Name of Department: - Computer Science and Engineering

1. Subject Code: TMA 402 Course Title: **Computer Based Numerical and Statistical Technique**
2. Contact Hours: L: 3 T: - P: -
3. Semester: IV

4. Pre-requisite: TMA 101, TMA 201, TCS 101, TCS 201

5. Course Outcomes: After completion of the course students will be able to

1. Develop the notion of errors, finding of errors, roots and apply them in problem solving in concern subject.
2. Use effectively interpolation techniques and use them for numerical differentiation and integration.
3. Interpret asymptotic notation, its significance, and be able to use it to analyse asymptotic performance for basic algorithmic examples.
4. Examine statistical control techniques and be able to relate these to practical examples.
5. Elaborate the basics of regression, curve fitting and be able to apply the methods from these subjects in problem solving.
6. Explain the concepts of numerical solutions of ordinary differential equations.

6. Detailed Syllabus

UNIT	CONTENTS	Contact Hrs
Unit – I	**Introduction:** Numbers and their accuracy, Computer Arithmetic, Mathematical preliminaries, Errors and their Computation, General error formula, Error in series approximations. **Solution of Algebraic and Transcendental Equation:** Bisection Method, Iteration method, Method of false position, Newton-Raphson method, Rate of convergence of Iterative methods. **Solution of system of linear equations:** Gauss Elimination method, Gauss Jordan method and Gauss Seidel method.	**10**
Unit - II	**Interpolation:** Finite Differences, Difference tables, Polynomial Interpolation: Newton's forward and backward formula, Central difference formulae: Gauss forward and backward formula, Stirling's, Bessel's, Everett's formula. Interpolation with unequal intervals: Lagrange's interpolation, Newton divided difference formula.	**10**
Unit – III	**Numerical Differentiation and Integration:** Introduction, Numerical differentiation Numerical Integration: Trapezoidal rule, Simpson's 1/3 and 3/8 rule, Weddle's rule	**9**
Unit – IV	**Numerical Solution of differential Equations:** Taylor's Method, Picard's Method, Euler's and modified Euler's method, Runge-Kutta Method, Milne's Predictor Corrector Method	**9**
Unit – V	**Statistical Computation:** Frequency charts, Curve fitting by method of least squares, fitting of straight lines, polynomials, exponential curves etc, Data fitting with Cubic splines, Regression Analysis, Linear, Non linear	**10**

	Regression and Multiple regression	
	Total	**48**

Text Books:

- Rajaraman V, “Computer Oriented Numerical Methods”, Pearson Education, 2000.
- Grewal B S, “Numerical methods in Engineering and Science”, Khanna Publishers, Delhi, 2005.

Reference Books:

- Goyal, M, “Computer Based Numerical and Statistical Techniques”, Laxmi Publication (P) Ltd., New Delhi, 2005.
- Jain, Iyengar and Jain, “Numerical Methods for Scientific and Engineering Computations”, New Age Int, 2003.
- T Veerarajan, T Ramachandran, “Theory and Problems in Numerical Methods, TM, 2004.
- Francis Scheld, “Numerical Analysis”, TMH, 2010.
- Sastry, S. S, “Introductory Methods of Numerical Analysis”, Pearson Education, 2009.

Name of Department:- Computer Science and Engineering

1. Subject Code: TCS 402 Course Title: **Finite Automata and Formal Languages**
2. Contact Hours: L: 3 T: 1 P: 0
3. Semester: IV

4. Pre-requisite: TMA 101, TMA 201

5. Course Outcomes: After completion of the course students will be able to

1. Demonstrate the conversion of NFA into DFA, ϵ-NFA into DFA and Minimization of Finite Automata by using Myhill-Nerode Theorem
2. Formulate DFA, RE and FA with output.
3. Design CFG and check the language is not CFL.
4. Design PDA and convert n-PDA into d-PDA.
5. Design Turing machines for addition, substraction, multiplication etc.
6. Formulate finite machines, push down automata and Turing machines for automated functioning of devices.

6. Detailed Syllabus

UNIT	CONTENTS	Contact Hrs
Unit – I	Introduction; Alphabets, Strings and Languages; Automata and Grammars, Deterministic finite Automata (DFA)-Formal Definition, Simplified notation: State transition graph, Transition table, Language of DFA, Nondeterministic finite Automata (NFA), NFA with epsilon transition, Language of NFA, Equivalence of NFA and DFA, Minimization of Finite Automata, Distinguishing one string from other, Myhill-Nerode Theorem	**10**
Unit - II	Regular expression (RE), Definition, Operators of regular expression and their precedence, Algebraic laws for Regular expressions, Kleen's Theorem, Regular expression to FA, DFA to Regular expression, Arden Theorem, Non Regular Languages, Pumping Lemma for regular Languages. Application of Pumping Lemma, Closure properties of Regular Languages, Decision properties of Regular Languages, FA with output: Moore and Mealy machine, Equivalence of Moore and Mealy Machine, Applications and Limitation of FA.	**10**
Unit – III	Context free grammar (CFG) and Context Free Languages (CFL): Definition, Examples, Derivation, Derivation trees, Ambiguity in Grammar, Inherent ambiguity, Ambiguous to Unambiguous CFG, Useless symbols, Simplification of CFGs, Normal forms for CFGs: CNF and GNF, Closure proper ties of CFLs, Decision Properties of CFLs: Emptiness, Finiteness and Membership, Pumping lemma for CFLs.	**9**
Unit – IV	Push Down Automata (PDA): Description and definition, Instantaneous Description, Language of PDA, Acceptance by Final state, Acceptance by empty stack, Deterministic PDA, Equivalence of PDA and CFG, CFG to PDA and PDA to CFG, Two stack PDA.	**10**

