2nd BOS BOOK

FACULTY OF ENGINEERING

Scheme of Instructions & Detailed Syllabus of

III & IV Semester

For

Four Year Degree Programme of

Bachelor of Engineering (B.E)

in

COMPUTER ENGINEERING

(With effect from the academic year 2022-23)
(Approved by College Academic Council on -- -- ----)

Estd. 2008

Issued by

Dean, Academics,

Stanley College of Engineering and Technology for Women
(Autonomous)
(Affiliated to Osmania University) (Accredited by NAAC with "A" Grade)
Abids, Hyderabad – 500 001, Telangana.

CME Scheme of Instruction & Examination for
Semester III

Associate Professor
Dept. of CSE College of Engg.
Osmania University, Hyd.

Head of Department
Computer Engineering
Stanley College of Engg. & Tech. for Women
(Autonomous)
Chapel Road, Abids, Hyderabad, T.S.

CME: SEMESTER – III

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/	CIE	SEE	SEE Duration in	
Theory Courses										
1	SBS301MT	Mathematics -III (Probability and Statistics)	3	-	-	3	40	60	3	3
2	SES301CM	Discrete Mathematics	3	-	-	3	40	60	3	3
3	SES302EC	Digital Electronics	3	-	-	3	40	60	3	3
4	SPC301CM	OOPs Using JAVA	3	-	-	3	40	60	3	3
5	SPC302CM	Concepts in Computer Organization & Microprocessor	3	-	-	3	40	60	3	3
6	SAC902EE	Electrical Technology	2	-	-	2	-	-	-	-
Practical/ Laboratory Courses										
7	SES311CM	Python programming Lab	-	-	4	4	40	60	3	2
8	SPC311CM	OOPs Using JAVA Lab	-	-	4	4	40	60	3	2
9	SPC312CM	Concepts in Computer Organization & Microprocessor Lab	-	-	4	4	40	60	3	2
		Total	**17**	**-**	**12**	**29**	**320**	**480**		**21**

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Course Code	Course Title						Core/Elective
SBS301MT	**Mathematics-III(Probability & Statistics) (Common to AI&DS, CME, CSE)**						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
SBS101MT SBS 201MT	3	-	-	-	40	60	3

Course Objectives:

1. To provide knowledge of probability distribution, tests of significance, correlation and regression.

Course Outcomes:

At the end of this course, the student will be able to

1. Apply probability theory to solve practical problems.
2. Apply various probability distributions to solve practical problems, to estimate unknown parameters and apply tests of hypothesis.
3. Apply continuous probability distributions like normal to solve the practical problems
4. Perform a regression analysis and to compute and interpret the coefficient of correlation.
5. Apply Chi-square test for goodness of fit and independent attributes

Unit I

Introduction of Probability: Conditional Probability, Theorem of total probability, Baye's heorem and its application, Random variables, types of random variables. Probability mass function and probability density function. Mathematical Expectations, moments, Skewness and Kurtosis.

Unit II

Discrete and Continuous probability distributions: Binomial, Poisson, Uniform, Normal and exponential. Mean, Variance, Moment generating function

Unit III

Curve fitting by the method of least squares: Straight line, second degree polynomial and more general curves. Correlation, regression and Rank correlation, Multiple regression, F-test,t-test and Chi-square tests.

Unit IV

Numerical Solutions of Differential Equations: Single step method, Taylor's, Euler's, R-K Method of 4" order, Predictor- Corrector method, Milne's Method, Adams - Bashforth Method.

Unit V

Linear Algebra: Vector spaces, subspaces, Linearly Independent, Linearly dependent vectors, Linear span, Basis, Dimensions, Rank, Impact, Singular value decomposition, connection between eigen values and eigen vectors, SVD with low rank, Relation between SVD and regularised least square methods.

TEXT/REFERENCE/ADDITIONAL BOOKS:

R.K. Jain and S.R. K. Iyengar, "Advanced Engineering Mathematics", Narosa Publications
Dr. B. S. Grewal "Higher Engineering Mathematics", Khanna Publications
P. Siva Rama Krishna Das & C. Vijaya Kumar, "Engineering Mathematics", Pearson India Education Services Pvt. Ltd.
N.P. Bali & M. Goyal, "A text Book of Engineering Mathematics", Laxmi Publications, 2010
S.C. Gupta & V.K. Kapoor, "Fundamentals of Mathematical Statistics", S. Chand Pub.

Course Code	Course Title						Core/Elective
SES301CM	**Discrete Mathematics (Common to AI&DS, CME)**						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	-	-	-	40	60	3

Course Objectives :- Throughout the course, students will be expected to demonstrate their understanding of Discrete Mathematics.

1. To learn mathematically correct terminology and notation and to perform the operations associated with sets, functions, groups and relations.
2. To apply logical reasoning to solve a variety of problems.
3. To analyze the properties of graphs and trees.

Course Outcomes :- After completion of the course, the students should be able to

1. Understand sets, functions, groups and relations.
2. Apply permutation and combination to handle different types of problems.
3. Apply propositional logic and predicate logic to solve logical statements.
4. Evaluate Boolean functions and simplify expressions using the properties of Boolean Algebra.
5. Develop the given problem as graph networks and solve with techniques of graph theory.

UNIT – 1:

Sets, Relation and Function: Operations and Laws of Sets, Cartesian Products, Binary Relation, Partial Ordering Relation, Equivalence Relation, Image of a Set, Sum and Product of Functions, Bijective functions, Inverse and Composite Function, Size of a Set, Finite and infinite Sets, Countable and uncountable Sets, Cantor's diagonal argument and The Power Set theorem, Schroeder-Bernstein theorem. Principles of Mathematical Induction: The Well-Ordering Principle, Recursive definition, The Division algorithm: Prime Numbers, The Greatest Common Divisor: Euclidean Algorithm, The Fundamental Theorem of Arithmetic.

UNIT – 2:

Elementary Combinations :-Basics of counting, combinations and permutations, with repetitions constrained repetitions ,Binomial coefficients. The principle of inclusion-exclusion, pigeon hole principle and its applications.

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UNIT 3 :

Propositional Logic: Syntax, Semantics, Validity and Satisfiability, Basic Connectives and Truth Tables, Logical Equivalence: The Laws of Logic, Logical Implication, Rules of Inference, The use of Quantifiers. Proof Techniques: Some Terminology, Proof Methods and Strategies, Forward Proof, Proof by Contradiction, Proof by Contraposition, Proof of Necessity and Sufficiency.

UNIT 4:

Algebraic Structures and Morphism: Algebraic Structures with one Binary Operation, Semi Groups, Monoids, Groups, Congruence Relation and Quotient Structures, Free and Cyclic Monoids and Groups, Permutation Groups, Substructures, Normal Subgroups, Algebraic Structures with two Binary Operation, Rings, Integral Domain and Fields. Boolean Algebra and Boolean Ring, Identities of Boolean Algebra, Duality, Representation of Boolean Function, Disjunctive and Conjunctive Normal Form

UNIT -5:

Graphs and Trees: Graphs and their properties, Degree, Connectivity, Path, Cycle, Sub Graph, Isomorphism, Eulerian and Hamiltonian Walks, Graph Coloring, Coloring maps and Planar Graphs, Coloring Vertices, Coloring Edges, List Coloring, Perfect Graph, definition properties and Example, rooted trees, trees and sorting, weighted trees and prefix codes, Bi-connected component and Articulation Points, Shortest distances.

Text Books:

1. Kenneth H. Rosen, Discrete Mathematics and its Applications, Tata McGraw – Hill
2. Susanna S. Epp, Discrete Mathematics with Applications,4th edition, Wadsworth Publishing Co. Inc
3. C L Liu and D P Mohapatra, Elements of Discrete Mathematics A Computer Oriented Approach, 3rd Edition by, Tata McGraw – Hill

References:

1. J.P.Trembly and R.Manohar ,Discrete Mathematical Structures with applications to Computer Science TMG Edition ,Tata MC Graw Hill.
2. JL Mott, A. Kandel, T.P. Baker, Discrete Mathematics for Computer Scientists & Mathematicians, 2nd Edition PHI.
3. Narsing Deo, Graph Theory: with Application to Engineering and Computer Science. Prentice Hall of India 2003.

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Course Code	Course Title						Core/Elective
SES302EC	**Digital Electronics (Common to AI&DS IV, CME III & CSE III)**						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	-	-	-	40	60	3

Course Objectives: To Expose the students to

1. To learn the principles of digital hardware and support given by it to the software.
2. To explain the operation and design of combinational and arithmetic logic circuits.
3. To design hardware for real world problems.

Course Outcome: On successful completion of the course, the students would be able to

1. Understand the deign process of digital hardware, use Boolean algebra to minimize the logical expressions and optimize the implementation of logical functions.
2. Understand the number representation and design combinational circuits like adders, MUX etc.
3. Design Combinational circuits using PLDS and write Verilog HDL code for basic gates and combinational circuits.
4. Analyse sequential circuits using flip-flops and design registers, counters.
5. Represent a sequential circuit using Finite State machine and apply state minimization techniques to design a FSM.

UNIT – I

Design Concepts: Digital Hardware, Design process, Design of digital hardware. Introduction to logic circuits – Variables and functions, Logic gates and networks. Boolean algebra, Synthesis using gates, Design examples. Optimized implementation of logic functions using K-Map upto 5 Variable maps and Quine-McCluskey Tabular method.

UNIT – II

Number representation: Addition and Subtraction of signed and unsigned numbers.

Combinational circuit building blocks: Adders and Subtractors, Multiplexers. Demultiplexers, Parity Checkers and Generators, Decoders. Encoders. Code converters, BCD to 7-segment converter, Arithmetic comparator circuits.Design of combination logic using VerilogHDL

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UNIT – III

Design of combinational circuits using Programmable Logic Devices (PLDs): General structure of a Programmable Array Logic (PAL), Programmable Logic Arrays (PLAs), Structure of CPLDs and FPGAs, 2-input and 3-input lookup tables(LUTs)

UNIT – IV

Sequential Circuits: Basic Latch, Gated SR Latch, gated D Latch, Master-Slave edge triggered flip-flops, T Flip-flop, JK Flip-flop, Excitation tables. Registers and Counters. Design of FFs uing Verilog

UNIT – V

Synchronous Sequential Circuits: Basic Design Steps, Finite State machine(FSM) representation using Moore and Mealy state models, State minimization, Design of FSM for Sequence Generation and Detection, Algorithmic State Machine charts.

Suggested Readings:

1. Moris Mano and Michael D CIletti, Digital Design, Pearson, fourth edition,2008
2. Zvi Kohavi, Switching and Finite Automata Theory, 3rd ed., Cambridge University Press-New Delhi, 2011.
3. R. P Jain, Modern Digital Electronics,4th ed., McGraw Hill Education (India) Private Limited, 2003
4. Ronald J.Tocci, Neal S. Widmer &Gregory L.Moss, "Digital Systems: Principles and Applications," PHI, 10/e, 2009.
5. Samir Palnitkar —Verilog HDL A guide to digital design and Synthesisl, Pearson, 2nd edition, 2015.

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Course Code	Course Title						Core/Elective
SPC301CM	**OOPS USING JAVA (Common to AI&DS, CSE & IT , CME IVSem)**						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Principles of Programming languages	3	-	-	-	40	60	3

Course Objectives:

1. To understand fundamentals of object-oriented programming in Java which includes defining classes, invoking methods, difference between applet and application programs, using class libraries
2. To create Java application programs using sound OOP practices such as interfaces, exception handling, multithreading.
3. Use Collection framework, AWT and event handling to solve real world problems.

Course Outcomes:

At the end of this course, the student will be able to

1. Identify classes, objects, members of a class and the relationships needed to solve a problem.
2. Use interfaces and creating user-defined packages.
3. Utilize exception handling and Multithreading concepts to develop Java programs.
4. Compose programs using the Java Collection API.
5. Design a GUI using GUI components with the integration of event handling.

UNIT-I

Introduction: OOP concepts, benefits of OOP, history of Java, Java buzzwords, data types, variables, scope andlife time of variables, operators, expressions, control statements, type conversion and casting.

Classes and Objects: Concept of classes, objects, constructors, methods, this keyword, super keyword, garbage collection, overloading methods and constructors, parameter passing, Arrays String handling: String, StringBuffer, StringBuilder

UNIT -II

Inheritance: Base class object, subclass, member access rules, super uses, using final with inheritance, method overriding, abstract classes.

Interfaces: Defining and implementing an interface, differences between classes and interfaces and extending interfaces Polymorphism.

Packages: Defining, creating and accessing a package, importing packages, exploring packages

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UNIT -III

Exception handling: Concepts and benefits of exception handling, exception hierarchy, checked and unchecked exceptions, usage of-try, catch, throw, throws and finally, built in exceptions, creating User defined exceptions.
Multithreading: Difference between multi-threading and multitasking, thread life cycle, creating threads, synchronizing threads, daemon threads, thread groups.

UNIT -IV

Basic I/O Streams: Java I/O classes and interfaces, Files, Stream and Byte classes, Character streams, Serialization Exploring java.lang: Object class, Wrapper classes Exploring java.util: Scanner, StringTokenizer, BitSet, Date, Calendar, Timer
Collections: Overview of Java Collection frame work, commonly used Collection classes – Array List, Linked List, Hash Set, Tree Set, Collection Interfaces – Collection, List, Set. Accessing Collection via iterator, working with Map.

UNIT -V

GUI Programming with java: The AWT class hierarchy, MVC architecture.
Exploring Swing: JLabel, ImageIcon, JTextField, the Swing buttons, JTabbedpane, JScrollPane, JList, JComboBox.
Layout manager: Border, Grid, Flow, Card and Grid Bag layouts.
Event Handling: Delegation Event Model, Event Classes, Source of Events, Event Listener Interfaces.Handling mouse and keyboard events, Adapter classes.
New Features in Java: Major enhancement made in Java5, Java6, Java7 and Java8 like auto-boxing, generics, var-args, java annotations, enum, premain method , lambda expressions, functional interface, method references.

Text Books:

1. Schildt and Herbert, Java The complete reference, McGraw, 8th edition, TMH, 2017.
2. R Nageswara Rao, Core JAVA: An Integrated Approach, Black Book, DreamTech, 2016.
3. Cay S. Horstmann, Core JAVA Volume I—Fundamentals, Kindle Edition, 2020.

References:

1. Core Java: An Integrated Approach, Dr R. Nageswara Rao, dreamtech.
2. Java How to Program, H.M. Dietel and P.J. Dietel, Sixth Edition, Pearson Education/PHI.
3. An Introduction to Object Oriented programming with Java,C Thomas Wu, Tata McGraw Hill, 2005.

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Course Code	Course Title						Core/Elective
SPC 302 CM	**Concepts in Computer Organization and Microprocessor (Common to AI&DS& CME, IT Sem IV)**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	40	60	3

Course Objectives

1. To understand the Instruction Set Architecture and the basic components of CPU.
2. To learn the interfacing of I/O Organization, Interrupt-driven I/O, and DMA
3. To understand the 8085 and 8051 architectures.

Course Outcomes

Students will be able to

1. Understand the Instruction Set Architecture: Instruction format, types, various addressing modes
2. Understand the basic components of the CPU
3. Understand the parallelism both in terms of a single processor and multiple processors
4. Understand the 8085 and 8051 architectures
5. Apply interfacing with I/O Organization, Interrupt-driven I/O, DMA

UNIT-I

Data Representation: Fixed and Floating Point representations. Overview of Computer Function and Interconnections: Computer components, Interconnection structures, Bus interconnection, Bus structure, and Data transfer.

Register Transfer Microoperations: Register Transfer Language, Register Transfer, Bus and Memory Transfers, Arithmetic, Logic and Shift microperations, Arithmetic Logic Shift Unit.

UNIT-II

Basic Computer Organization and Design: Instruction Codes, Computer Registers, Computer Instructions, Timing and Control, Instruction Cycle, Memory reference instruction, Input-Output and Interrupt. Microprogrammed Control: Control memory, Address Sequencing, Microprogram example, Design of Control Unit.

UNIT-III

Central Processing Unit: General Register Organization, Stack Organization, Instruction formats, Addressing modes, Data Transfer and Manipulation, and Program control. Floating Point Arithmetic Operations.

Pipeline Processing: Arithmetic, Instruction and RISC Pipelines.

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Memory Organization: Cache memory, Virtual memory, Memory Management hardware

UNIT-IV

8085 Architecture: Introduction to microprocessors and microcontrollers, 8085 Processor Architecture, Internal operations, Instructions and timings. Programming the 8085 - Introduction to 8085 instructions, Addressing modes and Programming techniques with Additional instructions.

Input-Output Organization: Modes of Transfer, Priority Interrupt, Direct Memory Access (DMA), I/O Processor. Basic Interfacing concepts with 8085, Programmable Interrupt Controller(8259A). Direct Memory Access(DMA) - DMA Controller (Intel 8257)

UNIT-V

Introduction to Microcontrollers, 8051 – Architecture, Instruction set, Addressing modes and Programming techniques. Comparison of various families of 8-bit micro controllers. System Design Techniques - Interfacing of LCD, ADC, Sensors, Stepper motor, Keyboard and DAC using microcontrollers. Communication Standards - Serial RS 232 and USB. Features of Multi-Core Processors architectures and Graphics Processing Units.

Text Books:

1. Carl Hamacher, ZvonkoVranesic, SafwatZaky, Computer Organization, 5th Edition, McGraw Hill, 2002.
2. Ramesh S Gaonkar, Microprocessor Architecture, Programming, and Applications with the 8085, 5/E PrenticeHall,2002.
3. Pal Chouduri, Computer Organization and Design, Prentice Hall ofIndia,1994.

Reference Books:

1. M. M. Mano, Computer System Architecture, 3rd Edition, PrenticeHall.
2. Ramesh S. Gaonkar "Microprocessor Architecture, Programming, and Applications with the 8085", 5/E, Prentice Hall, 2002.
3. Myke Predko "Programming and Customizing the 8051 Microcontroller", Tata McGraw Hill, 1994

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Course Code	Course Title						Core / Elective
SAC903EE	Electrical Technology						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
–	2	-	-	-	50	–	–

Course Objectives	Course Outcomes
• To introduce Generation of energy through conventional sources such as: Thermal, Hydro and Nuclear and renewable energy sources. • To familiarize present practices in working of static and dynamic machines and devices. • To familiarize mechanical design of Electrical vehicle and hybrid vehicle.	1. Gain knowledge of construction and operation of conventional and non-conventional sources of energy 2. Understand the working principle of single phase and three phase transformers 3. Understand the Working principle of generator and motor 4. Know the working of inverter and rectifier operation 5. Understand the concept of Electrical vehicles

UNIT I – Generation of Electrical Energy
Importance of Electrical Energy, Conventional Energy sources for generation of electrical energy, schematic diagram of steam power station, Hydro Electric power plants, Fissile materials, working principle of nuclear power plants and reactor control, Importance of Non-Conventional energy sources, Generation of electrical energy by using Solar and wind, Hybrid power generation.

UNIT II – Transformers
Electromagnetic induction, Faradays laws, statically induced Emf, Lenz law, BH characteristics, Construction and working of transformer, ideal and practical transformer, losses and efficiency.

UNIT III – DC Machines
Working principle of DC generator, dynamically induced Emf, Fleming's Right hand and Left-hand rules, Construction and principle of operation of DC generator, EMF equation, Types of DC Generators, OCC characteristics, applications, principle of operation of DC Motor, Types of DC motors, applications.

UNIT IV – Induction Motors
Generation of rotating magnetic fields, Construction and working of a three phase induction motor, squirrel cage IM, slip-ring IM, applications, Construction and principle of operation of 1-phase IM, Capacitor start & capacitor-run motor, applications.

Chairperson
(Dr. Nagasekhara Reddy N, HOD, SCETW)

University Nominee
(Dr. M. Manjula, Professor, OU)

Subject Expert 1
(Dr. N. Kiran Kumar, Professor, VCE)

K. Manjunath
Subject Expert 2
(Dr. K. Manjunath, Asst. Professor, IITRAM)

Industry Expert
(Mr. Srinivasa Chary, Chairman, Energy Studies, IEI)

Member 1
(Dr. A. S. Sreelatha, Associate Professor, SCETW)

Member 2
(Mrs. B. Vijaya Lakshmi, Asst. Professor, SCETW)

UNIT V – Batteries and Electric Vehicles

Introduction to Electrical vehicles, EV system, Components of Electrical Vehicle, Electrical vehicle advantages. Batteries: LED acid, Ni-Cd, Li-Ion batteries and battery characteristics and parameters. Hybrid Electrical Vehicle-Types of hybrid vehicles, advantages and disadvantages, comparison between Electrical vehicle and Hybrid Vehicle.

Text Books:

1. J.B. Gupta "Fundamentals of Electrical Engineering and Electronics" S.K. Kataria & Sons Publications, 2010.
2. P. S. Bimbhra, Electrical Machinery, Khanna Publishers, 2011.
3. Sunil R. Pawar "Electrical vehicle technology" Notion press, First edition 2021.

Reference Books:

1. Dr. P.S. Bhimbra, Power Electronics, Khanna Publishers, 2009.
2. Wadhwa C.L., Electrical Power Systems, New Age International (P) Ltd., 4th Edition, 2007.
3. Hughes, "Electrical Technology", VII Edition, International Student -on, Addison Welsey Longman Inc., 1995.

Chairperson (Dr. Nagasekhara Reddy N, HOD, SCETW)	University Nominee (Dr. M. Manjula, Professor, OU)	Subject Expert 1 (Dr. N. Kiran Kumar, Professor, VCE)	Subject Expert 2 (Dr. K. Manjunath, Asst. Professor, IITRAM)
Industry Expert (Mr. Srinivasa Chary, Chairman, Energy Studies, IEI)	Member 1 (Dr. A. S. Sreelatha, Associate Professor, SCETW)	Member 2 (Mrs. B. Vijaya Lakshmi, Asst. Professor, SCETW)	

Course Code	Course Title						Core/Elective
SES311CM	**Python Programming Lab**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	1	2	-	2	40	60	2

Course Objectives

The students will be able to:

1. Learn basic Programming using Python
2. Learn Object-oriented programming.
3. Design graphical-user interfaces (GUI).

Course Outcomes

After completing this course, the student will be able to:

1. Develop and execute simple programs using Python.
2. Use conditional control structures for problem solving
3. Decompose a problem using functions.
4. Represent compound data using lists, tuples, dictionaries using Python
5. Solve the complex problems using advanced Python concepts and design GUI.

1. Introduction to Python Programming:
    1. Executing instructions in Interactive interpreter and a Python Script.
    2. Raise Indentation Error and Correct it.
    3. Compute distance between two points taking input from the user
    4. Perform all arithmetic operations with minimum two numbers.
    5. Display the following information: Your name, Full Address, Mobile Number, College Name, Subjects.
2. Decision Making and Loops
    1. Check whether a given number is even or odd.
    2. Find the largest three integers using if-else
    3. To read a number (1-7) and display corresponding day using if_elif_else?
    4. Receives a series of positive numbers and display the numbers in an ascending order and calculate the sum.
    5. Get any number from user, Generate the series with reverse order (n to 1) using While loop.
3. Functions and Recursion
    1. Write a function to find mean, median, mode for the given set of numbers in a list
    2. Write a function to check whether two strings are nearly equal or not. Display how many characters are matching.

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3. To print Fibonacci Sequence up to a given number n
4. To find GCD of two integers.
5. To display prime number from 2 to n.
6. Functions that accept a string as an argument and return the number of vowels and consonants that the string contains.

4. Strings & List
    1. To check whether the given string is palindrome or not.
    2. To remove the n^{th} index character from an nonempty string
    3. To create a list and perform the following methods 1) insert() 2) remove() 3) append() 4) len() 5) pop() 6) clear()
    4. To remove duplicates from a list

5. Tuples & Dictionaries
    1. To Create a dictionary and apply the following methods 1) Print the dictionary items 2) access items 3) use get() 4)change values
    2. To count the number of characters in the string and store them in a dictionary data structure
    3. To convert nested list into dictionary.

6. Files
    1. Generate 1 to n random numbers and write it in a file then read from a file.
    2. To display a list of all unique words in a text file
    3. To analyse the two text files using set operations
    4. To print each line of a file in reverse order.
    5. To count frequency of words in a given file.

7. Exceptions
    1. Read two numbers n1 and n2. Write a function to compute n1/n2 and use try/except to catch the exceptions.
    2. To detect and handle the exception while solving the quadratic equation.
    3. To handle the run time errors while doing the file handling operation.
    4. To create and raise user defined exceptions.

8. Object Oriented Programming
    1. Program to implement the inheritance
    2. Program to implement the polymorphism

9. GUI Programming
    1. Design a GUI based calculator to perform arithmetic operations like addition, subtraction, multiplication and division.

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2. Design a GUI based application to convert temperature from Celsius to Fahrenheit.
3. Write a python program to perform various database operations (create, insert, delete, update)

10. Numpy-2
    1. Write a basic array of operations on single array to add x to each element of array and subtract y from each element of array.
    2. Write a program to add, subtract and multiply two matrices.
    3. Create multi-dimensional arrays and find its shape and dimension.
    4. Create a null matrix and unit matrix.
    5. Reshape and flatten data in the array
11. Numpy-2
    1. Append data vertically and horizontally
    2. Apply indexing and slicing on array
    3. Use statistical functions on array - Min, Max, Mean, Median and Standard Deviation
    4. Dot product and matrix multiplication of two arrays
    5. Compute the Eigen values of a matrix.
12. Numpy-3
    1. Compute the rank of a matrix
    2. Compute the determinant of a 2-dimensional array.
    3. Perform Sorting, Searching and Counting using Numpy methods.
13. Regular Expressions
    1. Write a python program to check the validity of a password given by the user. The password should satisfy the following criteria:
        1.1. Contain at least 1 letter between a and z
        1.2. Contain at least 1 number between 0 and 9
        1.3. Contain at least 1 letter between A and Z
        1.4. Contain at least 1 character from $, #, @
        1.5. Minimum length of password: 6
        1.6. Maximum length of password: 12
    2. Write a Python program to validate mobile number.

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Text Books:

1. Monu Singh Rakesh K . Yadav, Srinivas Arukonda "Zero To Mastery In Python Programming ", Vayu Education Of India, 2021
2. Martin C. Brown," PYTHON: The Complete Reference", McGraw-Hill, 2018
3. Allen Downey , "Learning with Python", Dreamtech Press; 1st edition , 2015

Reference Books:

1. Wesley J Chun," Core Python Applications Programming", Prentice Hall, 2012.
2. R. Nageswara Rao , "Core Python Programming" Dreamtech Press India Pvt Ltd 2018.
3. Allen B Downey," Think Python", O'Reilly, 2012.

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Course Code	Course Title						Core/Elective
SPC311CM	**OOPS USING JAVA LAB (Common to AI&DS, CSE, IT & CME SemIV)**						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	-	-	-	3	40	60	1.5

Course Objectives:

1. To introduce fundamentals of object-oriented concepts using java programming such as classes, inheritance, packages and interfaces.
2. To understand and apply concepts of exception handling, multithreading, collection framework.
3. To learn and use concepts of I/O streams, serialization, GUI programming using Swings, database connectivity.

Course Outcomes:

At the end of this course, the student will be able to

1. Understand object-oriented programming fundamental and java programming fundamentals such as classes, inheritance, abstract classes, interfaces, packages.
2. Apply exception handling, multithreading, input output basics and string handling.
3. Design and apply collection framework.
4. Design AWT and Swings concept.
5. Apply input-output operations through IO package.

List of Experiments: Write Programs using Java Language

1. To implement the concept of class with method overloading
2. To apply the concept of Single level and Multi level Inheritance.
3. To understand the concept of Interfaces.
4. To implement Abstract Classes concept.
5. To implement
   a) Checked Exception (IOException).
   b) Unchecked Exceptions. (Arithmetic Exception, Null Pointer Exception, Array Index Out Of Bounds Exception).
   c) User defined exception handling when user enters marks for a subject beyond the minimum and maximum range.
6. To implement
   a) The concept of threading using Thread Class and Runnable Interface.
   b) The concept of Thread synchronization.
7. To implement collection classes like Array List, Linked List, Tree map and Hash map.
8. To execute iteration over Collection using Iterator interface and List Iterator Interface.
9. To read a file name from the user, and display information about whether the file exists, whether the file is readable, whether the file is writable, the type of file and the length of the file in bytes. To copy contents of one file into another file.

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10. To implement serialization concept
11. To implement event handlers: mouse and key board events
12. To design a basic calculator application using swings.
13. To develop an applet that displays a simple message in center of a screen.

Text Books:

1. Java The complete reference, 8th edition, Herbert Schildt, TMH.
2. Core and Advanced Java, Black Book, Recommended by CDAC, Revised and Upgraded Dream tech Press.

References:

1. Core Java: An Integrated Approach, Dr R. Nageswara Rao, dreamtech.
2. Java How to Program, H.M. Dietel and P.J. Dietel, Sixth Edition, Pearson Education/PHI.
3. An Introduction to Object Oriented programming with Java,C Thomas Wu, Tata McGraw Hill, 2005.

Software Required: Java 8

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Course Code	Course Title						Core/Elective
SPC312CM	**CONCEPTS IN COMPUTER ORGANIZATION AND MICROPROCESSOR LAB (Common to AI&DS, CME & IT Sem IV)**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	2	40	60	1

Course Objectives

The objectives of the course are to impart knowledge of the:

- To become familiar with the architecture and Instruction set of Intel8085microprocessor.
- To provide practical hands on experience with Assembly Language Programming.
- To familiarize the students with interfacing of various peripheral devices with 8085 microprocessors

Course Outcomes

After the completion of the course, the student will be able to:

1. Interpret the principles of Assembly Language Programming, instruction set in developing microprocessor based applications.
2. Develop Applications such as: 8-bit Addition, Multiplication, Division, array operations, swapping, negative and positive numbers.
3. Analyse the interfaces like serial ports, digital-to-analog Converters and analog-to-digital converters etc.
4. Build interfaces of Input-output and other units like stepper motor.
5. Analyse the function of traffic light controller.

List of Experiments

PART A:

Programs using VERILOG

1. Review of the different logic design ckts., a) Gates b) Flip/Flop(RS, JK, D, T)
2. Familiarity with state of art IC-chips, e.g. a) Multiplexer , b) Decoder, c) Encoder, d) Counter, e)Shift-Register, f)adder Truth Table verification and clarification from Data-book.
3. Design a BCD adder.
4. Design an Adder/Subtracter composite unit
5. Design a carry-look ahead Adder
6. Design a ripple counter and carry-look ahead counter.
7. Design ALU and 4-bit processor

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PART B: 8085 Programming using Microprocessor Trainer Kit

8. Simple programming examples using 8085 instruction set. To understand the use of various instructions and addressing modes.
9. Interfacing and programming of 8255 (Eg. Traffic Light Controller)
10. Interfacing and programming of 8254.
11. Interfacing and programming of 8279.

PART C: 8051 Programming

12. Simple programming examples using 8051 Microcontroller
13. A/D and D/A converter interface
14. Stepper motor interface
15. Display Interface

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PART B: 8085 Programming using Microprocessor Trainer Kit

8. Simple programming examples using 8085 instruction set. To understand the use of various instructions and addressing modes.
9. Interfacing and programming of 8255 (Eg. Traffic Light Controller)
10. Interfacing and programming of 8254.
11. Interfacing and programming of 8279.

PART C: 8051 Programming

12. Simple programming examples using 8051 Microcontroller
13. A/D and D/A converter interface
14. Stepper motor interface
15. Display Interface

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CME: SEMESTER – IV

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/Wk	CIE	SEE	SEE Duration	
Theory Courses										
1	SHS401EG	Effective Technical Communication	2	-	-	2	40	60	3	2
2	SPC401CM	Automata Theory Languages and Computation	3	-	-	3	40	60	3	3
3	SPC402CM	Operating Systems	3	-	-	3	40	60	3	3
4	SPC403CM	Database Management Systems	3	-	-	4	40	60	3	3
5	SPC404CM	Design Analysis of Algorithms	3	1	-	4	40	60	3	4
Practical/ Laboratory Courses										
6	SPC411CM	Operating Systems Lab	-	-	4	4	40	60	3	2
7	SPC412CM	Database Management Systems Lab	-	-	4	4	40	60	3	2
8	SPC413CM	DAA Lab	-	-	2	2	40	60	3	1
9	SPW941CM	Internship-1	The students have to undergo an Internship of 4 week duration after IV-Semester SEE				50	-	-	1
Total			**14**	**2**	**8**	**24**	**370**	**480**		**21**

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Course Code	Course Title						Core / Elective
SHS401EG	Effective Technical Communication in English (Common to all Branches)						Core
Prerequisite	Contact Hours per week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	40	60	3

Course Objectives

1. To understand the process and barriers of communication
2. To learn the aspects of communication and presentation.
3. To comprehend the types of business correspondence
4. To analyze the techniques of report writing
5. To get the knowledge of basics of manual writing

Course Outcomes:

On successful completion of the course, the students should be able to:

- overcome the barriers of communication.
- handle technical and business communication effectively.
- build any kind of business correspondence.
- draft efficient reports.
- acquire adequate skills of manual writing.

UNIT I **Introduction to Communication**

- Definition and process of communication
- Channels of Communication
- ABC of Written Communication
- Barriers of Technical Communication

UNIT II **Aspects of Communication**

- Importance of listening and types of listening.
- Verbal communication and non-verbal communication (proxemics, kinesics).
- Persuasive techniques
- Presentation skills

UNIT III **Manual Writing**

- Types of manuals
- User manual
- Product and Process manual
- Operations manual

UNIT IV **Business Correspondence**

- Email etiquette and Mobile etiquette
- Agenda, Minutes of the Meeting and IOM (Inter Office Memorandum)
- Business letters (enquiry and response; complaint and adjustment; and sales)
- Business proposals

UNIT V **Report Writing**

- Types of reports (Informative, analytical, periodic and special, formal and informal)
- Structure of a report
- Feasibility report
- Progress report

Course Code	Course Title						Core/Elective
SHS401EG	**Effective Technical Communication CME IV & CSE IV**						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
SH901EG	2	-	-	-	40	60	2

Course Objectives:

1. To understand the process and barriers of communication.
2. To learn the aspects of communication and presentation.
3. To comprehend the types of business correspondence.
4. To analyze the techniques of report writing.
5. To get the knowledge of basics of manual writing.

Course Outcomes:

At the end of this course, the student will be able to

1. Overcome the barriers of communication.
2. Handle technical and business communication effectively.
3. Build any kind of business correspondence.
4. Draft efficient reports.
5. Acquire adequate skills of manual writing.

UNIT- I

Introduction to Communication.

Definition and process of communication.

Channels of Communication.

ABC of Written Communication.

Barriers of Technical Communication.

UNIT- II

Aspects of Communication

Importance of listening and types of listening.

Verbal communication and non-verbal communication (proxemics, kinesics).

Persuasive techniques.

Presentation skills

UNIT III

Manual Writing

Types of manuals

User manual

Product and Process manual
Operations manual

UNIT IV

Business Correspondence
Email etiquette and Mobile etiquette
Agenda, Minutes of the Meeting and 1OM (Inter Office Memorandum).
Business letters (enquiry and response; complaint and adjustment; and sales).
Business proposals

UNIT V

Report Writing
Types of reports (Informative, analytical, periodic and special, formal and informal)
Structure of a report
Feasibility report
Progress report

Suggested Readings

Raman, Meenakshi & Sharma, Sangeeta, "Technical Communication: Principles and Practices(3d edition), New Delhi (2015).

Rizvi, Ashrad, M, Effective Technical Communication(2nd Ed.). Tata McGraw Hill Education. New Delhi. (2017).

Sharma, R.C., & Mohan, Krishna Business Correspondance and Report Writing: A Practical Approach to Business & Technical Communication (4th ed.) Tata McGraw Hill Education, New Delhi (2017)

Tyagi, Kavitha & Misra, Padma, Advanced Technical Communication, New Delhi, PHI Learning (2011).

Course Code	Course Title						Core/Elective
SPC401CM	Automata Theory Languages and Computation						CORE
Prerequisite	Contact Hours per Week				CIE	SEE	CREDITS
	L	T	D	P			
Discrete Mathematics	3	1	-	-	40	60	3

Course Objectives: The students will be able to

1. To give an overview of the theoretical foundations of computer science from the perspective of formal languages
2. To illustrate finite state machines and push down automata to solve problems in computing
3. To familiarize Regular grammars, context frees grammar and context sensitive grammar

Course Outcomes:

After completion of this course, students will be able to

1. Gain the knowledge of basic kinds of finite automata and their capabilities.
2. Understand regular and context-free languages
3. Gain the knowledge to analyze regular expressions and grammars
4. Design finite automata, push down automata.
5. Constructing the Turing machine for Recursive languages.

UNIT-I

Automata: Introduction to Finite Automata, Central Concepts of Automata Theory.

Finite Automata: An informal picture of Finite Automata, Deterministic Finite Automata, Nondeterministic Finite Automata, An Application, Finite Automata with Epsilon Transitions.

UNIT-II

Regular Expression And languages: Regular Expressions, Finite Automata and Regular Expression, Applications of Regular Expressions, Algebraic Laws for Regular Expression.

Properties of Regular Languages: Proving Languages not to be Regular, Closure Properties of Regular Languages, Decision Properties of Regular Languages, Equivalence and Minimization of Automata.

UNIT-III

Context Free Grammars and Languages: Context-Free Grammars, Parse Trees, Applications, Ambiguity in Grammars and Languages

Properties of Context Free Languages: Normal Forms for Context-Free Grammars, Pumping Lemma, Closure Properties, Decision Properties of CFL 's.

UNIT-IV

Pushdown Automata: Definition, Model, Acceptance of CFL, Acceptance by Final State and

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Acceptance by Empty stack and its Equivalence, Equivalence of CFG and PDA.

Turing Machines (Tm): Formal definition and behaviour, Languages of a TM, TM as accepters, and TM as a computer of integer functions, Types of TMs.

UNIT-V

Recursive And Recursively Enumerable Languages (REL): Properties of recursive and recursively enumerable languages, Universal Turing machine, The Halting problem, Undecidable
problems about TMs. Context sensitive language and linear bounded automata (LBA), Chomsky hierarchy, Decidability, Post's correspondence problem (PCP), undecidability of PCP.

Text Books:

1. John Hopcroft, Rajeev Motwani, Jeffery D Ulman. Introduction to Automata Theory Languages and Computation, third edition, Pearson Education, 2009.

2. John C. Martin, Introduction to Languages and the Theory of computation, third Edition, Tata McGrawHill,2003.

3. Thomas Sudkamp, *Languages and Machines: An Introduction to the Theory of Computer Science*. (Third Edition)

Reference Books:

1. K. L. P Mishra, N. Chandrashekaran (2003), Theory of Computer Science-Automata Languages and Computation, 4th edition, Prentice Hall of India, India.

2. Kavi Mahesh, Theory of Computation A Problem solving approach, Wiley India Pvt. Ltd

3. Daniel I.A. Cohen, —Introduction to Computer Theory, John Wiley & Sons, 2nd Edition, 2004

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Course Code	Course Title						Core/Elective
SPC402CM	**OPERATING SYSTEMS (Common to AI&DS, CME, CSE & IT)**						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
SPC303CM	3	-	-	-	40	60	3

Course Objectives:

1. To learn fundamentals of Operating Systems.
2. To understand the functions of Operating Systems.
3. To learn memory management.

Course Outcomes:

At the end of this course, the student will be able to

1. Understand System calls and evaluate process scheduling.
2. Apply procedures for process synchronization.
3. Understand the concepts of deadlock.
4. Implement the concepts of memory management.
5. Understand file system interface and I/O systems.

UNIT-1

Introduction: Concept of Operating Systems, Generations of Operating systems, Types of Operating Systems, OS Services, System Calls, Structure of an OS - Layered, Monolithic, Microkernel Operating Systems, Concept of Virtual Machine.

UNIT-2

Processes: Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching.
Thread: Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads.
Process Scheduling: Foundation and Scheduling objectives, Types of Schedulers, Scheduling Criteria, Scheduling algorithms, multiprocessor scheduling.

UNIT-3

Process Synchronization: Inter-process Communication: Critical Section, Race Conditions, Mutual Exclusion, Peterson's Solution, classical problems of synchronization: The Bounded buffer problem, Producer\Consumer Problem, reader's writer problem, Dinning philosopher's problem. Semaphores, Event Counters, Monitors, Message Passing.
Deadlocks: Definition, Necessary and sufficient conditions for Deadlock, Methods for Handling: Deadlocks: Deadlock prevention, Deadlock Avoidance: Banker's algorithm,

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Course Code	Course Title						Core/Elective
SPC402CM	**OPERATING SYSTEMS (Common to AI&DS, CME, CSE & IT)**						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
SPC303CM	3	-	-	-	40	60	3

Course Objectives:

1. To learn fundamentals of Operating Systems.
2. To understand the functions of Operating Systems.
3. To learn memory management.

Course Outcomes:

At the end of this course, the student will be able to

1. Understand System calls and evaluate process scheduling.
2. Apply procedures for process synchronization.
3. Understand the concepts of deadlock.
4. Implement the concepts of memory management.
5. Understand file system interface and I/O systems.

UNIT-1

Introduction: Concept of Operating Systems, Generations of Operating systems, Types of Operating Systems, OS Services, System Calls, Structure of an OS - Layered, Monolithic, Microkernel Operating Systems, Concept of Virtual Machine.

UNIT-2

Processes: Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching.

Thread: Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads.

Process Scheduling: Foundation and Scheduling objectives, Types of Schedulers, Scheduling Criteria, Scheduling algorithms, multiprocessor scheduling.

UNIT-3

Process Synchronization: Inter-process Communication: Critical Section, Race Conditions, Mutual Exclusion, Peterson's Solution, classical problems of synchronization: The Bounded buffer problem, Producer\Consumer Problem, reader's writer problem, Dinning philosopher's problem. Semaphores, Event Counters, Monitors, Message Passing.

Deadlocks: Definition, Necessary and sufficient conditions for Deadlock, Methods for Handling: Deadlocks: Deadlock prevention, Deadlock Avoidance: Banker's algorithm,

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Deadlock detection and Recovery.

UNIT-4

Memory Management: Basic concept, Logical and Physical address map, Memory allocation: Contiguous Memory allocation, fragmentation, and Compaction; Paging: Principle of operation – Page allocation – Hardware support for paging, structure of page table, Protection and sharing, Disadvantages of paging.
Virtual Memory: Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page fault, Working Set, Dirty page/Dirty bit – Demand paging, Page Replacement algorithms, Trashing.

UNIT-5

File Management: Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods, Free-space management, directory implementation, efficiency, and performance.
Secondary-Storage Structure: Disk structure, Disk scheduling algorithms, Disk Management, RAID structure.

Text Books:
1. AviSilberschatz,PeterGalvin,GregGagne,OperatingSystemConceptsEssentials,9 th Edition, Wiley Asia Student Edition, 2017.
2. William Stallings, Operating Systems: Internals and Design Principles, 5 th Edition, Prentice Hall of India, 2016.
3. Maurice Bach, Design of the Unix Operating Systems, 8 th Edition, Prentice-Hall of India, 2009
4. Daniel P. Bovet, Marco Cesati, Understanding the Linux Kernel, 3 rd Edition, O'Reilly and Associates.
5. Naresh Chauhan, Principles of Operating Systems, Oxford University Press,2014

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Course Code	Course Title						Core/Elective
SPC403CM	**DATABASE MANAGEMENT SYSTEMS (Common to AI&DS, CME, IT & CSE IV Sem)**						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Programming for Problem Solving, Data Structures	3	-	-	-	40	60	3

Course Objectives:

1. To get familiar with fundamental concepts of database managements and with data base designing.
2. To master hands on SQL and PL/SQL concepts.
3. To impart knowledge in Indexing, hashing, transaction Management, concurrency control techniques and recovery techniques.

Course Outcomes:

At the end of this course, the student will be able to :

1. Understand the role of database management system in an organization and learn the database concepts.
2. Construct database queries using relational algebra and SQL
3. Design databases using data modeling and Logical database design techniques.
4. Evaluating the indexing, hashing techniques and transaction management.
5. Understand the concept of a database transaction and related concurrent, recovery facilities.

UNIT – I

Introduction: Database-System Applications, Purpose of Database Systems, View of Data, Database Languages, E.F. Codd rules.

Relational Databases: Database Design, Data Storage and Querying, Transaction Management, Database Architecture, Database Users and Administrators, History of Database Systems.

UNIT – II

Relational model: Structure of relational databases, fuundamental relational-algebra operations.

Introduction to SQL: Overview of the SQL, SQL Data Definition, Basic Structure of SQL Queries, Additional Basic Operations, Set Operations, Null Values, Aggregate Functions, Nested Sub queries, Modification of the Database.

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Advanced SQL: Join Expressions, Views, Transactions, Integrity Constraints, SQL Data Types and Schemas, Indexes and types of indexes. Functions, Procedures, Triggers, Cursors, Exceptions, and Packages.

UNIT – III

Database Design and the E-R Model: Overview of the Design Process, E-R Diagrams, Reduction to Relational Schemas, E-R Design Issues, Extended E-R Features.
Relational Database Design: Features of Good Relational Designs, Atomic Domains and First Normal Form, Decomposition Using Functional Dependencies, Functional-Dependency Theory, Algorithms for Decomposition, 2NF, 3NF, BCNF and 4NF

UNIT – IV

Indexing and Hashing: Sparse index and dense index, static and dynamic hashing.
Transactions: Transaction Concept, A Simple Transaction Model, Storage Structure, Properties of a transaction, Serializability, Implementation of Isolation Levels, Transactions as SQL Statements.

UNIT – V

Concurrency Control: Lock-Based Protocols, Multiple Granularity, Timestamp-Based Protocols, Validation-Based Protocols, Weak Levels of Consistency in Practice.
Backup and Recovery System: Failure Classification, Storage structure, Recovery and Atomicity, log based recovery with concurrent transactions, Buffer Management, Failure with Loss of Nonvolatile Storage, advanced recovery techniques, Remote Backup Systems.

Text Books:

1. Abraham Silberchatz, Henry F Korth and Sudarshan S, "Database System Concepts", Tata McGraw- Hill, 7th Edition.
2. Raghu Ramakrishnan and Johannes Gehrke, "Database Management Systems", Tata McGraw-Hill, 3rd Edition.
3. RamezElmasri and Shamkant B Navathe, "Fundamentals of Database Systems", Addison Wesley, USA, 6th Edition

Reference Books:

4. C J Date , "AN introduction to database systems", 8th Edition, Pearson.
5. Gupta G K, "Database Management System", Tata McGraw-Hill, New Delhi, 2011.

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Course Code	Course Title					Core/Title
SPC404CM	Design and Analysis of Algorithms (Common to CME IV, AI&DS,CSE,IT-V Sem)					Core
Prerequisite	Contact Hours Per Week			CIE	SEE	CREDITS
	L	T	P			
Problem Solving Skills, Data Structures, Discrete Structures	3	-	-	40	60	3

Course Objectives :

1. Analyze the asymptotic performance of algorithms
2. Demonstrate a familiarity with major algorithms and data structures,
3. Apply important algorithmic design paradigms and methods of analysis
4. Synthesize efficient algorithms in common engineering design situations.

Course Outcomes:

Upon completion of the course, the students will be able to:

1. Analyze the asymptotic performance of algorithms
2. Demonstrate a familiarity with major algorithms and data structures.
3. Apply important algorithmic design paradigms and methods of analysis
4. Synthesize efficient algorithms in common engineering design situations.

UNIT – I

Introduction: Algorithm definition and Specification, Asymptotic analysis, Performance measurements of Algorithms. Time and Space complexities, Analysis of Recursive algorithm.
Basic Data Structures: Disjoint set operations, Union and find algorithms, Dictionaries, Graphs and Trees.

UNIT – II

Divide and Conquer: General method, Control abstraction, Merge sort, Quick sort, Worst, Best, and Average case. Binary search
Brute Force: Closest Pair, Convex-Hull Problems, Exhaustive Search Travelling Salesman Problem, Knapsack problem, Assignment problem.

UNIT-III

Greedy Method: General Method, Knapsack problem, Job sequencing with deadlines, Minimum cost Spanning trees, Single source shortest path problem

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UNIT- IV

Dynamic Programming: General Method, All pairs shortest path problem, Optimal Binary search trees, 0/1knapsack problem.

Backtracking: General Method, Recursive backtracking algorithm, Iterative backtracking method, 8-Queen problem, Hamiltonian Cycle.

Branch and Bound: Control abstraction for Least Cost search, Bounding, FIFO branch and bound LC branch and bound, Traveling sales person problem, 0/1 Knapsack problem.

UNIT – V

Tries and Text Compression: Standard Tries, Compressed Tries, Suffix Tries, Huffman coding algorithm,

Strings and Pattern Matching Algorithms: String operations, Brute Force pattern matching, Boyer-Moore Algorithm

NP- Completeness: P and NP, NP-Completeness, NP Hard, Important NP-Complete Problems, Approximation Algorithms

Text Books:

1. E.Horowitz, S. Sahni, Fundamentals of Computer Algorithms.
2. M T Goodrich, Roberto Tamassia, Algorithm Design, John Wiley – 2002
3. Alfred V Aho, John E. Hopcroft and Jeffrey D. Ullman, "Data Structures Algorithm", Pearson Education, Reprint 2006

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Course Code	Course Title					Core/Title
SPC411CM	Operating Systems Lab (Common to AI&DS, CSE , IT , CME)					
Prerequisite	Contact Hours Per Week			CIE	SEE	CREDITS
	L	T	P			
	-	-	4	40	60	2

Course Objectives:

1. Understand unix commands.
2. Implement Process management related techniques.
3. Implement memory management techniques.

Course Outcomes:

Upon completion of the course, the students will be able to:

1. Execute the unix commands.
2. Implement CPU scheduling algorithms.
3. Implement producer-consumer problem reader-writers problem, dinning philosophers' problem.
4. Apply the Banker's algorithm for deadlock avoidance.
5. Implement page replacement and disk scheduling techniques.

1. Program to implement Unix system calls (fork(), wait(), exec(), sleep()) and file management.
2. Program to implement multithread concepts.
3. Program to implement CPU scheduling algorithms :
   (i) FCFS (ii) SJF (iii) Round Robin
4. Program to implement Shared memory and Inter Process Communication (IPC) techniques.
5. Program to implement Process Synchronization using Dining Philosopher
6. Program to implement Process Synchronization using Producer-Consumer.
7. Program to implement Process Synchronization using Readers-Writers.
8. Program to implement deadlock detection.
9. Program to implement Bankers Algorithm for Deadlock Avoidance.
10. Program to implement the following Page Replacement Algorithms using FIFO
11. Program to implement the following Page Replacement Algorithms using LRU and LFU.
12. Program to implement FCFS Disk Scheduling Algorithm.
13. Program to implement SSTF Disk Scheduling Algorithms

Text Books:

1.AviSilberschatz,PeterGalvin,GregGagne,OperatingSystemConceptsEssentials,9th Edition, Wiley Asia Student Edition, 2017.

2.Naresh Chauhan, Principles of Operating Systems, Oxford University Press,2014

Software Required: Putty interface, Windows

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Course Code	Course Title						Core/Elective
SPC412CM	**DATABASE MANAGEMENT SYSTEMS LAB (Common to AI&DS, CME, IT & CSE Sem IV)**						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
--	-	-	-	3	40	60	1.5

Course Objectives:

1. To practice various commands of SQL.
2. To write simple and Complex queries in SQL.
3. To familiarize with the PL/SQL programs.

Course Outcomes:

At the end of this course, the student will be able to

1. Implement the basic knowledge of SQL queries and relational databases.
2. Design and implement a database schema for a given problem.
3. Implement different constraints for refining of the databases.
4. Implement various triggers, procedures and cursors using PL/SQL.
5. Generate forms and reports.

List of Experiments:

1. Creation of database and writing SQL queries to retrieve information from the database.
2. Performing insertion, deletion, modifying, altering, updating and viewing records based on the conditions.
3. Creation of views, synonyms and savepoints.
4. To set various constraints.
5. Implementation of SQL inbuilt functions.
6. Implementation of Nested queries and Complex queries in SQL database.
7. Implementation of PL/SQL procedures and Functions?
8. Implementation of PL/SQL Cursors?
8. Implementation of different types of Exceptions in PL/SQL?
9. Implementation of Triggers in PL/SQL?
10. Implementation of PL/SQL Packages using various database objects?
11. Creation of Forms for Student information, Library information.
12. Report generation using SQL reports.
13. Creation of small full- fledged database application.

Text Books:

1. SQL, PL/SQL- The programming language of oracle, 4 th Edition, Ivan Bayross, BPB Publications.

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2. Oracle PL/SQL Training guide, SAMS, , BPB Publications.
3. The Complete Reference, SQL, 3 rd Edition, James R. Groff, Paul N.Weinberg, Andrew J. Oppel

Dr. Vaidehi

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Course Code	Course Title					Core/Title
SPC413CM	Design and Analysis of Algorithms Lab (Common to CME IV, AI&DS,CSE, - V Sem)					
Prerequisite	Contact Hours Per Week			CIE	SEE	CREDITS
	L	T	P			
Problem Solving Skills, Data Structures, Discrete Structures	-	-	2	40	60	1

Course Objectives:

1. To learn the importance of designing an algorithm in an effective way by considering space and time complexity.
2. To learn graph search algorithms.
3. To study network flow and linear programming problems.
4. To learn the dynamic programming design techniques..
5. To develop recursive backtracking algorithms.

Course Outcomes:

After Completion of the course, the students will be able to:

1. Design an algorithm in a effective manner.
2. Apply iterative and recursive algorithms.
3. Design iterative and recursive algorithms.
4. Implement optimization algorithms for specific applications.
5. Design optimization algorithms for specific applications.

List of Experiments:

SNo.	Description of the program
1	Print all the nodes reachable from a given starting node in a digraph using BFS method and Check whether a given graph is connected or not using DFS method.
2	Sort a given set of elements and determine the time required to sort the elements using following algorithms: • Merge Sort • Quick Sort
3	Implement Knapsack problem using • Brute Force Approach • Greedy Method • Dynamic Programming
4	Find Minimum Cost Spanning Trees of a given undirected graph using • Kruskal's algorithm • Prim's algorithm

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5 From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm

6 Implement Travelling Salesperson Problem using
- Brute Force Approach
- Dynamic Programming

7 Implement All-Pairs Shortest Paths Problem using Floyd's algorithm

8 Implement the following using Back Tracking
- N Queen's problem
- Hamiltonian Cycle
- Graph Coloring

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3rd BoS

FACULTY OF ENGINEERING

Scheme of Instruction & Examination

For

Four Year Degree Programme of

Bachelor of Engineering (B.E)

in

Computer Engineering

(With effect from the academic year 2023–24)

Estd. 2008

STANLEY COLLEGE OF ENGINEERING AND TECHNOLOGY FOR WOMEN (AUTONOMOUS)

(Affiliated to Osmania University)

(Accredited by NAAC with "A" Grade)

ABIDS, HYDERABAD-500001, Telangana.

