIDlets in a MIDlet Suite, J2ME Wireless Toolkit	08
3	**J2ME Best Practices and Patterns :** The Reality of Working in a J2ME World, Best Practices Commands, Items, and Event Processing J2ME User Interfaces: Display Class, C Command Class, Item Class, Exception	14

	Handling. High Level Display Screens: Screen Class, Alert Class, Form Class, Item Class, List Class, Text Box Class, Ticker Class	
4.	**Record Management System:** Record Storage, Writing and Reading Records, Record Enumeration, Sorting Records, Searching Records, Record Listener. JDBC Objects: The Concept of JDBC, JDBC Driver Types, JDBC Packages, Overview of the JDBC Process, Database Connection, statement Objects, Result set, Transaction Processing, Metadata, Data Types, Exception.	12
5.	**JDBC and Embedded SQL**: Model Programs, Tables, Indexing, Inserting Data into Tables, Selecting Data from a Table, Updating Tables, Deleting Data form a Table, Joining Tables, Calculating Data, Grouping and Ordering Data, Subqueries, VIEWs.	10

Text Book:

1. James Keogh, "J2ME the Complete Reference", Tata McGrawHill, 1st Edition, 2004.

Reference Books:

1. Michael Juntao Yuan, Enterprise J2ME, Developing Mobile Java Applications, Pearson Education, 2004.
2. Ray Rischpater , Beginning Java ME Platform, , Apress, 2009.
3. Sing Li, Jonathan B. Knudsen, Beginning J2ME: From Novice to Professional, Third Edition, Apress, 2005.

URL

1. http://biwatepata.tk/e5bc182fe.html
2. https://www.youtube.com/watch?v=1g2Pdge3-88

Note: Students are informed to visit NPTEL website(http://nptel.ac.in) and Swayam Online Courses website (https://swayam.gov.in) for additional information on the course.

Department: Computer Science and Engineering	
Course title: System Simulation and Modeling	***Course Code:CS665***
Credits(L:T:P): 4:0:0	***Core/Elective: Elective***
Type of Course: Lecture	***Total Contact Hours:52***
CIE Marks : 50	***SEE Marks: 100***

Pre-requisite: Probability and Statistics

Course Outcomes: After completing this course, students should be able to:

CO1: Recall the concepts discrete event system simulation

CO2: Analyzse different statistical methods to solve discrete system problems.

CO3: Apply various distribution techniques to verify and validate the models.

Unit No.	Course Content	Hours
1.	**Introduction to Simulation:** System and System environment, Components of system, Type of systems, Type of models, Steps in simulation study, Advantages and Disadvantages of simulation. Simulation Examples: Simulation of Queuing systems, Other examples of simulation.	12
2.	**General Principles:** Concepts of discrete event simulation, List processing, Simulation Software: Software Characteristics, Simulation Tools; Statistical Models in Simulation: Useful statistical model, Discrete distribution, Continuous distribution, Poisson process, Empirical distribution. Queuing Models: Characteristics of Queuing systems, Queuing notations;	10
3	**Random Number Generation:** Properties of random numbers, Generation of pseudo random numbers, Techniques for generating Random numbers, Tests for random numbers Random Variate Generation: Inverse transform technique, Convolution method, Acceptance rejection techniques;	10
4.	**Input Modeling:** Data Collection, Identifying the Distribution of	12

	data,Parameter estimation, Goodness of fit tests, Selection input model without data, Multivariate and Time series input models.	
5.	**Verification and Validation of Simulation Model**:Model building, Verification, and Validation, Verification of simulation models, Calibration and Validation of models; Output Analysis for a Single Model: Types of simulations with respect to output analysis, Stochastic nature of output data, Measure of performance and their estimation, Output analysis of terminating simulators, Output analysis for steady state simulation, Optimization via simulation.	08

Text Book:

1. Discrete event System simulation by Jerry banks, john carson, barry nelson, david nicol,5th edition Mcgraw hill publications, 2013.

Reference Books:

1. Modeling and Simulation of Discrete- Event Systems by Byoung Kyu Choi, 1st Edition 2013.
2. Introduction To Discrete Event Systems by Lafortune, Christos G., Stephane, Cassandras, 2nd Edition, Springer-verlag,2008.

URL

1. https://www.youtube.com/watch?v=-gYcZt5iKPA
2. https://www.youtube.com/watch?v=P_tbPDQ9RAM

Note: Students are informed to visit NPTEL website(http://nptel.ac.in) and Swayam Online Courses website (https://swayam.gov.in) for additional information on the course.

Semester-VII

Department: Computer Science and Engineering	
Course Title: Computer Architecture	***Course Code: CS710***
Credits(L:T:P): 4:0:1	***Core/Elective: Core***
Type of Course: Lecture, Practical	***TotalContactHours:52:0:26***
CIEMarks:50	***SEEMarks:100***

Pre-requisite: Data structures, Computer Organization

Course Outcomes: After completing this course, students should be able to:

CO1: Investigate the architectural and organizational innovations used in modern computers.

CO2: Analyze the computer architecture through an emphasis on cost-performance-energy trade-offs and good engineering design.

CO3: Evaluate the performance of different architectures with respect to ILP, DLP and TLP.

Unit No.	Course Content	Hours
1.	**Fundamentals of Quantitative design and analysis** Introduction, classes of computers, Defining computer architecture, Trends in technology, power and energy and cost. Dependability. Measuring, Reporting and summarizing performance, Quantitative principles of computer design. Putting It All Together: Performance, Price and Power.	08
2.	**Review of memory Hierarch:** Introduction, Cache Performance, Six Basic Cache Optimizations, Virtual Memory, Protection and Examples of Virtual memory Memory Hierarchy Design: Introduction, Ten Advanced Optimizations of Cache performance, Memory Technology and Optimization, Protection: Virtual	12

	Memory and virtual machines, Putting it all together: Memory Hierarchies in ARM Cortex-A8	
3	**Pipelining:** Basics and Intermediate concepts: Introduction, The Major Hurdles of Pipelining-Pipeline Hazards, How is Pipelining Implemented? **Instruction-Level Parallelism and Its Exploitation – I:** Instruction-Level Parallelism: Concepts and Challenges, Basic compiler Techniques for Exposing ILP, Reducing Branch Costs with Advanced Branch Prediction, Overcoming Data Hazards with Dynamic Scheduling, Dynamic Scheduling: Examples and the Algorithm, Hardware-Based Speculation,	10
4.	**Instruction-Level Parallelism and Its Exploitation – II:** Exploiting ILP Using Multiple Issue and Static Scheduling, Exploiting ILP Using Dynamic Scheduling, Multiple Issue, and Speculation, Advanced Techniques for Instruction Delivery and Speculation, Studies of the Limitations of ILP, Putting it all together: ARM Cortex-A8 **Data-Level Parallelism in Vector, SIMD, and GPU Architectures:** Introduction, Vector Architecture, SIMD Instruction Set Extensions for Multimedia, Graphics Processing	12
5.	**Thread Level Parallelism:** Introduction, Centralized shared memory architectures, Performance of symmetric shared memory multiprocessors, distributed shared memory and directory based coherence, synchronization: The basics, models of memory consistency: An introduction	10

Text book:

1. John L. Hennessy and David A. Patterson. Computer Architecture: A Quantitative Approach, Fifth Edition, Elsevier, 2012.

Reference Books:

1. Kai Hwang: Advanced Computer Architecture - Parallelism, Scalability, Programmability, 2nd Edition, Tata McGraw Hill, 2010.

2. Richard Y. Kain, "Advanced Computer Architecture- A System Design approach", Printice Hall 1996.

URL

1. https://www.youtube.com/watch?v=4TzMyXmzL8M

Note: Students are informed to visit NPTEL website(http://nptel.ac.in) and Swayam Online Courses website (https://swayam.gov.in) for additional information on the course.

Department: Computer Science and Engineering	
Course title: Agile Software Engineering	***CourseCode:CS720***
Credits(L:T:P): 4:0:1	***Core/Elective: Core***
Type of Course: Lecture, Practical	***Total Contact Hours:52:0:26***
CIE Marks: 50	***SEE Marks: 100***

Pre-requisite: Software Engineering

Course Outcomes: After completing this course, students should be able to:

CO1: Apprehend the concepts of agile software development process.

CO2: Analyze and apply different agile software development Techniques.

CO3: Design and develop software systems using Agile concepts.

Unit No.	Course Content	No. of Hours
1.	**Agile: Background and Motivation** Backround: Iterative development, time-boxed iterative development, evolutionary and adaptive development, evolutionary requirement analysis, evolutionary and adaptive Planning, incremental delivery, evolutional delivery, most common mistakes, specific iterative and evolutionary methods. Motivation: The facts of change on software projects, key motivation for iterative development, meeting the requirement challenge iteratively. problems with waterfall.	10
2.	**The foundations of Agile** th agile?, How to be agile, traditional v/s agile projects, Plan driven development v/s agile development, agile and the business, Agile manifesto, agile methods and principles, agile method applicability, Problems with agile methods, agile fear factors, agile criticism, Agile mindset, agile team, agile principles, practices and values, Overview of agile methodologies: extreme	10

	programming(XP), scrum, lean, kanban, dynamic system development method(DSDM), agile project management, unified process etc.	
3	**A generic agile framework** A generic agile process: Agile operating model; Common agile roles: the customer, agile lead, the team, the stakeholders; common agile practices: short feedback loops, face to face communication, daily stand-ups, show and tells, retrospectives, emergent documentation, visual boards, sustainable pace, focus on quality; common agile techniques: stories and backlog refinement, agile estimation, agile planning; Agile testing: what it is, how it differs, agile testing principles and practices, success factors, Roles of agile tester, testing approaches and techniques, testing quadrants, test automation	12
4.	**Extreme Programming(XP)** Understanding XP: Essence of extreme programming, XP and Agile principles, XP Life cycle, XP team, XP concepts User stories, short cycles, acceptance tests, Extreme programming principles: incremental planning, simple release, simple design, sustainable pace, Test first development, refactoring, Pair programming, collective ownership, continuous integration, onsite customer, informative workspace, root cause analysis, Retrospectives	10
5.	**Scrum** Agile and Scrum, Scrum Principles, Scrum-an agile project Management, Scrum-an agile Process, Functionality of scrum: the Scrum process, Sprint, Sprint cycle, Sprint planning meeting, sprint review meeting, daily scrum, scrum board; Scrum roles: Product owner, Scrum Master, the team; scrum artifacts: Product backlog, Sprint Backlog, Burn-down charts; Scrum pros and cons.	10

Text Books:

1. The Art of Agile Development (Pragmatic guide to agile software development), James shore, Chromatic, O'Reilly Media, Shroff Publishers & Distributors, 2007.
   "Agile and Iterative Development A Manger's Guide", Craig Larman Pearson Education, First Edition, India, 2004.
2. Agile Foundations: Principles, practices and frameworks, Peter Measey and Radtac, BCS the charted institute for IT.

Reference Books:

1. Agile software engineering, Orit Hazzan and yael Dubinsky, Springer Publications.
2. Agile Software development : principles patterns and Practices, Robert Cecil Martin,
3. Pearson Education.

URL

1. http://nptel.ac.in/courses/106101061/26

Note: Students are informed to visit NPTEL website(http://nptel.ac.in) and Swayam Online Courses website (https://swayam.gov.in) for additional information on the course.

Department: Computer Science and Engineering	
Course title: Internet of Things (IoT)	***Course Code: CS731***
Credits(L:T:P): 4:0:0	***Core/Elective: Elective***
Type of Course: Lecture	***Total Lecture Hours:52***
CIE Marks : 50	***SEE Marks: 100***

Pre-requisite: Computer Network

Course Outcomes: After completing this course, students should be able to:

CO1: Interpret the impact and challenges posed by IoT networks, compare and contrast the deployment of smart objects and technologies.

CO2: Appraise the role of IoT protocols for efficient network communication and elaborate the need for Data Analytics and Security in IoT.

CO3: Illustrate different sensor technologies for sensing real world entities and identify the applications of IoT in Industry.

Unit No.	Course Content	Hours
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.	10
2.	Smart Objects: The "Things" in IoT, Sensors, Actuators, and Smart Objects, Sensor Networks, Connecting Smart Objects, Communications Criteria, IoT Access Technologies.	10
3.	IP as the IoT Network Layer, The Business Case for IP, The need for Optimization, Optimizing IP for IoT, Profiles and Compliances, Application	10

	Protocols for IoT, The Transport Layer, IoT Application Transport Methods.	
4.	Data and Analytics for IoT, An Introduction to Data Analytics for IoT, Machine Learning, Big Data Analytics Tools and Technology, Edge Streaming Analytics, Network Analytics, Securing IoT, A Brief History of OT Security, Common Challenges in OT Security, How IT and OT Security Practices and Systems Vary, Formal Risk Analysis Structures: OCTAVE and FAIR, The Phased Application of Security in an Operational Environment	10
5.	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, Smart and Connected Cities, An IoT Strategy for Smarter Cities, Smart City IoT Architecture, Smart City Security Architecture, Smart City Use-Case Examples.	12

Text Books:

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, “IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things”, 1stEdition, Pearson Education (Cisco Press Indian Reprint). (ISBN: 978-9386873743)
2. Srinivasa K G, “Internet of Things”,CENGAGE Leaning India, 2017.

Reference Books:

1. Daniel Minoli, “Building the Internet of Things with IPv6 and MIPv6:The Evolving World of M2M Communications”, Wiley, 2013.
2. Arshdeep Bahga, Vijay Madisetti, “Internet of Things: A Hands on Approach” Universities Press., 2015.

URL

1. https://www.youtube.com/playlist?list=PL2UlrhJ_JwyBJWvc9GRCqIIs33cUm-Iqt
2. https://www.youtube.com/watch?v=ug7e2LBQgN4
3. www.youtube.com/watch?v=WUYAjxnwjU4&t=724s
4. Swayam Online Courses website:
   https://swayam.gov.in/courses/4407-introduction-to-internet-of-things

Note: Students are informed to visit NPTEL website(http://nptel.ac.in) and Swayam Online Courses website (https://swayam.gov.in) for additional information on the course.

Educate Elevate Enlighten

JSS Mahavidyapeetha

JSS Science And Technology University

(Established Under JSS Science and Technology University Act No. 43 of 2013)

(Formerly Known as SJCE)

JSS SCIENCE AND TECHNOLOGY UNIVERSITY MYSURU

Department: Computer Science and Engineering	
Course Title: Big Data Analytics	***Course Code: CS732***
Credits(L:T:P): 4:0:0	***Core/Elective: Elective***
Type of Course :Lecture	***Total Contact Hours:52***
CIE Marks: 50	***SEE Marks: 100***

Pre-requisite: Database System

Course Outcomes: After completing this course, students should be able to:

CO1: Describe Big data with other data and identify computing platforms available for Big data

CO2: Distinguish stream computing and summarize analytical techniques for real time stream applications

CO3: Apply frameworks, analytical and visualization techniques for solving big data related problems

Unit No.	Course Content	No. of Hours
1.	**Introduction To Big Data:** What Is Big Data? Is The "Big" Part Or The "Data" Art More Important? How Is Big Data Different? How Is Big Data More Of The Same? Risks Of Big Data -Why You Need To Tame Big Data -The Structure Of Big Data- Exploring Big Data, Most Big Data Doesn't Matter- Filtering Big Data Effectively -Mixing Big Data With Traditional Data- The Need For Standards-Today's Big Data Is Not Tomorrow's Big Data. Web Data: The Original Big Data -Web Data Overview -What Web Data Reveals -Web Data In Action? A Cross-Section Of Big Data Sources And The Value They Hold.	12
2.	**Data Analysis:** Evolution Of Analytic Scalability, Convergence, Parallel Processing Systems, Cloud Computing , Grid Computing , Map Reduce , Enterprise Analytic Sand Box , Analytic Data Sets , Analytic Methods , Analytic Tools : Cognos, Microstrategy , Pentaho. Analysis Approaches , Statistical Significance , Business Approaches , Analytic Innovation , Traditional Approaches , Iterative	08

3	**Mining Data Streams :** Introduction To Streams Concepts, Stream Data Model And Architecture, Stream Computing, Sampling Data In A Stream, Filtering Streams, Counting Distinct Elements In A Stream, Estimating Moments, Counting Oneness In A Window, Decaying Window, Realtime Analytics Platform(RTAP) Applications, Case Studies, Real Time Sentiment Analysis, Stock Market Predictions.	10
4.	**Frequent Itemsets And Clustering :** Mining Frequent Itemsets , Market Based Model – Apriori Algorithm , Handling Large Data Sets In Main Memory , Limited Pass Algorithm, Counting Frequent Itemsets In A Stream , Clustering Techniques , Hierarchical , K- Means , Clustering High Dimensional Data , CLIQUE And PROCLUS , Frequent Pattern Based Clustering Methods , Clustering In Non-Euclidean Space , Clustering For Streams And Parallelism.	12
5.	**Frameworks And Visualization :** Mapreduce , Hadoop, Hive, Mapr , Sharding , Nosql Databases S3 , Hadoop Distributed File Systems , Visualizations ,Visual Data Analysis Techniques, Interaction Techniques; Systems And Applications:	10

Text Books:

1. Bill Franks, Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with advanced analytics, John Wiley & sons, 2012
2. Anand Rajaraman and Jeffrey David Ullman, Mining of Massive Datasets, Cambridge University Press, 2014.

Reference Books:

1. Paul Zikopoulos, Chris Eaton, Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data: Analytics for Enterprise Class Hadoop and Streaming Data, McGraw Hill Professional, 2011.
2. Michael Berthold, David J. Hand, Intelligent Data Analysis, Springer, 2007.
3. Glenn J. Myatt, Making Sense of Data, John Wiley & Sons, Pete Warden, Big Data Glossary, O‟Reilly
4. Alex Holmes “Hadoop in Practice”, Manning Press, Dreamtech Press.
5. Dan McCreary and Ann Kelly “Making Sense of NoSQL” – A guide for managers and the rest of us, Manning Press.

URL

1. https://www.youtube.com/watch?v=3SK9iJNYehg
2. http://nptel.ac.in/courses/106104135/48

Note: Students are informed to visit NPTEL website(http://nptel.ac.in) and Swayam Online Courses website (https://swayam.gov.in) for additional information on the course.

Department: Computer Science and Engineering	
Course title: Distributed Computing Systems	***Course Code:CS733***
Credits(L:T:P): 4:0:0	***Core/Elective: Elective***
Type of Course: Lecture	***Total Contact Hours:52***
CIE Marks : 50	***SEE Marks: 100***

Pre-requisite: Computer Network, Operating System

Course Outcomes: After completing this course, students should be able to:

CO1: Describe different concepts of distributed computing techniques and methodologies. Know about the communication and interconnection architecture of multiple computer systems.

CO2: Understand the application of fundamental Computer Science methods and algorithms in the development of distributed applications

CO3: Design and develop various distributed computing applications.

Unit No.	Course Content	No. of Hours
1.	**Basic Distributed System Concepts:** Introduction, What is a Distributed System?, Architectures for Distributed Systems, Distributed Computing Models, Comparison of the Distributed Computing Models, Advantages of Distributed Systems, Disadvantages of Distributed Systems, Software Concepts, Network Operating System, Distributed Operating System, Multiprocessor Time-Sharing System, Comparison of Different Operating Systems, Design issues in distributed systems: Transparency, Flexibility, Reliability , Performance, Scalability, Security, Fault Tolerance, Client-Server Model, Basic Concepts, Client-Server Addressing, Client-Server Implementation, Client-Server Architecture, Network Communication: LAN and WAN Technologies:	10

	Introduction to LAN and WAN , Classification of Networks, Protocols for Network Systems: The ISO/OSI Reference Model, Internet Protocols, Asynchronous Transfer Mode: Introduction to ATM, ATM Protocol Reference Model, Protocols for Distributed Systems: Fast Local Internet Protocol (FLIP), Versatile Message Transfer Protocol.	
2.	**Inter process Communication:** Message Passing: Introduction to Message Passing, Advantages and Features of Message-Passing Systems, IPC Message Format, IPC Synchronization, Message Buffering Strategies, Multi-datagram Messaging, Process Addressing Techniques, Failure Handling Mechanism, Group Communication, Types of Group Communication: Group Management, Group Addressing and Message Delivery, Reliability Mechanism, Message Ordering, API for Internet Protocol: Synchronous and Asynchronous Communications, Sockets, UDP and TCP, Java API for UDP and TCP Protocols, **Remote Communication:** Introduction to Remote Communication, Middleware, Remote Procedural Call Basics, Basic RPC Operation, Stub Generation in RPC, RPC Implementation, RPC Messages, Parameter Passing Semantics, Server Management, RPC Communication, RPC Call Semantics, RPC Communication Protocols, Client-Server Binding, Other RPC Issues, Exception Handling and Security, RPC in Heterogeneous Environment, Failure Handling, RPC Optimization, Complicated and Special RPCs, Case Study: Sun RPC, Remote Method Invocation Basics, Distributed Object Concepts, RMI Implementation, Design Issues in RMI, RMI Execution, Types of Objects, Binding a Client to an Object, RMI Parameter Passing.	10
3	**Synchronization:** Introduction, Clock synchronization: Physical Clocks, Use of Synchronized Clocks, Logical clocks: Event Ordering, Implementation of logical clock, Lamport's Timestamps, Vector Timestamps, Global state, Mutual exclusion: Centralized Algorithm, Distributed Algorithm, Token Ring Algorithm, Comparison of Various Algorithms, Election algorithms: Bully algorithm, Ring algorithm, Election in wireless networks, Deadlocks in Distributed systems: Modelling, Handling Deadlock, Prevention, Detection, Recovery, Issues in Recovery from Deadlocks.	10
4.	**Distributed System Management:** Introduction, Resource Management: Desirable Features of a Global Scheduling Algorithm, Resource Management, Task Assignment Approach, Load Balancing Approach, Load Sharing Approach, Process Management and Migration, Threads, Fault Tolerance.	10
5.	**Distributed Shared Memory:** DSM Concepts, Hardware DSM, Design Issues	12

	in DSM Systems, Implementing Issues in DSM Systems, Heterogeneous and other DSM systems, **Distributed File System:** Introduction DFS, File Models, DFS Design, Semantics File Sharing, DFS Implementation, File Caching in DFS, Replication in DFS, Sun Network File System, Google File System, Emerging Trends in Distributed Systems, **Emerging Trends in Distributed Computing:** Introduction, Grid Computing, Service Oriented Architecture, Cloud Computing, The Future of Emerging Trends.	