Unit – V	Turing machines (TM): Basic model, definition and representation, Instantaneous Description, Language acceptance by TM, Variants of Turing Machine, TM as Computer of Integer functions, Universal TM, Church's Thesis, Recursive and recursively enumerable languages, Halting problem, Introduction to Undecidability, Undecidable problems about TMs. Post correspondence problem (PCP), Modified PCP, Introduction to recursive function theory.	**8**
	Total	**47**

Text Book:

- Hopcroft, Ullman, "Introduction to Automata Theory, Languages and Computation", Pearson Education.
- KLP Mishra and N. Chandrasekaran, "Theory of Computer Science: Automata, Languages and Computation", PHI Learning Private Limited, Delhi India.

Reference Books:

- Michael Sipser," Introduction to Theory of Computation", (2nd edition), Thomson, 2006
- Peter Linz, "An Introduction to Formal Language and Automata", Narosa Publishing house.
- Elaine Rich ,"Automata, Computability, Complexity-Theory and applications"

Name of Department:- Computer Science and Engineering

1. Subject Code: TCS 403 Course Title: **Microprocessors**

2. Contact Hours: L: 3 T: - P: -

3. Semester: IV

4. Pre-requisite: TEC 101, TEC 201, TCS 101, TCS 301

5. Course Outcomes: After completion of the course students will be able to

1. Understanding of 8085 and 8086 microprocessors and memory segmentation
2. Analysis of Instruction set of 8085and 8086.
3. Implementation of different programs on 8085 and 8086 based microcomputer kit.
4. Interfacing of 8255 and 8085/8086.
5. Interfacing of microprocessor with Timing Devices
6. This course will act as foundation for projects based on Embedded system and interfacing of different ICs

6. Detailed Syllabus

UNIT	CONTENTS	Contact Hrs
Unit – I	Introduction to Microprocessors: Evolution of Microprocessors, Classification-Brief Evolution, Example of an 8085 based System, Microprocessor Internal Architecture, hardware model of 8085, Pin diagram and function of each pin, memory interfacing.	**9**
Unit - II	Programming with 8085: Instruction set, programming model of 8085, addressing modes, assembly language programming, Timing and control, peripheral I/O, memory mapped I/O, 8085 Interrupts, Stack and subroutines.	**10**
Unit – III	16 Bit Processor: 16-bit Microprocessors (8086): Architecture, pin diagram, Physical address, segmentation, memory organization, Bus cycle, Addressing modes, Instruction set ,Assembly Language Programming of 8086, comparison of 8086 & 8088	**8**
Unit – IV	Interfacing (Data Transfer) with Microprocessor: Data Transfer Schemes: Introduction, handshaking signals, Types of transmission, 8255 (PPI), Serial Data transfer (USART 8251), memory interfacing, 8257 (DMA), programmable interrupt Controller (8259).	**8**
Unit – V	Interfacing of Microprocessor with Timing Devices: Programmable Interval Timer/ Counter (8253/8254): Introduction, modes, Interfacing of 8253, applications. Introduction to DAC & ADC, ADC & DAC Interfacing (0808, 0809).	**9**
	Total	**44**

Text Book:

1. Ramesh Gaonkar, “Microprocessor Architecture, Programming, and Applications with the 8085”, 5th Edition, Penram International Publication (India) Pvt. Ltd.
2. Douglas V. Hall, “Microprocessors and Interfacing”, 2nd Edition, TMH, 2006.

Reference Book:

1. Kenneth L. Short, “Microprocessors and programmed Logic”, 2nd Ed, Pearson Education Inc.
2. A.K.Ray&K.M.Bhurchandi, “Advanced Microprocessors and peripherals” , Tata McGraw Hill, 2000.2nd edition

Name of Department:- Computer Science and Engineering

1. Subject Code: TCS 404 Course Title: **Computer Organization**
2. Contact Hours: L: 3 T: 1 P: 0
3. Semester: IV

4. Pre-requisite: Fundamentals of Computer System, TCS301

5. Course Outcomes: After completion of the course students will be able to

1. Understand the basic components of a computer and milestones in their historical development.
2. Discuss the operation of the arithmetic unit including the algorithms & implementation of fixed-point and floating-point addition, subtraction, multiplication & division.
3. Have a clear understanding of the elements of CPU working and Instruction Set Architecture
4. Identify the impact of the hierarchical memory system including cache memories and virtual on the overall computer system design
5. Evaluate the various aspects I/O operations and their impact on the overall performance and functioning of computers
6. Review the current trends in development of processor architectures with emphasis on instruction level parallelism, latency operations in pipeline design, fault tolerance etc.

6. Detailed Syllabus

UNIT	CONTENTS	Contact Hrs
Unit – I	**Introduction:** The main components of a Computer, Historical Development: First through Fourth Generation Computers, Moore's Law, The Von Neumann and Non Von Neumann Model, The Evolution of the Intel x86 Architecture **Data Representation in Computer Systems:** Signed Integer Representation, Complement Systems: One's complement and Two's complement, Addition and Subtraction using signed numbers, Multiplication of Positive Numbers, Signed Operand Multiplication, Integer Division; Floating Point Representation, , The IEEE-754 Floating Point Standard,Floating Point Arithmetic, Floating Point Errors	**10**
Unit - II	**Machine Instructions and Programs:** Memory Location and Addresses, Memory Operations, Instructions and Instruction Sequencing, Addressing Modes, , Execution of a Complete Instruction, Single Bus Organization, Control Unit Operations: Instruction sequencing, Micro operations and Register Transfer. Hardwired Control, Micro-programmed Control: Basic concepts, Microinstructions and micro-program sequencing **Performance** – Processor Clock, Basic Performance Equation, Clock Rate, Performance Measurement Concept of Pipelining, Amdahl's Law	**12**
Unit – III	**Input/Output Organization:** Accessing I/O Devices, Interrupts – Interrupt	**9**

	Hardware, Enabling and Disabling Interrupts, Handling Multiple Devices, Controlling Device Requests, Exceptions, Direct Memory Access, Buses Interface Circuits, Standard I/O Interfaces – PCI Bus, SCSI Bus, USB	
Unit – IV	**Memory System:** Basic Concepts, Types of Memory, Speed, Size, and Cost, The Memory Hierarchy, Locality of Reference, Cache Memories – Mapping Functions, Replacement Algorithms, Effective Access Time and Hit Ratio, Virtual Memory-Paging, Advantages and Disadvantages of Paging and Virtual Memory, Segmentation, Paging Combined with Segmentation, Real World Example of Memory Management-Pentium 4 Memory Management	**9**
Unit – V	**Introduction to Alternative Architectures:** RISC Machines, Flynn's Taxonomy, Parallel and Multiprocessor Architectures: Instruction level pipelining,Superscalar and VLIW, Vector Processors, Interconnection Networks, Shared Memory Multiprocessors, Closely and Loosely coupled multiprocessors systems; Alternative Parallel Processing Approaches: Dataflow Computing, Neural Networks.	**8**
	Total	**48**

Text Books:

- William Stallings:" Computer Organization & Architecture", 8th Edition, PHI, 2010.
- Carl Hamacher, ZvonkoVranesic, SafwatZaky:" Computer Organization", 5th Edition, Tata McGraw Hill, 2002.

Reference Books:

- David A. Patterson, John L. Hennessy: "Computer Organization and Design – The Hardware / Software Interface ARM Edition", 4th Edition, Elsevier
- Linda Null, Julia Lobur: "Computer Organization and Architecture", Jones and Bartlett Publishers, 2003 Edition

Name of Department:- Computer Science and Engineering

1. Subject Code: TCS 408 Course Title: **Java Programming Language**
2. Contact Hours: L: 3 T: - P: -
3. Semester: IV

4. Pre-requisite: TCS 101, TCS 201, TCS 302, TCS 307

5. Course Outcomes: After completion of the course students should be able to

1. Explain the Java programming features and develop programs to demonstrate the same.
2. Make use of object oriented concepts to develop applications
3. Classify exceptions and demonstrate applications for file handling and multithreading.
4. Analyze collection framework and develop applications using GUI.
5. Compare and utilize collection framework for programming applications
6. Design applications for event handling and accessing databases using Java features.

