Course Name: **MCA 3rd Semester**

Subject Code: **CS-5517**

Subject Name: **Automata Theory and Compiler Construction**

Aim of the Subject

The aim of this course is to provide students the theoretical knowledge needed to understand and analyze the behavior of discrete computing systems as well as abilities to design and implement compilers.

Learning Outcomes

The students are expected to learn following after completion of the course:

- Adequate knowledge to understand abstract machine models and formal languages.
- Basic knowledge of compilation steps; ability to apply automata theory and knowledge on formal languages.
- Ability to design and implementation scanner modules in compilers.
- Ability to identify and select suitable parsing strategies for various cases.

Unit 1

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), Equivalence of NFA and DFA, Minimization of Finite

Automata, Regular Expressions, Arden's theorem.

Unit 2

Compiler Structure: Compilers and Translators, Various Phases of Compiler, Pass

Structure of Compiler, Bootstrapping of Compiler. Lexical Analysis: The role of

Lexical Analyzer, A simple approach to the design of Lexical Analyzer,

Implementation of Lexical Analyzer. The Syntactic Specification of Programming

Languages: CFG, Derivation and Parse tree, Ambiguity, Capabilities of CFG.

Basic Parsing Techniques: Top-Down parsers with backtracking, Recursive

Descent Parsers, Predictive Parsers.

Unit 3

Bottom–up Parsers, Shift-Reduce Parsing, Operator Precedence Parsers, LR parsers (SLR, Canonical LR, LALR) Syntax Analyzer Generator: YACC, Intermediate Code Generation: Different Intermediate forms: three address code, Quadruples & Triples. Syntax Directed translation mechanism and attributed definition. Translation of Declaration, Assignment, Control flow, Boolean expression, Array References in arithmetic expressions, procedure calls, case statements, postfix translation.

Unit 4

Run Time Memory Management: Static and Dynamic storage allocation, stack based memory allocation schemes, Symbol Table management Error Detection and Recovery: Lexical phase errors, Syntactic phase errors, Semantic errors.

Unit 5

Optimization and Code Generation: Local optimization, Loop optimization, Peephole optimization, Basic blocks and flow graphs, DAG, Data flow analyzer, Machine Model, Order of evaluation, Register allocation and code selection.

Text Book(s)

1. Hopcroft, Ullman, “Introduction to Automata Theory, Languages and Computation”, Pearson Education.

2. Alfred V Aho, Jeffrey D. Ullman, “Principles of Compiler Design”, Narosa.

Reference Material(s)

1. Michal Sipser, “Theory of Computation”, Cengage learning.

2. K.L.P. Mishra and N.Chandrasekaran, “Theory of Computer Science : Automata, Languages and Computation”,PHI.

3. Louden, “Compiler construction”, Cengage learning.

4. A.V. Aho, R. Sethi and J.D

Course Name: **MCA 3rd Semester**

Subject Code: **CS-6518**

Subject Name: **Cloud Computing**

Aim of the Subject

To provide students with the fundamentals and essentials of Cloud Computing, thus creating a sound foundation while enabling students to start using and adopting Cloud Computing services and tools in their real-life scenarios.

Learning Outcomes

The students are expected to learn following after completion of the course:

- Learn the main concepts, key technologies, strengths, and limitations of cloud computing and the possible applications for state-of-the-art cloud computing
- Identify the architecture and infrastructure of cloud computing, including SaaS, PaaS, IaaS,
- public cloud, private cloud, hybrid cloud, etc.
- Learn Hands-on exercises on AWS, Salesforce and Google Cloud.
- Understanding of appropriate cloud computing solutions and recommendations according
- to the applications.
- Learn the core issues and latest trends and technologies of cloud computing.

Unit 1

Introduction to cloud computing, History, Importance of cloud computing in the current era, characteristics of cloud computing, what cloud computing really is and isn't, pros and cons of cloud computing, technologies in cloud computing, migrating into cloud.

Unit 2

Types of clouds, cloud infrastructure, cloud application architecture, working of cloud computing, trends in cloud computing, cloud service models, cloud deployment models, cloud computing and services pros and cons.

Unit 3

Cloud computing technology, cloud life cycle model, role of cloud modelling and architecture, cloud system architecture, virtualization, types of virtualization, importance and limitations of various types of virtualization, virtualization in cloud computing.

Unit 4

Data storage, introduction to enterprise data storage, data storage management, file system, cloud data stores, cloud storage characteristics, applications utilizing cloud storage.

Unit 5

Introduction to web services, cloud service deployment tools, management/ administrative services, risk management in cloud computing, introduction to apache Hadoop.

Text Book(s)

1. Cloud Computing: A practical approach for learning and implementation, 1st edition, Pearson, A. Srinivasan, J. Suresh.

Reference Material(s)

1. Investigating various tools such as VMWare, Eucalyptus etc.

2. Examining cloud applications in context to social networking, email, document/ spreadsheet hosting services etc. and various Google cloud applications.

Course Name: **MCA 3rd Semester**

Subject Code: **CS-5717**

Subject Name: **Artificial Intelligence and Machine Learning**

Aim of the Subject

The aim is to instruct students in the foundational ideas and game-changing applications of artificial intelligence and machine learning.

Learning Outcomes

The students are expected to learn following after completion of the course:

- The students are expected to learn the following after completion of the course: 1. Fundamental concepts of Artificial Intelligence & Machine Learning
- Innovative solutions to challenging problems in the field of Artificial Intelligence & Machine Learning.
- Real world applications and projects.

Unit 1

Overview of AI: AI: past, present, and future. Search: Depth- First Search, Breadth- First Search, Greedy Best-First Search, A* Search, Adversarial Search, Alpha-Beta Pruning, Depth-Limited Minimax. Knowledge: Knowledge- Based Agents, Propositional Logic, Inference, Knowledge Engineering, Inference Rules, Knowledge and Search Problems, