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 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