Detailed Syllabus

UNIT	CONTENTS	Contact Hrs
Unit - I	**Introduction to Java :**Importance and features of Java, Concepts of Java Virtual machine (JVM) Keywords, Constants, Variables and data types, operators and expressions, Control statements, Conditional statements,loops and iterations,Wrapper classes,Scanner Class: Scanner class methods (next(),nextLine() etc. **Concept of class:** Class definition, adding variables and methods, creating objects, constructors, defining methods, calling methods, Arrays,String Handling in java(String, StringBuffer classes)	**10**
Unit - II	**Object Oriented Programming concepts:**Inheritance, super classes, multilevel hierarchy, abstract and final classes, overloading and overriding **Packages and interfaces**: Packages, Defining Packages, Using Packages, import and static import, Access protection. **Interface:**Defining Interfaces, abstract methods declarations, implementing interfaces, extended interfaces, interface references.	**9**
Unit – III	**Exception handling:** Exception Types, Exception class, RuntimeException Class, Error Class, Checked and uncheced Exceptions, Defining new exceptions; Handling: try, catch and finally; throw statement, throws clause. **Input/Output:**Basics, Byte and Character Streams, reading and	**9**

	writing from console and file. **Multithreaded programming:** Java thread model, synchronization, messaging, thread class, Runnable interface, inter thread communication, Producer/ consumer problems, Wait () and notify ().	
Unit – IV	**Collection and Generic Framework:** Introduction to Collection and Generic Framework: Interfaces Iterator, List, Set, ArrayList, LinkedListHashSet and ArrayDeque classes **AWT & Swing:**Introduction to AWT and Swings, Swings advantages over AWT, Swing applications,Swing Controls : JButton ,JLabel , JCheckBox , JRadioButton , JList , JComboBox, JTextFiled, JTextArea , JScrollBar, JTable, Graphics in swing	**9**
Unit – V	**Event Handling:**Event delegation model, classes, Event Listener Interfaces,Adapter classes. **Java Database Connectivity (JDBC):**The Concept of JDBC, JBDC drivers(Type1 Driver,Type4 Driver), Connection interface, Statement interface, ResultSet interface, Creating and executing SQL statements.	**9**
	Total	**46**

Text books:

1. Patrick Naughton and Herbert Schildt, "Java 2 The Complete Reference", 9th edition, McGraw Hill Education, 2017.
2. Bruce Eckel, "Thinking in Java", 4thedition,Pearson Education India, 2008
3. E. Balaguruswamy, "Programming with Java a Primer", 4thedition, Tata McGraw Hill, 2009.

Reference Books:

1. Cay S Horstmann and Gary Cornell, "Core Java Volume –I and II", Standard edition, Sun Microsystems, 2001
2. Harvey Deitel and Paul Deitel, "Java How to Program" , 4thedition, PHI Learning, 2004

Name of Department:- Computer Science and Engineering

1. Subject Code: TCS 451 Course Title: **Virtualization and Cloud Computing**
2. Contact Hours: L: 3 T: - P: 2
3. Semester: IV
4. Pre-requisite: TCS 101, TCS351
5. Course Outcomes: After completion of the course students will be able to

    1. Understand the concepts applied in Cloud Computing
    2. Describe the different paradigms of cloud computing
    3. Implement the Virtualization
    4. Compare parallel and distributed computing
    5. Describe the architectures of cloud computing.
    6. Use the cloud services

6. Detailed Syllabus

Sl. No.	Contents	Contact Hours
Unit -1	**Understand the Concepts in Cloud Computing and its Use** Why Cloud Computing (CC)? Different Perspectives on CC, Different Stakeholders in CC, Total cost of ownership (TCO), Characteristics of cloud computing, Characteristics of cloud computing as per NIST, Cloud Definitions	08
Unit -2	**Unit- 2 Introduction to Cloud Computing** Cloud Computing at a Glance, The Vision of Cloud Computing, Cloud Computing Reference Model, Challenges Ahead, Historical Developments, Distributed Systems, Virtualization, Web 2.0, Service-Oriented Computing, Utility-Oriented Computing, Building Cloud Computing Environments, Application Development, Infrastructure and System Development, Computing Platforms and Technologies, Amazon Web Services (AWS), Google AppEngine, Microsoft Azure, Hadoop, Force.com and Salesforce.com	08
Unit -3	**Virtualization** Introduction, Characteristics of Virtualized Environments, Taxonomy of Virtualization Techniques, Execution Virtualization, Other Types of Virtualization, Virtualization and Cloud Computing, Pros and Cons of Virtualization, Technology Examples, Xen: Para virtualization, VMware: Full Virtualization, Microsoft	10

	Hyper-V	
Unit-4	**Principles of Parallel and Distributed Computing** Eras of Computing, Parallel vs. Distributed Computing, Elements of Parallel Computing, What is Parallel Processing?, Hardware Architectures for Parallel Processing, Approaches to Parallel Programming, Levels of Parallelism, Laws of Caution, Elements of Distributed Computing, General Concepts and Definitions, Components of a Distributed System, Architectural Styles for Distributed Computing, Models for Inter-Process Communication, Technologies for Distributed Computing, Remote Procedure Call, Distributed Object Frameworks, Service Oriented Computing	10
Unit-5	**Cloud Computing Architecture** Introduction, Cloud Reference Model, Architecture, Infrastructure / Hardware as a Service, Platform as a Service, Software as a Service, Types of Clouds, Public Clouds, Private Clouds Hybrid Clouds, Community Clouds, Economics of the Cloud, Open Challenges, Cloud Interoperability and Standards, Scalability and Fault Tolerance, Security, Trust, and Privacy, Organizational Aspects	08
	Total	44

Text Books:

1. Raj Kumar Buyya," Mastering the Cloud Computing",MacGraw Hill Education (India), 2013
2. Tim Mather, SubraKumaraswamy, ShahedLatif:" Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance"
3. J.R. ("Vic") Winkler: "Securing the Cloud"
4. Haley Beard, "Cloud Computing Best Practices for Managing and Measuring Processes for On-demand Computing, Applications and Data Centers in the Cloud with SLAs", Emereo Pty Limited, July 2008.

Reference Books:

5. Michael Miller," Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online", Que Publishing, August 2008.
6. David Chisnall, "The Definitive Guide to Xen Hypervisor", Prentice Hall; Reprint edition (9 November 2007)

Name of Department:- Computer Science and Engineering

1. Subject Code: TCS 471 Course Title: **Statistical Data Analysis with R**
2. Contact Hours: L: 3 T: - P: 2
3. Semester: IV

4. Pre-requisite: TMA101, TCS 201, TCS351

5. Course Outcomes: After completion of the course students will be able to

1. Understand the concepts of statistics
2. Apply the probability distribution techniques in different applications.
3. Understand the needs of data preprocessing
4. Implement the manipulation and processing of data in R
5. Apply the concepts of functions in R
6. Understand the use of R in data Analytics

6. Detailed Syllabus

UNIT	CONTENTS	Contact Hrs
Unit – I	**Statistics:** Introduction to Statistics- Descriptive Statistics, Summary Statistics Basic probability theory, Statistical Concepts (uni-variate and bi-variate sampling, distributions, re-sampling, statistical Inference, prediction error),	**9**
Unit - II	**Probability Distribution:** Introduction to Probability**,** Probability Distribution (Continuous and discrete- Normal, Bernoulli, Binomial, Negative Binomial, Geometric and Poisson distribution) , Bayes' Theorem, Central Limit theorem, Data Exploration & preparation, Concepts of Correlation, Regression, Covariance, Outliers.	**10**
Unit – III	**Introduction to R and Data Preprocessing:** Introduction & Installation of R, R Basics, Finding Help, Code Editors for R, Command Packages, Manipulating and Processing Data in R, Reading and Getting Data into R, Exporting Data from R	**10**
Unit – IV	**Objects and Data Types**: Data Objects-Data Types & Data Structure. Viewing Named Objects, Structure of Data Items, Manipulating and Processing Data in R (Creating, Accessing, Sorting data frames, Extracting, Combining, Merging, reshaping data frames), Control Structures	**8**
Unit – V	**Functions:**Functions in R (numeric, character, statistical), working with objects, Viewing Objects within Objects, Constructing Data Objects, Building R Packages, Running and Manipulating Packages, Non parametric Tests-ANOVA, chi-Square, t-Test, U-Test, Introduction to Graphical Analysis, Using Plots(Box Plots, Scatter plot, Pie Charts, Bar charts, Line Chart),	**9**

	Plotting variables, Designing Special Plots, Simple Liner Regression, Multiple Regression	
	Total	**46**

Text/ Reference Books:

1. Dr. Mark Gardener, “Beginning R: The Statistical Programming Language”, John willey& Sons, 2012
2. John M. Quick, “Statistical Analysis with R”, Pckt Publishing, 2010

Name of Department:- Computer Science and Engineering

1. Subject Code: TCS 431 Course Title: **Microcontroller and Its Interfacing**
2. Contact Hours: L: 3 T: - P: 2
3. Semester: IV

4. Pre-requisite: TCS331

5. Course Outcomes: After completion of the course students will be able to

    1. Understanding the concept of embedded system.
    2. Assembly language programming of 8051
    3. Study of Arduino.
    4. Interfacing of different IC with 8051.
    5. Design and develop systems based on 8051 micro-controller and its interfaces.
    6. Understand the working of interrupts

6. Detailed Syllabus

Sl. No.	**Contents**	**Contact Hours**
1	MICROCONTROLLER: Difference between Microprocessors and Micro-controllers, Types of Micro-controllers, Memory structure of 8051, Processor Architecture – Harvard v/s Von Neumann, CISC v/s RISC, 8051 Architecture ,Micro-controller Memory types – control storage, variable area, stack, hardware register space, SFR,8051 pin diagram..	10
2	8051 Instruction Set: Addressing modes, external addressing, Instruction execution, Instruction set – data movement, arithmetic, bit operators, branch, Software development tools like assemblers, simulators, O/P file formats. Assembling and running an 8051 program, 8051 data types, 8051 flag bits and the PSW register, 8051 register banks and stack	9
3	**PROGRAMMING OF 8051 and INTERRUPTS:** Programming of 8051, I/O bit manipulation. Timer, counter, programming of timer, 8051 interrupts, Interrupts priority in the 8051, and interrupts programming.	9

4	**INTRODUCTION TO ARDUINO IDE PLATFORM** Introduction to ATMEGA328 microcontroller and to Arduino IDE, Hardware,Characteristics,Interfacing with different peripheral devices,Debugging hardware errors,Using PWM I/O pins,Interfacing Arduino hardware with Internet of Things	9
5	**INTERFACING:** Interfacing with 8051: LCD, Keyboard, ADC, DAC interfacing, Sensor interfacing and Signal Conditioning, Stepper motor and DC motor, Basics of serial communications, 8051 connection to RS-232, 8051 serial port programming assembly.	8
	Total	**45**

Text Books

1. Mazidi,"The 8051 Microcontrollers & Embedded Systems", Pearson Education, 2007
2. MykePredko ,"Programming and Customizing the 8051 Micro-controller",Tata McGraw-Hill edition, 2003
3. Brad Kendall,"Arduino Make use of:A complete beginner guide",2013

Reference Books

1. Kenneth Ayala, "The 8051 Microcontroller", West Publishing Company, 1993
2. Julien Bayle,"C-Programming for Arduino" , 2013

Name of Department:- Computer Science and Engineering

1. Subject Code: **TCS 491** Course Title: Introduction to Cryptography

2. Contact Hours: L: 3 T: - P: -

3. Semester: IV

4. Pre-requisite: None

5. Course Outcomes: After completion of the course students will be able to

i. Classify security vulnerabilities involved in data communication over Internet and make use of classical algorithms to address the vulnerabilities.
ii. Make use of symmetric block ciphers to secure data transmission and storage
iii. Analyze challenges involved in key distribution and select approache that can be adopted
iv. Appreciate the design of Public Key algorithms, mathematical background and make use of the same for data communication and message authentication
v. Categorize types of viruses, worms, intrusion and decide measures to counter the threats.
vi. Understand the legal aspects related to Cybercrime, Intellectual Property, Privacy, Ethical Issues.

6. Detailed Syllabus

UNIT	CONTENTS	Contact Hrs
Unit - I	Introduction: Computer Security Concepts: The OSI Security Architecture, Security Attacks, Security Services, Security Mechanisms, a Model for Network Security, Standards Cryptography fundamentals and terminology; Cryptanalysis and Brute-Force Attack, Fundamental techniques of cryptography – Substitution and Transposition; Classical Ciphers; Basics of Steganography	**8**
Unit - II	Modern Cryptography : Symmetric Encryption and Message Confidentiality: Symmetric Encryption Principles,Fiestal structure. Symmetric Block Encryption Algorithms Simple DES, DES and Simple AES, Stream Ciphers and RC4, Random and Pseudorandom Numbers,	**9**
Unit – III	Symmetric key distribution using symmetric encryption: A Key Distribution Scenario, Session Key Lifetime, A Transparent Key Control Scheme, Decentralized Key Control, Controlling Key Usage Mathematical Background for cryptography: Prime and Relatively Prime Numbers, Euclid's algorithm for GCD, Extended Euclid's Algorithm for Multiplicative Inverse, Euler's Totient function.	**10**
Unit – IV	Public-Key Cryptography: Public-Key Encryption Structure,	**9**

	Applications for Public-Key Cryptosystems, Requirements for Public-Key Cryptography, The RSA Public-Key Encryption Algorithm, Digital Signature. Message Authentication: Approaches to Message Authentication, Authentication Using Conventional Encryption, Message Authentication without Message Encryption, MD5 Hash Algorithm.	
Unit – V	Electronic mail security-pretty good privacy (PGP). System Security: Intruders, Intrusion Detection, Password Management, Types of Malicious Software, Viruses, Virus Countermeasures, Worms and Principles of Firewalls Legal and Ethical Aspects: Cybercrime and Computer Crime, Intellectual Property, Privacy, Ethical Issues	**8**
	Total	**44**

Text Books:

- William Stallings, Network Security Essentials – Applications and Standards, 4th edition, Pearson Education, 2011
- William Stallings , Cryptography and Network Security, 7th Edition , Pearson Education, 2017

Reference Books:

- Behrouz Forouzan , Cryptography and Network Security, 3rd Edition, McGraw Hill, 2015
- Atul Kahate, "Cryptography and Network Security", Third edition, McGraw Hill Education, 2017.

Name of Department:- Computer Science and Engineering

1. Subject Code: TCS 421 Course Title: **Fundamental of Statistics and AI**
2. Contact Hours: L: 3 T: 1 P: 2
3. Semester: IV

4. Pre-requisite: TMA101, TMA201

5. Course Outcomes: After completion of the course students will be able to

1. Demonstrate knowledge of statistical and exploratory data analysis data analysis techniques utilized in decision making.
2. Apply principles of Data Science to the analysis of business problems.
3. To use Machine Learning Algorithms to solve real-world problems.
4. To provide data science solution to business problems and visualization.
5. To learn the basic concepts and techniques of AI and machine learning
6. To explore the various mechanism of Knowledge and Reasoning used for building expert system.