Dr. Sridevi
BoS-chairperson
[CME]

Abbreviation	Meaning
HS	Humanities, Social Sciences and Management
BS	Basic Sciences including Mathematics, Physics and Chemistry
ES	Engineering Sciences including Workshop, Drawing, Basic Electrical / Electronics
PC	Professional Core Subjects
PE	Professional Elective Subjects
OE	Open Elective Subjects
PW	Project Work, Seminars, Internship
MC	Mandatory Courses
PY	Philosophy
EC	Electronics and Communication Engineering.
CE	Civil Engineering,
MP	Mechanical / Production Engineering
IT	Information Technology
CS	Computer Science Engineering
EE	Electrical and Electronics Engineering
CM	Computer Engineering
AD	Artificial Intelligence and Data Science
L	Lecture
T	Tutorial
P	Practical
G	Grade
D	Drawing
CIE	Continuous Internal Evaluation
SEE	Semester End Evaluation
	Each contact hour is a clock hour
	The duration of the Practical class is two hours; however, it can be extended wherever necessary, to enable the student to complete the experiment.

SMC901CM Induction Program (Mandatory)	3 weeks' duration
Induction program for students to be offered right at the start of the first year	• Physical Activity, Creative Arts • Universal Human Values • Literary , Proficiency Modules • Lectures by Eminent People • Visits to local Areas • Familiarization to Dept./Branch & Innovations

CME: SEMESTER – I

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/	CIE	SEE	SEE Duration in	
Theory Courses										
1	SHS901EG	English	2	-	-	2	40	60	3	2
2	SBS101MT	Mathematics- I	3	1	-	4	40	60	3	4
3	SBS902PH	Physics	3	-	-	3	40	60	3	3
4	SES101CS	Programming for Problem Solving	3	-	-	3	40	60	3	3
5	SMC903PO	Mandatory Course	2	-	-	2	40	60	3	-
6	SMC904PY	Mandatory Course	2	-	-	2	40	60	3	-
Practical/ Laboratory Courses										
7	SHS911EG	English Lab	-	-	2	2	40	60	3	1
8	SBS912PY	Physics Lab	-	-	4	4	40	60	3	2
9	SES111CS	Programming for Problem Solving Lab	-	-	4	4	40	60	3	2
10	SES914ME	Workshop	-	-	6	6	40	60	3	3
		Total	**15**	**1**	**16**	**32**	**400**	**600**		**20**

[Dr. K. VAIDEHI]
BOS - chairperson

Prof S. Srinivasa Rao
[as Nominee, Dept of CSE, OU]

CME: SEMESTER – II

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/	CIE	SEE	SEE Duration in	
Theory Courses										
1	SBS201MT	Mathematics-II	3	1	-	4	40	60	3	4
2	SBS903CH	Chemistry	3	-	-	3	40	60	3	3
3	SES901EC	Basic Electrical & Electronics Circuits	3	-	-	3	40	60	3	3
4	SES202CS	Data Structures using C	3	-	-	3	40	60	3	3
5	SMC902CE	Mandatory Course	2	-	-	2	40	60	3	-
6	SAC901CM	Audit Course	2	-	-	2	50	-	-	-
Practical/ Laboratory Courses										
7	SBS913CH	Chemistry Lab	-	-	4	4	40	60	3	2
8	SES915ME	Engineering Graphics & Design	1	-	4	5	40	60	3	3
9	SES212CS	Data Structures using C Lab	-	-	2	2	40	60	3	1
10	SES911EC	Basic Electrical & Electronics Circuits Lab	-	-	4	4	40	60	3	2
11	SPW211CM	Field Work	The Students have to undergo a Field work of 2-week duration after II-Semester SEE				50	-	-	1
Total			**17**	**01**	**14**	**32**	**460**	**540**		**22**

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CME: SEMESTER – III

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/	CIE	SEE	SEE Duration in	
Theory Courses										
1	SBS301MT	Mathematics -III (Probability and Statistics)	3	-	-	3	40	60	3	3
2	SES301CM	Discrete Mathematics	3	-	-	3	40	60	3	3
3	SES302EC	Digital Electronics	3	-	-	3	40	60	3	3
4	SPC301CM	OOPs Using JAVA	3	-	-	3	40	60	3	3
5	SPC302CM	Concepts in Computer Organization & Microprocessor	3	-	-	3	40	60	3	3
6	SAC902EE	Electrical Technology	2	-	-	2	-	-	-	-
Practical/ Laboratory Courses										
7	SES311CM	Python programming Lab	-	-	4	4	40	60	3	2
8	SPC311CM	OOPs Using JAVA Lab	-	-	4	4	40	60	3	2
9	SPC312CM	Concepts in Computer Organization & Microprocessor Lab	-	-	4	4	40	60	3	2
		Total	**17**	**-**	**12**	**29**	**320**	**480**		**21**

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CME: SEMESTER – IV

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/Wk	CIE	SEE	SEE Duration in Hrs	
Theory Courses										
1	SHS401EG	Effective Technical Communication	2	-	-	2	40	60	3	2
2	SPC401CM	Automata Theory Languages and Computation	3	-	-	3	40	60	3	3
3	SPC402CM	Operating Systems	3	-	-	3	40	60	3	3
4	SPC403CM	Database Management Systems	3	-	-	4	40	60	3	3
5	SPC404CM	Design Analysis of Algorithms	3	1	-	4	40	60	3	4
Practical/ Laboratory Courses										
6	SPC411CM	Operating Systems Lab	-	-	4	4	40	60	3	2
7	SPC412CM	Database Management Systems Lab	-	-	4	4	40	60	3	2
8	SPC413CM	Design and Analysis of Algorithms Lab	-	-	2	2	40	60	3	1
9	SPW941CM	Internship-1	The students have to undergo an Internship of 4 week duration after IV- Semester SEE				50	-	-	1
Total			**14**	**2**	**8**	**24**	**370**	**480**		**21**

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CME: SEMESTER – V

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/Wk	CIE	SEE	SEE Duration in	
		Theory Courses								
1	SPC501CM	Artificial Intelligence	3	-	-	3	40	60	3	3
2	SPC502CM	Data Communication & Computer Networks	3	-	-	3	40	60	3	3
3	SPC503CM	Compiler Design	3	-	-	3	40	60	3	3
4	PE-I	Professional Elective-I	3	1	-	4	40	60	3	4
5	OE-I	Open Elective-I	3	-	-	3	40	60	3	3
		Practical/ Laboratory Courses								
6	SPC511CM	Artificial Intelligence Lab	-	-	4	4	40	60	3	2
7	SPC512CM	Data Communication & Computer Networks Lab	-	-	4	4	40	60	3	2
8	SPC513CM	Compiler Design Lab	-	-	2	2	40	60	3	1
		Total	**15**	**1**	**10**	**26**	**320**	**480**		**21**

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CME: SEMESTER – VI

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/Wk	CIE	SEE	SEE Duration in	
Theory Courses										
1	SHS904BM	Managerial Economics & Financial Accounting	3	-	-	3	40	60	3	3
2	SPC601CM	Data Science	3	-	-	3	40	60	3	3
3	SPC602CM	Software Engineering	3	-	-	3	40	60	3	3
4	SPC603CM	Internet of things	3	-	-	4	40	60	3	3
5	PE-II	Professional Elective-II	3	-	-	3	40	60	3	3
Practical/ Laboratory Courses										
6	SPC611CM	Data Science Lab	-	-	4	4	40	60	3	2
7	SPC612CM	Software Engineering Lab+ Mini Project	-	-	4	4	40	60	3	2
8	SPC613CM	Web Technology & Applications Lab	-	1	2	2	40	60	3	2
9	SPW961CM	Technical Seminar –I	-	-	2	2	50	-	3	1
10	SPW962CM	Internship-2	The students have to undergo an Internship of 4 week duration after VI-Semester SEE				50	-	-	1
Total			**15**	**1**	**12**	**28**	**420**	**480**		**23**

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Dr. Vaidehi

CME: SEMESTER – VII

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/Wk	CIE	SEE	SEE Duration in	
Theory Courses										
1	SPC701CM	Machine Learning Techniques	3	-	-	3	40	60	3	3
2	PE-III	Professional Elective-III	3	-	-	3	40	60	3	3
3	PE-IV	Professional Elective-IV	3	-	-	3	40	60	3	3
4	PE-V	Professional Elective-V	3	-	-	3	40	60	3	3
5	OE-II	Open Elective-II	3	-	-	3	40	60	3	3
Practical/ Laboratory Courses										
6	SPC711CM	Machine Learning Techniques Lab	-	-	2	2	40	60	3	1
7	SPE71XCM	Professional Elective-IV Lab	-	-	2	2	40	60	3	1
8	SPW711CM	Project work-I	-	-	6	6	40	60	3	3
9	SPW971CM	Technical Seminar -2	-	-	2	2	50	-	-	1
Total			**15**	**-**	**12**	**27**	**370**	**480**		**21**

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Prof. S. Srinivasa

CME: SEMESTER - VIII

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/Wk	CIE	SEE	SEE Duration in	
Theory Courses										
1	OE-III	Open Elective-III	3	-	-	3	40	60	3	3
Practical/ Laboratory Courses										
2	SPW821CM	Project work-II	-	-	16	16	40	60	3	8
Total			**03**	**-**	**16**	**19**	**80**	**120**		**11**

PC: Professional Course PE: Professional Elective
HS: Humanities and social Science
MC: Mandatory Course
L: Lecture **T:** Tutorial
P: Practical **D:** Drawing
CIE: Continuous Internal Evaluation
SEE: Semester End Examination (Univ. Exam)

Note:
1. Each contact hour is a Clock Hour
2. The practical class can be of two and half hour (clock hours) duration as per the requirement of a particular laboratory.

Note-: ** Subject is not offered to the students of CSE and IT Department.

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Professional Elective-I		
Sl.No	**Course Code**	**Course Title**
1.	PE501CM	Computer Graphics
2.	PE501CM	Data Warehousing & Data Mining
3.	PE501CM	Advanced Databases
4.	PE501CM	Signals & Systems
5.	PE501CM	Cryptography & Network Security

Professional Elective-II		
Sl.No	**Course Code**	**Course Title**
1.	PE601CM	Computer Vision
2.	PE601CM	Mathematical Modeling for Data Science
3.	PE601CM	Distributed Systems
4.	PE601CM	Embedded Systems
5.	PE601CM	Cyber Security

Professional Elective-III		
Sl.No	**Course Code**	**Course Title**
1.	PE701CM	Natural Language Processing
2.	PE701CM	Data Visualization
3.	PE701CM	Cloud Computing
4.	PE701CM	Advance Internet of Things(IOT)
5.	PE701CM	Digital Forensics

Professional Elective-IV		
Sl.No	**Course Code**	**Course Title**
1.	PE702CM	Cognitive Science and Analytics
2.	PE702CM	NO SQL Databases
3.	PE702CM	Modern Architecture for Large Applications
4.	PE702CM	Wireless Sensor Network
5.	PE702CM	Database Security & Administration

Professional Elective-V		
Sl.No	**Course Code**	**Course Title**
1.	PE703CM	Deep Learning
2.	PE703CM	Data Analytics
3.	PE703CM	Architecting Applications for Cloud
4.	PE703CM	Block Chain Technology
5.	PE703CM	Malware Analysis

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LIST OF OPEN ELECTIVES

Open Elective-I			
Sl.No	**Course Code**	**Course Title**	**Course Offered by the Department**
1.	SOE501MB	Entrepreneurship	(MBA)
2.	SOE501EG	Soft Skills and Interpersonal Skills	(H&S)
3.	SOE501MT	Operations Research	(Mathematics)
4.	SOE501CE	Road Safety Engineering	(CE)
5.	SOE501CE	Industry Safety	(Mechanical)

Open Elective-II			
Sl.No	**Course Code**	**Course Title**	**Course Offered by the Department**
1.	SOE701EG	Technical Writing for Research	(H&S)
2.	SOE701MB	Human Resource Management	(MBA)
3.	SOE701CE	Disaster Mitigation	(CE)
4.	SOE701EE	Renewable Energy Sources	(EEE)
5.	SOE701EC	Digital Signal Processing	(ECE)

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CME:SEMESTER-V

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/Wk	CIE	SEE	SEE Duration in	
Theory Courses										
1	SPC501CM	Artificial Intelligence	3	-	-	3	40	60	3	3
2	SPC502CM	Data Communication & Computer Networks	3	-	-	3	40	60	3	3
3	SPC503CM	Compiler Design	3	-	-	3	40	60	3	3
4	PE-I	Professional Elective-I	3	1	-	4	40	60	3	4
5	OE-I	Open Elective-I	3	-	-	3	40	60	3	3
Practical/ Laboratory Courses										
6	SPC511CM	Artificial Intelligence [redacted] Lab	-	-	4	4	40	60	3	2
7	SPC512CM	Data Communication & Computer Networks Lab	-	-	4	4	40	60	3	2
8	SPC513CM	Compiler Design Lab	-	-	2	2	40	60	3	1
		Total	**15**	**1**	**10**	**26**	**320**	**480**		**21**

Professional Elective-I		
Sl. No	**Course Code**	**Course Title**
1.	PE511CM	Computer Graphics
2.	PE512CM	Data Warehousing & Data Mining
3.	PE513CM	Advanced Databases
4.	PE514CM	Signals & Systems
5.	PE515CM	Cryptography & Network Security

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SYLLABUS
B.E. V – SEMESTER
(COMPUTER ENGINEERING)

Course Code	Course Title						Core/Elective
SPC501CM	ARTIFICIAL INTELLIGENCE						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
SBS301MT, SES311CM-Mathematics - III(Probability and Statistics) Python	3	-	-	-	40	60	3

Course Objectives:

1. Understand the importance of the field of AI by discussing its history and various applications.
2. Learn methods of expressing knowledge by a machine with appropriate reasoning and different mathematics involved behind it.
3. To discuss the various components that is involved in solving an AI problem.

Course Outcomes: At the end of this course, the student will be able to

1. Formalize a problem in the language/framework of different AI methods.
2. Illustrate basic principles of AI in solutions that require problem solving, search, Inference.
3. Represent natural language/English using Predicate Logic to build knowledge through various representation mechanisms.
4. Demonstrate understanding of steps involved in building of intelligent agents, expert systems, Bayesian networks.
5. Differentiate between learning paradigms to be applied for an application

UNIT-I

Introduction: Foundations of AI, History, State of the Art, Risks and Benefits.
Intelligent agents: Agents and Environment, The Concept of Rationality, Structure of an Agent. Solving problems by Search- Problem-Solving Agents, State space representation, Search graph and Search tree Searching for Solutions, Uninformed Search Strategies: Breadth-first search, Uniform cost search, Depth- first search, Best first search, Iterative deepening Depth-first search, Bidirectional search.

UNIT-II

Informed (Heuristic) Search Strategies: Greedy best-first search, A* search, Heuristic Functions, Hill- climbing search, Simulated annealing search.

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Adversarial Search: Game Theory, Optimal Decisions in Games, Alpha–Beta Pruning, Imperfect Real-Time Decisions. Constraint Satisfaction Problems.

UNIT-III

Logic Concepts and Logic Programming: Introduction, Propositional Calculus Propositional Logic, Natural Deduction System, Axiomatic System, Semantic Table, A System in Propositional Logic, Resolution, Refutation in Propositional Logic, Predicate Logic, Logic Programming.

Structured knowledge representation- Knowledge Representation using Semantic Network, Extended Semantic Networks for KR, Knowledge Representation using Frames.

Expert System and Applications: Introduction, Phases in Building Expert Systems, Expert System Architecture, Applications.

Unit IV

Planning – STRIPS Planning Systems, States and Goals, Forward Search Methods, Recursive STRIPS, Plans with Run-Time Conditionals, The Susman Anomaly, Backward Search Methods, Plan Spaces and Partial-Order Planning, Hierarchical Planning

Uncertainty: Basic probability, Baye's rule, belief networks, inference in Bayesian networks, utility functions.

UNIT-V

Fuzzy System: Fuzzy Logic Control, Sugeno style of Fuzzy inference processing, Fuzzy Hedges, α-cut threshold, Neuro Fuzzy systems.

Evolutionary Computation: Introduction, Soft Computing, Genetic Algorithms, Genetic Programming Concepts, Evolutionary programming, Swarm Intelligence, Ant Colony Paradigm, Particle Swarm Optimization, Applications.

TEXT BOOKS:

1. Saroj Kaushik, Artificial Intelligence, Cengage learning -2nd Edition 2022.
2. Stuart Russell and Peter Norvig: Artificial Intelligence – A Modern Approach, 4th Edition, Pearson education Press, 2021
3. Kevin Knight, Elaine Rich, B. Nair, Artificial Intelligence, 3rd edition, McGraw Hill 2008.

REFERENCES BOOKS:

1. Deepak Khemani, First Course in Artificial Intelligence, MC-Graw Hills Education India, 2013
2. Kevin Knight, Elaine Rich, B. Nair, Artificial Intelligence, 3rd edition, McGraw Hill 2008
3. N.J. Nilsson, "Artificial Intelligence – A New Synthesis", Morgan Kaufmann Publisher, 2015.

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Course Code	Course Title						Core/Elective
SPC502CM	DATA COMMUNICATION & COMPUTER NETWORKS						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	40	60	3

Course Objectives: The educational objectives of this course are

1. To introduce internet routing architecture and protocols.
2. To learn the flow control and congestion control algorithms in Transport Layer.
3. To learn basic and advanced socket system calls.

Course Outcomes: At the end of this course, the student will be able to

1. Identify various networking components.
2. Understand the function of each layer of OSI and trace the flow of information from one node to another node in the network.
3. Understand the principles of IP addressing and internet routing.
4. Describe the working of various networked applications such as DNS, mail, file transfer and www.
5. Implement client-server socket-based networked applications.

UNIT I

DATA COMMUNICATIONS: Components, analog and digital signals and Encoders, Modems, RS232 Interfacing Switching: Circuit Switching, Message Switching and Packet Switching. Topologies – Concept of layering -Protocols and Standards – ISO / OSI model, TCP/IP

UNIT II

DATA LINK LAYER: Error Control: Error detection and correction (CRC and Hamming code for single bit correction) Flow Control: stop and wait – - sliding window protocols-go back-N ARQ – selective repeat ARQ MAC LAYER: Ethernet IEEE 802.3LAN, Manchester encoding, Binary exponential algorithm, Efficiency calculation, ARP and RARP.

Prof S. Srinivasa Rao

UNIT III

NETWORK LAYER: Internetworks – virtual circuit and Datagram approach Routing – Distance Vector Routing, Link State Routing, OSPF and BGP IPv4 , addressing, Subnetting, IPv6, CIDR, ICMP and IGMP protocols.

UNIT IV

TRANSPORT LAYER: Services of transport layer, Multiplexing and crash recovery Transmission Control Protocol (TCP) – TCP window management Congestion Control, timer management and User Datagram Protocol (UDP)

UNIT V

APPLICATION LAYER: Domain Name Space (DNS) – SMTP – FTP – HTTP.
SOCKET PROGRAMMING: Primitive and advanced system calls, client/server iterative and concurrent programs IO multiplexing, Asynchronous IO and select system call.

TEXT BOOKS:

1. Computer Networks (5th Edition), Authors: Andrew S. Tanenbaum, David J. Wetherall, Pearson
2. Computer Networks: A Systems Approach, Authors: Larry Peterson and Bruce Davie, Elsevier
3. Computer Networking: A Top-Down Approach (6th Edition), Authors: James F. Kurose , Keith W. Ross, Pearson

REFERENCES BOOKS:

1. Data Communications and Networking, 4th edition, Behrouz A Forouzan, Tata McGraw Hill, 2007.
2. Data and Computer Communication, 8th edition, William Stallings, Pearson Prentice Hall India.

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Course Code	Course Title						Core/Elective
SPC503CM	COMPILER DESIGN						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
SPC401CM(Automata Theory Languages and Computation)	3	-	-	-	40	60	3

Course Objectives:

1. To understand the process of compilation and different methods of lexical analysis
2. Design top-down and bottom-up parsers and identify synthesized and inherited attributes
3. Develop syntax directed translation schemes and generate code for a target machine

Course Outcomes: At the end of this course, the student will be able to

1. Understand the different phases of compiler.
2. Develop the lexical analyzer for a given syntax.
3. Design top-down and bottom-up parsers for a given grammar.
4. Develop syntax directed translation schemes.
5. Develop algorithms for generating intermediate code.

UNIT-I

Introduction: The Structure of a Compiler, Phases of Compilation, The Translation Process, Major Data Structures in a Compiler, Linkers, Loaders, Bootstrapping and Porting.

Lexical Analysis (Scanner): The Role of the Lexical Analyzer, Input Buffering, Specification of Tokens, Recognition of Tokens.

UNIT-II

Syntax Analysis (Parser): The Role of the Parser, Syntax Error Handling and Recovery, Top-Down Parsing-recursive- Descent Parsing FIRST and FOLLOW-LL(1) Grammars-Non Recursive Predictive Parsing. Bottom-Up Parsing, LR Parsing-SLR Parser, Canonical LR Parser-LALR-Parser Generators-YACC.

UNIT-III

Syntax-Directed Translation: Syntax-Directed Definitions, Evaluation Orders for SDD's Applications of Syntax-Directed Translation.

Symbol Table: Structure, Operations, Implementation and Management.

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UNIT-IV

Intermediate Code Generation: Variants of Syntax Trees, Three-Address Code, Types and Declarations, Translation of Expressions, Type Checking.

Run-time environment: Storage Organization, Stack Allocation of Space, Access to Nonlocal Data on the Stack, Parameter passing.

UNIT-V

Code Generation: Issues in the Design of a Code Generator, The Target Language, Addresses in the Target Code, Basic Blocks and Flow graphs.

Code Optimization: Optimization of Basic Blocks, Peephole Optimization, Register Allocation and Assignment. Machine-Independent Optimizations: The Principal Sources of Optimizations, Introduction to Data-Flow Analysis

TEXT BOOKS:

1. Alfred V. Aho, Monica S. Lam, Ravi Sethi, & Jeffrey D. Ullman , Compilers :Principles, Techniques and Tools, 2nd Edition, Pearson Education, 2006.
2. Allen I.Holub, "Compiler Design in C", Prentice Hall of India, 2003.

REFERENCE BOOKS:

1. Bennet J.P.,Introduction to Compiler Techniques, Tata McGraw-Hill, 2nd Edition.2003.
2. Kenneth C. Louden, Compiler Construction: Principles and Practice, Thomson Learning Inc., 1997.
3. P.Trembley and P.S.Sorenson, The Theory and Practice of Compiler Writing, TMH 1985

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Course Code	Course Title						Core/Elective
SPC511CM	ARTIFICIAL INTELLIGENCE LAB						Core
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
SES311CM(PYTHON)	-	-	-	4	40	60	2

Course Objective-

1. To study the applications of AI and agent based approach to AI.
2. To study first-order predicate calculus, logical reasoning and problem solving using Prolog language.
3. To study and discuss various techniques and algorithms of AI used in general problem solving.

Course Outcome- After completing this course, the student will be able to:

1. Explain artificial intelligence, its characteristics and its application areas.
2. Formulate real-world problems as state space problems.
3. Select and apply appropriate algorithms and AI techniques to solve complex problems.
4. Design and develop an expert system by using appropriate tools and techniques.
5. To analyze different learning paradigms.

List of Experiments:

1. Implement
   a. 3 missionaries and 3 cannibal's problem.
   b. Water jug problem
2. Write a program to implement Uninformed search techniques:
   a. BFS
   b. DFS
3. Write a program to implement informed search techniques
   a. Greedy Best first search
   b. A* algorithm
4. Study of Prolog, its facts, and rules.
   a. Write simple facts for the statements and querying it.
   b. Write a program for Family-tree.
5. Write a program to implement basic fuzzy set operation
6. Write a program to implement bayesian Belief Network for a given Probabilistic acyclic graph.

Prof. S. Srinivasa Rao

7. In addition to the above program, student should be encouraged to study implementation of any one of the following Gamebot(tic-tac-toe,8 puzzle),Expert System, Chatbot

TEXT BOOKS:

1. Stuart Russell and Peter Norvig: Artificial Intelligence – A Modern Approach, 4th Edition, Pearson education Press, 2021.
2. Saroj Kaushik, Artificial Intelligence, Cengage learning -2022, 2nd Edition.
3. John J. Craig, "Introduction to Robotics", Addison Wesley publication.

REFERENCES BOOKS:

1. Deepak Khemani, First Course in Artificial Intelligence, MC-Graw Hills Education India, 2013.
2. Kevin Knight, Elaine Rich, B. Nair, Artificial Intelligence, 3rd edition, McGraw Hill 2008.
3. N.J. Nilsson, "Artificial Intelligence – A New Synthesis", Morgan Kaufmann Publisher, 2015.

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Course Code	Course Title						Core/Elective
SPC512CM	DATA COMMUNICATION & COMPUTER NETWORKS LAB						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Java, Python	-	-	-	4	40	60	2

Course Objectives:

1. Learn to implement the different protocols.
2. Be familiar with the various routing algorithms, socket programming and simulation tools.
3. To use simulation tools to analyze the performance of various network protocols

Course Outcomes: At the end of this course, the student will be able to

1. Implement various protocols using TCP and UDP.
2. Program using sockets.
3. Use simulation tools to analyze the performance of various network protocols.
4. Implement and Analyze various routing algorithms.

List of Experiments:

1. Configuration of hub. (using real devices or simulators)
2. Configuration of switch, router. (using real devices or simulators)
3. Configuration of Home Automation System using Cisco Packet tracer Tool
4. Running and using services/commands like tcp dump, nets tat, ifconfig, nslookup, FTP,
5. TELNET and trace route. Capture ping and trace route PDUs using a network protocol analyzer and examine.
6. Study of Network simulator (NS) and Simulation of Congestion Control Algorithms using NS. Performance evaluation of Routing protocols using Simulation tools.

Prof. S. Srinivasa Rao

7. Network packet analysis using tools like Wireshark, tcpdump, etc.
8. Network simulation using tools like Cisco Packet Tracer, NS3, etc.
9. Network simulation using tools like OMNeT++.
10. Socket programming using UDP (e.g., simple DNS, data & time client/server, echo client/server, iterative & concurrent servers)
11. Socket programming using TCP (e.g., simple DNS, data & time client/server, echo client/server, iterative & concurrent servers)
12. Programming using raw sockets.

Note: The Instructor may add/delete/modify/tune experiments, wherever he/she feels in a justified manner. Laboratory requirement for students:

TEXT BOOKS:

1. Computer Networks (5th Edition), Authors: Andrew S. Tanenbaum , David J. Wetherall, Pearson
2. Computer Networks: A Systems Approach, Authors: Larry Peterson and Bruce Davie, Elsevier
3. Computer Networking: A Top-Down Approach (6th Edition), Authors: James F. Kurose , Keith W. Ross , Pearson

REFERENCES BOOKS:

1. Data Communications and Networking, 4th edition, Behrouz A Forouzan, Tata McGraw Hill, 2007.
2. Data and Computer Communication, 8th edition, William Stallings, Pearson Prentice Hall India.

Hardware: Standalone desktops

Software:

1. C / C++ / Java / Python / Equivalent Compiler

2. Network simulator like NS2/NS3/OPNET/ CISCO Packet Tracer / Equivalent

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Course Code	CourseTitle						Core/Elective
SPC513CM	COMPILER DESIGN LAB						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-----	-	-	-	2	40	60	1

CourseObjectives:

1. To Learn usage of tools like LEX, YACC
2. To develop a code generator
3. To implement different code optimization schemes

Course Outcomes: At the end of this course, the student will be able to

1. Generate scanner and parser from formal specification
2. Generate top down parsing tables using predictive parsing,
3. Implement bottom up parsers: SLR and LR parsers..
4. Apply the knowledge of YACC to syntax directed translations for generating intermediate code– 3 address code.
5. Build a code generator using different intermediate codes and optimize the target codes.