Text Book:

1. Sunita Mahajan, Seema Shah, "Distributed Computing", Oxford, second edition

Reference Books:

1. Andrew S Tanenbaum and Maarten van Steen "Distributed systems: principles and paradigms", 2007 Pearson Education. Inc, second edition.
2. Coulouris, Dollimore, Kindberg & Blair "Distributed Systems: Concepts and Design, 5th Edition", Fifth Edition.
3. http://nptel.ac.in/courses/117105101/

URL

1. https://www.youtube.com/watch?v=ylbDPIUlNQQ
2. https://www.youtube.com/watch?v=RZy1JOBpFJI
3. http://slideplayer.com/slide/9448481/

Note: Students are informed to visit NPTEL website(http://nptel.ac.in) and Swayam Online Courses website (https://swayam.gov.in) for additional information on the course

Department: Computer Science and Engineering	
Course title: Multimedia Communication	***Course Code: CS734***
Credits(L:T:P): 4:0:0	***Core/Elective: Elective***
Type of Course: Lecture	***Total Lecture Hours: 52***
CIEMarks:50	***SEEMarks:100***

Pre-requisite: Data Structures, Design and Analysis of Algorithms

Course Outcomes: After completing this course, students should be able to:

CO1: Gain knowledge on multimedia hardware, supporting operating system, media types and its extensions.

CO2: Analysis and design of multimedia techniques.

CO3: Apply algorithms for representing real world multimedia data.

Unit No.	Course Content	No. of Hours
1.	**Introduction, Media and Data Streams, Audio Technology** : Multimedia Elements; Multimedia Applications; Multimedia Systems Architecture; Evolving Technologies for Multimedia Systems; Defining Objects for Multimedia Systems; Multimedia Data Interface Standards; The need for Data Compression; Multimedia Databases. Media: Perception Media, Representation Media, Presentation Media, Storage Media, Transmission Media, Information Exchange Media, Presentation Spaces & Values, and Presentation Dimensions; Key Properties of a Multimedia System: Discrete & Continuous Media, Independence Media, Computer Controlled Systems, Integration; Characterizing Data Streams: Asynchronous Transmission Mode, Synchronous Transmission Mode, Isochronous Transmission Mode; Characterizing Continuous Media Data Streams. Sound: Frequency, Amplitude, Sound Perception and Psychoacoustics; Audio Representation on Computers; Three Dimensional Sound Projection; Music and MIDI Standards; Speech Signals; Speech Output; Speech Input;	12

	Speech Transmission.	
2.	**Graphics and Images, Video Technology, Computer-Based Animation :** Capturing Graphics and Images Computer Assisted Graphics and Image Processing; Reconstructing Images; Graphics and Image Output Options. Basics; Television Systems; Digitalization of Video Signals; Digital Television; Basic Concepts; Specification of Animations; Methods of Controlling Animation; Display of Animation; Transmission of Animation; Virtual Reality Modelling Language.	12
3	**Data Compression:** Storage Space; Coding Requirements; Source, Entropy, and Hybrid Coding; Basic Compression Techniques; JPEG: Image Preparation, Lossy Sequential DCT-based Mode, Expanded Lossy DCT-based Mode, Lossless Mode.	08
4.	**Optical Storage Media and Content Analysis:** History of Optical Storage; Basic Technology; Video Discs and Other WORMs; Compact Disc Digital Audio; Compact Disc Read Only Memory; CD-ROM Extended Architecture; Further CD-ROM-Based Developments; Compact Disc Recordable; Compact Disc Magneto-Optical; Compact Disc Read/Write; Digital Versatile Disc. Simple Vs. Complex Features; Analysis of Individual Images; Analysis of Image Sequences; Audio Analysis; Applications.	10
5.	**Data and File Format Standards and Multimedia Application Design:** Rich-Text Format; TIFF File Format; Resource Interchange File Format (RIFF); MIDI 106 File Format; JPEG DIB File Format for Still and Motion Images; AVI Indeo File Format; MPEG Standards; TWAIN Multimedia Application Classes; Types of Multimedia Systems; Virtual Reality Design; Components of Multimedia Systems; Organizing Multimedia Databases; Application Workflow Design Issues; Distributed Application Design Issues.	10

Text Book:

1. Ralf Steinmetz, Klara Narstedt: Multimedia Fundamentals: Vol 1-Media Coding and Content Processing, 2nd Edition, Pearson Education, 2002. (Reprint 2014).

Reference Books:

1. Prabhat K. Andleigh, Kiran Thakrar: Multimedia Systems Design, 1st Edition, PHI, 2015.
2. K.R Rao, Zoran S. Bojkovic and Dragorad A. Milovanovic: Multimedia Communication Systems: Techniques, Standards, and Networks, 2nd Edition, PHI Learning, 2009.

URL

1. https://onlinecourses.nptel.ac.in/multimediacommunication Course offered by IIT Khanapur
2. http://www.nptelvideos.in/2012/11/multimedia-and-its-applications.html
3. https://freevideolectures.com/course/multimediacomputing

Note: Students are informed to visit NPTEL website(http://nptel.ac.in) and Swayam Online Courses website (https://swayam.gov.in) for additional information on the course.

Department: Computer Science and Engineering	
Course Title: Web Technologies	***Course Code: CS735***
Credits(L:T:P): 4:0:0	***Core/Elective: Elective***
Type of Course: Lecture	***Total Contact Hours: 52***
CIE Marks: 50	***SEE Marks:100***

Pre-requisite: Nil

Course Outcomes: After completing this course, students should be able to:

CO1: Analyze and associate the basic building blocks of client and server side web pages

CO2: Apply and analyze the use of scripting languages and Document object modelling to transfer data and add interactive components to web pages

CO3: Design and Develop dynamic Web-based applications to interact with server and database with good aesthetic sense

Unit No.	Course Content	Hours
1.	**Introduction to HTML** What Is HTML and Where Did It Come from?, HTML Syntax, Semantic Markup, Structure of HTML Documents, Quick Tour of HTML Elements, HTML5 Semantic Structure Elements, Introducing Tables, Introducing Forms, Form Control Elements.	10
2.	**Introduction to Styles sheets and Frameworks** Introduction to CSS, What Is CSS, CSS Syntax, Location of Styles, Selectors, The Cascade: How Styles Interact, The Box Model, CSS Text Styling, Positioning Elements, Floating Elements, Responsive Design, CSS Frameworks	10
3	**JavaScript: Client-Side Scripting** What Is JavaScript and What Can It Do? , Client-Side Scripting, JavaScript's History and Uses, Where Does JavaScript Go?, Syntax, JavaScript Objects, The	12

	Document Object Model (DOM), JavaScript Events, Forms. **jQuery Foundations**, Including jQuery in Your Pagex, jQuery Selectors, jQuery Attributes, jQuery Listeners, Modifying the DOM	
4.	**Introduction to Server-Side Development with PHP** What Is Server-Side Development?, Quick Tour of PHP, Program Control, Functions, Arrays, $_GET and $_POST Superglobal Arrays, $_SERVER Array, $_FILES Array, Reading/Writing Files, Accessing MySQL in PHP, Sample Database Techniques	12
5.	**Introduction to Data Interchange Format** XML Overview, Well-Formed XML, Valid XML, XSLT, XPath, XML Processing, XML Processing in JavaScript, XML Processing in PHP, JSON, Using JSON in JavaScript, Using JSON in PHP	8

Text Book:

1. Randy Connolly, Ricardo Hoar, "Fundamentals of Web Development", 1st Edition, Pearson Education India. 2015.

Reference Books:

1. Luke Welling, Laura Thomson, "PHP and MySQL Web Development", 5th Edition, Pearson Education, 2016. (ISBN:978-9332582736)
2. Nicholas C Zakas, "Professional JavaScript for Web Developers", 3rd Edition, Wrox/Wiley India, 2012. (ISBN:978-8126535088)
3. Jeffrey C. Jackson: Web Technologies- A Computer Science Perspective, Pearson Education, Eleventh Impression, 2012.

URL

1. NPTEL : http://nptel.ac.in/courses/106105084/

Note: Students are informed to visit NPTEL website(http://nptel.ac.in) and Swayam Online Courses website (https://swayam.gov.in) for additional information on the course.

.

Educate Elevate Enlighten

JSS Mahavidyapeetha

JSS Science And Technology University

(Established Under JSS Science and Technology University Act No. 43 of 2013)

(Formerly Known as SJCE)

JSS SCIENCE AND TECHNOLOGY UNIVERSITY MYSURU

Department: Computer Science and Engineering	
Course Title: Optimization Techniques	***Course Code: CS741***
Credits(L:T:P):4:0:0	***Core/Elective:Elective***
Type of Course: Lecture	***Total Contact Hours:52***
CIE Marks: 50	***SEE Marks: 100***

Pre-requisite: Engineering Mathematics

Course Outcomes: After completing this course, students should be able to:

CO1: Examine the Linear programming models and analyze the various problem solving techniques

CO2: Design and solve transportation and assignment problems for a given LP system

CO3: Analyze the applications of decision analysis, game theory and heuristic approaches for problem solving

Unit No.	Course Content	No. of Hours
1.	**1. Introduction, Linear Programming** Introduction: The origin, nature and impact of OR; Defining the problem and gathering data; Formulating a mathematical model; Deriving solutions from the model; Testing the model; Preparing to apply the model; Implementation . Introduction to Linear Programming: Prototype example; The linear programming (LP) model. Assumptions of LP; Additional examples.	12
2.	**2. Simplex Method and Duality Theory:** The essence of the simplex method; Setting up the simplex method; Algebra of the simplex method; The simplex method in tabular form; Tie breaking in the simplex method. Adapting to other model forms; The essence of sensitivity analysis; Applying sensitivity analysis. The essence of duality theory; Economic interpretation of duality. Primal dual relationship; Adapting to other primal forms. The role of duality in sensitive analysis; The dual simplex method;	12

3	**Transportation and Assignment Problems** The transportation problem; A streamlined simplex method for the transportation problem; The assignment problem; A special algorithm for the assignment problem.	10
4.	**Game Theory, Decision Analysis** Game Theory: The formulation of two persons, zero sum games; Solving simple games- a prototype example; Games with mixed strategies; Graphical solution procedure; Solving by linear programming, Extensions. Decision Analysis: A prototype example; Decision making without experimentation; Decision making with experimentation; Decision trees.	10
5.	**Meta heuristics** The nature of Meta heuristics, Tabu Search, Simulated Annealing, Genetic Algorithms	08

Text Books:

1. Frederick S. Hillier and Gerald J. Lieberman: Introduction to Operations Research, 10th Edition, Tata McGraw Hill, 2015.
2. S D Sharma: Operations Research, 15th edition, Kedar Nath Ram Nath, 2002.