6.Detailed Syllabus

Sl. No.	**Contents**	**Contact Hours**
1	**Introduction to AI** Definition, Problem, State space representation. Intelligent Systems: Categorization of Intelligent System, Components of AI Program, Foundations of AI, Applications of AI, Current trends in AI, Intelligent Agents: Anatomy, structure, Types.	10
2	**Problem solving** Solving problem by Searching: Problem Solving Agent, Formulating Problems. Uninformed Search Methods: Breadth First Search (BFS), Depth First Search (DFS), Depth Limited Search, Depth First Iterative Deepening (DFID), Informed Search Methods: Greedy best first Search, A* Search, Memory bounded heuristic Search. Local Search Algorithms and Optimization Problems: Hill climbing search Simulated annealing, Local beam search.	9

3	**An Introduction to Data Science** Definition, working, benefits and uses of Data Science, Data science vs BI, The data science process, Role of a Data Scientist.	9
4	**Statistical Data Analysis & Inference** Populations and samples, Statistical modelling, probability distributions, fittings a model, Statistical methods for evaluation, Exploratory Data Analysis, Getting started with R, Manipulating and Processing data in R, working with function in R, Working with descriptive Statistics, Working with graph plot in R.	9
5	**Statistical Applications** Basic Statistical operations, Linear Regression Analysis, Logistic and Exponential Regression, Time Series Analysis, Probability Distribution, ANOVA, Correlation and Covariance.	8
	Total	**45**

Text/ Reference Books:

1. Tom M. Mitchell. "Machine Learning" McGraw-Hill, 1997.
2. “Statistical programming in R”, Oxford University Press 2017

Name of Department:- Computer Science and Engineering

1. Subject Code: TCS432 Course Title: **Hadoop Fundamentals**
2. Contact Hours: L: 3 T: - P: -
3. Semester: IV

4. Pre-requisite: Object Oriented Programming

5. Course Outcomes: After completion of the course students will be able to

1. Understand the various paradigms of Hadoop
2. Compare the Hadoop distributed file systems with other file systems
3. Understand the storage mechanism in distributed storage architecture
4. Create Map-Reduced program
5. Apply query through HiveQL
6. Explore the challenges of Bigadata

6. Detailed Syllabus

UNIT	CONTENTS	Contact Hours
Unit-1	Big Data Overview: Understanding of Big Data, What it is and why It Matters, Tools and technique used in Big Data, How Big Data transforming Business, Applications of Big data, Challenges of Big Data	**8**
Unit -2	Hadoop: What is Hadoop, Hadoop Distributed file System, HDFS architecture, Daemons of Hadoop, Google file system, Hadoop Ecosystem, Hadoop core components.	**9**
Unit-3	Data Storage in Hadoop, Data replication, Installation, and set-up of Hadoop, Accessing HDFS through CLI and Java based approach, Fault Tolerance.	**8**
Unit-4	Map-reduce: Introduction to MapReduce, Basic flow of MapReduce program, Types of file input formats in MapReduce, Writable in MapReduce, implementation of Combiner and Reducer through a program.	**9**
Unit -5	Introduction to Hive, Hive Architecture, Hive vs RDBMS, Demonstration of Basic HiveQL, Case Study: Flight Data Analysis	**9**

Text Book:

1. Tom White, "Hadoop: A definitive guide, 3/e", O' Reilly Press, 2012.

Reference Books:

1. Apache Hadoop Yarn 2nd Edition (Jeff Markham, Arun C. Murthy, Doug Eadline, Vinod Kumar Vavilapalli, Joseph Niemiec, Neil Trevett)

Name of Department:- Computer Science and Engineering

1. Subject Code: TCS434 Course Title: **Python Programming**
2. Contact Hours: L: 3 T: - P: -
3. Semester: IV

4. Pre-requisite: TCS 101, TCS 201 and Object Oriented Programming

5. Course Outcomes: After completion of the course students will be able to

1. Describe the principles of structured programming and be able to describe, design, implement, and test structured programs using currently accepted methodology.
2. Explain what an algorithm is and its importance in computer programming.

3. Recognize and construct common programming idioms: variables, loop, branch, subroutine, and input/output.
4. Define and demonstrate the use of the built-in data structures 'list' and 'dictionary'.
5. Apply idioms to common problems such as text manipulation, web page building, and working with large sets of numbers.
6. Design and implement a program to solve a real-world problem using the language idioms, data structures,, and standard library