List of experiments to be performed:

1. Sample programs using LEX
2. Scanner Generation using LEX
3. Elimination of Left Recursion in a grammar
4. Left factoring a grammar
5. LL(1) parser ,Recursive Descent parser
6. LR parsers-Shift Reduce parser, SLR ,LALR parsers
7. Parser generation using YACC
8. Intermediate Code Generation
9. Target Code Generation
10. Code Optimization

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TEXT BOOKS:

1. Alfred V. Aho, Monica S. Lam, Ravi Sethi, & Jeffrey D. Ullman , Compilers :Principles, Techniques and Tools, 2nd Edition, Pearson Education, 2006.
2. Allen I.Holub, "Compiler Design in C", Prentice Hall of India, 2003.

REFERENCE BOOKS:

1. Bennet J.P., "Introduction to Compiler Techniques", Tata McGraw-Hill, 2nd Edition.2003.
2. Kenneth C. Louden, Compiler Construction: Principles and Practice, Thomson Learning Inc., 1997.
3. P.Trembley and P.S.Sorenson, The Theory and Practice of Compiler Writing, TMH 1985

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PROFESSIONAL ELECTIVES-I

Course Code	Course Title						Core/Elective
SPE511CM	COMPUTER GRAPHICS						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	1	-	-	40	60	4

Course Objectives:

1. To introduce the concept of synthetic camera model , programmable pipeline and OpenGL API
2. To study different interaction modes and data structures that store 2-D and 3-D geometric objects
3. To study different rasterization and rendering algorithms

Course Outcomes: At the end of this course, the student will be able to

1. Describe the steps in graphics programming pipeline
2. Write interactive graphics applications using OpenGL geometricprimitives
3. Apply affine transformations for viewing and projections
4. Create realistic images of 3-d objects that involve lighting shadingaspects
5. Use of geometric transformations on graphics objects.

UNIT-I

Graphics Systems and Models: Graphics system, Images, Physical and Synthetic, Imaging system, Synthetic camera model, Programming interface, Graphics architectures, Programmable pipelines.

Graphics Programming: Programming two-dimensional applications, OpenGL API, Primitives and attributes, Color, Viewing and Control functions.

UNIT-II

Input and Interaction: Input devices, Display lists & modeling, Programming event-driven input, Picking, Building interactive models,Animating interactive programs, Logic operations.

Geometric Objects: Three-dimensional primitives, Coordinatesystems and frames, Frames in Open GL, Modeling colored cube.

Prof. S. Srinivasa Rao

UNIT-III

Transformations: Affine transformations, Transformations in Homogeneous coordinates, Concatenation of transformations, OpenGLtransformation matrices.
Viewing: Classical and Computer views, Viewing with a computer, Positioning of camera, Simple projections, Projections in OpenGL,Hidden surface removal, Parallel-projection matrices, Perspective-projection matrices.

UNIT-IV
Lighting and Shading: Light sources, The Phong lighting model, Computational vectors, Polygonal shading, Light sources in OpenGL, Specification of matrices in OpenGL, Global illumination.
From Vertices to Frames: Basic implementation strategies, Line-segment clipping, Polygon clipping, Clipping in three dimensions, Rasterization, Anti-aliasing.

UNIT-V

Modeling & Hierarchy: Hierarchal models, Trees and traversal, Use oftree data structure, Animation, Graphical objects, Scene graphs, Simplescene graph API, Open Scene graph, Other tree structures.

TEXT BOOKS

1. Edward Angel, Interactive Computer Graphics: A Top-Down Approach Using OpenGL, Pearson Education, 5th edition, 2009.
2. David J. Eck," Introduction to Computer Graphics",http://math.hws.edu/graphicsbook, version 1.3.1, 2021.
3. Hearn Donald, Pauline M Baker, Computer Graphics, 2nd edition, 1995.

REFERENCE BOOKS

1. Jim X. Chen, Foundations of 3D Graphics Programming using JOGL and Java3D, Springer Verlag, 2006.
2. Francis S Hill Jr., Stephen M Kelley, Computer Graphics using OpenGL, Prentice Hall Inc., 3 rd Edition, 2007.

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Course Code	Course Title						Core/Elective
SPE512CM	DATA WAREHOUSING & DATA MINING						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	1	-	-	40	60	4

Course Objectives:

1. To learn about the how data iscollected from various data bases.
2. To learn how data will be transformed according to the users query.
3. To understand how the query is processed by the warehouse and according to the query the pattern will get as an output.

Course Outcomes: At the end of this course, the student will be able to

1. Understand the functionality of the various data ware housing component.
2. To study the methodology of engineering legacy databases for datawarehousing to derive business rules for decision support systems.
3. Apply suitable pre-processing and visualization techniques for data analysis.
4. Apply frequent pattern and association rule mining techniques for data analysis.
5. Develop skill in selecting the appropriate data mining algorithm for solving practical problems.

UNIT-I

Data Warehouse Fundamentals: Introduction to Data Warehouse, OLTP Systems; Differences between OLTP Systems and Data Warehouse: Characteristics & Functions of Data Warehouses, Advantages and Applications of Data Warehouse, Top- Down and Bottom-Up Development Methodology: Tools for Data warehouse development: Data Warehouse Types. **Data Warehouse Architecture:** Introductions, Components of Data warehouse Architecture: Technical Architectures; Data warehouse architectures Tool selection: Federated Data Warehouse Architecture:

UNIT-II

Dimensional Modeling: Introduction: E-R Modeling: Dimensional Modeling: E-R Modeling VS Dimensional Modeling: Data Warehouse Schemas; Star Schema, Inside Dimensional Table, Inside Fact Table, Fact Less Fact Table, Granularity, Star Schema Keys: Snowflake Schema, Fact Constellation Schema

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Extract, Transform and Load: Introduction: ETL Overview or Introduction to ETL: ETL requirements and steps: Data Extraction; Extraction Methods, Logical Extraction Methods, Physical Extraction Methods: Data Transformation; Basic Tasks in Transformation, Major Data Transformation Types: Data loading; Data Loading Techniques: ETL Tools:

UNIT-III

Introduction: Data mining, Kinds of data, Kinds of pattern, Major issues in data mining.
Getting to know your data: Data Objects and Attribute Types, Basic Statistical Descriptions of Data, Measuring Data Similarity and Dissimilarity.
Data Pre-processing: An Overview, Data Cleaning, Data Integration, Data Reduction, Data Transformation and Data Discretization.

UNIT-IV

Mining Frequent Patterns, Associations, and Correlations: Basic Concepts and Methods Basic Concepts, Frequent Item set Mining Methods, Apriori, Fp-growth Pattern Evaluation Methods.
Classification: Basic Concepts, Basic Concepts, Decision Tree Induction, Bayes Classification Methods, Rule-Based Classification

UNIT-V

Cluster Analysis: Basic Concepts and Methods: Cluster Analysis, Partitioning Methods, Hierarchical Methods: Agglomerative versus Divisive Hierarchical Clustering, Distance Measures in Algorithmic Methods, DBSCAN, Evaluation of Clustering, Clustering graph and network data.

TEXT BOOKS:

1. Alex Berson and Stephen J.Smith, Data Warehousing, Data Miningand OLAP, Tata McGraw – Hill Edition, 35th Reprint 2016.
2. Jiawei Han and Micheline Kamber, Data Mining Concepts and techniques, 3rd Edition, Elsevier, 2012.

REFERENCE BOOKS:

1. Data Ware Housing Fundamentals, Pualraj Ponnaiah, Wiley Student Edition.
2. Ralph Kimball, Margy Ross, "The Data Ware House Toolkit" , Wiley, 3rd Edition,2013.
3. VikaramPudi, P Radha Krishna, Data Mining, Oxford University Press.

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Course Code	Course Title				Core/Elective
SPE513CM	ADVANCED DATABASES				ELECTIVE
Prerequisite	Contact Hours Per Week			CIE	SEE	CREDITS
	L	T	P			
	3	1	-	40	60	4

Course Objectives:

1. To acquire knowledge on parallel and distributed databases and its applications.
2. To study the usage and applications of Object Oriented and Intelligent databases.
3. To understand the merging databases like Mobile, XML, Cloud and Big data.

Course Outcomes: After Completion of the course, the students will be able to:

1. Describe the features added to object-relational systems to distinguish them from standard relational systems.
2. Model a relational / semi-structured database using XML Schema.
3. Understand different algorithms used in the implementation of query evaluation engine
4. Understand the different concurrency control and commit protocols in distributed databases
5. Demonstrate an understanding of the role and the concepts involved in special purpose databases such as Temporal, Spatial, Mobile and other similar database types

UNIT – I

Object Based Databases: Overview, Complex Data Types, Structured Types and Inheritance in SQL, Table Inheritance, Array and Multi-set. Types in SQL, Object-Identity and Reference Types in SQL, Implementing O-R features, Persistent Programming Languages, Object-Relational Mapping, and Object-Oriented versus Object-Relational.

UNIT – II

XML: Motivation, Structure of XML data, XML Document Schema, Querying and Transformation, Application Program Interface to XML, Storage of XML data, XML applications.

UNIT-III

Query Processing: Overview, Measures of Query Cost, Selection Operation, Sorting, join Operation, Other Operations, Evaluation of Expressions.

Prof. S. Srinivasa Rao

Query Optimization: Overview, Transformation of Relational Expressions, Estimating Statistics of Expression Results, Choice of Evaluation Plans, Materialized Views.

UNIT- IV

Parallel Databases: Introduction, 1/0 Parallelism, Inter query Parallelism, Intra query Parallelism, Intra-operation Parallelism, Interoperation Parallelism.

Distributed Databases: Homogeneous and Heterogeneous Database, Distributed Data Storage, Distributed. Transactions, Commit Protocols, Concurrency Control in Distributed Databases.

UNIT- V

Advanced Application Development: Performance Tuning, Performance Benchmarks Other Issues in Application Development.

Spatial and Temporal Data and Mobility: Spatial and Geographic Data, Multimedia Databases, Mobility and Personal Databases.

TEXT BOOKS:

1. Abraham Silberschatz, Henry F Korth, S Sudarshan, Database System Concepts, McGraw Hill International Edition, 6th Edition, 2010.
2. Elmasri Navathe, Somayajulu, Gupta, Fundamentals of Database Systems, Pearson Education, 4th Edition, 2006.

REFERENCE BOOKS:

1. CJ Date, A Kannan, S Swamynathan, An Introduction to Database Systems, Pearson Education, 8th Edition, 2006.
2. Raghu Rama Krishnan and Johannes Gehrke, Database Management Systems, McGraw-Hill International Edition, 3rd Edition, 2002.

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Course Code	Course Title				Core/Elective
SPE514CM	SIGNALS & SYSTEMS				Elective
Prerequisite	Contact Hours Per Week			CIE	SEE	CREDITS
	L	T	P			
	3	1	-	40	60	4

Course Objectives:

1. To explain signals and systems representations/classifications and also describe the time and frequency domain analysis of continuous time signals with Fourier series, Fourier transforms and Laplace transforms.
2. To understand Sampling theorem, with time and frequency domain analysis of discrete time signals with DTFS, DTFT and Z-Transform
3. To present the concepts of convolution and correlation integrals and also understand the properties in the context of signals/systems and lay down the foundation for advanced courses.

Course Outcomes: After Completion of the course, the students will be able to:

1. Define and differentiate types of signals and systems in continuous and discrete time
2. Apply the properties of Fourier transform for continuous time signals
3. Relate Laplace transforms to solve differential equations and to determine the response of the Continuous Time Linear Time Invariant Systems to known inputs
4. Apply Z-transforms for discrete time signals to solve Difference equations.
5. Obtain Linear Convolution and Correlation of discrete time signals with graphical representation

UNIT – I

Some Useful Operations on Signals: Time shifting, Time scaling, Time inversion. Signal models: Impulse function, Unit step function, Exponential function, Even and odd signals. Systems: Linear and Non-linear systems, Constant parameter and time varying parameter systems, Static and dynamic systems, Causal and Non-causal systems, Lumped Parameter and distributed parameter systems, Continuous-time and discrete- time systems, Analog and digital systems.

UNIT – II

Fourier Series: Signals and Vectors, Signal Comparison: correlation, Signal representation by orthogonal signal set, Trigonometric Fourier Series, Exponential Fourier Series, LTI system response to periodic inputs.

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UNIT – III

Continuous-Time Signal Analysis: Fourier Transform: A periodic signal representation by Fourier integral, Fourier Transform of some useful functions, Properties of Fourier Transform, Signal transmission through LTI Systems, ideal and practical filters, Signal energy. Laplace transform: Definition, some properties of Laplace transform, solution of differential equations using Laplace transform.

UNIT – IV

Discrete-Time Signals and Systems: Introduction, some useful discrete-time signal models, Sampling continuous-time sinusoids and aliasing, Useful signal operations, examples of discrete-time systems. Fourier analysis of discrete-time signals, periodic signal representation of discrete-time Fourier series, aperiodic signal representation by Fourier integral.

UNIT – V

Discrete-time signal analysis: Z-Transform, some properties of Z-Transform, Solution to Linear difference equations using Z-Transform, System realization. Relation between Laplace transform and Z-Transform.

DTFT: Definition, Properties of DTFT, comparison of continuous-time signal analysis with discrete-time signal analysis.

TEXT BOOKS:

1. B. P. Lathi, Linear Systems and Signals, Oxford University Press, 2nd Edition, 2009
2. Alan V O P Penheim, A. S. Wlisky,Signals and Systems, 2nd Edition, Prentice Hall
3. Rodger E. Ziemer, William H Trenter, D. Ronald Fannin, Signals and Systems, 4th Edition, Pearson 1998.

REFERENCE BOOKS:

1. Douglas K. Linder, Introduction to Signals and Systems, McGraw Hill, 1999
2. P. Ramakrishna Rao, Signals and Systems, TMH.
3. Anand Kumar, Signals & Systems, PHI publication, 2nd Edition, 2012.
4. Oppenheim & Willsky, Signals & Systems, PHI Publications, 2nd Edition, 1996

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Course Code	Course Title					Core/Elective
SPE515CM	CRYPTOGRAPHY & NETWORK SECURITY					Elective
Prerequisite	Contact Hours Per Week			CIE	SEE	CREDITS
	L	T	P			
	3	1	-	40	60	4

Course Objectives:

1. Understand the basic categories of threats to computers and networks
2. Understand various cryptographic algorithms and describe public-key cryptosystem
3. Discuss Web security and generate and distribute a PGP key pair.

Course Outcomes: After Completion of the course, the students will be able to:

1. Identify the security issues in the network and resolve it
2. Analyze the vulnerabilities in any computing system and hence be able to design a security solution
3. Ability in designing suitable encryption, decryption algorithms for ensuring secure communication
4. Evaluate security mechanisms using rigorous approaches by key ciphers and Hash functions
5. Demonstrate various network security applications, IPSec, Email Security etc

UNIT – I

Security Concepts: Introduction, The need for security, Security approaches, Principles of security, Types of Security attacks, Security services, Security Mechanisms, A model for Network Security Cryptography Concepts and Techniques: Introduction, plain text and cipher text, substitution techniques, transposition techniques, encryption and decryption, symmetric and asymmetric key cryptography, steganography.

UNIT – II

Symmetric Key Ciphers: Block Cipher principles, DES, AES, Blowfish, RC5, IDEA, Block cipher operation, Stream ciphers, RC4.Asymmetric key Ciphers: Principles of public key cryptosystems, RSA algorithm, Diffie-Hellman Key Exchange, Knapsack Algorithm.

UNIT – III

Cryptographic Hash Functions: Message Authentication, Secure Hash Algorithm (SHA-512), Message authentication codes: Authentication requirements, HMAC, CMAC, Digital signature.
Key Management and Distribution: Symmetric Key Distribution Using Symmetric & Asymmetric Encryption, Distribution of Public Keys, Kerberos, X.509 Authentication Service, Public –Key Infrastructure

Prof S. Srinivasa Rao

UNIT - IV

Transport-level Security: Web security considerations, Secure Socket Layer and Transport Layer Security, HTTPS, Secure Shell (SSH)

Wireless Network Security: Wireless Security, Mobile Device Security, IEEE 802.11 Wireless LAN

UNIT – V

E-Mail Security: Pretty Good Privacy, S/MIME IP Security: IP Security overview, IP Security architecture, Authentication Header, Encapsulating security payload, combining security associations, Internet Key Exchange

TEXT BOOKS:

1. Cryptography and Network Security - Principles and Practice: William Stallings, Pearson Education, 7th Edition
2. Cryptography and Network Security: AtulKahate, Mc Graw Hill, 3rd Edition

REFERENCE BOOKS:

1. Cryptography and Network Security: C K Shyamala, N Harini, Dr T R Padmanabhan, Wiley India, 1st Edition.
2. Cryptography and Network Security: Forouzan Mukho padhyay, Mc Graw Hill, 3rd Edition.
3. Information Security, Principles, and Practice: Mark Stamp, Wiley India.
4. Principles of Computer Security: WM. Arthur Conklin, Greg White, TMH.
5. Introduction to Network Security: Neal Krawetz, CENGAGE Learning.
6. Network Security and Cryptography: Bernard Menezes, CENGAGE Learning.

Sh. Vaidehi

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CME: SEMESTER – VI

No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/Wk	CIE	SEE	SEE Duration	
		Theory Courses								
1	SHS904BM	Managerial Economics & Financial Accounting	3	-	-	3	40	60	3	3
2	SPC601CM	Data Science	3	-	-	3	40	60	3	3
3	SPC602CM	Software Engineering	3	-	-	3	40	60	3	3
4	SPC603CM	Internet of things	3	-	-	4	40	60	3	3
5	PE-II	Professional Elective-II	3	-	-	3	40	60	3	3
		Practical/ Laboratory Courses								
6	SPC611CM	Data Science Lab	-	-	4	4	40	60	3	2
7	SPC612CM	Software Engineering Lab+ Mini Project	-	-	4	4	40	60	3	2
8	SPC613CM	Web Technology & Applications Lab	-	1	2	2	40	60	3	2
9	SPW961CM	Technical Seminar –I	-	-	2	2	50	-	3	1
10	SPW962CM	Internship-2	The students have to undergo an Internship of 4 week duration after VI-Semester SEE				50	-	-	1
		Total	**15**	**1**	**12**	**28**	**420**	**480**		**23**

Professional Elective-II

Sl. No	Course Code	Course Title
1.	PE621CM	Computer Vision
2.	PE622CM	Mathematical Modeling for Data Science
3.	PE623CM	Distributed Systems
4.	PE624CM	Embedded Systems
5.	PE625CM	Cyber Security

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Syllabus
B.E. VI – SEMESTER
(COMPUTER ENGINEERING)

Course Code	Course Title					Core/Elective
SPC601CM	DATA SCIENCE					Core
Prerequisite	Contact Hours Per Week			CIE	SEE	CREDITS
	L	T	P			
	3	-	-	40	60	3

Course Objectives:
1. Provide knowledge and expertise about data to become a proficient data scientist.
2. To learn basics of Programming environment.
3. To learn various statistical concepts and visualization of data.

Course Outcomes: After Completion of the course, the students will be able to:
1. To learn the concepts of data science.
2. Analyze and Extract Statistical Inferences from data.
3. Able to visualize the data.
4. Prepare the data for training and testing.
5. Able to predict the data

UNIT-I

Introduction: Introduction to Data Science, Need of Data Science, Data science process, Life Cycle of Data Science, Data science toolkit, Types of data, Data Security Issues, Data Science Classification, Applications of data science.

UNIT II

Statistics: Sample Statistics, Correlation, Variance, Inference: Statistical Hypothesis Testing, Confidence Intervals, P hacking, Bayesian Inference, ANOVA.

UNIT-III

Data Pre-Processing: Data Pre-Processing Overview, Data Cleaning: Missing values, dealing with noisy data, Spread, outliers Data. Transformation Discretization: Transformation strategies overview, transformation by normalization, discretization by binning, Feature Selection and Feature Extraction.

UNIT-IV

Data Visualization: Introduction, Types of Visualization, Types of Data, Data Encoding, Visual Encoding, Redundant Encoding, Color Encoding, Retinal Variables, Exploratory Data Analysis.

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UNIT V

Data Science Libraries: NumPy-Installing and Importing NumPy, Creating Arrays, Indexing and Slicing, Element-by-element operations, NumPy Math, Pandas-Creating Data Frames, Interacting with Data Frames, Manipulating Data Frames, Manipulating Data, Mat plot lib-Styling Plots, Labeled Data, Plotting Multiple Sets of Data, Object-Oriented Style, Scikit-Learn: Splitting the Data, Learning More About Scikit-Learn, Seaborn, NLTK. Predictive Modeling: Linear Regression, Simple Linear Regression model building, Multiple Linear Regression, **Error Metrics**-MSE, RMSE, MAE.

TEXT BOOKS:

1. Kennedy R.Behrman, "Foundation python for data science", Addison – Wesley, 2021
2. Vijay Kotu and Bala Deshpande, "Data Science concepts and practice", Morgan Kaufmann Publishers, 2nd edition, 2018.
3. Jiawei Han and Jian Pei,"Data Mining Concepts and Techniques "Morgan Kaufmann Publishers, 2018.

REFERENCE BOOKS:

1. Jain V.K., "Data Sciences", Khanna Publishing House, Delhi, 2018.
2. Peter Bruce, Andrew Bruce & Peter Gedeck, "Practical Statistics for Data Scientists", 2nd edition, 2020.
3. Seema Acharya, "Data Analytics using R", 1nd edition, McGraw Hill Publication.2018.

MOOC Courses

1. https://onlinecourses.nptel.ac.in/noc23_cs21/preview
2. https://onlinecourses.nptel.ac.in/noc21_cs69/preview

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Course Code	Course Title				CIE	SEE	Core/Elective
SPC602CM	SOFTWARE ENGINEERING						Core
Pre requisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
----	3	-	-	-	40	60	3

Course Objectives:

1. To introduce the basic concepts of software development processes from defining a product to shipping and maintaining
2. To impart knowledge on various phases, methodologies and practices of software development
3. To understand the importance of testing in software development, study various testing strategies along with its relationship with software quality and metrics

Outcomes: Student will be able to:

1. Acquired working knowledge of alternative approaches and techniques for each phase of software development
2. Judge an appropriate process model(s) assessing software project attributes and analyze necessary requirements for project development eventually composing SRS
3. Creation of visual models to describe (non-) algorithmic solutions for projects using various design principles.
4. Acquire skills necessary as an independent or as part of a team for architecting a complete software project by identifying solutions for recurring problems exerting knowledge on patterns.
5. Concede product quality through testing techniques employing appropriate metrics by understanding the practical challenges associated with the development of a significant software system.

UNIT– I

Introduction to Software Engineering

A generic view of Process: Software Engineering, Process Framework, CMM Process Patterns, Process Assessment.
Process Models: Prescriptive Models, Waterfall Model, Incremental Process Models, Evolutionary Process Models, Specialized Process Models, The Unified Models, Personal and Team Process Models, Process Technology, Product and Process.
An Agile view of Process: Introduction to Agility and Agile Process, Agile Process Models.

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Unit-II

Software Engineering Principles: SE Principles, Communication Principles, Planning Principles, Modeling Principles, Construction Principles, Deployment.
System Engineering: Computer-based Systems, The System Engineering Hierarchy, Business Process Engineering, Product Engineering, System Modeling.
Requirements Engineering: A Bridge to Design and Construction, Requirements Engineering Tasks, Initiating Requirements Engineering Process, Eliciting Requirements, Developing Use-Cases, Building the Analysis Model, Negotiating Requirements, Validating Requirements.

UNIT– III

Building the Analysis Model: Requirements Analysis Modeling Approaches, Data Modeling Concepts, Object-Oriented Analysis, Scenario-based Modeling, Flow-oriented Modeling, Class-based Modeling, Creating a Behavioral Model.
Design Engineering: Design within the context of SE, Design Process and Design Quality, Design Concepts, The Design Model, Pattern-based Software Design.

UNIT– IV

Creating an Architectural Design: Software Architecture, Data Design, Architectural Styles and Patterns, Architectural Design.
Modeling Component-Level Design: Definition of Component, Designing Class-based Components, Conducting Component-level Design, Object Constraint Language, Designing Conventional Components.
Performing User Interface Design: The Golden Rules, User Interface Analysis and Design, Interface Analysis, Interface Design Steps, Design Evaluation.

UNIT– V

Testing: Strategies: A Strategic Approach to Conventional Software Testing, Test Strategies for O-O Software. **Tactics:** Software Testing Fundamentals, Black-box and White-box Testing, Basis Path Testing, Control Structure Testing, O-O Testing Methods.
Debugging: Debugging Techniques, The Art of Debugging.
Product Metrics: A Framework for Product Metrics, Metrics for each phase of software development.
Software Quality: Definition, **Quality Assurance:** Basic Elements, Formal Approaches, Statistical Software Quality Assurance, Software Reliability, ISO9000 Quality Standards, SQA plan.

TEXT BOOKS:

1. Roger S. Pressman, Software Engineering: A Practitioner"s Approach, 7th Edition, McGraw Hill, 2009
2. AliBeh forooz and Frederick J.Hudson, Software Engineering Fundamentals, Oxford University Press, 1st Edition, 1996.

Prof. S. Srinivasa Rao

3. Pankaj Jalote, An Integrated Approach to Software Engineering, 3rd Edition, Narosa Publishing House, 2008

REFERENCE BOOKS

1. Pressman, Roger Software Engineering: A Practitioner' Approach, McGraw Hill , New York 7th Edition, 2010.
2. Sommer ville, Ian Software Engineering, Addison-Wesley, Boston, 9th Edition, 2011.
3. Stephens, Rod Beginning Software Engineering, Wrox, 2015.

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Course Code	Course Title						Core/Elective
SPC603CM	INTERNET OF THINGS						Core
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
----	3	-	-	-	40	60	3

Objectives: Students understanding will be enhanced by:-

1. To introduce the concepts of automation in daily life and IoT based communication systems.
2. To understand the importance of cloud technologies in the field of IoT and standard embedded boards like Raspberry Pi.
3. To study a real time system with a view of an application program interface (API).

Course Outcomes: Student will be :

1. Able to design IoT based solutions for given problem statements.
2. Able to develop programs for Raspberry Pi.
3. Able to demonstrate the functionality of cloud communication.
4. Able to analyze the technologies used in IoT.
5. Able to incorporate multiple sensors to develop an IoT based system.

UNIT I

Introduction to Internet of Things

Definition and Characteristics of IoT, Physical Design of IoT: Things in IoT, IoT protocols, Logical Design of IoT: IoT functional Blocks, Communication Models, APIs, IoT enabling Technologies: Wireless Sensor Networks, Cloud Computing, Big Data

UNIT II

Internet Principles and communication technology

Internet Communications: An Overview – IP, TCP, IP protocol Suite, UDP. IP addresses – DNS, Static and Dynamic IP addresses, MAC Addresses, TCP and UDP Ports, Application Layer Protocols – HTTP, HTTPS, Cost Vs Ease of Production, Prototypes and Production, Open Source Vs Closed Source. Prototyping Embedded Devices – Sensors, Actuators, Microcontrollers, SoC, Choosing a platform, Prototyping Hardware platforms – Arduino, Raspberry Pi. Prototyping the physical design – Laser Cutting, 3D printing, CNC Milling

UNIT III

API Development and Embedded programming

Getting started with API, Writing a new API, Real time Reactions, Other Protocols, Techniques for writing embedded code: Memory management, Performance and Battery Life, Libraries, Debugging. Developing Internet of Things: IoT design Methodology, Case study on IoT System for weather Monitoring.