Reference Books:

1. Wayne L. Winston: Operations Research Applications and Algorithms, 4th Edition, Thomson Course Technology, 2003.
2. Hamdy A Taha: Operations Research: An Introduction, 8th Edition, Prentice Hall India, 2007.

URL

1. https://www.youtube.com/watch?v=SHbb9dV-we8
2. https://www.youtube.com/watch?v=eo2tOPV3AoE

Note: Students are informed to visit NPTEL website(http://nptel.ac.in) and Swayam Online Courses website (https://swayam.gov.in) for additional information on the course.

Educate Elevate Enlighten

JSS Mahavidyapeetha

JSS Science And Technology University

(Established Under JSS Science and Technology University Act No. 43 of 2013)

(Formerly Known as SJCE)

JSS SCIENCE AND TECHNOLOGY UNIVERSITY MYSURU

Department: Computer Science and Engineering	
Course title: Human Computer Interactions	***Course Code: CS742***
Credits(L:T:P): 4:0:0	***Core/Elective: Elective***
Type of Course: Lecture	***Total Contact Hours:52***
CIE Marks : 50	***SEE Marks: 100***

Pre-requisite: Nil

Course Outcomes: After completing this course, students should be able to:

CO1: Understanding of user interfaces and detect usability problems by doing usability studies (observations) with human subjects

CO2: Analyzse a complex interactive system into simpler components, using appropriate design patterns

CO3: Apply an appropriate interaction style for a given need GUI, command-line, natural language, etc., Choose appropriate widgets for a GUI.

Unit No.	Course Content	No. of Hours
1.	**Course Overview:** Why Design for Usability? Historical Perspective: machinery, the PC, the GUI, the Web, Possible Futures Human Perception and Information Presentation, Perception, gestalt perception, typography, Color, Graphic design, Displays, Paper, and other Output Devices Information Visualization.	10
2.	**The Human Body and Device Design:** Input Devices and Ergonomics, Virtual Reality. Low-Level Human Cognition: Time-scales and the Illusion of Multi-Tasking, GOMS Keystroke-Level Modeling, Hypothesis Testing and Statistical Significance Higher Cognition and Interaction Styles: Metaphor, Direct Manipulation, Widget Survey, Command Languages, Other Interaction Styles, Choosing Among Interaction Styles	10

3	**Usability Engineering:** Observing Users , Mindset, Subject-Running Techniques, Usability Studies. Usability Analysis: Error Handling, Error Prevention, Cognitive Walkthroughs, Heuristic Evaluation, Usability Guidelines, Choosing Among Usability Methods Specifying and Prototyping: Low-Fidelity Prototyping, Transition Diagrams, Visual Basic Prototyping Task Analysis and User-centered Design: Systems Analysis Techniques: Task Decomposition, CARD, Ethnographic Observation, Allocation of Functions, Usability Engineering in the Business Context.	10
4.	**Interface Design and Programming**: Forms Design, Interface Design Patterns Development Tools, Events and Handlers, MVC, Responsiveness Issues. Web Usability: Content Analysis, Information Architecture, Supporting Navigation, Implementation: HTML, CSS, JavaScript, Browser and Device (In)Dependence , Assigning Functions to Client and Server	10
5.	**Special Application Areas:** Small-Screen/Mobile Devices, Group ware Spoken Dialog Systems, Strengths and Weakness of Speech, Games	12

Text Book:

1. Designing the User Interface by Ben Shneiderman and Catherine Plaisant, 5th Edition.. Addison Wesley, 2010.

Reference Books:

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, "Human Computer Interaction", 3rd Edition, Pearson Education, 2010.
2. Brian Fling, "Mobile Design and Development", First Edition , O'Reilly Media Inc., 2009
3. Bill Scott and Theresa Neil, "Designing Web Interfaces", First Edition, O'Reilly, 2009.

URL

1. https://www.youtube.com/watch?v=_Mwdrbmpkk4
2. https://www.youtube.com/watch?v=tu2OsSawaaM

Note: Students are informed to visit NPTEL website(http://nptel.ac.in) and Swayam Online Courses website (https://swayam.gov.in) for additional information on the course.

Educate Elevate Enlighten

JSS Mahavidyapeetha

JSS Science And Technology University

(Established Under JSS Science and Technology University Act No. 43 of 2013)

(Formerly Known as SJCE)

JSS SCIENCE AND TECHNOLOGY UNIVERSITY MYSURU

Department: Computer Science and Engineering	
Course title: Cryptography and Network Security	***Course Code: CS743***
Credits(L:T:P): 4:0:0	***Core/Elective: Elective***
Type of Course: Lecture	***Total Contact Hours: 52***
CIEMarks:50	***SEE Marks: 100***

Pre-requisite: Computer Network

Course Outcomes: After completing this course, students should be able to:

CO1: Attain the knowledge of various cryptographic techniques and network security concepts.

CO2: Analyze and apply cryptographic and network security algorithms.

C03: Realize the role of security at different OSI layers of network.

Unit No.	Course Content	No. of Hours
1.	**Encryption techniques and Data Encryption Standards** ***Introduction:*** Computer security concepts, OSI security Architecture, Security attacks and Services, Security mechanism and model for Network Security. ***Classical Encryption Techniques*:** Symmetric Cipher Model, Substitution Techniques: Caesar Cipher, Mono alphabetic Cipher, Play fair Cipher, Hill Cipher, Polyalphabetic Cipher, Onetime Pad. Transposition Techniques, Steganography ***Traditional Block Cipher:*** Feistel structure, Block cipher design Principles. Data Encryption Standard(DES), DES example, The Strength of DES, Multiple encryption and Triple DES	12
2.	**Public-Key cryptography and Hash Functions function** ***Public-Key cryptography:*** Principles of Public-Key Cryptosystems, The RSA Algorithm, Diffie-Hellman Key Exchange.	10

	***Cryptographic Hash Functions*:** Applications of Cryptographic Hash Functions, Two simple hash functions, Requirements and security, secure hash algorithm (SHA).	
3	**Authentication and Key Management** ***Message Authentication*:** Authentication Requirements, Authentication Functions, Message Authentication Codes (MAC), Security of MACs, HMAC. Authentication Applications: Kerberos, Digital signature. ***User authentication*:** Remote user authentication principles, Remote user Authentication using symmetric Encryption, Remote user authentication using Asymmetric Encryption. ***Key Distribution:*** Symmetric key distribution using symmetric and asymmetric encryption, Distribution of public keys.	12
4.	**Security at Application layer and Transport Layer** ***Application Layer Security:*** Pretty Good Privacy (PGP), Multipurpose Internet Mail Extensions (MIME) and secured Multipurpose internet Mail extensions(S/MIME). ***Transport Layer Security:*** Web security considerations, Secure socket layer (SSL), Transport Layer security.	10
5.	**Network Security** ***IP Security:*** IP Security Overview, IP Security Policy, Encapsulation Security Payload(ESP), ***Wireless network security:*** wireless security, Mobile device security.	08

Text Book:

1. William Stallings, "Cryptography and Network Security", Sixth Edition, 2016, Pearson Education Inc Publishing as Prentice hall (PHI).

Reference Books:

1. Behrouz A forouzan, debdeep Mukhopadhyay, "Cryptography and Network security", 3rd edition, Mc Graw Hill education, 2015.
2. Charles P. Pfleeger, Shari Lawrence Pfleeger – Security in computing Third Edition –

URL

1. https://onlinecourses.nptel.ac.in/noc18_cs07 Course offered by IIT KHARAGPUR
2. http://www.nptelvideos.in/2012/11/cryptography-and-network-security.html by Prof. D. Mukhopadhyay.
3. http://geek4arab.net/?cat=2829

4. https://freevideolectures.com/course/3027/cryptography-and-network-security/39
5. https:// www.cse.wustl.edu/~jain/cse571-14 by Raj Jain, Washington University in saint Louis.

Note: Students are informed to visit NPTEL website(http://nptel.ac.in) and Swayam Online Courses website (https://swayam.gov.in) for additional information on the course.

Department: Computer Science and Engineering	
Course title: Data Compression	***Course Code: CS744***
Credits(L:T:P): 4:0:0	***Core/Elective: Elective***
Type of Course: Lecture	***Total Contact Hours: 52***
CIE Marks: 50	***SEE Marks: 100***

Pre-requisite: Engineering Mathematics, Discrete Mathematical Structures

Course Outcomes: After completing this course, students should be able to:

CO1: Acquire knowledge on lossless, lossy compression techniques and its extensions.

CO2: Simulate the working of various compression algorithms.

CO3: Design and implement compression techniques for real world applications.