6. Detailed Syllabus

UNIT	CONTENTS	Contact Hrs
Unit – I	**: Introduction To Python Programming** Introduction to Python: Importance of Python, Installing and working with Python in Windows, Linux and Mac, Using Python as calculator, Comments, How to define main function in Python The concept of data types - Variables, Arithmetic Operators and Expressions String manipulations - Subscript Operator, Indexing, Slicing a string, Converting strings to numbers and vice versa, split function Control flow - if statements, for and while loops, nested loops, Short-circuit (lazy evaluation), range() function, break and continue statements, pass statements	**10**
Unit - II	**Data Structures in Python** Data Structures: Lists - Basic list operations, Replacing, inserting, removing an element; Searching and sorting a list, Methods of list objects, Using lists as Stacks and Queues, How efficient lists are when used as stack or queue, List and nested list Comprehensions Tuple, Sets, Difference between list and tuple Dictionary - adding and removing keys, accessing and replacing values, traversing dictionarie	**10**
Unit – III	**: Python Functions and OOP Concepts** Python functions and modules - **OS** and **SYS** modules, Defining python functions, calling a function, function arguments, Lambda and map function, Importing python module Useful Python Packages - BeautifulSoup, NumPy, iPython, tkinter Classes and OOP - Class definition syntax, objects, class and instance variables, Inheritance and multiple inheritance, Polymorphism, Overloading, Overriding, Data Hiding	**9**
Unit – IV	**Regular Expressions in Python** Regular Expressions - re module, Searching a string (match and search), Finding a string (findall), Break string into substrings (split), Replace part of a string (sub)	**9**

	Examples of Regex - Return the first word of a given string, Extract all the words of a given string, Extract domain name from given e-mail id's, Extract date from given string, Return all the words of a string that starts with vowel, Split a string with multiple delimiters, Retrieve some information from HTML or XML file	
Unit – V	**File and Exception Handling in Python** File Handling - Reading keyboard input, opening and closing file, Read, Write and Append mode, Create and Read a text file, Looping over a file object, Writing on a file, with statements, splitting lines in a text file, Renaming and Deleting files Exception Handling - Exceptions, Why use exceptions, Raising an exception, try and except, try, except and else clause; try and finally	**10**
	Total	**48**

Text Books:

- Kenneth A. Lambert, "The Fundamentals of Python: First Programs", Cengage Learning.,2011

Reference Books:

- Laila M. Dawson ,"Python Programming for the Absolute Beginner "
- Zed A.Shaw ,"Learn Python the Hard Way "
- Mark Putz ,"Learning Python"
- Python Documentation (https://docs.python.org).

Name of Department: - Computer Science and Engineering

1. Subject Code: TCS441 Title: Introduction to cryptography and PKC
2. Contact Hours: L:3 T: - P: -
3. Semester: IV

4. Prerequisite: Fundamental of Information Security and Blockchain.

5. Course Outcomes: After completion of the course students will be able to

1. Explain symmetric and asymmetric key cryptosystems
2. Know the working of cryptography techniques
3. Analyse the different types of cryptosystems
4. Use cryptographic techniques to implement information security protocols
5. Apply cryptographic techniques in different applications
6. Develop symmetric and asymmetric key cryptosystems.

6. Detailed Syllabus

UNIT	CONTENTS	Contact Hrs
Unit-I	**Basics of cryptography** What is cryptography, what is confidentiality, data integrity, authentication, and nonrepudiation, applications of cryptography - chip based payment cards, digital currencies, computer passwords, digital communications, plaintext, cipher-text, cipher - characteristics of a good cipher, encryption, decryption, Key - significance of key length, symmetric and asymmetric key cryptography, cryptanalysis, OSI security architecture- security attacks, security services, security mechanisms	**10**
Unit-II	**Mathematics for cryptography** Concept of divisibility, prime numbers, importance of prime numbers in cryptography, euclid theorem for GCD, extended euclidean algorithm, modular arithmetic, random number generators, deterministic and nondeterministic random number generators, XOR, bit shifts, euler's	**8**

	totient theorem, chinese remainder theorem	
Unit-III	**Symmetric key cryptosystem** Secret Key (symmetric) cryptography - stream and block ciphers, additive and multiplicative ciphers, rail fence technique, playfair cipher, hill cipher, vernam cipher, Vigenère Cipher, RC4 algorithm, DES, 2DES, 2-3DES, 3DES, AES, block cipher modes of operations	**10**
Unit - IV	**Asymmetric key cryptosystem** RSA, Diffie Hellman key exchange protocol, Elliptic curve cryptography (ECC), ElGamal encryption system.	**8**
Unit-V	**Digital signature and message integrity mechanisms** DSS algorithm, RSADS algorithm, ECDSA algorithm, Message integrity, hash functions, MAC functions, HMAC, secure electronic transaction, use of ECDSA in blockchain implementation	**10**
	Total	**46**

Text Books:

- William Stallings, “Cryptography and Network Security: Principles and Practice”, Pearson publication, 2020.

Reference Books:

- Charles P. Pfleeger, Shari Lawrence Pfleeger, Jonathan Margulies, “Security in Computing”, 5th Edition, Prentice Hall.
- William Stallings, “Network Security Essentials: Applications and Standards”, Prentice Hall.
- Roger Wattenhofer, “Distributed Ledger Technology, The science of the Blockchain”, Inverted Forest Publishing,(2e), 2017