Prof. S. Srinivasa Rao

UNIT IV

IoT Systems - Logical Design using Python

Introduction to Python, Data Types and Structures, Control Flow, Functions, Modules, Packages, File Handling, Date/Time Operations., Classes, and Python packages for IoT, IoT Physical Devices and Endpoints: Raspberry Pi, Interfaces of Pi, Programming pi with Python - Controlling LED and LDR using Pi with python programming.

UNIT V

Applications of IoT

Analytics IoT Applications: Smart Home, Smart Cities, Smart Environment, Smart Energy, Smart Retail and Logistics, Smart Agriculture and Industry, Smart Industry and smart Health (Ref1)

Cloud computing and Data analytics and IoT Product Manufacturing Introduction to Cloud storage models and Communication APIs, Amazon webservices for IoT, Sky net IoT Messaging Platform. Introduction to Data Analytics for IoT (Ref 1). Case studies illustrating IoT Design – Smart Lighting, Weather Monitoring, Smart Irrigation.(Ref 1) Business model for IoT product manufacturing, IoT Startups, Mass manufacturing, Ethical issues in IoT.

TEXT BOOKS:

1. Vijay Madisetti, Arshdeep Bahga," Internet of Things A Hands-On- Approach", 1st Edition, 2014.
2. Adrian McEwen (Author), Hakim Cassimally, —Designing the Internet of Things, Wiley India Publishers, 1st Edition, 2013.
3. Kenneth A Lambert and B.L. Juneja, —Fundamentals of Pythonl, Cenage Learning, 1st Edition, 2015.

REFERENCE BOOKS

1. Adrian McEwen, "Designing the Internet of Things", Wiley Publishers, ISBN: 978-1-118-43062-0, 2013.

Online Open-source Hardware and Software Resource

1. "Introduction to ARDUINO",https://www.arduino.cc/en/guide/introduction,
2. "Built-In Examples",https://www.arduino.cc/en/Tutorial/BuiltInExamples
3. "ArduinoIoT Cloud", https://www.arduino.cc/en/IoT/HomePage

Industry Survey Article ©

Postscapes, "IoT Standards and Protocols", 01/02/2020,https://www.postscapes.com/internet-of- things-protocols,

Case Studies

ARDUINO Project Hub, https://create.arduino.cc/projecthub,

Online Learning: MOOC courses on Raspberry Pi,https://www.raspberrypi.org/training/online

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Course Code	Course Title						Core/Elective
SPC611CM	DATA SCIENCE LAB						Core
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
----	-	-	-	4	40	60	2

Course Objectives:

1. Provide knowledge and expertise about data to become a proficient data scientist.
2. To learn basics of programming environment.
3. To learn various statistical concepts and visualization of data.

Outcomes: After Completion of the course, the students will be able to:

1. Apply the different data preprocessing techniques.
2. Calculate statistics about the data.
3. Apply data visualization techniques.
4. Prepare the data for training and testing.
5. Implement data science techniques to real world problems.

LIST OF EXPERIMENTS

1. **Download and Install Libraries:** NumPy, Pandas, Matplotlib, Scikit-Learn, Seaborn.
2. **Reading and Writing Different Types of Datasets**
   a. Reading different types of data sets (.txt, .csv) from Web and disk and writing in file in specific disk location.
   b. Reading Excel data sheet.
   c. Reading XML dataset.
   d. Reading data from database.
3. **Descriptive Statistics**
   a. Write a program to calculate, that measures the central tendency and dispersion of data.
   b. Write a program to find basic descriptive statistics using summary, str, quartile function on mt cars dataset.
   c. Write a program to find subset of dataset by using subset (), aggregate () functions on iris dataset.
4. **Perform data preprocessing operations.**
   a. Noise Removal
   b. Filling Missing Values

Prof S. Srinivasa Rao

c. Outlier Detection

5. **Perform Data Transformation Operations**

a. Min max normalization

b. Z-score normalization

6. **Inferential Statistics**

a. Write a program to find F Test, T Test for the given dataset.

7. **Correlation and Covariance**

a. Find the correlation matrix.
b. Plot the correlation plot on dataset and visualize giving an overview of relationships among data on iris data.
b. Analysis of covariance.

8. **Visualizations**

a. Find the data distributions using box and scatter plot.
b. Find the outliers using plot.
c. Plot the histogram, bar chart and pie chart on sample data.

9. Write a program to build a linear regression model, check the model on test data and predict the result.

TEXT BOOKS:

1. Kennedy R.Behrman, "Foundation python for data science", Addison – Wesley, 2021.
2. Vijay Kotu and Bala Deshpande, "Data Science concepts and practice", Morgan Kaufmann Publishers, 2nd edition,2018.
3. Jiawei Han and Jian Pei, " Data Mining Concepts and Techniques " Morgan Kaufmann Publishers,2018.

REFERENCE BOOKS:

1. Jain V.K., "Data Sciences", Khanna Publishing House, Delhi, 2018.
2. Peter Bruce, Andrew Bruce & Peter Gedeck, "Practical Statistics for Data Scientists", 2nd edition, 2020.
3. Seema Acharya, "Big Data and Analytics", 2nd edition, 2019.

MOOC Courses

1. https://onlinecourses.nptel.ac.in/noc23_cs21/preview
2. https://onlinecourses.nptel.ac.in/noc21_cs69/preview

Prof. S. Srinivasa Rao

Course Code	Course Title						Core/Elective
SPC612CM	SOFTWARE ENGINEERING LAB & MINIPROJECT						Core
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
----	-	-	-	4	40	60	2

Course Objectives:

1. To understand the software engineering methodologies for project development.
2. To gain knowledge about open source tools for Computer Aided Software Engineering (CASE).
3. To develop test plans and test cases to perform various testing.

Course Outcomes: Student will be able to:

1. Analyze and design software requirements in an efficient manner.
2. Use open source case tools to develop software.
3. Implement the design, debug and test the code.
4. Evaluate different solutions based on economic and technical feasibility.
5. Demonstrate effective coding, written, presentation and oral communication skills

I. FORWARD ENGINEERING

Students have to form a team with a batch size of two or three and take up a case study based project to analyze, plan, design UML models and create a prototypical model (identifying deliverables) by coding the developed design s and finally documenting considering any one example of the following domains:

1. Academics (Course registration System , Student marks analyzing system)
2. Health Care (Expert system to prescribe medicines forgiven symptoms, Remote Diagnostics, Patient/Hospital Management System)
3. Finance (Banking: ATM/ Net Banking, UPI: Pay TM / Phone Pay)
4. E-Commerce(any Online shopping portal) Logistics(Postal/Courier: India Post /DTDC /UPS)
5. Hospitality (Tourism Management: Telangana Tourism/Incredible India, Event Management)
6. Social Networking(LinkedIn, Face Book, Shaadi.com, Bharat Matrimony, Tinder)
7. Customer Support(Banking Ombudsman ,Indian Consumer Complaints Forum)
8. Booking/Ticketing(Online Food Ordering ,Travel: {Cars: Uber/OLA/Zoom, Railways: IRCTC, Buses: Online TSRTC/Red Bus /Abhi Bus, Flights: Make MyTrip)

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REVERSE ENGINEERING: Students have to refer any project repository: GitLab/ GitHub, execute the code in order to observe its functionalities/features/requirements and by the help of any tool derive the designs from the code for understanding the relationships among various subsystems/ classes/ components and If the tool partially generates models then identify by associating elements to judge/make the appropriate relationships.

II. TESTING: Prepare Test Plan and develop Test Case

Hierarchy monitor run cover/report errors using manual/automated testing tools Software Required: Star UML/ Umbrello Net Beans /Eclipse IDE , XAMP/MEAN stack, JUnit, JMeter, Selenium ,Bugzilla.

GUIDELINES FOR MINI PROJECT

The students are required to carry out mini projects in any of the areas such as Data Structures, Micro processors and Interfacing, Database Management Systems, Operating Systems, Design and Analysis of Algorithms, Software Engineering, Data Communications, Web Programming & Services, Computer Networks, Compiler Construction, Object Oriented System Development.

Problems Statements are suggested to be taken can also be taken from **Smart India Hackathon (SIH)** Portal invited from the Ministries /PSUs /MNCs/ NGOs to be worked out through.
The project could be classified as hard ware, software, modeling, simulation etc. The project should involve one or many elements of techniques such as analysis, design, and synthesis.

The department will appoint a project Coordinator who will coordinate the following:

1. Grouping of students (maximum of 3 students in a group)
2. Allotment of projects and project guides.
3. All projects allotment is to be completed by the 4th week of the semester so that the students get sufficient time for completion of the project.

Disseminate guidelines given by monitoring committee comprising of senior faculty members to the students and their guides.

4. Three periods of contact load will also be assigned to each project guide for project guidance and monitoring at regular intervals.
5. Sessional marks are to be awarded by the monitoring committee.
6. Common norms will be established for the final presentation and documentation of the project report by the respective departments.
7. Students are required to submit a presentation and report on the mini project at the end of the semester.

Prof. S. Srinivasa Rao

TEXT BOOKS:

1. Roger S. Pressman, Software Engineering: A Practitioner's Approach, 7th Edition, McGraw Hill, 2009.
2. Ali Beh forooz and Frederick J.Hudson, Software Engineering Fundamentals, Oxford University Press, 1996.
3. Pankaj Jalote, An Integrated Approach to Software Engineering, 3rd Edition, Narosa Publishing House, 2008.

REFERENCES BOOK:

1. Summerville, Ian Software Engineering, Addison-Wesley, Boston, MA. (2011).
2. Stephens, Rod Beginning Software Engineering, Wrox.2015.

Prof. S. Srinivasa Rao

Course Code	Course Title				CIE	SEE	Core/Elective
SPC613CM	WEB TECHNOLOGY & APPLICATIONS LAB						Core
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
----	-	1	-	2	40	60	2

Course Objectives: The students will try to learn:

1. Programming skills in Html5, CSS3, Bootstrap 4.
2. Developing skills of Web application user interaction using JavaScript.
3. Web application Development Database with React and React Native.

Course outcomes: Students will be able:

1. To design layouts.
2. To understand the BOOTSTRAP for designing applications.
3. To understand the concepts of JAVA script and implement dynamic forms.
4. To design and develop games using HOOKS .
5. To develop a full stack application.

1. HTML LAYOUTS AND LINKS
   a. Develop a web application to control over different layouts.
   b. Create a webpage with HTML describing your department use paragraph and list tags.
   c. Apply various colors to suitable distinguish key words, also apply font styling like italics, underline and two other fonts to words you find appropriate, also use header tags.
   d. Create links on the words e.g. "Wi-Fi" and "LAN" to link them to Wikipedia pages.

2. Web Application Design Formatting
   a. Develop a web application with background banner image and navigation menus.
   b. Develop a web application with responsive images.
   c. Develop a web application using left menu.
   d. Develop setting to change the theme of entire web Application.

3. INTRODUCTION TO RESPONSIVE INTERFACE USING BOOTSTRAP.
   a. Write code for developing responsive web application with Admin panel and tables with static data.

4. Building Interfaces Using Javascript
   a. Set up the Folder Structure.

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b. Write the Model code and initialize the application.
c. Implement the list objects and use cases.
d. Implement the create object use case.
e. Implement the update object use case.

5. Introduction to Interative Forms and Ajax Data Binding
   a. Developing Web Page Styles using JavaScript and CSS.
   b. Develop Script interactive forms
   c. Data binding using Ajax.

6. React Environment Setup
   a. Setting up development environment.
   b. Integration with Existing Apps.
   c. Running on Device.
   d. Debugging
   e. Testing
   f. Write source code using Typescript.

7. Programming With React
   a. Basics Interactive examples.
   b. Function Components and Class Components
   c. React Native Fundamental, Handling Text Input,
   d. Using a scroll View, using List View.
   e. Platform Specific Code.

8. Build a Drunken Snake Game Using Hooks
   a. Introduction and scaffolding the project.
   b. Components, Props and Styles.
   c. State and Lifecycle Events.
   d. Extended Game Functionality.
   e. Finishing up and Deployment.

9. Node JS Modules
   a. Functions, Buffer, Module, Modules Types, Core Module, Local Modules and Modules Exports
   b. Node Package Manager: What is NPM? Installing Packages Locally, installing package globally, adding dependency in package Json and Updating packages

10. Creating Web Server using Node.js:
    a. Creating Web Server, Sending Requests and Handling HTTP requests.
    b. File System: Read File, writing a File, opening a File Deleting a File, Writing a file asynchronously and Other I/O Operations.
    c. Events: Event Emitter class, Inheriting Events and Returning event emitter

11. Databases Handling

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a. Role Based Access.
b. Messages Likes and deletion.
c. File and Audio Chat Messages
d. Extended Chat Features and Deployment

TEXT BOOK:

1. Adam Boduch and Roy Derks, "React and React Native: A Complete Hands-on Guide to Modern Web and Mobile Development with React.js", 3rd Edition, 2020.
2. W Hans Bergsten, "Java Server Pages", O'Reilly, 3rd Edition, 2003.
3. Ethan Brown, "Web Development with Node and Express", Oreilly Publishers, 1st edition, 2014

REFERENCE BOOKS:

1. D. Flanagan, "Java Script", O'Reilly, 6th edition, 2011.
2. Jon Duckett, "Beginning Web Programming", WROX, 2nd edition, 2003.

Prof. S. Srinivasa Rao

Course Code	Course Title						Core/Elective
SPW961CM	TECHNICAL SEMINAR 1						Core
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
----	-	-	-	2	50	-	1

Outcomes: Student will be able to:

1. Develop the habit of referring the journals for literature review.
2. Understand the gist of the research paper.
3. Identify the potential for further scope.
4. Present the work in an efficient manner.
5. Write the documentation in standard format.

Seminar topics may be chosen by the students with advice from the faculty members and the student shall read further relevant articles in the domain.

The seminar must be clearly structured and the power point presentation shall include following aspects:

1. Introduction to the field
2. Literature survey
3. Consolidation of available information
4. Summary and Conclusions
5. References

Each student is required to:

1. Deliver the seminar for a maximum duration of 30 minutes, where the presentation should be for 20 minutes in PowerPoint, followed by Question and Answers session for 10minutes.
2. Submit the detailed report of the seminar in spiral bound in a précised format as suggested by the Department.

Guidelines for awarding marks		
S. No.	**Description**	**Max. Marks**
1	Contents and relevance	10
2	Presentation skills	10
3	Preparation. of PPT slides	05
4	Questions and answers	05

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5	Report in a prescribed format	20

Note:

1. The seminar presentation should be of at least five research papers from Peer-review journals.

2. The seminar report should be in the following order: Background of work, literature review, techniques used, prospective deliverables, and discussion on results, conclusions, critical appraisal and reference.

3. At least two faculty members will be associated with the seminar presentation to evaluate and award marks.

4. Attendance of all the students for weekly seminar presentations is compulsory. If the student fails to secure minimum attendance as per O.U. rules, the marks awarded in the seminar presentation shall remain void.

Prof. S. Srinivasa Rao

Course Code	Course Title						Core/Elective
SPW962CM	INTERNSHIP-II						Core
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
----	-	-	-	-	50	-	1

Course Objectives:

1. To give an experience to the students in solving real life practical problems with all its constraints.
2. To give an opportunity to integrate different aspects of learning with reference to real life problems.
3. To enhance the confidence of the students while communicating with industry engineers and give an opportunity for useful interaction with them and familiarize with work culture and ethics of the industry

Course Outcomes: Student will be:

1. Able to design/develop a small and simple product in hardware or software.
2. Able to complete the task or realize a pre-specified target, with limited scope, rather than taking up a complex task and leave it.
3. Able to learn to find alternate viable solutions for a given problem and evaluate these alternatives with reference to pre-specified criteria.
4. Able to implement the selected solution and document the same.

Summer Internship is introduced as part of the curricula for encouraging students to work on problems of interest to industries. A batch of two or three students will be attached to a person from an Industry / R & D Organization / National Laboratory for a period of 4 weeks. This will be during the summer vacation following the completion of the VI semester course. One faculty member will act as an internal guide for each batch to monitor the progress and interacts with the Industry guide.

After the completion of the project, students will submit a brief technical report on the project executed and present the work through a seminar talk to be organized by the department. Award of session marks are based on the performance of the student at the work place and awarded by industry guide and internal guide (25Marks) followed by presentation before the committee constituted by the department (25Marks). One faculty member will coordinate the overall activity of Summer Internship. Each group will be required to:

1. Submit a one page synopsis before the seminar for display on notice board.
2. Give a 30 minutes presentation followed by 10 minutes discussion.

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3. Submit a technical write-up on the talk.

PROFESSIONAL ELECTIVES-II

Course Code	Course Title				Core/Elective	
SPE621CM	COMPUTER VISION				Core	
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
----	3	-	-	-	40	60	3

Objectives:

1. To understand the basic concepts of computer vision and segmentation.
2. To gain knowledge in foundation of image formation and image analysis.
3. To understand the Basic concepts of Recognition.

Outcomes: Student will be able to:

1. Understand the fundamental problems of computer vision.
2. Implement various techniques and algorithms used in computer vision.
3. Acquire knowledge and understanding of Feature detection and matching.
4. Demonstrate awareness of the current key research issues in computer vision.
5. Exhibit knowledge in Image stitching and Recognition.

UNIT – I

Introduction Image formation - Geometric primitives and transformations -Geometric primitives - 2D transformations - 3D transformations - 3Drotations - 3D to 2D projections - Lens distortions – Photometric image formation - Lighting - Reflectance and shading – Optics – The digital camera - Sampling and aliasing – Color – Compression.

UNIT – II

Feature Detection& Matching: Points and patches - Feature detectors - Feature descriptors – Feature matching - Feature tracking - Application: Performance driven animation - Edges - Edge detection - Edge linking - Application: Edge editing and enhancement – Lines - Successive approximation – Hough transforms - Vanishing points -Application: Rectangle detection.

UNIT – III

Prof. S. Srinivasa Rao

Segmentation: Active contours - Snakes - Dynamic snakes and CONDENSATION –Scissors - Level Sets - Application: Contour tracking and roto scoping– Split and merge - Watershed - Region splitting - Region merging -Graph-based segmentation - Probabilistic aggregation – Mean shift and mode finding - K-means and mixtures of Gaussians - Mean shift– Normalized cuts - Graph cuts and energy-based methods -Application: Medical image segmentation.

UNIT – IV

Structure from Motion: Triangulation - Two-frame structure from motion – Factorization - Bundle adjustment - Constrained structure and motion. Dense motion estimation - Translational alignment – Parametric motion - Spline-based motion - Optical flow - Layered motion.

UNIT – V

Image Stitching and Recognition: Motion models - Global alignment – Compositing - Recognition -Object detection - Face detection - Pedestrian detection – Face recognition – Eigen faces - Active appearance and 3D shape models -Instance recognition - Geometric alignment - Large databases -Category recognition - Bag of words - Part-based models Recognition with segmentation - Context and scene understanding -Learning and large image collections - Recognition databases and test sets

TEXT BOOKS:

1. Forsyth, A., D. and Ponce, J., Computer Vision: A Modern Approach, Pearson Education, 2nd edition, 2012.
2. Szeliski, R., Computer Vision: Algorithms and Applications, Springer-Verlag London Limited, 1st edition, 2011

REFERENCES BOOKS:

1. Gonzalez C. R., and Woods E. R., Digital Image Processing, Addison-Wesley, 4th edition, 2018.
2. Hartley, R. and Zisserman, A., Multiple View Geometry in Computer Vision, Cambridge University Press, 2nd Edition, 2003
3. Fukunaga, K., Introduction to Statistical Pattern Recognition, Academic Press, Morgan Kaufmann, 2nd edition, 1990
4. Trucco and Verri, Introductory Techniques for 3D Computer

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Course Code	Course Title				CIE	SEE	Core/Elective
SPE622CM	MATHEMATICAL MODELING FOR DATA SCIENCE						Elective
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
----	3	-	-	-	40	60	3

Objectives:

1. To introduce the various mathematical concepts and models, and provide skills required to implement the models.
2. To undertake a critical evaluation of a wide range of numerical and data.
3. To develop designing skills for modeling non-deterministic problems.

Outcomes: Student will be able to:

1. Demonstrate understanding of basic mathematical concepts in data science, relating to linear algebra, probability, and calculus and employ them.
2. Apply linear models for regression and linear models for classification.
3. Employ kernel models.
4. Conceptualize problems as graphical models, mixture models and analyze using estimation-maximization algorithms
5. Demonstrate with illustrative examples PCA

UNIT-I

Linear Algebra: Matrices, solving linear equations, vector spaces, linear independence, basis and rank, linear mappings, affine spaces, norms, inner products, orthogonality, orthonormal basis, inner product of functions, orthogonal projections.

UNIT-II

Matrix Decompositions: Determinant and trace, Eigen values and Eigen vectors, Cholesky decomposition, Eigen decomposition, Singular value decomposition, matrix approximation.

UNIT-III

Vector Calculus: Differentiation of Univariate Functions, Partial Differentiation and Gradients, Gradients of Vector Valued Functions, Gradients of Matrices, Useful Identities for Computing Gradients, Back propagation and Automatic Differentiation, Higher-Order Derivatives, Linearization and Multivariate Taylor Series.

UNIT-IV

Probability, Distributions and optimizations: Construction of a Probability Space, Discrete and Continuous Probabilities, Sum Rule, Product Rule, and Bayes' Theorem, Summary Statistics

Prof. S. Srinivasa Rao

and Independence, Gaussian Distribution, Conjugacy and the Exponential Family, Change of Variables/Inverse Transform, Continuous Optimization, Optimization Using Gradient Descent, Constrained Optimization and Lagrange Multipliers, Convex Optimization.

UNIT-V

Data Models: Data, Models, and Learning, Empirical Risk Minimization, Parameter Estimation, Probabilistic Modeling and Inference, Directed Graphical Models, Model Selections.

Linear Regression and Dimensionality Reduction: Linear Regression - Problem Formulation, Parameter Estimation, Bayesian Linear Regression, Maximum Likelihood as Orthogonal Projection, Dimensionality Reduction with Principal Component Analysis.

Text books:

1. Marc Peter Deisenroth, A. Aldo Faisal, and Cheng Soon Ong, Mathematics for Machine Learning, Cambridge University Press, 2020.

Reference Books

1. Matthias Dehmer, Salissou Moutari, Frank Emmert-Streib, Mathematical Foundations of Data Science Using R, De Gruyter Oldenbourg, 2020.
2. Norman Matloff, Probability and Statistics for Data Science: Math + R + Data, CRC Data Science Series, 2019.

Prof. S. Srinivasa Rao

Course Code	Course Title						Core/Elective
SPE623CM	DISTRIBUTED SYSTEMS						Elective
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
----	3	-	-	-	40	60	3

Course Objectives:

1. To acquire an understanding of the issues in distributed systems.
2. To learn about Naming and synchronization with different algorithms.
3. To impart knowledge architectures and working of Distributed file systems, distributed web-based system.

Course Outcomes: Student will be able to:

1. Analyze and understand asymptotic performance of an algorithm and basic data structures.
2. Apply the divide and conquer and brute force techniques to a given problem.
3. Implement greedy methods and dynamic programming techniques to real world problems.
4. Relate the Backtracking and Branch and Bounds techniques to real world problems.
5. Evaluate NP-Hard and NP-Completeness of algorithms and different tries methods.

UNIT-I

Introduction: Characteristics & Properties of Distributes Systems – Taxonomy - Types of Distributed Systems Design goals – Transparency Issues.

Architectures: Architectural Styles, System Architectures, Architectures versus Middleware, and Self- Management in Distributed Systems.

Communication: Inter process communication Mechanisms, Remote Procedure Call, Remote Method Invocation, Message-Oriented Communication, Stream- Oriented Communication, and Multicast Communication.

UNIT-II

Naming: Names, Identifiers and Addresses, Flat Naming, Structured Naming and Attribute-Based Naming. Synchronization: Mutual Exclusion, Election Algorithms.

Prof. S. Srinivasa Rao

Consistency and Replication: Introduction, Data Centric Consistency Models, Client- Centric Consistency Models, Replica Management, and Consistency Protocols.

UNIT-III

Fault Tolerance: Introduction to Fault Tolerance, Process Resilience, Reliable Client- Server Communication, Reliable Group Communication, Distributed Commit, and Recovery.

Distributed Object-Based Systems: GLOBE -Architecture, Processes, Communication, Naming, Synchronization, Consistency and Replication, Fault Tolerance, and Security.

UNIT-IV

Distributed File Systems: File system, DFS- definition, Characteristics, Goals, SUN NFS- NFS Architecture, NFS Implementation, Protocols,The GOOGLE file system-Definition, Architectures, GFS Architecture

Distributed Web-Based Systems: Traditional Web-Based Systems, Web Services Fundamentals, The Apache Web Server, Web Server Clusters, Communication, HTTP Fundamentals, Simple Object Access Protocol SOAP, Web Proxy Caching, Replication for Web Hosting Systems-CDN"S, Service-Oriented Architectures, REST and Web Services

UNIT-V

Distributed Coordination-Based Systems: Architecture, Naming and Security

Emerging Trends in Distributed Systems: Emerging Trends Introduction, Grid Computing, Cloud Computing and its roots in distributed systems mechanisms and self- management of distributed systems, Virtualization, Service Oriented Architecture, The Future of Emerging Trends.

Map-Reduce: Architecture, Apache Hadoop Architecture, HDFS.

TEXT BOOKS:

1. Andrew S. Tanenbaum and Maarten Van Steen, Distributed Systems, PHI 2nd Edition, 2009.
2. Distributed Computing, Sunita Mahajan and Seema Shah, Oxford University
3. R. Hill, L. Hirsch, P. Lake, S. Moshiri, Guide to Cloud Computing, Principles and Practicel, Springer, 2013.
4. R. Buyya, J. Borberg, A. Goscinski, Cloud Computing-Principles and Paradigms, Wiley, 2013.

REFERENCE BOOKS:

1. Distributed Systems: Principles and Paradigms, Taunenbaum
2. Distributed Computing, Fundamentals, Simulations and Advanced topics, 2nd Edition, HagitAttiya and Jennifer Welch, Wiley India
3. Distributed Systems: Concepts and Design, G. Coulouris, J. Dollimore, and T. Kindberg,

Prof. S. Srinivasa Rao

Course Code	Course Title						Core/Elective
SPE624CM	EMBEDDED SYSTEMS						Elective
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
---	3	-	-	-	40	60	3

Course Objectives:

1. To provide an overview of Design Principles of Embedded System.
2. To introduce and discuss Interfacing of various real-world devices with 8051 microcontrollers.
3. Comprehend the real time operating system used for the embedded system.

Course Outcomes: Student will be able to:

1. Demonstrate the role of individual components involved in a typical embedded system.
2. Describe the architectural features and instructions of Intel 8051Microcontroller.
3. Apply the knowledge gained for Programming ARM for different applications.
4. Expected to visualize the role of Real time Operating Systems in Embedded Systems.
5. Interpret the basic hardware components and their selection method based on the characteristics and attributes of an embedded system.

UNIT – I

Embedded Computing: Introduction, Complex Systems and Microprocessor; Embedded System Design Process, Design Examples.

8051 Microcontrollers: Introduction, 8051 Micro Controller Hardware, Input/Output Ports and Circuits, External Memory, Counter and Timers, Serial data Input/Output, interrupts.