Unit No.	Course Content	No. of Hours
1.	**Introduction, Lossless Compression - 1:** Compression techniques; Modeling and coding. Mathematical preliminaries for lossless compression: Overview; Basic concepts of Information Theory; Models; Coding; Algorithmic information theory; Minimum description length principle. Huffman coding: Overview; The Huffman coding algorithm, Minimumvariance Huffman codes; Application of Huffman coding for text compression.	08
2.	**Lossless Compression – 2:** Dictionary Techniques: Overview; Introduction; Static dictionary; Adaptive dictionary; Applications: UNIX compress, GIF, PNG, V.42. Lossless image compression: Overview; Introduction; Basics; CALIC; JPEG-LS; Multiresoution approaches; Facsimile encoding: Run-length coding, T.4 and T.6.	12
3	**Basics of Lossy Coding:** Some mathematical concepts: Overview; Introduction; Distortion criteria; Models. Scalar quantization: Overview; Introduction; The quantization problem; Uniform quantizer; Adaptive quantization.	08
4.	**Vector Quantization, Differential Encoding:**Vector quantization: Overview;	12

	Introduction; Advantages of vector quantization over scalar quantization; The LBG algorithm. Differential Encoding: Overview; Introduction; The basic algorithm; Prediction in DPCM; Adaptive DPCM; Delta modulation; Speech coding; Image coding.	
5.	**Some Mathematical Concepts, Transform coding, Subband Coding and Audio Coding:** Some mathematical concepts: Linear systems; Sampling; Discrete Fourier transform; Z-transform. Transform coding: Overview; introduction; The transform; Transforms of interest; Quantization and coding for transform coefficients; Application to image compression – JPEG; Application to audio compression – MDCT. Subband Coding: Overview; introduction; Filters; The basic subband coding algorithm; Bit allocation; Application to speech coding – G.722; Application to audio coding – MPEG audio; Application to image compression. Audio Coding: Overview; Introduction; MPEG audio coding; MPEG advanced audio coding; Dolby AC3; Other standards.	12

Text Book:

1. Khalid Sayood: Introduction to Data Compression, 5th Edition, Morgan Kaufmann, Elsevier, 2017.

Reference Books:

1. Adam Drozdek: Elements of Data Compression, Cengage Learning India, 2009.
2. D. Salomon: Data Compression: The Complete Reference, 4th Edition, Springer, 2007.

URL

1. https://onlinecourses.nptel.ac.in/datacompression Course offered by IIT Kharagpur.
2. http://www.nptelvideos.in/2012/11/datacompression-techniques.html.
3. https://freevideolectures.com/course/datacompression.

Note: Students are informed to visit NPTEL website(http://nptel.ac.in) and Swayam Online Courses website (https://swayam.gov.in) for additional information on the course.

Educate Elevate Enlighten

JSS Mahavidyapeetha

JSS Science And Technology University

(Established Under JSS Science and Technology University Act No. 43 of 2013)

(Formerly Known as SJCE)

JSS SCIENCE AND TECHNOLOGY UNIVERSITY MYSURU

Department: Computer Science and Engineering	
Course title: Software Architecture	***Course Code: CS745***
Credits(L:T:P): 4:0:0	***Core/Elective:Elective***
Type of Course: Lecture	***Total Contact Hours: 52***
CIE Marks: 50	***SEE Marks:100***

Pre-requisite: Software Engineering

Course Outcomes: After completing this course, students should be able to:

CO1: Infer and associate various software architectural styles and patterns viewing the importance of documentation for a non-trivial system .

CO2: Apply and analyse the various architectural styles and patterns for distributed Systems.

CO3: Design and develop architectural styles and patterns for adaptive systems achieving quality attributes with documentation.

Unit No.	Course Content	No. of Hours
1.	**Introduction, Architectural Styles and Case Studies:** The Architecture Business Cycle: Where do architectures come from? Software processes and the architecture business cycle; What makes a "good" architecture? What software architecture is and what it is not; Other points of view; Architectural patterns, reference models and reference architectures; Importance of software architecture; Architectural structures and views. Architectural styles; Pipes and filters; Data abstraction and object-oriented organization; Event-based, implicit invocation; Layered systems; Repositories; Interpreters; Process control; Other familiar architectures; Heterogeneous architectures. Case Studies: Keyword in Context; Instrumentation software; Mobile robotics; Cruise control; Three vignettes in mixed style.	12
2.	**Understanding and Achieving Quality Attributes:** Functionality and architecture; Architecture and quality attributes; System quality attributes; Quality attribute scenarios in practice; Other system quality attributes; Business	10

	qualities; Architecture qualities. Achieving Quality: Introducing tactics; Availability tactics; Modifiability tactics; Performance tactics; Security tactics; Testability tactics; Usability tactics; Relationship of tactics to architectural patterns; Architectural patterns and styles.	
3	**Architectural Patterns – From Mud to Structures, Distributed:** Introduction: From mud to structure: Layers, Pipes and Filters, Blackboard. Distributed Systems: Broker; Interactive Systems: MVC, Presentation-Abstraction-Control	12
4.	**Adaptable Systems & Other systems:** Adaptable Systems: Microkernel; Reflection. Structural decomposition: Whole – Part; Organization of work: Master – Slave; Access Control: Proxy	10
5.	**Designing and Documenting Software Architecture:** Architecture in the life cycle; Designing the architecture; Forming the team structure; Creating a skeletal system.Uses of architectural documentation; Views; Choosing the relevant views; Documenting a view; Documentation across views.	08

Text Books:

1. Len Bass, Paul Clements, Rick Kazman: Software Architecture in Practice, 3d Edition, Pearson Education, 2013.
2. Frank Buschmann, Regine Meunier, Hans Rohnert, Peter Sommerlad, Michael Stal: Pattern- Oriented Software Architecture, A System of Patterns, Volume 1, John Wiley and Sons, 2012.
3. Mary Shaw and David Garlan: Software Architecture -Perspectives on an Emerging Discipline, Prentice Hall of India, 2007.

Reference Books:

1. Richard N. Taylor, NenadMedvidovic and Eric M. Dashofy: Software Architecture: Foundations, Theory, and Practice, Wiley-India 2012.
2. http://www.nptel.ac.in/syllabus/106104027/

URL

1. https://www.youtube.com/watch?v=x30DcBfCJRI
2. https://www.youtube.com/watch?v=W_RH7Q6rinI

Note: Students are informed to visit NPTEL website(http://nptel.ac.in) and Swayam Online Courses website (https://swayam.gov.in) for additional information on the course.

Semester–VIII

Department: Computer Science and Engineering	
Course title: Enterprise Resource Planning	***Course Code: CS810***
Credits(L:T:P): 4:0:0	***Core/Elective: Core***
Type of Course: Lecture	***Total Contact Hours:52***
CIE Marks: 50	***SEE Marks: 100***

Pre-requisite: Nil.

Course Outcomes: After completing this course, students should be able to:

CO1: Comprehend the basic use of Enterprise software, and its role in integrating business functions.

CO2: Analyze the implementation strategies, methodologies, deployment methods and business modules of ERP systems.

CO3: Explore and appreciate some popular products, relevant technologies, current and future trends in the area of ERP.

Unit No.	Course Content	No. of Hours
1.	**INTRODUCTION AND RELATED TECHNOLOGIES:** Enterprise – An Overview, Introduction to ERP, Benefits of ERP ERP and Related Technologies, Business Process Reengineering (BPR), Data Warehousing and Data Mining, Online analytical processing (OLAP), Product Life Cycle Management, Supply Chain Management (SCM), Customer relationship management (CRM)	12
2.	**ERP IMPLEMENTATION:** Implementation challenges, ERP Implementation Strategies, ERP Implementation Lifecycle, Implementation Methodologies, ERP Deployment	12

	Methods, Vendors and Consultants, Contracts with Vendors, Consultants and Employees, Project Management and Monitoring	
3	**THE BUSINESS MODULES:** Business modules in an ERP Package, Financials, Manufacturing, Human Resources Management, Plant Maintenance, Materials Management, Quality Management, Sales, Distribution and Service	10
4.	**THE ERP MARKET:** ERP Market Place and Marketplace Dynamics, ERP Vendors, SAP AG, Oracle Corporation, Microsoft Dynamics, Infor, Epicor, Sage Group PLC, Plex Systems, QAD, 31 Infotech, Ramco systems	08
5.	**ERP – PRESENT AND FUTURE:** Turbo Charge the ERP System, Enterprise Application Integration (EAI), ERP and E-Business, ERP, Internet and WWW, Future Directions and Trends in ERP	10

Text Book:

1. Alexis Leon, "ERP Demystified", Third Edition, Tata McGraw Hill, 2012

Reference Books:

1. Joseph A Brady, Ellen F Monk, Bret Wagner, "Concepts in Enterprise Resource Planning", Thompson Course Technology, USA, 2001.
2. Vinod Kumar Garg "Enterprise Resource Planning Concepts and Practice", Second Edition of PHI Edition 2008.

URL

1. http://nptel.ac.in/courses/110105083/1 and series of lectures
2. https://www.youtube.com/watch?v=E0tgKVOxihI and other related videos

Note: Students are informed to visit NPTEL website(http://nptel.ac.in) and Swayam Online Courses website (https://swayam.gov.in) for additional information on the course.

Educate Elevate Enlighten

JSS Mahavidyapeetha

JSS Science And Technology University

(Established Under JSS Science and Technology University Act No. 43 of 2013)

(Formerly Known as SJCE)

JSS SCIENCE AND TECHNOLOGY UNIVERSITY MYSURU

Department: Computer Science and Engineering	
Course title :Pattern Classification	***Course Code: CS821***
Credits(L:T:P): 4:0:0	***Core/Elective: Elective***
Type of Course: Lecture	***Total Contact Hours:52***
CIE Marks:50	***SEE Marks: 100***

Pre-requisite: Nil.

Course Outcomes: After completing this course, students should be able to:

CO1: Infer and associate various feature extraction, pattern classification and clustering techniques.

CO2: Apply and analyse the effects of Parametric and Non-Parametric techniques used for reduced features in pattern classification of different data samples.

CO3: Design and develop real world applications using Parametric and Non-Parametric techniques for pattern classification.

Unit No.	Course Content	No. of Hours
1.	**Introduction:** Applications of Pattern Recognition, Statistical Decision Theory, Image processing and analysis. **Probability:** Introduction, Probabilities of Events, random variables, Joint Distributions and Densities, Moments of Random variables, estimation of Parameters from samples, Minimum Risk estimators.	12
2.	**Statistical Decision Making :** Introduction, Bayes' Theorem, Multiple Features, Conditionally Independent Features, Decision Boundaries, Unequal Costs of Error, Estimation of Error Rates, The Leaving-One-Out Techniques, Characteristic Curves, Estimating the Composition of Populations.	12
3	**Nonparametric Decision Making:** Introduction, Histograms, kernel and Window Estimators, Nearest Neighbor Classification Techniques, Adaptive Decision Boundaries, Adaptive Discriminant Functions, Minimum Squared Error Discriminant Functions, Choosing a Decision Making technique.	10

4.	**Clustering :** Introduction, Hierarchical Clustering, Partitional Clustering,	10
5.	**Dimensionality Reduction:** Singular Value Decomposition, Principal Component Analysis, Linear Discriminant Analysis, Independent Component Analysis, Case studies.	08

Text Book:

1. Earl Gose , Richard Johnsonbaugh, Steve Jost, "Pattern recognition and Image analysis" PHI. 2015.

Reference Books:

1. Richard O.Duda, Peter E.Hart, David G. Stork, "Pattern Classification", John Wiley publication, 2nd edition, 2009.
2. Christopher M. Bishop ,"Pattern Recognition and Machine Learning", Springer publication, 2006
3. http://nptel.ac.in/courses/117105101/

URL

1. https://www.youtube.com/watch?v=1rdD9Qe6-4s

Note: Students are informed to visit NPTEL website(http://nptel.ac.in) and Swayam Online Courses website (https://swayam.gov.in) for additional information on the course.

Educate Elevate Enlighten

JSS Mahavidyapeetha

JSS Science And Technology University

(Established Under JSS Science and Technology University Act No. 43 of 2013)

(Formerly Known as SJCE)

JSS SCIENCE AND TECHNOLOGY UNIVERSITY MYSURU

Department: Computer Science and Engineering	
Course title: Cloud Computing	***Course Code :CS822***
Credits(L:T:P): 4:0:0	***Core/Elective: Elective***
Type of Course: Lecture	***Total Contact Hours: 52***
CIE Marks :50	***SEE Marks: 100***

Pre-requisite: Operating Systems, Computer Network

Course Outcomes: After completing this course, students should be able to:

CO1: Identify and summarize the cloud computing concepts along with its challenges

CO2: Design and develop scalable cloud based applications

CO3: Analyze and apply virtualization techniques, Google web services and security algorithms/tools for cloud computing

Unit No.	Course Content	No. of Hours
1.	**Introduction:** Defining Cloud Computing, Cloud Types: NIST Model, Cloud Cube Model, Deployment models, Service Models. Characteristics of Cloud Computing: Paradigm shift, Benefits of Cloud computing, Disadvantages of cloud computing, Role of Open Standards, Assessing the Value Proposition: Measuring the Cloud's Value, Avoiding Capital Expenditures, Computing the Total Cost of Ownership, Specifying Service Level Agreements, Defining Licensing Models.	10
2.	**Understanding Cloud Architecture:** Exploring the Cloud Computing Stack: Composability, Infrastructure, Platforms, Virtual Appliances, Communication Protocols, Applications, Connecting to the cloud: Jolicloud Netbook OS, Chromium OS: The Browser as an Operating System.	10

3	**Understanding Services, Applications, Abstraction and Virtualization:** Defining Infrastructure as Service (IaaS), Defining Platform as a Service (PaaS), Defining Software as a Service (SaaS), Defining Identity as a Service (IDaaS), Defining Compliance as a Service (CaaS), Using Virtualization Technologies, Load Balancing and Virtualization: Advanced load balancing, Google cloud, Understanding Hypervisors: Virtual Machine types, VM ware v Sphere	12
4.	**Using Google Web Services:** Exploring Google Applications, Surveying the Google Application Portfolio: Indexed Search, The dark Web, Aggregation and disintermediation, Productivity applications and services, Enterprise offerings, Google Analytics, Google Translate, Exploring the Google Toolkit, Working with Google App Engine	10
5.	**Understanding Cloud Security:** Securing the Cloud: The security boundary, Security service boundary, Security mapping. Security Data: Brokered cloud storage access, Storage location and tenancy, Encryption, Auditing and compliance. Establishing Identity and Presence: Identity protocol standards, Windows Azure identity standards, Presence.	10

Text Book:

1. Cloud Computing Bible , Barrie Sosinsky, Wiley India. 2011

Reference Books:

1. Cloud Computing: Principles and Paradigms, Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Wile, 2011
2. Cloud Computing: Principles, Systems and Applications, Nikos Antonopoulos, Lee Gillam, Springer, 2012
3. Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Ronald L. Krutz, Russell Dean Vines, Wiley-India, 2010
4. Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance, Tim

URL

1. http://nptel.ac.in/courses/106105167/ By Prof. Soumya Kanti Ghosh, IIT, Kharagpur
2. https://swayam.gov.in/courses/3742-cloud-computing by Prof. Soumya Kanti Ghosh, IIT, Kharagpur

Note: Students are informed to visit NPTEL website(http://nptel.ac.in) and Swayam Online Courses website (https://swayam.gov.in) for additional information on the course.

Educate Elevate Enlighten

JSS Mahavidyapeetha

JSS Science And Technology University

(Established Under JSS Science and Technology University Act No. 43 of 2013)

(Formerly Known as SJCE)

JSS SCIENCE AND TECHNOLOGY UNIVERSITY MYSURU

Department: Computer Science and Engineering	
Course Title: Storage Area Networks	***Course Code: CS823***
Credits(L:T:P): 4:0:0	***Core/Elective: Elective***
Type of Course: Lecture	***Total Contact Hours:52***
CIE Marks:50	***SEEMarks:100***

Pre-requisite: Computer Network

Course Outcomes: After completing this course, students should be able to:

CO1: Identify, discuss and summarize Storage area Network related concepts like Disk sub systems, virtualization, network Backup.

CO2: Interpret and Compare various components of Storage Area Network like RAID, virtualization

CO3: Analyze and Apply storage area network techniques for solving the scalability and availability related issues.

Unit No.	Course Content	No. of Hours
1.	**Introduction:** Server Centric IT Architecture and its Limitations; Storage - Centric IT Architecture and its advantages; Case study: Replacing a server with Storage Networks; The Data Storage and Data Access problem; The Battle for size and access. **Intelligent Disk Subsystems:** Architecture of Intelligent Disk Subsystems; Hard disks and Internal VO Channels, JBOD, Storage virtualization using RAID and different RAID levels; Caching: Acceleration of Hard Disk Access;	12

	Intelligent disk subsystems; Availability of disk subsystems.	
2.	**I/O Techniques:** The Physical I/O Path from the CPU to the Storage System, SCSI, The Fibre Channel Protocol Stack, Fibre Channel SAN, **File System and NAS:** Local File Systems; Network file Systems and file servers; Shared Disk file systems; Comparison of fibre Channel and NAS.	12
3	**Storage Virtualization:** Definition of Storage virtualization; Implementation Considerations; Storage virtualization on Block or file level; Storage virtualization on various levels of the storage Network; Symmetric and Asymmetric storage virtualization in the Network.	8
4.	**Application of Storage Networks:** Definition of the Term 'Storage Network', Storage Sharing, Availability of Data, Adaptability and Scalability of IT Systems	10
5.	**Network Backup:** General Conditions for Backup, Network Backup Services, Components of Backup Servers, Backup Clients, Performance Gains as a Result of Network Backup, Performance Bottlenecks of Network Backup, Limited Opportunities for Increasing Performance, Next Generation Backup, Backup of File Systems, Backup of Databases	10

Text Book:

1. Storage Networks Explained, Ulf Troppens, Rainer Erkcns and Wolfgang Muller, John Wiley & Sons, 2009.

Reference Books:

1. Storage Area Network Essentials: A Complete Guide to understanding and Implementing SANs Richard Barker and Paul Massiglia, John Wiley India, reprint 2011.
2. Storage Networking Fundamentals, Marc Farley, CISCO Press, 2005.
3. Storage Networks - The Complete Reference, Robert Spalding, Tata McGraw Hill, 2003.

URL

1. https://www.youtube.com/watch?v=ziF37nAHgRc

Note: Students are informed to visit NPTEL website(http://nptel.ac.in) and Swayam Online Courses website (https://swayam.gov.in) for additional information on the course.

Department: Computer Science and Engineering	
Course Title: Advanced Web Technologies	***CourseCode:CS824***
Credits(L:T:P): 4:0:0	***Core/Elective:Elective***
Type of Course: Lecture	***Total Contact Hours: 62***
CIE Marks: 50	***SEE Marks: 100***

Pre-requisite: Object Oriented Programming, Web Technologies

Course Outcomes: After completing this course, students should be able to:

CO1: Interpret and associate the potential solutions for Web 2.0 accessibility issues and "mash up" from existing applications.
CO2: Apply and analyze Rail application frame work for Ajax-enabled applications web services.
CO3: Design and develop client desktop web applications that invoke web services

Unit No.	Course Content	No. of Hours
1.	**Introduction Web 2.0**, Content Networks, User-Generated Content, Blogging, Social Networking, Social Media, Tagging, Social Bookmarking, Software Development, Rich Internet Applications (RIAs), Web Services, Mashups, Widgets and Gadgets, Location-Based Services, XML, RSS, Atom, JSON and VoIP, Web 2.0 Monetization Models, Web 2.0 Business Models, Future of the Web	12
2.	**Ajax-Enabled Rich Internet Applications** Introduction, Traditional Web Applications vs. Ajax Applications, Rich Internet Applications (RIAs) with Ajax, History of Ajax, Ajax Example Using the XMLHttpRequest Object, Using XML and the DOM, Creating a Full-Scale Ajax-Enabled Application, Dojo Toolkit	8
3	**Adobe® Flex™ 2 and Rich Internet Applications** Introduction, Flex Platform Overview, Creating a Simple User Interface,	10

	Accessing XML Data from Your Application, Interacting with Server-Side Applications, Customizing Your User Interface, Creating Charts and Graphs, Connection Independent RIAs on the Desktop: Adobe Integrated Runtime (AIR) , Flex 3 Beta	
4.	**Programming with Ruby on Rails** Introduction Ruby, Rails Framework, ActionController and ActionView, A Database-Driven Web Application, Case Study: Message Forum, Logging In and Logging Out, Embellishing the Models, Generating Scaffold Code, Forum Controller and Forum Views, Message Controller and Message Views, Ajax-Enabled Rails Applications	12
5.	**Web Services** Introduction, Java Web Services Basics, 5 Describing a Web Service with the Web Service Description Language (WSDL), SOAP, Session Tracking in Web Services, Passing an Object of a User-Defined Type to a Web Service, REST-Based Web Services in ASP.NET	10

Text Book:

1. Paul and Harvey Deitel AJAX, Rich Internet Applications, and Web Development For Programmers, Prentice Hall, 2008

Reference Books:

1. Colin Moock, Essential Actionscript 3.0 , O'Reilly publications, 2007.
2. Steven Holzner, Ajax Bible Wiley India Edition, 2007.
3. Justin Gehtland et al, A Web 2.0 Primer Pragmatic Ajax, SPD Publications, 2006.

URL

1. https://www.youtube.com/watch?v=82hnvUYY6QA

Note: Students are informed to visit NPTEL website(http://nptel.ac.in) and Swayam Online Courses website (https://swayam.gov.in) for additional information on the course.

Educate Elevate Enlighten

JSS Mahavidyapeetha

JSS Science And Technology University

(Established Under JSS Science and Technology University Act No. 43 of 2013)

(Formerly Known as SJCE)

JSS SCIENCE AND TECHNOLOGY UNIVERSITY MYSURU

Department: Computer Science and Engineering	
Course Title: Machine Intelligence & Expert Systems	***CourseCode:CS825***
Credits(L:T:P):4:0:0	***Core/Elective: Elective***
Type of Course: Lecture	***Total Contact Hours: 52***
CIE Marks: 50	***SEE Marks: 100***

Pre-requisite: Analysis and Design of Algorithms

Course Outcomes: After completing this course, students should be able to:

CO1: Examine and Demonstrate the various problem solving techniques and knowledge representation

CO2: Apply and analyse the effects of various problem solving techniques and knowledge representation

CO3: Design and simulate expert systems for real world applications

Unit No.	Course Content	No. of Hours
1.	**Problem and search**: Introduction to Artificial intelligence, Domains of AI problems, Problem spaces and searching in problem space. BFS algorithm and DFS algorithm, Advantages of BFS example, Production system characteristics.	10
2.	**Heuristic Search Techniques** Generate and Test, Hill climbing algorithms, OR graphs A* algorithm, Problem reduction, Means end analysis. Knowledge Representation: Approaches to knowledge representation, representational adequacy, Inferential adequacy, inferential efficiency, acquisition efficiency, issues in knowledge representation	10
3	**Predicate logic:** Representing simple facts in logic, Representing instance and ISA relationships, Computable functions and predicates, resolution, the basis of resolution, unification algorithm.	10
4.	**Knowledge representation:** Representing knowledge using rules, Procedural Vs Declarative knowledge, forward and backward reasoning, semantic nets,	12

	frames, scripts and conceptual dependency.	
5.	**Game playing:** Overview, The min-max procedure, alpha beta cut-offs. Planning and its components Goal stock planning**.** Expert Systems	10

Text Book:

1. Ellaine Rich, Kelvin Knight and Shivashankar B Nair, "Artificial intelligence" ,3rd edition-2009, Tata McGraw Hill publications.

Reference Books:

1. Stuart J Russel, Peter Norvig, "Artificial intelligence" ,3rd edition, Pearson, 2015

URL

1. https://nptel.ac.in/courses/106105077/
2. https://www.youtube.com/watch?v=TjZBTDzGeGg&list=PLUl4u3cNGP63gFHB6xb-kVBiQHYe_4hSi

Note: Students are informed to visit NPTEL website(http://nptel.ac.in) and Swayam Online Courses website (https://swayam.gov.in) for additional information on the course.

Educate Elevate Enlighten

JSS Mahavidyapeetha

JSS Science And Technology University

(Established Under JSS Science and Technology University Act No. 43 of 2013)

(Formerly Known as SJCE)

JSS SCIENCE AND TECHNOLOGY UNIVERSITY MYSURU

Department: Computer Science and Engineering	
Course title: Web Mining	***Course Code: CS831***
Credits(L:T:P): 4:0:0	***Core/Elective: Elective***
Type of Course: Lecture	***Total Contact Hours:52***
CIE Marks:50	***SEE Marks: 100***

Pre-requisite: Web Technologies

Course Outcomes: After completing this course, students should be able to:

CO1: Recall supervised & unsupervised learning, Information retrieval and basic crawling algorithms

CO2: Express techniques for crawling, data extraction and sentiment analysis

CO3: Apply the concepts for discovering knowledge from semi structured and unstructured data

Unit No.	Course Content	No. of Hours
1.	**Introduction:** World Wide Web, History of the Web and the Internet, What is Data Mining? What is Web Mining? Introduction to Association Rule Mining, Supervised Learning & Unsupervised Learning. Information Retrieval and Web Search: Basic Concepts of Information Retrieval, Information Retrieval Models, Relevance Feedback, Evaluation Measures, Text and Web Page Pre-Processing, Inverted Index and Its Compression, Latent Semantic Indexing, Web Search, Meta-Search: Combining Multiple Rankings, Web Spamming.	10
2.	**Social Network Analysis:** Introduction, Co-Citation and Bibliographic Coupling, PageRank, HITS Algorithm, Community Discovery. Web Crawling: A Basic Crawler Algorithm, Implementation Issues, Universal Crawlers, Focused Crawlers, Topical Crawlers, Evaluation, Crawler Ethics and Conflicts.	10
3	**Structured Data Extraction:** Wrapper Generation, Preliminaries, Wrapper Induction, Instance-Based Wrapper Learning, Automatic Wrapper Generation:	10

	Problems, String Matching and Tree Matching, Building DOM Trees, Extraction Based on a Single List Page, Extraction Based on Multiple Pages	
4.	**Information Integration:** Introduction to Schema Matching, Pre-Processing for Schema Matching, Schema -Level Matching, Domain and Instance-Level Matching, Combining Similarities, 1: m Match, Integration of Web Query Interfaces, Constructing a Unified Global Query Interface. Opinion Mining and Sentiment Analysis: The Problem of Opinion Mining, Document Sentiment Classification, Sentence Subjectivity and Sentiment Classification, Opinion Lexicon Expansion, Aspect-Based Opinion Mining, Opinion Search and Retrieval, Opinion Spam Detection.	12
5.	**Web Usage Mining:** Data Collection and Pre-Processing, Data Modeling for Web Usage Mining, Discovery and Analysis of Web Usage Patterns, Recommender Systems and Collaborative Filtering, Query Log Mining, Computational Advertising.	10

Text Book:

1. Wilbert Liu, Bing, "Web Data Mining", 2nd Edition, Elseiver, 2011.

Reference Books:

1. Soumen Chakrabarti, "Mining the Web", Morgan-Kaufmann Publishers, Elseiver, 2002.

URL

1. https://www.cs.uic.edu/~liub/WebMiningBook.html
2. http://www.ieee.org.ar/downloads/Srivastava-tut-pres.pdf

Note: Students are informed to visit NPTEL website(http://nptel.ac.in) and Swayam Online Courses website (https://swayam.gov.in) for additional information on the course.

Educate Elevate Enlighten

JSS Mahavidyapeetha

JSS Science And Technology University

(Established Under JSS Science and Technology University Act No. 43 of 2013)

(Formerly Known as SJCE)

JSS SCIENCE AND TECHNOLOGY UNIVERSITY MYSURU

Department: Computer Science and Engineering	
Course title: Wireless Networks and Mobile Computing	***Course Code:CS832***
Credits(L:T:P): 4:0:0	***Core/Elective: Elective***
Type of Course: Lecture	***Total Lecture Hours:52***
CIE Marks : 50	***SEE Marks: 100***

Pre-requisite: Data Communication, Computer Network

Course Outcomes: After completing this course, students should be able to:

CO1: Recall the fundamental working principles of Wireless Networks and Mobile Computing.

CO2: apply the knowledge about different mobile platforms and development real time applications.

CO3: Analyze networking principles and fundamental challenges of wireless devices, number portability in cellular networks

Unit No.	Course Content	No. of Hours
1.	**Mobile Computing Architecture:** Architecture for Mobile Computing, 3-tier Architecture, Design Considerations for Mobile Computing. Wireless Networks : Global Systems for Mobile Communication (GSM and Short Service Messages (SMS): GSM Architecture, Entities, Call routing in GSM, PLMN Interface, GSM Addresses and Identities, Network Aspects in GSM, Mobility Management, GSM Frequency allocation. Introduction to SMS, SMS Architecture, SM MT, SM MO, SMS as Information bearer, applications, GPRS and Packet Data Network, GPRS Network Architecture, GPRS Network Operations, Data Services in GPRS, Applications for GPRS, Billing and Charging in GPRS, Spread Spectrum technology, IS-95, CDMA versus GSM, Wireless Data, Third Generation Networks, Applications on 3G, Introduction to WiMAX.	12
2.	**Mobile Client:** Moving beyond desktop, Mobile handset overview, Mobile	10

	phones and their features, PDA, Design Constraints in applications for handheld devices. Mobile IP: Introduction, discovery, Registration, Tunneling, Cellular IP, Mobile IP with IPv6	
3	**Mobile OS and Computing Environment :** Smart Client Architecture, The Client: User Interface, Data Storage, Performance, Data Synchronization, Messaging. The Server: Data Synchronization, Enterprise Data Source, Messaging. Mobile Operating Systems: WinCE, Palm OS, Symbian OS, Linux, Proprietary OS Client Development: The development process, Need analysis phase, Design phase, Implementation and Testing phase, Deployment phase, Development Tools, Device Emulators	10
4.	**Building, Mobile Internet Applications**: Thin client: Architecture, the client, Middleware, messaging Servers, Processing a Wireless request, Wireless Applications Protocol (WAP) Overview, Wireless Languages: Markup Languages, HDML, WML, HTML, cHTML, XHTML, VoiceXML.	10
5.	**J2ME:** Introduction, CDC, CLDC, MIDP; Programming for CLDC, MIDlet model, Provisioning, MIDlet life-cycle, Creating new application, MIDlet event handling, GUI in MIDP, Low level GUI Components, Multimedia APIs; Communication in MIDP, Security Considerations in MIDP	10

Text Books:

1. Ashok Talukder, Roopa Yavagal, Hasan Ahmed: Mobile Computing, Technology, Applications and Service Creation, 2nd Edition, Tata McGraw Hill, 2010.
2. Martyn Mallik: Mobile and Wireless Design Essentials, Wiley India, 2003

Reference Books:

1. Nikolay Elenkov “Android Security Internals: An In-Depth Guide to Android's Security Architecture” No Starch Press; 1 edition (November 2, 2014)
2. Tomasz Imielinski et.al, “Mobile Computing”, Kluwer Academic Press 3. Raj Kamal, “Mobile Computing”, Oxford University Press, 2nd edition, September 2012

URL

1. http://nptel.ac.in/courses/106106147/
2. http://www.nptelvideos.com/video.php?id=553&c=5

Note: Students are informed to visit NPTEL website(http://nptel.ac.in) and Swayam Online Courses website (https://swayam.gov.in) for additional information on the course.

Department: Computer Science and Engineering	
Course Title: Adhoc Networks	***Course Code: CS833***
Credits(L:T:P):4:0:0	***Core/Elective: Elective***
Type of Course: Lecture	***Total Contact Hours:52***
CIE Marks: 50	***SEE Marks: 100***

Pre-requisite: Data Communication, Computer network

Course Outcomes: After completing this course, students should be able to:

CO1: Examine the fundamental principles of Ad hoc networks along with MAC protocol

CO2: Analyze and Design routing protocols for Ad hoc networks with respect to protocol design issues.

CO3: Apply the algorithms to address the issues of Ad hoc Wireless Networks in Security, energy and QoS related performance measurements.

Unit No.	Course Content	No. of Hours
1.	**Ad hoc Wireless Networks:** Introduction, Issues in Ad hoc Wireless Networks, Adhoc Wireless Internet; MAC Protocols for Ad hoc Wireless Networks:Introduction, Issues in Designing a MAC Protocol, Design Goals of MAC Protocols, Classification of MAC protocols, Contention-Based Protocols, Contention-Based Protocols with Reservation Mechanisms, Contention-Based Protocols with Scheduling Mechanisms, MAC Protocols that Use Directional Antennas	12
2.	**Routing Protocols for Ad Hoc Wireless Networks:** Introduction, Issues in Designing a Routing Protocol for Ad hoc Wireless Networks; Classification of Routing Protocols; Table Driven Routing Protocols; On-Demand Routing Protocols, Hybrid Routing Protocols, Hierarchical Routing Protocols and Power-Aware Routing Protocols	10
3	**Multicast Routing in Ad hoc Wireless Networks:** Introduction, Issues in	10

	Designing a Multicast Routing Protocol, Operation of Multicast Routing Protocols, An Architecture Reference Model for Multicast Routing Protocols, Classifications of Multicast Routing Protocols, Tree-Based Multicast Routing Protocols and Mesh-Based Multicast Routing Protocols.	
4.	**Transport Layer and Security Protocols for Ad hoc Networks:** Introduction, Issues in Designing a Transport Layer Protocol; Design Goals of a Transport Layer Protocol; Classification of Transport Layer Solutions; TCP over Transport Layer Solutions; Other Transport Layer Protocols for Ad hoc Networks; Security in Ad hoc Wireless Networks, Issues and Challenges in Security Provisioning, Network Security Attacks, Key Management and Secure Touting Ad hoc Wireless Networks.	10
5.	**Quality of Service and Energy Management in Ad hoc Wireless Networks** Introduction, Issues and Challenges in Providing QoS in Ad hoc Wireless Networks,Classification of QoS Solutions, MAC Layer Solutions, Network Layer Solutions; Energy Management in Ad hoc Wireless Networks: Introduction, Need for Energy Management in Ad hoc Wireless Networks, Classification of Energy Management Schemes, Battery Management Schemes, Transmission Management Schemes, System Power Management Schemes.	10

Text Book:

1. Ad hoc Wireless Networks, C. Siva Ram Murthy & B. S. Manoj, 2nd Edition, Pearson Education, 2011

Reference Books:

1. Ad hoc Wireless Networks, Ozan K. Tonguz and Gianguigi Ferrari, John Wiley, 2007.
2. Ad hoc Wireless Networking, Xiuzhen Cheng, Xiao Hung, Ding-Zhu Du, Kluwer Academic Publishers, 2004.
3. Ad-hoc Mobile Wireless Networks- Protocols and Systems, C.K. Toh, Pearson Education, 2002.
4. Wireless Sensor Networks, Feng Zhao and Leonidas, MorganKaufman Publishers, 2004.

URL

1. http://nptel.ac.in/courses/106105160
2. https://onlinecourses.nptel.ac.in/noc17_cs07/preview

Note: Students are informed to visit NPTEL website (http://nptel.ac.in) and Swayam Online Courses website (https://swayam.gov.in) for additional information on the course.

Department: Computer Science and Engineering	
***Course title: Ubiquitous* Computing**	***Course Code: CS834***
Credits(L:T:P): 4:0:0	***Core/Elective: Elective***
Type of Course: Lecture	***Total Contact Hours:52***
CIE Marks : 50	***SEE Marks: 100***

Pre-requisite: Data Communications, Computer Network

Course Outcomes: After completing this course, students should be able to:

CO1: Define the concept of Ubiquitous computing.

CO2: Understanding of devices and services of ubiquitous environments.

CO3: Analyse the applications of qbiquitous systems.

Unit No.	Course Content	No. of Hours
1.	**Introduction:** Ubiquitous Computing : Basics and Vision, Living in a Digital World: Illustrative Ubiquitous Computing Applications: Personal memories, Adaptive Transport Scheduled Service, Foodstuff Management, utility Regulation, Modelling the key ubiquitous computing properties, Core Properties of UbiCom Systems, Distributed ICT System, Implicit Human Computer Interaction (iHCI), Context Awareness, Autonomy, Ubiquitous system Environment Interactions, Human –ICT Device Interaction (HCI), ICT Device to Physical World Interaction (CPI), Architectural Design for UbiCom Systems: Smart DEI Model, Smart Devices, Smart Environment, Smart Interaction, Common Myths about Ubiquitous Computing.	12
2.	**Applications Requirements, Smart Mobiles cards and Device Networks:** Smart Devices: CCI, Smart Boards, Pads and Tabs, Active Badge, Bat and Floor, Smart Environments: CPI and CCI, Classroom 2000, Smart Space and Meeting Room, Interactive Workspaces and iRoom, Cooltown, Easy Living and	12

	SPORT, HomeLab and Ambient Intelligence, Smart Devices: CPI, Smart Devices: iHCI and HPI, Everyday Applications in the Virtual, Human and Physical World, Human –Computer Interaction, Human to- Human Interaction Applications, human –Physical World Computer Interaction (HPI) and (CPI), Achievements from Early Projects and Status Today: Smart Devices, Smart Physical world Environments, Context –Awareness and Services Discovery, Wearable Smart Devices and Implants. Smart Mobile Devices, Users, Resources and Code, Operating systems for Mobile Computers and Communication Devices, Smart Card Devices, Smart Card OS, Smart Card Development, Device Networks	
3	**Tagging, Sensing and Controlling:** Introduction to Tagging, Sensing and Controlling, Tagging the Physical world, Active RFID and Passive RFID, Sensors and sensor networks, MEMS: Fabrications,microactuators, microsensors smart surfaces, skin,paint matter and dust. and Robots: mobile Robots, Biologically inspired Robots and Nano Bots.	08
4.	**Context-Aware System:** Introduction to Context-Aware System**,** Modelling context-aware systems, Context creation and context composition, context aware adaption, Environment modelling, context representation, challenges in context awareness, Mobility awareness, call routing, mobile phone location determination, Mobile user awareness as example of composite context awareness, Tourism services for mobile users, spatial awareness, spatial context creation, location and other spatial abstractions, user context creation and context aware adaption, spatial context queries and management :GIS Temporal Awareness: Clock synchronization, Temporal models,	10
5.	**Intelligent System:** Basic concepts, Intelligent System Architecture, Reactive Intelligent System model, Environment model based Intelligent System, Goal based Intelligent System, Utility based Intelligent System, Learning based Intelligent System, Hybrid Intelligent System Semantic Knowledge Based Intelligent System, Classical Logic Intelligent Systems, Soft Computing Intelligent System Models, Intelligent System Operations: Searching, Classical (Deterministic) Planning, Non-Deterministic Planning.	10

Text Book:

1. Stefen Poslad: Ubiquitous Computing: Smart Devices, Environments and Interactions, Wiley, Reprint 2014.

Reference Books:

1. Jochen Burkhardt, Horst Henn, Stefan Hepper, Thomas Schaech & Klaus Rindtorff, Pervasive Computing, Technology and Architecture of Mobile Internet Applications, Pearson Education, 2009.
2. A. Genco, S. Sorce: Pervasive Systems and Ubiquitous Computing, WIT Press, 2012.
3. Ajith Abraham (Ed.): Pervasive Computing, Springer-Verlag, 2012.

URL

1. https://www.youtube.com/watch?v=bS6XqjBO99Q
2. https://www.youtube.com/watch?v=bSLhQA2OQB4

Note: Students are informed to visit NPTEL website(http://nptel.ac.in) and Swayam Online Courses website (https://swayam.gov.in) for additional information on the course.

Department: Computer Science and Engineering	
Course title: Game Theory	***Course Code: CS835***
Credits(L:T:P): 4:0:0	***Core/Elective: Elective***
Type of Course: Lecture	***Total Contact Hours: 52***
CIE Marks: 50	***SEE Marks: 100***

Pre-requisite: Linear algebra

Course Outcomes: After completing this course, students should be able to:

CO1: Comprehend different types of games for evaluation of decision makers for modelling.

CO2: Understand the strengths and weaknesses of game theory as a modelling tool.

CO3: Evaluate the appropriateness of game theory models in a number of areas of business

Unit No.	Course Content	No. of Hours
1.	**Introduction, Strategic Games, Mixed Strategy Equilibrium:** The theory of rational choice; interacting decision makers. Strategic games; Examples: The prisoner's dilemma, Bach or Stravinsky, Matching pennies; Nash equilibrium;Best-response functions; Dominated actions; Equilibrium in a single population: symmetric games and symmetric equilibrium. Mixed strategy Nash equilibrium; dominated actions; Pure equilibrium, Illustration: Expert Diagnosis; Equilibrium in a single population, Reporting a crime; The formation of players' beliefs; Extensions; Representing preferences by expected payoffs.	10
2.	**Extensive Games:** Extensive games with perfect information; Strategies and outcomes; Nash equilibrium; Subgame perfect equilibrium; Finding sub game perfect equilibrium of finite horizon games: Backward induction. Illustrations: The ultimatum game, Stackelberg's model of duopoly, buying votes. Extensions and Discussions:Extensions: Allowing for simultaneous moves, Illustrations:	12

	Entry in to a monopolized industry, Electoral competition with strategic voters, Committee decision making, Exit from a declining industry; Allowing for exogenous uncertainty, Discussion: subgame perfect equilibrium and backward induction.	
3	**Bayesian Games, Extensive Games with Imperfect Information:** Motivational examples; General definitions; Two examples concerning information; Illustrations: Cournot's duopoly game with imperfect information, Providing a public good, Auctions; Auctions with an arbitrary distribution of valuations. Extensive games with imperfect information; Strategies; Beliefs and sequential equilibrium; Signaling games; Strategic information transmission.	10
4.	**Strictly Competitive Games, Evolutionary Equilibrium:** Strictly competitive games and maximization; Maximization and Nash equilibrium; Evolutionary Equilibrium: Monomorphic pure strategy equilibrium; Mixed strategies and polymorphic equilibrium; Asymmetric contests; Variations on themes: Sibling behavior, Nesting behavior of wasps, The evolution of sex ratio.	10
5.	**Iterated Games, Coalitional Games and Bargaining:** Repeated games: The main idea; Preferences; Finitely and infinitely repeated Prisoner's dilemma; Strategies and Nash equilibrium of an infinitely repeated Prisoner's dilemma, Nash equilibrium payoffs, Coalitional games. The Core. Ownership and distribution of wealth, exchanging homogeneous items, exchanging heterogeneous items, Voting, Matching. Bargaining as an extensive game; Illustration of trade in a market; Nash's axiomatic model of bargaining.	10

Text Book:

1. Martin Osborne: An Introduction to Game Theory, Oxford University Press, Indian Edition, 2004

Reference Books:

1. Roger B. Myerson: Game Theory: Analysis of Conflict, Harvard University Press, 1997.
2. Andreu Mas-Colell, Michael D. Whinston, and Jerry R. Green: Microeconomic Theory. Oxford University Press, New York, 1995.
3. Philip D. Straffin, Jr.: Game Theory and Strategy, the Mathematical Association of America, January 1993

URL

1. https://www.youtube.com/watch?v=h0bdo06qNVw
2. https://nptel.ac.in/noc/individual_course.php?id=noc16-mg01

Note: Students are informed to visit NPTEL website(http://nptel.ac.in) and Swayam Online Courses website (https://swayam.gov.in) for additional information on the course.