UNIT – II

Basic Assembly Language Programming Concepts: Assembly Language Programming Process, Programming Tools and Techniques, Programming the 8051, Data Transfer and Logical Instructions. Arithmetic Operations, Decimal Arithmetic, Jump and Call Instructions, Further Details on Interrupts.

UNIT – III

Interfacing real world devices with 8051 micro controllers: Analog to Digital converters (ADC) & Digital to Analog Converter (DAC) basics. ADC, DAC and Temperature Sensor interfacing with 8051 micro controllers. LCD and Matrix Keyboard interfacing with 8051 micro controller.

Prof. S. Srinivasa Rao

UNIT – IV

Introduction to Real-Time Operating Systems: Tasks and Task States, Tasks and Data, Semaphores, Shared Data, Message Queues, Mailboxes and Pipes, Timer Functions, Events, Memory Management, Interrupt Routines in an RTOS Environment.

UNIT – V

Embedded Software Development Tools: Host and Target machines, Linker/Locators for Embedded Software, Getting Embedded Software into the Target System. Debugging Techniques.

TEXT BOOKS:

1. Wayne Wolf, Computers as Components-Principles of Embedded Computer System Design, Morgan Kaufmann publishers, 3rd edition, 2012.
2. Randal E. Bryant, David R, O' Hallaron, "Computer Systems- A Programmer's Perspective" Pearson Publication, 3rd Edition, 2016.
3. Mohamed Ali Mazidi, Janice Gillispie Mazidi, Rolin McKinlay, the 8051 Microcontroller and Embedded Systems: Using Assembly and C, 2nd edition, Pearson education, 2011.
4 Raj Kamal, Embedded Systems: Architecture, Programming and Design, 3rd Edition, McGraw Hill Education (India), 2014.

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Course Code	Course Title						Core/Elective
SPE625CM	CYBER SECURITY						Elective
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
----	3	-	-	-	40	60	3

Course Objectives: Students should be able to understand

1. The difference between threat and attacks, how threats materialize into attacks.
2. Security in Operating Systems & Networks, Countermeasures
3. Security Planning, Risk Analysis, Cyber Warfare, Cyber space and Law, Privacy in Cyberspace.

Course Outcomes: Student will be able to:

1. Acquire adequate knowledge about threat and attacks
2. Enhance their skills to implement security in design of Operating Systems
3. Use various techniques of Security Countermeasures
4. Acquire understanding in Privacy Principles and Policies in Cyberspace
5. Enhance their understanding in Security Planning, Risk Analysis, Cyber Warfare, Cyberspace and Law

UNIT I

Introduction To Cyber Security

Introduction -Computer Security - Threats -Harm - Vulnerabilities -Controls - Authentication - Access Control and Cryptography -Web—User Side - Browser Attacks - Web Attacks Targeting Users -Obtaining User or Website Data - Email Attacks

UNIT II

Security In Operating System & Networks

Security in Operating Systems - Security in the Design of Operating Systems -Rootkit - Network security attack- Threats to Network Communications - Wireless Network Security - Denial of Service -Distributed Denial-of-Service.

UNIT III

Defences: Security Counter measures

Cryptography in Network Security - Firewalls - Intrusion Detectionand Prevention Systems - Network Management - Databases -Security Requirements of Databases - Reliability and Integrity -Database Disclosure - Data Mining and Big Data.

Prof. S. Srinivasa Rao

UNIT IV

Privacy In Cyberspace

Privacy Concepts -Privacy Principles and Policies -Authentication andPrivacy - Data Mining - Privacy on the Web - Email Security – Privacy Impacts of Emerging Technologies - Where the Field Is Headed.

UNIT V

Management and Incidents

Security Planning - Business Continuity Planning – Handling Incidents - Risk Analysis - Dealing with Disaster – Emerging Technologies - The Internet of Things - Economics – Electronic Voting - Cyber Warfare- Cyberspace and the Law – International Laws - Cyber crime - Cyber Warfare and Home Land Security.

TEXT BOOKS:

1. Charles P. Pfleeger Shari Lawrence Pfleeger Jonathan Margulies, Security in Computing, 5th Edition , Pearson Education , 2015
2. George K.Kostopoulous, Cyber Space and Cyber Security, CRC Press, 2013.

REFERENCE BOOKS:

1. Michael E Whitman and Herbert J Mattord, Pirnciples of Information Security, Cengage Learning, 2011
2. Database System Concepts 7th Edition by Abraham Silberschatz (Author), Henry F. Korth (Author), S. Sudarshan (Author)

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CME:SEMESTER-VII

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/Wk	CIE	SEE	SEE Duration in Hrs	
		Theory Courses								
1	SPC701CM	Machine Learning Techniques	3	-	-	3	40	60	3	3
2	PE-III	Professional Elective-III	3	-	-	3	40	60	3	3
3	PE-IV	Professional Elective-IV	3	-	-	3	40	60	3	3
4	PE-V	Professional Elective-V	3	-	-	3	40	60	3	3
5	OE-II	Open Elective-II	3	-	-	3	40	60	3	3
		Practical/ Laboratory Courses								
6	SPC711CM	Machine Learning Techniques Lab	-	-	2	2	40	60	3	1
7	SPE71XCM	Professional Elective- Lab	-	-	2	2	40	60	3	1
8	SPW711CM	Project work-I	-	-	6	6	40	60	3	3
9	SPW971CM	Technical Seminar -2	-	-	2	2	50	-	-	1
		Total	**15**	**-**	**12**	**27**	**370**	**480**		**21**

Professional Elective-III		
SI.No	**Course Code**	**Course Title**
1.	SPE731CM	Natural Language Processing
2.	SPE732CM	Data Visualization
3.	SPE733CM	Cloud Computing
4.	SPE734CM	Advance Internet of Things(IOT)
5.	SPE735CM	Digital Forensics

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Professional Elective-IV		
Sl.No	Course Code	Course Title
1.	SPE741CM	Cognitive Science and Analytics
2.	SPE742CM	NO SQL Databases
3.	SPE743CM	Modern Architecture for Large Applications
4.	SPE744CM	Wireless Sensor Network
5.	SPE745CM	Database Security & Administration

Professional Elective-V		
Sl.No	Course Code	Course Title
1.	SPE751CM	Neural Networks & Deep Learning
2.	SPE752CM	Data Analytics
3.	SPE753CM	Architecting Applications for Cloud
4.	SPE754CM	Block Chain Technology
5.	SPE755CM	Malware Analysis

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SYLLABUS
B.E. VII – SEMESTER
(COMPUTER ENGINEERING)

Course Code	Course Title						Core/Elective
SPC701CM	MACHINE LEARNING TECHNIQUES						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	-	-	-	40	60	3

Course Objectives:

1. To learn the concepts of machine learning and types of learning along with evaluation metrics.
2. To study various supervised, unsupervised and reinforcement learning algorithms.
3. To learn ensemble techniques and study applications of machine learning.

Course Outcomes: At the end of this course, the student will be able to

1. Identify supervised, unsupervised and reinforcement learning algorithms.
2. Compute the performance metrics for regression and classification problems.
3. Extract features that can be used for a particular machine learning approach in various applications.
4. Apply ensemble techniques for improvement of classifiers
5. Apply classification, clustering and reinforcement learning to various applications.

Unit – I

Introduction: Learning, Types of Machine Learning Algorithms: Parametric and Nonparametric Machine Learning Algorithms, Supervised, Unsupervised, Semi-Supervised and Reinforced Learning.

Preliminaries: Feature Representation (Vectors, Spaces), Training, Testing, and Validation Sets, Over fitting, Evaluation of classification: cross validation, hold out, The Confusion Matrix.

Evaluation Measures: SSE, MSE, RMSE, R2, Precision, Recall, F-Score, Receiver Operator Characteristic (ROC) Curve.

Some basic statistics: The Gaussian (normal distribution), the bias-variance tradeoff.

Unit-II

Supervised Algorithms:

Regression: Linear Regression, Logistic Regression.

Classification: Brief Overview, Inductive learning, Learning with Decision Tree Problems Suitable for Decision Trees, Entropy, Constructing a Decision Tree with ID3, Naïve Bayes, K-Nearest Neighbors, Support Vector Machines.

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Unit – III

Neural Networks: Multilayer Perceptron, Back propagation Algorithm, Activation Functions, Gradient Descent for Machine Learning.

Dimensionality Reduction: Curse of Dimensionality, Principal Component Analysis, Linear Discriminant Analysis.

Ensemble Learning: Boosting, Bagging, Random Forest.

Unit – IV

Unsupervised Learning:

Cluster Analysis: Similarity Measures, categories of clustering algorithms, Hierarchical Methods, Partitional Algorithms, Expectation-Maximization Algorithm, Fuzzy c-means algorithm.

Unit – V

Reinforcement Learning: Overview, State and Action Spaces, The Reward Function, Discounting, Action Selection, Policy, Markov decision processes, Q-learning, Uses of Reinforcement learning.

Applications of Machine Learning.

TEXT BOOKS:

1. Stephen Marsland, Machine Learning: An Algorithmic Perspective, 2nd Edition, Chapman & Hall/CRC, 2014.
2. Kevin Murphy, Machine Learning: A Probabilistic Perspective, MIT Press, 2012.
3. Tom Mitchell, Machine Learning, McGraw-Hill, 1st edition, 1997.

REFERENCE BOOKS:

1. Stuart Russell, Peter Norvig: Artificial Intelligence, A Modern Approach, Pearson Education, 2nd edition, 2004
2. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning: Data Mining, Inference, and Prediction. Second Edition, Springer Series in Statistics.(2009).
3. Christopher Bishop, Pattern Recognition and Machine Learning, Springer, 1st edition, 2016.
4. Uma N. Dulhare, Khaleel Ahmad, Khairol Amali Bin Ahmad, Machine Learning and BigData:Concepts, Algorithms, Tools and Applications, Scrivener publishing, Wiley,1st edition, 2020.

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Course Code	Course Title						Core/Elective
SPC711CM	MACHINE LEARNING TECHNIQUES LAB						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	-	-	-	2	40	60	1

Course Objectives:

1. To understand the training data and testing data, validation data.
2. To understand the basic theory of underlying machine learning algorithms.
3. Demonstration of different classifiers on different data.

Course Outcomes: At the end of this course, the student will be able to

1. Use scikit-learn, Keras and Tensorflow to apply ML techniques.
2. Apply machine learning algorithms: dataset preparation, model selection, model building etc.
3. Apply various supervised & unsupervised learning methods by considering appropriate datasets.
4. Compare the performance of different algorithms and ensemble techniques.
5. Evaluate the performance of various Machine Learning algorithms.

LIST OF EXPERIMENTS:

1. Basic Data Preprocessing:

   a. Installation of python environment for machine learning: installing python modules/Packages like scikit-learn, Keras and Tensor flow etc.
   b. Programs involving pandas, Numpy and Scipy libraries.

2. Programs for classification:

   a. Build models using linear regression and logistic regression and apply it to classify a new instance
   b. Write a program to demonstrate the following classifiers. Use an appropriate data set for building the model. Apply the model to classify a new instance.

      I. Decision tree
      II. K nearest neighbor
      III. Naïve bayes
      IV. Support vector machine

3. Demonstrate ensemble techniques like boosting, bagging, random forests etc. Build a classifier, compare its performance with an ensemble technique like random forest.

4. Demonstration of Clustering algorithms using:
   a. k-means
   b. Hierarchical algorithms (agglomerative etc). Interpret the clusters obtained.
5. Evaluate various classification algorithms performance on a dataset using various measures like accuracy, precision, recall etc.

6. Case study: Apply supervised/unsupervised learning algorithms in the area of text processing, image processing & speech processing.

TEXTBOOKS:

1. Stephen Marsland, Machine Learning: An Algorithmic Perspective, 2nd Edition Chapman & Hall/Crc Machine Learning Pattern Recognition) (2014)
2. Kevin Murphy, Machine Learning: A Probabilistic Perspective, MIT Press, 2012.
3. Tom M. Mitchell, Machine Learning, McGraw Hill Education, 1997.
4. Christopher Bishop, Pattern Recognition and Machine Learning, Springer, 2007.

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Course Code	Course Title						Core/Elective
SPW711CM	PROJECT WORK – I						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	-	-	-	6	40	60	3

Course Objectives:

1. To familiarize tools and techniques of systematic literature survey and documentation
2. To expose the students to industry practices and team work.
3. To encourage students to work with innovative and entrepreneurial ideas

Course Outcomes: At the end of this course, the student will be able to

1. To understand project characteristics and various stages of project
2. Demonstrate the ability to synthesize and apply the knowledge and skills acquired in the academic program to the real-world problems.
3. Evaluate different solutions based on economic and technical feasibility
4. Effectively plan a project and confidently perform all aspects of project management
5. Demonstrate effective written and oral communication skills

The department can initiate the project allotment procedure at the end of VI semester and finalize it in the first two weeks of VII semester. The department will appoint a project coordinator who will coordinate the following:

Collection of project topics/ descriptions from faculty members (Problems can also be invited from the industries)

- Grouping of students (max 3 in a group)
- Allotment of project guides

The aim of project work is to develop solutions to realistic problems applying the knowledge and skills obtained in different courses, new technologies and current industry practices. This requires students to understand current problems in their domain and methodologies to solve these problems. To get awareness on current problems and solution techniques, the first 4 weeks of VII semester will be spent on special lectures by faculty members, research scholars, post graduate students of the department and invited lectures by engineers from industries and R&D institutions. After completion of these seminars each group has to formalize the project proposal based on their own ideas or as suggested by the project guide.

Seminar schedule will be prepared by the coordinator for all the students from the 5th week to the last week of the semester which should be strictly adhered to.

Prof. S. Srinivasa Rao

Course Code	Course Title				Core/Elective		
SPW711CM	PROJECT WORK – I				Core		
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	-	-	-	6	40	60	3

Course Objectives:

1. To familiarize tools and techniques of systematic literature survey and documentation
2. To expose the students to industry practices and team work.
3. To encourage students to work with innovative and entrepreneurial ideas

Course Outcomes: At the end of this course, the student will be able to

1. To understand project characteristics and various stages of project
2. Demonstrate the ability to synthesize and apply the knowledge and skills acquired in the academic program to the real-world problems.
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The aim of project work is to develop solutions to realistic problems applying the knowledge and skills obtained in different courses, new technologies and current industry practices. This requires students to understand current problems in their domain and methodologies to solve these problems. To get awareness on current problems and solution techniques, the first 4 weeks of VII semester will be spent on special lectures by faculty members, research scholars, post graduate students of the department and invited lectures by engineers from industries and R&D institutions. After completion of these seminars each group has to formalize the project proposal based on their own ideas or as suggested by the project guide.

Seminar schedule will be prepared by the coordinator for all the students from the 5th week to the last week of the semester which should be strictly adhered to.

Prof. S. Srinivasa Rao

Each group will be required to:

1. Submit a one-page synopsis before the seminar for display on notice board.
2. Give a 30 minutes' presentation followed by 10 minutes' discussion.
3. Submit a technical write-up on the talk.

At least two teachers will be associated with the Project Seminar to evaluate students for the award of sessional marks which will be on the basis of performance in all the 3 items stated above.

The seminar presentation should include the following components of the project:

1. Problem definition and specification
2. Literature survey
3. Broad knowledge of available techniques to solve a particular problem.
4. Planning of the work, preparation of bar (activity) charts
5. Presentation- oral and written.

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Course Code	Course Title						Core/Elective
SPW971CM	TECHNICAL SEMINAR-II						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	-	-	-	2	50	-	1

Course Outcomes: At the end of this course, the student will be able to

1. Develop the habit of referring the journals for literature review.
2. Understand the gist of the research paper.
3. Identify the potential for further scope.
4. Present the work in an efficient manner.
5. Write the documentation in standard format.

Seminar topics may be chosen by the students with advice from the faculty members and the student shall read further relevant articles in the domain.

The seminar must be clearly structured and the power point presentation shall include following aspects:

1. Introduction to the field
2. Literature survey
3. Consolidation of available information
4. Summary and Conclusions
5. References

Each student is required to:

1. Deliver the seminar for a maximum duration of 30 minutes, where the presentation should be for 20minutes in PowerPoint, followed by Question and Answers session for 10 minutes.

2. Submit the detailed report of the seminar in spiral bound in a précised format as suggested by the Department.

Guidelines for awarding marks		
S. No.	Description	Max. Marks
1	Contents and relevance	10
2	Presentation skills	10
3	Preparation of PPT slides	05
4	Questions and answers	05
5	Report in a prescribed format	20

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Sri. Vaidehi

Note:

1. The seminar presentation should be of at least five research papers from Peer-review UGC recognized journals.
2. The seminar report should be in the following order: Background of work, literature review, techniques used, prospective deliverables, and discussion on results, conclusions, critical appraisal and reference.
3. At least two faculty members will be associated with the seminar presentation to evaluate and award marks.
4. Attendance of all the students for weekly seminar presentations is compulsory. If the student fails to secure minimum attendance as per O.U. rules, the marks awarded in the seminar, presentation shall remain void.

Prof S. Srinivasa Rao

Note:

1. The seminar presentation should be of at least five research papers from Peer-review UGC recognized journals.
2. The seminar report should be in the following order: Background of work, literature review, techniques used, prospective deliverables, and discussion on results, conclusions, critical appraisal and reference.
3. At least two faculty members will be associated with the seminar presentation to evaluate and award marks.
4. Attendance of all the students for weekly seminar presentations is compulsory. If the student fails to secure minimum attendance as per O.U. rules, the marks awarded in the seminar, presentation shall remain void.

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PROFESSIONAL ELECTIVES-III

Course Code	Course Title						Core/Elective
SPE731CM	NATURAL LANGUAGE PROCESSING						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	-	-	-	40	60	3

Course Objectives:

1. To learn the fundamentals of natural language processing
2. To understand the role of syntax , semantics and pragmatics in NLP
3. To apply the NLP techniques to Text processing applications

Course Outcomes: At the end of this course, the student will be able to

1. Explain and apply the fundamental algorithms and techniques in the area of Natural Language Processing (NLP).
2. Design an application using NLP components.
3. Extract information from text automatically using concepts and methods from natural language processing (NLP) including, n-grams, POS tagging, and parsing.
4. Understand the concept of word sense disambiguation.
5. To compare and contrast the use of different statistical approaches for different types of NLP applications.

UNIT I

Introduction of NLP: Definition, History of NLP, Corpus, Type of Corpus, Ambiguity in Language, NLP Phases, Lexical Resources, Word Net, Regular Expressions, Text Processing with Unicode, Regular Expressions for Detecting Word Patterns, Normalizing Text, Regular Expressions for Tokenizing Text, Segmentation, Word count, Type and Token Ratio, Zips Law.

UNIT II

Word Level Analysis: Text Representation: One-Hot Encoding Model, Bag-of-Word Model, Count Vectors and TF-IDF Vectors, N-Gram Language Model, Word2vec Embedding, Glove Embedding, Fast text Embedding Morphology, Types of Morphology, Lemmatization, Stemming, Transducers for Lexicon and Rules, Word Classes, Tag and Tagset, Part-of-Speech Tagging, Rule-Based, Stochastic and Transformation-Based Tagging, Issues in Pos Tagging – Hidden Markov and Maximum Entropy Models.

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UNIT-III

Syntactic Analysis:

Context-Free Grammar, Parsing with Context-Free Grammar, Dependencies and Dependency Grammar, Grammar Development , Shallow parsing – Probabilistic CFG

UNIT_IV

Semantics and Pragmatics

Representing Meaning – Semantic Analysis, Lexical Semantics, Word Senses, Relations Between Senses, Thematic Roles, Word Sense Disambiguation (WSD) , WSD using Supervised, Dictionary & Thesaurus, Bootstrapping Methods, Word Similarity using Thesaurus and Distributional Methods.

UNIT-V

Discourse Analysis and Lexical Resources

Pragmatics: Discourse segmentation, Coherence – Reference Phenomena, Anaphora Resolution, Coreference Resolution, Dialog and Conversational agents , Natural language generation, Statistical alignment and Machine translation: Text alignment, word alignment , statistical machine translation.

TEXT BOOKS:

1. Daniel Jurafsky, James H. Martin—Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, Pearson Publication, 2014.
2. Steven Bird, Ewan Klein and Edward Loper, —Natural Language Processing with Python, First Edition, OReilly Media, 2009.
3. Tanveer Siddiqui, U. S. Tiwary,- " Natural Language Processing and Information Retrieval, Oxford University Press, 2008.

REFERENCE BOOKS:

1. Breck Baldwin, —Language Processing with Java and Ling Pipe Cookbook, Atlantic Publisher, 2015.
2. Richard M Reese, —Natural Language Processing with Javal, OReilly Media, 2015.
3. Nitin Indurkhya and Fred J. Damerau, —Handbook of Natural Language Processing, 2nd Edition, Chapman and Hall/CRC Press, 2010.

Prof. S. Srinivasa Rao

Course Code	Course Title						Core/Elective
SPE731CM Lab	NATURAL LANGUAGE PROCESSING LAB						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	-	-	-	2	40	60	1

Course Objectives:

1. To learn the various NLP libraries for word and text processing.
2. To understand the process involved in computing with natural language specifically: Texts and Words.
3. To study various concepts in speech processing through various signal processing techniques.

Course Outcomes: At the end of this course, the student will be able to

1. Understand the basic NLP libraries using python
2. Apply Text Classification techniques used in NLP.
3. Work with applications of natural language processing.
4. Understand the concept of word sense disambiguation.
5. To compare and contrast the use of different statistical approaches for different types of NLP applications

LIST OF EXPERIMENTS

1. Write a program to demonstrate the usage of various NLP libraries and methods.
2. Write a program to illustrate CFG/PCFG.
3. Write a program to retrieve bi-grams, tri-grams and n-grams of the given sample text using python NLTK library.
4. Write a program to remove stop words for a given passage from a text file using Natural Language Toolkit (NLTK).
5. Write a program to implement stemming for a given sentence using NLTK.
6. Write a program to implement Lemmatization using NLTK.
7. Write a program to implement POS tagging on text.
8. Wrote a program for Named entity recognition.
9. Write a program for Text Classification in a given sentence using NLTK.
10. Write a program to text classification using Naïve Bayes and SVM classification.
11. Write a program to implement Text Summarization /Language Detection and Translation

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TEXT BOOKS:

1. Breck Baldwin, —Language Processing with Java and Ling Pipe Cookbook, Atlantic Publisher, 2015.
2. Richard M Reese, —Natural Language Processing with Javal, O_Reilly Media, 2015.
3. Nitin Indurkhya and Fred J. Damerau, —Handbook of Natural Language Processing, Second Edition, Chapman and Hall/CRC Press, 2010.

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Course Code	Course Title						Core/Elective
SPE732CM	DATAVISUALIZATION						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	-	-	-	40	60	3

Course Objectives:

1. Familiarize students with the basic and advanced techniques of information visualization and scientific visualization,
2. To learn key techniques of the visualization process
3. To comprehend the considerations in information dashboard design.

Course Outcomes: At the end of this course, the student will be able to :

1. Design and create data visualizations.
2. Conduct exploratory data analysis using visualization.
3. Craft visual presentations of data for effective communication.
4. Use knowledge of perception and cognition to evaluate visualization design alternatives.
5. Design and evaluate color palettes for visualization based on principles of perception.

Unit-I:

Introduction of visual perception, visual representation of data, Gestalt principles, information overloads. Creating visual representations, visualization reference model, visual mapping, visual analytics, Design of visualization applications.

Unit-II:

Classification of visualization systems, Interaction and visualization techniques misleading, Visualization of one, two and multi-dimensional data, text and text documents.

Unit-III:

Visualization of groups, trees, graphs, clusters, networks, software, Map Color and Other Channels –Color Theory – Color maps – Other Channels – Reduce items and attributes – Reasons to Reduce – Filter– Aggregate – Manipulate View – Reasons for Change - Change View over Time – Select Elements –Navigate: Changing Viewpoint, Reducing Attributes.

Unit-IV:

Visualization of volumetric data, vector fields, processes and simulations, Visualization of maps, geographic information, GIS systems.

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Unit-V:
Dashboards – Purpose – Importance – Reasons for Failure – Common Mistakes in Dashboard Design – Assessing what is needed from dashboards – Fundamental considerations in Dashboard design – Visual perception and cognition to design dash board – An ideal library of Graphs useful on dashboards.

TEXT BOOKS:

1. Cole Nussbaumer Knaflic, "Storytelling with data – a data visualization guide for business professionals", WILEY
2. Stephen Few, "Information Dashboard Design: Displaying Data for at-a-glance Monitoring", Analytics Press, Second Edition, 2013.
3. E Tufte, " The visual display of quantitative information", Graphics Press

REFERENCE BOOKS:

1. Dirken Jos, " Expert Data Visualization", Packt Publishing Ltd
2. Stephanie Evergreen, " Effective Data Visualization: The right chart for the right data", SAGE publications
3. Claus. O Wilke, " Fundamentals of data visualization: A primer on making informative and compelling figures", O'Reilly
4. Ben Fry, "Visualizing Data", O'Reilly, 2008.
5. Alexander Telea, "Data Visualization Principles and Practice", CRC Press, Second Edition, 2014
6. Julia Steele, Noah Ilinsky, "Beautiful Visualization: Looking at Data through the Eyes of Experts", O'Reilly, 2010.

Prof S. Srinivasa Rao

Course Code	Course Title						Core/Elective
SPE732CM Lab	DATAVISUALIZATION LAB						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	40	60	3

Course Objectives:

1. To learn the interface in R and Python for creating visualization.
2. To understand the methods for drawing charts, graphs, maps and tables.
3. To prepare dashboard design for data analytics applications.

Course Outcomes: At the end of this course, the student will be able to :

1. Understand and describe the main concepts of data visualization.
2. How to recognize good (and bad) data visualization and interpret data visualization.
3. Discover the various elements in the interface to load and analyze data.
4. Design filters for data visualization
5. Develop dashboard design for typical data analytics applications.

Task – 1:

1. Study of interface, screen and visual cues in R and Python
2. Connecting to tutorial dataset
3. Creating first charts
4. Filtering and sorting data.

Task – 2:

1. Connecting with various data sources: Text, Excel, XML and database
2. Working with measures and dimensions

Task – 3:

1. Working with colors
2. Applying Gestalt principles on charts

Task – 4:

1. Working with Expressions, Functions, Dates, Time
2. Drawing charts and graphs

Task – 5:

1. Creating Maps using GISTools, Choroplethr, ggplot2, Leaflet in R

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Task – 6:

1. Creating Maps using Geopandas, Ipyleaflet and Folium in Python

Task – 7:

1. Working with Table calculations
2. Sorting Data
3. Applying Filters

Task – 8

1. Dashboard Design
2. Introduction to data storytelling
3. Making dashboard in R shiny

Task – 9

1. Dashboard Design: Making dashboard using Python Dash

TEXT BOOK:

1. Visualization Analysis & Design by Tamara Munzner, 2014. (ISBN 9781466508910)

REFERENCES BOOKS:

1. Interactive Data Visualization for the Web by Scott Murray 2nd Edition, 2017.
2. D3.js in Action by Elijah Meeks 2nd Edition, 2017.
3. Semiology of Graphics by Jacques Bertin, 2010.
4. The Grammar of Graphics by Leland Wilkinson.
5. ggplot2 Elegant Graphics for Data Analysis by Hadley Wickham

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Course Objectives:

1. To understand the various issues in cloud computing
2. To familiarize themselves with the lead players in cloud
3. To appreciate the emergence of cloud as the next generation computing paradigm.

Course Outcomes: At the end of this course, the student will be able to:

1. Define Cloud Computing and related concepts and describe the characteristics, advantages, risks and challenges associated with cloud computing.
2. Explain virtualization technique.
3. Understand various business management mechanisms
4. Explain characteristics various cloud service models, cloud deployment models
5. Illustrate the use of various cloud services available online

Unit-I

Introduction – Historical Development –System Models for Distributed and Cloud Computing, Cloud Computing Architecture – The Cloud Reference Model – Cloud Characteristics – Cloud Deployment Models: Public, Private, Community, Hybrid Clouds, Challenges and Risks, Cloud Delivery Models: IaaS, PaaS, SaaS.

Unit-II

Virtual Machines & Cloud Computing Mechanisms: Levels of Virtualization, Virtualization Technology, Tools and Mechanisms, Virtualization of CPU, Memory and I/O Devices, Virtual Clusters and Resource Management, Cloud Infrastructure Mechanism: Cloud Storage, Cloud Usage Monitor

Unit-III

Cloud Management Mechanisms: Cloud Management Mechanism: Remote Administration System, Resource Management System, SLA Management System, State Management

Database– Cloud Management Mechanism: Remote Administration System, Resource Management System, SLA Management System

UNIT-IV:

Cloud Security and Trust Management, Data Security in the Cloud: An Introduction to the Idea of Data Security, The Current State of Data Security in the Cloud, Crypt Db: Onion Encryption layers DET, RND, OPE, JOIN, SEARCH, HOM and Homo morphic Encryption.

Unit–V:

Case Studies: Google App Engine (GAE) – GAE Architecture – Functional Modules of GAE – Amazon Web Services (AWS) – GAE Applications – Cloud Software Environments – Eucalyptus – Open Nebula –Open Stack.

TEXT BOOKS:

1. K. Chandra sekhran, Essentials of cloud Computing, CRC press, 2014.
2. John W. Ritting house, "Cloud Computing: Implementation, Management, and Security". James F. Ransome, CRC Press, 2009.
3. Thomas Erl, Zaigham Mahood, Ricardo Puttini, —Cloud Computing, Concept, Technology and Architecturel, Prentice Hall, 2013.
4. Douglas Comer "The Future of Computing Explained· 2021"

Reference Books:

1. RalucaAdaPopa, Catherine M.S.Redfield, NickolaiZeldovich, and HariBalakrishnan, "CryptDB: Protecting Confidentiality with encrypted Query Processing", 23rd ACM Symposium on Operating Systems Principles (SOSP2011), Cascais, Portugal October 2011.
2. A Fully HomomorhicEncryption Scheme, Craig Gentry, September 2009.
3. David Marshall, Wade A.Reynolds, "Advanced Server Virtualization: VMware and Microsoft Plat form in the Virtual Data Center",Auerbach Publications,2006.
4. A.Srinivasan, J.Suresh "Cloud Computing:A Practical Approach for learning and Implementation 1st edition.

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Database– Cloud Management Mechanism: Remote Administration System, Resource Management System, SLA Management System

UNIT-IV:

Cloud Security and Trust Management, Data Security in the Cloud: An Introduction to the Idea of Data Security, The Current State of Data Security in the Cloud, Crypt Db: Onion Encryption layers DET, RND, OPE, JOIN, SEARCH, HOM and Homo morphic Encryption.

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3. David Marshall, Wade A.Reynolds, "Advanced Server Virtualization: VMware and Microsoft Plat form in the Virtual Data Center",Auerbach Publications,2006.
4. A.Srinivasan, J.Suresh "Cloud Computing:A Practical Approach for learning and Implementation 1st edition.

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Course Code:	Course Title:						Credits:
SPT33C01 Lab	CLOUD COMPUTING Lab						Elective Lab
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Programming Skills, Scripting, integers, Database knowledge	–	–	–	2	40	60	1

Course Objectives:

1. To develop web applications in cloud
2. To learn the design and development process involved in creating a cloud based application
3. To implement and use parallel programming using Hadoop.

Course Outcomes: At the end of this course, the student will be able to:

1. Configure various virtualization tools such as Virtual Box, VMware workstation.
2. Design and deploy a web application in a PaaS environment.
3. Learn how to simulate a cloud environment to implement new schedulers.
4. Install and use a generic cloud environment that can be used as a private cloud.
5. Manipulate large data sets in a parallel environment.

List of Experiments to be done

1. Install Virtual box/VMware Workstation with different flavors of linux or windows OS on top of windows7 or 8.
2. Implement simple C Programs in the virtual machine created using virtual box with C Compiler.
3. Install Google App Engine. Create hello world app and other simple web applications using python/java.
4. Use GAE launcher to launch the web applications.
5. Simulate a cloud scenario using CloudSim and run a scheduling algorithm.
6. Transfer the files from one virtual machine to another virtual machine.
7. Launch virtual machine using try stack (Online Open stack Demo Version)
8. Install Hadoop single node cluster and run simple applications like word count.

Course Code	Course Title				Core/Elective		
SPE733CM Lab	CLOUD COMPUTING Lab				Elective Lab		
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Programming Skills, Scheduling strategies, Database knowledge	-	-	-	2	40	60	1

Course Objectives:

1. To develop web applications in cloud
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Course Code	Course Title						Core/Elective
SRE734CM	ADVANCE INTERNET OF THINGS(IOT)						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	40	60	3

Course Objectives:

1. Understand Internet of Things (IoT) sensors and technological challenges faced by IoT devices, with a focus on wireless, energy, power, RF and sensing modules
2. Market forecast for IoT devices with a focus on sensors
3. Learn the Sensors and Actuators used in Automotive Industry and Security.

Course Outcomes: At the end of this course, the student will be able to

1. Identify the IoT networking components with respect to sensors.
2. Build schematic for IoT solutions with sensors.
3. Design and develop IoT based sensor systems.
4. Select the appropriate sensors for various industrial applications
5. Evaluate the wireless sensor technologies for IoT.

UNIT-1

Introduction to sensors for IoT: Internet of Things Promises–Definition– Scope–Sensors for IoT Applications–Structure of IoT– IoT Map Device.

Sensors and actuator: Introduction to Sensors and Actuator- Sensor and Actuator Characteristics- Primary factors driving the deployment of sensor technology

UNIT-2

Seven generations of IoT sensors: Industrial sensors – Description & Characteristics–First Generation – Description & Characteristics–Advanced Generation – Description & Characteristics–Integrated IoT Sensors – Description & Characteristics–Sensors' Swarm – Description & Characteristics–Printed Electronics – Description & Characteristics–IoT Generation Roadmap

UNIT-3

Development of sensor communication protocols, Protocols: Modbus, relay, ZigBee, Zwave, X10, Bluetooth, ANT, etc.

Prof. S. Srinivasa Rao

Course Code	Course Title						Core/Elective
SRE734CM	ADVANCE INTERNET OF THINGS(IOT)						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	40	60	3

Course Objectives:

1. Understand Internet of Things (IoT) sensors and technological challenges faced by IoT devices, with a focus on wireless, energy, power, RF and sensing modules
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UNIT-2

Seven generations of IoT sensors: Industrial sensors – Description & Characteristics–First Generation – Description & Characteristics–Advanced Generation – Description & Characteristics–Integrated IoT Sensors – Description & Characteristics–Sensors' Swarm – Description & Characteristics–Printed Electronics – Description & Characteristics–IoT Generation Roadmap

UNIT-3

Development of sensor communication protocols, Protocols: Modbus, relay, ZigBee, Zwave, X10, Bluetooth, ANT, etc.

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Energy Harvesting Technologies: Wireless Sensor Structure–Energy Storage Module–Power Management Module–RF Module– Sensing Module

UNIT-4

Sensors for Automotive Vehicle and Security applications: Tyre pressure monitoring systems - Two wheeler and Four wheeler security systems - Parking guide systems - Anti-lock braking system - Future safety technologies- Vehicle diagnostics and health monitoring

Sensor and Actuators in smart cities: Sensors in Home activity monitoring, human activity recognition, road traffic management.

UNIT-5

Developing an IoT based Applications: Smart Energy Monitor Based on IoT, Develop a Face Recognizing Robot, Build an IoT based Smart Home System, IoT Based Air Quality Index Monitoring, IoT Based Contactless Body Temperature Monitor. Recent Trends

TEXT BOOKS:

1. Timothy Chou, Precision: Principles, Practices and Solutions for the Internet of Things, Cloud book Inc., USA. Ist edition, 2020.
2. Maggie Lin and Qiang Lin., Internet of Things Ecosystem: 2nd Edition,. January 19, 2021., independently published

REFERENCE BOOKS

1. Patranabis, Sensors and Actuators, 2nd edition, PHI, 2013
2. D. Patranabis, Sensors and Transducers, 1st edition, PHI Learning Private Limited,2013
3. Monk, Simon. Programming the Raspberry Pi: getting started with Python, 1st edition, McGraw-Hill Education, 2016.

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Course Code	Course Title						Core/Elective
SPE734CM Lab	ADVANCE INTERNET OF THINGS(IOT) LAB						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	2	40	60	1

Course Objectives:

1. Understand Internet of Things (IoT) sensors and technological challenges faced by IoT devices, with a focus on wireless, energy, power, RF and sensing modules
2. Market forecast for IoT devices with a focus on sensors
3. Learn the Sensors and Actuators used in Automotive Industry and Security

Course Outcomes: At the end of this course, the student will be able to

1. Identify the IoT networking components with respect to sensors.
2. Build schematic for IoT solutions with sensors.
3. Evaluate the wireless sensor technologies for IoT.
4. Learning the programing in Raspberry Pi
5. Design and develop an IoT Prototype projects using Raspberry Pi

List of Experiments:

1. Using Temperature Sensors Calculate the temperature of the filament when the light bulb is lit.
2. By using Pyroelectric motion sensor or PIR Sensors detect the motion of a body within the Lab.
3. By Using pressure sensor measure the air pressure and its characteristics
4. 4 Design a the digital response an IR motion sensor and to determine its range.
5. Design a motion sensitive intruder alarming system
6. Calculate the distance of an object using SONAR principle by ultrasonic proximity sensor also determine the accuracy of the instrument
7. By Using DHT sensors calculate the humidity and accuracy of the system
8. By Using Soil Moister sensors calculate the soil Moister and accuracy of the system
9. Calculate the corrosion rate by using corrosion rate sensors also calculate the resistance.
10. Calculate the velocity by using Fluid velocity sensor in a channel
11. Calculate Stress and strain produced by an ultrasonic actuator also the test the cracks in the contacting metal.
12. By using Carbon monoxide sensor calculate CO in a home and provide an alarm for concentrations greater than 50 ppm
13. Design a network to monitor water quality using water quality monitoring sensors

Note: Execute any 10 Experiments

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TEXT BOOKS:

1. Timothy Chou,. Precision: Principles, Practices and Solutions for the Internet of Things, Cloud book Inc., USA. April-13 2020.
2. Maggie Lin and Qiang Lin., Internet of Things Ecosystem: 2nd Edition,. January 19, 2021., independently published.

REFERENCE BOOKS

1. Patranabis, Sensors and Actuators, 2 nd edition, PHI, 2013
2. D. Patranabis, Sensors and Transducers, 1st edition, PHI Learning Private Limited,2013
3. Monk, Simon. Programming the Raspberry Pi: getting started with Python, 1st edition, McGraw-Hill Education, 2016.

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Course Code	Course Title						Core/Elective
SPE735CM	DIGITAL FORENSICS						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	40	60	3

Course Objectives:

1. To learn about examination, preventing and fighting digital crimes
2. To model about data acquisition and storing digital evidence
3. To explore operating system file structure, file system and mobile device forensics and its acquisition procedures

Course Outcomes: At the end of this course, the student will be able to

1. Infer the role of a Computer forensics profession for investigation.
2. Summarize the requirements for use of data acquisition.
3. Identify the need of Process crime and Incident scenes for digital evidence.
4. Choose suitable data Recover techniques in windows environment.
5. Analyze various validation techniques of forensics data.

UNIT- 1

Computer Forensics and Investigation: Understanding computer forensics, Preparing for Computer Investigations, Corporate High Tech Investigation

UNIT-2

Data Acquisition and Recovery: Storage formats, Using acquisition tools, Data Recovery: RAID Data acquisition.

Processing Crime and Incident Scene: Identifying and collecting evidence, Preparation for search, Seizing and Storing Digital evidence

UNIT-3

Computer Forensics tools (Encase) and Windows Operating System: Understanding file structure and file system, NTFS disks, Disk Encryption and Registry Manipulation. Computer Forensics software and hardware tools

UNIT-4

Computer Forensics Analysis and Validation: Data collection and analysis, validation of forensics data, Addressing – data hiding technique

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Course Code	Course Title						Core/Elective
SPE735CM	DIGITAL FORENSICS						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	40	60	3

Course Objectives:

1. To learn about examination, preventing and fighting digital crimes
2. To model about data acquisition and storing digital evidence
3. To explore operating system file structure, file system and mobile device forensics and its acquisition procedures

Course Outcomes: At the end of this course, the student will be able to

1. Infer the role of a Computer forensics profession for investigation.
2. Summarize the requirements for use of data acquisition.
3. Identify the need of Process crime and Incident scenes for digital evidence.
4. Choose suitable data Recover techniques in windows environment.
5. Analyze various validation techniques of forensics data.

UNIT- 1

Computer Forensics and Investigation: Understanding computer forensics, Preparing for Computer Investigations, Corporate High Tech Investigation

UNIT-2

Data Acquisition and Recovery: Storage formats, Using acquisition tools, Data Recovery: RAID Data acquisition.

Processing Crime and Incident Scene: Identifying and collecting evidence, Preparation for search, Seizing and Storing Digital evidence

UNIT-3

Computer Forensics tools (Encase) and Windows Operating System: Understanding file structure and file system, NTFS disks, Disk Encryption and Registry Manipulation. Computer Forensics software and hardware tools

UNIT-4

Computer Forensics Analysis and Validation: Data collection and analysis, validation of forensics data, Addressing – data hiding technique

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Email Investigation and Mobile device Forensics: Investigation e-mail crimes and Violations, Using specialized E-mail forensics tools. Understanding mobile device forensics and Acquisition procedures.

UNIT-5

Role of Digital Forensics in Real time applications: SANS SIFT Investigative tool, PRO Discover Basic, Voltality, Sleuth Kit, CAINE investigative environment. Industry Trends

TEXT BOOKS:

1. Bill Nelson, Amelia Philips, Christopher Steuart, Guide to Computer Forensics and Investigations, Fourth Edition, Cengage Learning, 2016
2. David Lilburn Watson, Andrew Jones, Digital Forensics Processing and Procedures, Syngress, 2013.

REFERENCE BOOKS

1. Cory Altheide, Harlan Carvey, Digital Forensics with Open Source Tools, British Library Cataloguing-in-Publication Data, 2011
2. Greg Gogolin,Digital Forensics Explained,CRC Press, 2013.

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Course Code	Course Title						Core/Elective
SPE735CM Lab	DIGITAL FORENSICS LAB						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	2	40	60	1

Course Objectives:

1. To learn about examination, preventing and fighting digital crimes
2. To model about data acquisition and storing digital evidence
3. To explore operating system file structure, file system and mobile device forensics and its acquisition procedures

Course Outcomes: At the end of this course, the student will be able to

1. Experiment with current computer forensics hardware and software tools for E-mail investigation and mobile device forensics.
2. Prioritize the challenges associated with real time forensics applications/tools
3. Identify the need of Process crime and Incident scenes for digital evidence.
4. Choose suitable data Recover techniques in windows environment.
5. Analyze various validation techniques of forensics data.

List of Challenging Experiments (Indicative)

1. Computer Forensics Investigation Process
2. Computer Forensics Lab
3. Understanding Hard Disks and File Systems
4. Windows Forensics
5. Data Acquisition and Duplication
6. Recovering Files and Partitions
7. Forensics Investigation Using Encase
8. Stenography and Image file Forensics
9. Application Password Cracker
10. Log Capturing and Event Correlation
11. Network Forensics, Investigating log and Network Traffic

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12. Tracking and Investigating Email Crimes

13. Mobile Forensics

TEXT BOOKS:

1. Bill Nelson, Amelia Philips, Christopher Steuart, Guide to Computer Forensics and Investigations, Fourth Edition, Cengage Learning, 2016
2. David Lilburn Watson, Andrew Jones, Digital Forensics Processing and Procedures, Syngress, 2013.

REFERENCE BOOKS

1. Cory Altheide, Harlan Carvey, Digital Forensics with Open Source Tools, British Library Cataloguing-in-Publication Data, 2011
2. Greg Gogolin,Digital Forensics Explained,CRC Press, 2013.

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PROFESSIONAL ELECTIVES-IV

Course Code	Course Title						Core/Elective
SPE741CM	COGNITIVE SCIENCE AND ANALYTICS						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	-	-	-	40	60	3

Course Objectives: To understand the concept of cloud computing.

1. To study the basic concepts and approaches in the field of cognitive science
2. To apply the concepts of planning, reasoning and learning models in cognitive applications
3. To analyze language and semantic models of cognitive process

Course Outcomes: At the end of this course, the student will be able to

1. Understand the basic concepts of cognitive science
2. Learn and understand the learning model an apply the same to appropriate real world applications
3. Apply reasoning methodology to real world applications
4. Understand and apply declarative and logic models
5. Envisage the concept of cognitive learning and acquire knowledge in language processing and understanding

UNIT – 1

Introduction to Cognitive Science: Fundamental concepts of cognitive science, computers in cognitive science, applied cognitive science, the interdisciplinary nature of cognitive science, artificial intelligence: Knowledge representation, semantic networks frames, conceptual dependency, scripts, ontology-understanding, common sense reasoning.

UNIT – 2

Planning and Learning Methods: Planning, Situation logic, learning in cognitive systems, rote learning, learning by examples, incremental concept learning, inductive learning, classification techniques, statistical reasoning, Bayesian classification, Bayesian networks, concept learnings, version spaces, discrimination trees.

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UNIT- 3

Reasoning Methods: Reasoning by analogy, explanation based reasoning, case based reasoning, constraint satisfaction, constraint propagation, temporal reasoning, temporal constraint networks, spatial reasoning, visual spatial reasoning, meta reasoning, learning by correcting mistakes, AI ethics.

UNIT - 4

Cognitive Modeling: Declarative/ logic-based computational cognitive modeling, connectionist models of cognition, Bayesian models of cognition, cognitive models of memory and language, computational models of episodic and semantic memory, modeling psycholinguistics (with emphasis on lexical semantics) – towards deep understanding, modeling the interaction of language, memory and learning.

UNIT – 5

Modeling Paradigm: Modeling select aspects of cognition classical models of rationality, symbolic reasoning and decision making under uncertainty, formal models of inductive generalization causality –categorization and similarity analysis.

TEXTBOOKS:

1. Jose Luis Bermudez, "Cognitive Science: An introduction to the science of the mind", Cambridge University Press, New York, 2014

2. Mallick, Pradeep Kumar, Borah, Samarjeet, "Emerging trends and applications in cognitive computing", IGI Global publishers, 2019

3. Elaine Rich, Kevin Knight, Shiva shankar B Nair, "Artificial Intelligence", 3rd edition, Tata McGraw-hill education, 2012

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Course Code	Course Title						Core/Elective
SPE742CM	NOSQL DATABASE						Elective
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
DBMS	3	-	-	-	40	60	3

Course Objectives:

1. Able to Understand the Comparison between NOSQL and RDBMS.
2. Able to Understand the architecture and features of NOSQL.
3. Able to apply NOSQL tools on different types of NO SQL databases

Course Outcomes: At the end of the Course the student will be able to

1. Explain and compare different types of NoSQL Databases
2. Compare and contrast RDBMS with different NoSQL databases.
3. Demonstrate the detailed architecture and performance tune of Document-oriented NoSQL databases.
4. Explain performance tune of Key-Value Pair NoSQL databases.
5. Apply Nosql development tools on different types of NoSQL Databases.

UNIT-I :

Overview and History of NoSQL Databases. Definition of the Four Types of NoSQL Database, The Value of Relational Databases, Getting at Persistent Data, Concurrency, Integration, Impedance Mismatch, Application and Integration Databases, Attack of the Clusters, The Emergence of NoSQL, Key Points.

UNIT-II:

Comparison of relational databases to new NoSQL stores, MongoDB, Cassandra, HBASE, Neo4j use and deployment, Application, RDBMS approach, Challenges NoSQL approach, Key-Value and Document Data Models, Column-Family Stores, Aggregate-Oriented Databases. Replication and sharding, MapReduce on databases. Distribution Models, Single Server, Sharding, Master-Slave Replication, Peer-to-Peer Replication, Combining Sharding and Replication.

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UNIT-III

NoSQL Key/Value databases using MongoDB, Document Databases, Document oriented Database Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Web Analytics or Real-Time Analytics, E-Commerce Applications, Complex Transactions Spanning Different Operations, Queries against Varying Aggregate Structure.

UNIT-IV

Column- oriented NoSQL databases using Apache HBASE, Column-oriented NoSQL databases using Apache Cassandra, Architecture of HBASE, Column-Family Data Store Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Counters, Expiring Usage.

UNIT-V

NoSQL Key/Value databases using Riak, Key-Value Databases, Key-Value Store, Key-Value Store Features, Consistency, Transactions, Query Features, Structure of Data, Scaling, Suitable Use Cases, Storing Session Information, User Profiles, Preferences, Shopping Cart Data, Relationships among Data, Multi operation Transactions, Query by Data, Operations by Sets. Graph NoSQL databases using Neo4, NoSQL database development tools and programming languages, Graph Databases, Graph Database. Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases.

TEXT BOOKS

1. Ganesh Chandra Deka "NoSQL: Database for Storage and Retrieval of Data in Cloud" 1 st Edition
2. Pramod J. Sadalage; Martin Fowler. NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence. Addison-Wesley. 2012 ISBN: 0321826620 (PS)
3. Shannon Bradshaw , Eoin Brazil , Kristina Chodorow "MongoDB: The Definitive Guide: Powerful and Scalable Data Storage 3rd Edition"

REFERENCE BOOKS

1. Shashank Tiwari. Professional NoSQL. John Wiley and Sons. ISBN:978--470-94224-6.

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Course Code	Course Title						Core/Elective
SPE743CM	MODERN ARCHITECTURE FOR LARGE APPLICATIONS						PE
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
DBMS	3	-	-	-	40	60	3

Course Objectives:

1. To introduce the idea of difference between implementing Machine learning algorithms and large scale Machine learning
2. To understand and implement the specific libraries useful for running ML applications using spark.
3. To learn the importance of processing using streaming data

Course Outcomes: At the end of the Course the student will be able to

1. Build architecture suitable for scaling across different kinds of applications.
2. Understand and suggest the mechanism in building scalable systems.

UNIT-I

Introduction to Scalable applications, challenges with running applications using Machine Learning with scaling, Algorithms for Large scale Learning, Overview of Hadoop and current Big Data systems.

UNIT-II

Programming for Data Flow Differs, Basic Spark, working with Vectors and Matrices in Spark, Brief tour of Spark Ml, Beyond parallelization, practical Big Data.

UNIT-III

Antonomy of Fast Data Applications, SMACK Stack- functional decomposition, Message Backbone- Understanding messaging requirements ,Data ingestion, Fast data &low latency, Message Delivery Semantics, Distributing Messages.

UNIT-IV

Compute engines- micro Batch Processing ,One-at-a time processing, choice of processing engine, storage as the Fast Data Boarders, The Message Backbone as Transition point

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UNIT-V

Sharing Stateful Streaming State, Data Driven micro-services, State and Micro-services, Deployment environments for Fast Data Applications, applications containerization, resource scheduling, Apache Mesos, Kubernetes, Cloud Deployments.

TEXT BOOK:

1. Jan Kunig k, Ian Buss, Paul Wilkinson & Lars George, "architecting Modern Data Platforms",O'reilly,2019

REFERENCES BOOKS:

1. Gerard Maas, Stavros Kontopoulos, Sean Glover, "Designing Fast Data Application Architectures", O' reilly Media, Inc. ,June 2018.

2. Bill Chambers, Matei Zaharia "Spark –the definitive Guide", O' reilly media, Inc., june 2019,

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Course Code	Course Title				CIE	SEE	Core/Elective
SPE744CM	WIRELESS SENSOR NETWORK						PE
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
DBMS	3	-	-	-	40	60	3

Course Objectives:

1. Comprehend the applications of network applications and Fundamental concepts in the understanding of communications systems.
2. Introduction to network model and some of the network layers including physical layer, data link layer, network layer and transport layer.
3. Evolution of wireless systems and Applications of current wireless technologies.

Course Outcomes: At the end of the Course the student will be able to

1. Understand the sensor networks architecture and their history.
2. Evolution of communication technologies from traditional telephony systems to modern wireless communication systems.
3. Working of analog and digital communication systems.
4. Description about OSI network model and the working of data transmission.
5. Knowledge on various sensor applications and IEEE case studies.

UNIT-I

Introduction and Overview of Wireless Sensor Networks: Background of Sensor Network Technology, Basic Sensor Network Architectural Elements, Brief Historical Survey of Sensor Networks Basic Wireless Sensor Technology: Sensor Node Technology, Sensor node architecture, Sensor Taxonomy,

UNIT-II

Characteristics Of WSN: Characteristic requirements for WSN - Challenges for WSNs – WSN vs Adhoc Networks - Commercially available sensor nodes –Imote, IRIS, Mica Mote, EYES nodes, BT nodes, TelosB, Sunspot -Physical layer and transceiver design considerations in WSNs, Energy usage profile, Choice of modulation scheme, Dynamic modulation scaling, Antenna considerations.

Prof. S. Srinivasa Rao

UNIT-III

Medium Access Control Protocols: Fundamentals of MAC protocols - Low duty cycle protocols and wakeup concepts – Contention based protocols - Schedule-based protocols - SMAC - BMAC - Traffic- adaptive medium access protocol (TRAMA) - The IEEE 802.15.4 MAC protocol.

UNIT-IV

Routing And Data Gathering Protocols: Routing Challenges and Design Issues in Wireless Sensor Networks, Flooding and gossiping – Data centric Routing – SPIN – Directed Diffusion – Energy aware routing - Gradient-based routing - Rumor Routing – COUGAR – ACQUIRE – Hierarchical Routing - LEACH, PEGASIS – Location Based Routing – GF, GAF, GEAR, GPSR – Real Time routing Protocols – TEEN, APTEEN, SPEED, RAP - Data aggregation - data aggregation operations - Aggregate Queries in Sensor Networks - Aggregation Techniques – TAG, Tiny DB.

UNIT-V

Applications Of WSN: WSN Applications - Home Control - Building Automation - Industrial Automation - Medical Applications - Reconfigurable Sensor Networks - Highway Monitoring - Military Applications - Civil and Environmental Engineering Applications - Wildfire Instrumentation - Habitat Monitoring – Nano scopic Sensor Applications – Case Study: IEEE 802.15.4 LR-WPANs Standard - Target detection and tracking - Contour/edge detection - Field sampling.

TEXT BOOKS:

1). Kazem Sohraby, Daniel Minoli and TaiebZnati, "Wireless Sensor Networks Technology, Protocols, and Applications", John Wiley & Sons, 2007.

2). Holger Karl and Andreas Willig, "Protocols and Architectures for Wireless Sensor Networks", John Wiley & Sons, Ltd, 2005.

3). K. Akkaya and M. Younis, "A survey of routing protocols in wireless sensor networks", Elsevier Ad Hoc Network Journal, Vol. 3, no. 3, pp. 325--349

4). Philip Levis, " TinyOS Programming" 3.Anna Ha´c, "Wireless Sensor Network Designs", John Wiley & Sons Ltd,

Prof. S. Srinivasa Rao

Course Code	Course Title						Core/Elective
SPE745CM	Database Security & Administration						PE
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
DBMS	3	-	-	-	40	60	3

Course Objectives:

1. To study the different models involved in database security
2. To study their applications in real time world to protect the database and information associated with them.
3. Prove that the data integrity is preserved, only authorized user has access to the data

Course Outcomes: At the end of the Course the student will be able to

1. Avoid unauthorized data observation & modification
2. Ensure the data confidentiality.
3. Identify security threats in database systems.
4. Design and Implement secure database systems
5. Solve Complex Problems in a Team of database works.

UNIT - I

Introduction to Databases Security Problems in Databases Security Controls Conclusions Security Models - Introduction Access Matrix Model Take-Grant Model Acten Model PN Model Hartson and Hsiao's Model Fernandez's Model Bussolati and Martella's Model for Distributed databases

UNIT – II

Security Models - Bell and LaPadula's Model Biba's Model Dion's Model Sea View Model Jajodia and Sandhu's Model The Lattice Model for the Flow Control conclusion Security Mechanisms Introduction User Identification/Authentication Memory Protection Resource Protection Control Flow Mechanisms Isolation Security Functionalities in Some Operating Systems Trusted Computer System Evaluation Criteria

Prof. S. Srinivasa Rao

UNIT- III

Security Software Design Introduction A Methodological Approach to Security Software Design Secure Operating System Design Secure DBMS Design Security Packages Database Security Design Statistical Database Protection & Intrusion Detection Systems Introduction Statistics Concepts and Definitions Types of Attacks Inference Controls evaluation Criteria for Control Comparison .Introduction IDES System RETISS System ASES System Discovery

UNIT- IV

Models For The Protection Of New Generation Database Systems -1 Introduction A Model for the Protection of Frame Based Systems A Model for the Protection of Object Oriented Systems SORION Model for the Protection of Object-Oriented Databases

UNIT – V

Models for The Protection Of New Generation Database Systems -2 A Model for the Protection of New Generation Database Systems: the Orion Model Jajodia and Kogan's Model A Model for the Protection of Active Databases Conclusions

TEXT BOOKS:

1. Database Security and Auditing, Hassan A. Afyouni, India Edition, CENGAGE Learning, 2009.

2. Database Security, Castano, Second edition, Pearson Education.

REFERENCE BOOK:

1. Database security by alfredbasta, melissazgola, CENGAGE learning

Prof. S. Srinivasa Rao

PROFESSIONAL ELECTIVES-V

Course Code	Course Title						Core/Elective
SPE751CM	DEEP LEARNING						Elective
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
----	3	-	-	-	40	60	3

Course Objectives:

1. To understand the theoretical foundations, algorithms and methodologies of Neural Network
2. To design and develop an application using specific deep learning models
3. To provide practical knowledge in handling and analyzing real world applications.

Course Outcomes:

1. Understand and Apply different neural network algorithms for variety of problems.
2. Understanding the Deep learning architectures.
3. Identify and apply appropriate CNN and Transfer learning algorithms for variety of problems.
4. Understand and Apply different sequence to sequence models for variety of problems.
5. Apply auto-encoders in NLP, Speech applications

UNIT I

Introduction: History of Deep Learning, McCulloch Pitts Neuron, Multilayer Perceptrons (MLPs), Representation Power of MLPs, Sigmoid Neurons, Activation Functions: RELU, LRELU, ERELU, Unsupervised Training of Neural Networks.

UNIT II

Activation functions and parameters: Gradient Descent (GD), Momentum Based GD, Nesterov Accelerated GD, Stochastic GD, Principal Component Analysis and its interpretations, Singular Value Decomposition, Parametersv/s Hyper-parameters

Prof. S. Srinivasa Rao

UNIT III

Auto-encoders & Regularization: Auto encoders and relation to PCA, Regularization in auto encoders, Denoising auto encoders, Sparse auto encoders, Regularization: Bias Variance Tradeoff, L2 regularization, Early stopping, Dataset augmentation, Encoder Decoder Models, Attention Mechanism, Attention over images, Batch Normalization

UNIT-IV

Deep Learning Models: Introduction to CNNs, Architecture, Convolution/pooling layers, CNN Applications, LeNet, AlexNet, ZF-Net, VGGNet, GoogLeNet, ResNet, Applications

UNIT V

Sequence Modelling: Introduction to Recurrent Neural Networks(RNN), Back propagation through time (BPTT), Vanishing and Exploding Gradients , Truncated BPTT, Bidirectional RNNs, BPTT for training RNN, Long Short-Term Memory (LSTM) Networks.

Deep Learning Applications: Image Processing, Natural Language Processing, Speech recognition, Video Analytics

TEXT BOOK:

1. Ian Goodfellow, YoshuaBengio and Aaron Courville, "Deep Learning", MIT Press, 2017.
2. Josh Patterson, Adam Gibson "Deep Learning: A Practitioner's Approach O'Reilly Media,2017
3. Umberto Michelucci "Applied Deep Learning. A Case-based Approach to understanding deep neural networks" Apress, 2018.

REFERENCE BOOKS:

1. Bengio, Yoshua. " Learning deep architectures for AI." Foundations and trends in Machine Learning 2.1, Now Publishers, 2009
2. Deep Learning, Rajiv Chopra, Khanna Book Publishing, Delhi 2020.
3. NPTEL : https://nptel.ac.in/courses/106/106/106106184/
4. COURSEERA: https://www.coursera.org/specializations/deep-learning
5. Giancarlo Zaccone, Md. Rezaul Karim, Ahmed Menshawy "Deep Learning with Tensor Flow: Explore neural networks with Python", Packt Publisher, 2017.

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Course Code	Course Title						Core/Elective
SPE752CM	DATA ANALYTICS						Elective
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
----	3	-	-	-	40	60	3

Course Objectives:

1. Overview of Data and Data analytics on huge datasets.
2. Prepare Qualitative Data to perform different strategies of analytics.
3. Able to realistically assess the application of data analytics technologies for different usage scenarios.

Course Outcomes: Student will be able to

1. Demonstrate proficiency with statistical analysis of data.
2. Develop the ability to build and assess data-based models.
3. Execute statistical analyses with professional statistical software.
4. Demonstrate skill in data management.
5. Apply data science concepts and methods to solve problems in real-world contexts and will communicate these solutions effectively.

UNIT – I

Getting to Know Your Data - Data Objects and Attribute Types - Attribute, Nominal Attributes, Binary Attributes, Ordinal Attributes, Numeric Attributes, Discrete versus Continuous Attributes. Basic Measuring Data Similarity and Dissimilarity - Data Matrix versus Dissimilarity Matrix, Proximity Measures for Nominal Attributes, Proximity Measures for Binary Attributes, Dissimilarity of Numeric Data: Minkowski Distance, Proximity Measures for Ordinal Attributes, Dissimilarity for Attributes of Mixed Types, Cosine Similarity.

UNIT – II

Introduction to Data Analytics - Big Data and Data Science, Small Data, A Short Taxonomy of Data Analytics, Examples of Data Use, Breast Cancer in Wisconsin, Polish Company Insolvency Data, A Little History on Methodologies for Data Analytics. Descriptive Statistics - Scale Types, Descriptive Univariate Analysis, Univariate Frequencies, Contents, Univariate

Prof. S. Srinivasa Rao

Data Visualization, Univariate Statistics, Common Univariate Probability Distributions, Descriptive Bivariate Analysis, Two Quantitative Attributes, Two Qualitative Attributes, at Least one of them Nominal, Two Ordinal Attributes.

UNIT – III

Descriptive Multivariate Analysis - Multivariate Frequencies, Multivariate Data Visualization, Multivariate Statistics, Location Multivariate Statistics, Dispersion Multivariate Statistics. Data Quality and Preprocessing - Data Quality, Missing Values, Redundant Data, Inconsistent Data, Noisy Data, Outliers, Converting to a Different Scale Type, Converting Nominal to Relative, Converting Ordinal to Relative or Absolute, Converting Relative or Absolute to Ordinal or Nominal, Converting to a Different Scale.

UNIT – IV

Data Analytics Lifecycle Overview - Key Roles for a Successful Analytics Project, Background and Overview of Data Analytics Lifecycle - Discovery, Data Preparation, Model Planning, Model Building, Communicate Results, Operationalize and Case Study. Data Analytics Methods using R - Introduction to R, R Graphical User Interfaces, Data Import and Export, Attribute and Data Types, Descriptive Statistics, Exploratory Data Analysis, Visualization Before Analysis, Dirty Data Visualizing a Single Variable Examining Multiple Variables, Data Exploration Versus Presentation.

UNIT – V

Data Visualization Basics - Key Points Supported with Data, Evolution of a Graph, Common Representation Methods, How to Clean Up a Graphic, Additional Considerations. Applications of Data Analytics on Text & Web: Working with Texts, Data Acquisition, Feature Extraction, Tokenization, Stemming, Conversion to Structured Data, Trends, Sentiment Analysis, Web Mining, & Recommender Systems.

TEXT BOOKS:

1. Seema Acharya, "Data Analytics using R" ,McGraw Hill, 1st Edition, 2018.
2. Data Mining: Concepts and Techniques Second Edition – Jiawei Han and Micheline Kamber – Morgan KaufMan Publisher, 2011.
3. A General Introduction to Data Analytics, Joao Mendes Moreira, AndreC.P.L.F.deCarvalho, Tomas Horvath, Wiley Publications., 2018.

REFERENCE BOOKS

1. David Dietrich, Barry Hiller, "Data Science & Big Data Analytics", EMC education services, Wiley publications, 2012.
2. U Dinesh Kumar, "Data Analytics", Wiley Publication, 1st Edition , 2017.

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Course Code	Course Title				Core/Elective	
SPE753CM	ARCHITECTING APPLICATIONS FOR CLOUD				Elective	
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
—	3	-	-	-	40	60	3

Course Objectives:

1. Understand the concepts of cloud computing for developing the cloud applications.
2. Understand task scheduling algorithms and virtualization.
3. Analyze and understand the importance of various applications of cloud computing.

Course Outcomes:

1. Understand the cloud services
2. Understand the applications developments of Amazon web services
3. Memorize the Cloud architecture and programming model
4. Understand the cloud resource virtualization
5. Understand the Cloud Resource Management and Scheduling

UNIT-1

Cloud Computing Architecture: Cloud computing stack: Comparison with traditional computing architecture (client/server), Services provided at various levels, How Cloud Computing Works, Role of Networks in Cloud computing, protocols used, Role of Web services Service Models (XaaS): Infrastructure as a Service(IaaS), Platform as a Service(PaaS) , Software as a Service(SaaS) Deployment Models: Public cloud , Private cloud , Hybrid cloud, Community cloud

UNIT-II

Infrastructure as a Service(IaaS): Introduction to IaaS, IaaS definition, Introduction to virtualization, Different approaches to virtualization, Hypervisors, Machine Image, Virtual Machine(VM) Resource Virtualization: Server, Storage , Network. Virtual Machine(resource) provisioning and manageability, storage as a service, Data storage in cloud computing(storage as a service)Examples: Amazon EC2, Renting, EC2 Compute Unit, Platform and Storage,

Prof. S. Srinivasa Rao

pricing, customers, Eucalyptus Platform as a Service(PaaS): Introduction to PaaS, What is PaaS, Service Oriented Architecture (SOA)

Cloud Platform and Management: Computation, Storage, Examples: Google App Engine, Microsoft Azure , SalesForce.com's Force.com platform

UNIT-III

Software as a Service(PaaS): Introduction to SaaS, Web services, Web 2.0, Web OS, Case Study on SaaS Service Management in Cloud Computing; Service Level Agreements(SLAs), Billing & Accounting ,Comparing Scaling Hardware: Traditional vs. Cloud, Economics of scaling: Benefitting enormously, Managing Data: Looking at Data, Scalability & Cloud Services, Database & Data Stores in Cloud, Large Scale Data Processing

UNIT-IV:

CLOUD APPLICATION: Applications of cloud computing: Healthcare, energy systems, transportation, manufacturing, education, government, mobile communication, application development CLOUD ARCHITECTURE, PROGRAMMING MODEL: Cloud Architecture, programming model: NIST reference architecture, architectural styles of cloud applications, single, multi, hybrid cloud site, redundant, non redundant, 3 tier, multi tier architectures; Programming model: Compute and data intensive.

UNIT-V

CLOUD RESOURCE VIRTUALIZATION Cloud resource virtualization: Basics of virtualization, types of virtualization techniques, merits and demerits of virtualization, Full vs Para - virtualization, virtual machine monitor/hypervisor. Virtual machine basics, taxonomy of virtual machines, process vs system virtual machines.

TEXT BOOKS:

1. Dan Marinescu, "Cloud Computing: Theory and Practicel", M K Publishers, 1st Edition, 2013,
2. Kai Hwang, Jack Dongarra, Geoffrey Fox," Distributed and Cloud Computing, From Parallel Processing to the Internet of Thingsl", M K Publishers, 1st Edition, 2011.

REFERENCE BOOKS:

1. Anthony T. Velte, Toby J. Velte, Robert Elsenpeter, "Cloud Computing: A Practical Approach", McGraw Hill, 1st Edition, 2009.
2. Arshdeep Bahga, "Cloud Computing: A Hands on Approach", Vijay Madisetti Universities Publications, 1st Edition, 2013.
3. Cloud Computing Bible, Barrie Sosinsky, Wiley-India, 2010
4. Cloud Computing: Principles and Paradigms, Editors: Raj kumar Buyya, James Broberg, Andrzej M. Goscinski, Wile, 2011
5. Cloud Computing: Principles, Systems and Applications, Editors: Nikos Antonopoulos,

Prof. S. Srinivasa Rao

Lee Gillam, Springer, 2012
6. Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Ronald L. Krutz, Russell Dean Vines, Wiley-India, 2010

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Course Code	Course Title				CIE	SEE	Core/Elective
SPE754CM	BLOCKCHAIN TECHNOLOGY						Elective
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
----	3	-	-	-	40	60	3

Course Objectives:

1. Understand how block chain systems (mainly Bit coin and Ethereum) work.
2. To securely interact with them.
3. Design, build and deploy smart contracts and distributed applications.
4. Integrate ideas from block chain technology in to their own projects.

Course Outcomes:

1. Understand the distributed databases
2. Explain about the block chain technology
3. Explain Nakamo to consensus.
4. Learn about the crypto currency
5. Design, build and deploy a distributed application.

UNIT–I

Basics: Distributed Database, Two General Problem, Byzantine General problem and Fault Tolerance, Hadoop Distributed File System, Distributed Hash Table, ASIC resistance, Turing Complete.

Cryptography: Hash function, Digital Signature - ECDSA, Memory Hard Algorithm, Zero Knowledge Proof.

UNIT–II

Block chain: Introduction, Advantage over conventional distributed database, Block chain Network, Mining Mechanism, Distributed Consensus, Merkle Patricia Tree, Gas Limit, Transactions and Fee, Anonymity, Reward, Chain Policy, Life of Block chain application, Soft & Hard Fork, Private and Public block chain.

UNIT–III

Distributed Consensus: Nakamo to consensus, Proof of Work, Proof of Stake, Proof of Burn, Difficulty Level, Sybil Attack, Energy utilization and alternate.

Prof. S. Srinivasa Rao

UNIT–IV

Crypto currency: History, Distributed Ledger, Bitcoin protocols - Mining strategy and rewards, Ethereum- Construction, DAO, Smart Contract, GHOST, Vulnerability, Attacks, Side chain, Name coin

UNIT–V

Crypto currency Regulation: Stakeholders, Roots of Bitcoin, Legal Aspects-Crypto currency Exchange, Black Market and Global Economy.
Applications: Internet of Things, Medical Record Management System, Domain Name Service and future of Block chain.

Case study: Naïve Block chain construction, Memory Hard algorithm- Hash cash implementation, Direct Acyclic Graph, Play with Go- Ethereum, Smart Contract Construction, Toy application using Block chain, Mining puzzles

TEXT BOOK:

1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Gold feder, Bitcoin and Crypto currency Technologies: A Comprehensive Introduction, Princeton University Press, 2016.
2. Satoshi Nakamoto, Bitcoin: A Peer-to-Peer Electronic Cash System. DR.GavinWood,"ETHEREUM: A Secure Decentralized Transaction Ledger, "Yellow paper.2014.
3. Nicola Atzei, Massimo Bartoletti, and TizianaCimoli, A survey of attacks on Ethereum smart contracts.

REFERENCE BOOKS:

1. Nicola Atzei, Massimo Bartoletti, and TizianaCimoli, A survey of attacks on Ethereum smart contracts.
2. Kumar Saurabh, AshutoshSaxena, Blockchain Technology: Concepts and Applications. Wiley Publications, 2020.
3. Dr. Gavin Wood, Andreas M. Antonopoulos, Mastering Ethereum: Building Smart Contracts and Dapps, O'Reilly.

Prof. S. Srinivasa Rao

Course Code	Course Title				CIE	SEE	Core/Elective
SPE755CM	MALWARE ANALYSIS						Elective
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
----	3	-	-	-	40	60	3

Course Objectives:

1. Identify and describe common traits of malware
2. Explain the process and procedures for safe handling of malware
3. Examine and analyze malware using static and dynamic analysis techniques.

Course Outcomes:

1. Identify malware and their characteristics.
2. Explain the methodology in malware analysis
3. Apply the tools and technologies used in malware analysis

UNIT-I

Introduction:

The cyber kill chain, Definition of malware and its role in the kill chain, Different types of malware , The goal of malware analysis ,Types of malware analysis , Setting up a safe environment for malware analysis

UNIT-II

Analyzing malicious Windows programs ,The Portable Executable file format, PE header and sections ,The Windows loader, Windows API, Import Address Table, Import functions, Export functions , System architecture, processes, threads, memory management, registry , PE files on disk and in memory.

UNIT-III

Basic analysis: Basic static analysis - Introducing concepts and tools for basic static analysis: hash functions, VirusTotal, strings, PEiD, PE Explorer, CFF Explorer, and Resource Hacker. - - Identifying file obfuscation techniques: packers and cryptors. Introduction to Yara. , Basic dynamic analysis - Introducing concepts and tools for basic dynamic analysis: Sysinternals tools, sandboxes. - Persistence techniques. , Network analysis - Faking a network for safe malware analysis. - - Introduction to Wireshark. Command and Control communication of malware.

Prof. S. Srinivasa Rao

UNIT-IV

Advanced analysis: Introduction to x86 architecture - Memory, instructions, opcodes, operands, registers, functions, stack. - The difference between source code and compiled code. Examining simple examples using different compilers. Advanced static analysis - Introduction to dis assemblers and decompilers. - - Static code analysis with IDA/Ghidra. Obfuscation techniques. Advanced dynamic analysis - Introduction to debuggers. - - - Dynamic analysis with OllyDbg. Process injection techniques and hooking. User mode and kernel mode debugging. Ransomware analysis - Cryptographic algorithms used by ransomware. - Cryptographic flaws in ransomware.

UNIT-V

Analysis of malicious documents File formats: OLE2, OOXML, RTF and PDF. Malicious macro. Document exploits, e.g. exploit example for Equation editor vulnerability (CVE-201711882). Introduction to oletools. Defeat malware Examples of how to use the information we got during malware analysis to defend against malware attacks. Threat Intelligence, IOCs. Security solutions. Open source tools: Yara, Snort/Suricata.

TEXT BOOKS:

1. Michael Sikorski and Andrew Honig: Practical Malware Analysis, The Hands-On Guide to Dissecting Malicious Software. No Starch Press. ISBN: 978-1-593-27290-6
2. Monnappa K A: Learning Malware Analysis: Explore the concepts, tools, and techniques to analyze and investigate Windows malware. Packt Publishing. ISBN: 978-1788392501

REFERENCE BOOKS

1. Michael Hale Ligh, Steven Adair, Blake Hartstein and Matthew Richard: Malware Analyst's Cookbook and DVD: Tools and Techniques for Fighting Malicious Code. Wiley. ISBN: 978-0470-61303-0
2. Chris Eagle: The IDA Pro Book: The Unofficial Guide to the World's Most Popular Dis assembler Second Edition. No Starch Press. ISBN: 978-1-59327-289-0

Prof S. Srinivasa Rao

CME: Semester VIII

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/ Wk	CIE	SEE	SEE Duration	
Theory Courses										
1	OE-III	Open Elective-III	3	-	-	3	40	60	3	3
Practical/ Laboratory Courses										
2	SPW821CM	Project work-II	-	-	16	16	40	60	3	8
		Total	03	-	16	19	80	120		11

Open Elective-III			
SI.No	Course Code	Course Title	Course Offered by the Department
1.	SOE801ME	Industrial Robotics	(Mechanical)
2.	SOE801MB	Management Information System	(MBA)
3.	SOE801EC	Power Management for IOT Devices	(ECE)
4.	SOE801EE	Industrial Instrumentation	(EEE)

Prof. S. Srinivasa Rao

Course Code	Course Title						Core/Elective
SPW821CM	PROJECT WORK – II						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	-	-	-	16	40	60	8

Course Objectives:

1. To familiarize tools and techniques of systematic literature survey and documentation
2. To expose the students to industry practices and team work.
3. To encourage students to work with innovative and entrepreneurial ideas

Course Outcomes: At the end of this course, the student will be able to

1. To understand project characteristics and various stages of project
2. Demonstrate the ability to synthesize and apply the knowledge and skills acquired in the academic program to the real-world problems.
3. Evaluate different solutions based on economic and technical feasibility
4. Effectively plan a project and confidently perform all aspects of project management
5. Demonstrate effective written and oral communication skills

The aim of Project work –II is to implement and evaluate the proposal made as part of Project Work - I. Students can also be encouraged to do full time internship as part of project work-II based on the common guidelines for all the departments. The students placed in internships need to write the new proposal in consultation with industry coordinator and project guide within two weeks from the commencement of instruction.

The department will appoint a project coordinator who will coordinate the following:

i. Re-grouping of students - deletion of internship candidates from groups made as part of project work-I
ii. Re-Allotment of internship students to project guides
iii. Project monitoring at regular intervals

All re-grouping/re -allotment has to be completed by the 1st week of VIIIth semester so that students get sufficient time for completion of the project.

All projects (internship and departmental) will be monitored at least twice in a semester through student presentation for the award of sessional marks. Sessional marks are awarded by a monitoring committee comprising of faculty members as well as by the supervisor. The first review of projects for 25 marks can be conducted after completion of five weeks. The second review for another 25 marks can be conducted after 12 weeks of instruction.

Prof. S. Srinivasa Rao

Common norms will be established for the final documentation of the project report by the respective departments. The students are required to submit draft copies of their project report within one week after completion of instruction.

Note: Three periods of contact load will be assigned to each project guide.

Prof. S. Srinivasa Rao

Course Code	Course Title						Core/Elective
SOE903CM	DATA SCIENCE USING R PROGRAMMING						OPEN ELECTIVE
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
——	3	-	-	-	40	60	3

Course Objectives:

1. To learn basics of R Programming environment: R language, R- studio and R packages
2. To learn various statistical concepts like linear and logistic regression, cluster analysis, time series forecasting
3. To learn Decision tree induction, association rule mining and text mining

Course Outcomes: At the end of the course, the student will be able to:

1. Use various data structures and pack ages in R ford at a visualization and summarization
2. Use linear, non-linear regression models, and classification techniques for data analysis
3. Use clustering methods including K-means and CURE algorithm

UNIT I

Data Science: Introduction to data science, Linear Algebra for data science, Linear equations, Distance, Hyper planes, half spaces, Eigen values, Eigenvectors.

UNIT II

Statistical Modelling, Random variables, Probability mass/density functions, sample statistics, hypothesis testing.

UNIT III

Introduction to R Programming, getting started with R: Installation of R software and using the interface, Variables and data types, R Objects, Vectors and lists, Operations: Arithmetic, Logical and Matrix operations, Data frames, functions, Control structures, Debugging and Simulation in R.

UNIT IV

Predictive Modelling: Linear Regression, Simple Linear Regression model building, Multiple Linear Regression, Multiple linear regression implementation in R, Logistic regression, Logistic regression, Logistic regression implementation in R

Mof. S. Srinivasa Rao

UNIT V

Classification: performance measures, K-Nearest neighbors (KNN), K-Nearest neighbors Implementation in R,

Clustering: K-Means Algorithm, K-Means implementation in R.

Time Series in R: Introduction, What Is Time Series Data, Reading Time Series Data, Decomposing Time Series Data, Forecasts Using Exponential Smoothing, ARIMA Models.

TEXT BOOKS:

1. Nina Zumel, Practical Data Science with R, Manning Publications,2014.
2. Peter Bruce and Andrew Bruce, Practical Statistics for Data Scientists, O'Reilly,2017.
3. Hadley Wickham and Garrett Grolemund, R for Data Science, O'Reilly,2017.

REFERENCE BOOKS:

1. Roger D Peng, R Programming for Data science, Lean Publishing,2016.
2. Rafael A Irizarry, Introduction to Data Science, LeanPublishing,2016.

Prof. S. Srinivasa Rao

Course Code	Course Title						Core/Elective
SOE902CM	DATABASE MANAGEMENT SYSTEMS						OPEN ELECTIVE
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
----	3	-	-	-	40	60	3

Course Objectives:

1. Identify different issues involved in the design and implementation of a database system.
2. Understand transaction processing.
3. Understand Indexing and Hashing techniques.

Course Outcomes: At the end of the course, the student will be able to:

1. Identify the functional components of database management system. Create conceptual data model using Entity Relationship Diagram
2. Transform a conceptual data model into a relational model
3. Design database using normalization techniques
4. Apply indexing and hashing techniques for effective data retrieval
5. Explain transaction processing.

UNIT-I

Introduction: Database System Application, Purpose of Database Systems, View of Data, Database Languages, Relational Database, Database Architecture, Database Users and Administrators. Database Design and E-R Model: Overview of the Design Process, the E-R Model, Constraints, E-R Diagrams.

UNIT-II

Relational Model: Structure of Relation Database, Relational Algebra Operations, Modification of the Database.

Structured Query Language: Introduction, Basic Structure of SQL Queries, Set Operations, Aggregate Functions, Null Values, Nested Sub queries, Views, Join Expressions.

UNIT-III

Relational Database Design: Features of Good Relational Designs, Atomic Domains and first Normal form, Decomposition Using Functional Dependencies, functional Dependency Theory.

Mr. Vinodkumar

Mr. S. Srinivasa Rao

UNIT-IV

Indexing and Hashing: Basic Concepts, Ordered Indices, B+ Tree Index Files, B-Tree Files, Multiple Key Access, Static Hashing, Dynamic Hashing, Comparison of Ordered Indexing and Hashing.

UNIT-V

Transaction Management: Transaction concept, Storage Structure, Transaction Atomicity and Durability, Transaction Isolation and Atomicity, Serializability, Recoverability

TEXT BOOKS:

1. Abraham Silberschatz, Henry F Korth, Sudharshan S, Database System Concepts, 6th Edition(2011), McGraw-Hill International Edition.
2. Date CJ, Kannan A, Swamynathan S, An Introduction to Database System , 8th Edition(2006)Pearson Education.
3. Raghu Ramakrishna, and Johannes Gehrke, Database Management Systems, 3rd Edition (2003), McGraw Hill.
4. Ramez Elmasri, Durvasul VLN Somyazulu, Shamkant B Navathe, Shyam K Gupta, Fundamentals of Database Systems, 4th Edition (2006), Pearson Education.

REFERENCES BOOKS:

1. Peter rob, Carlos coronel, Database Systems, (2007), Thomoson.
2. http://nptel.ac.in/courses/106106093

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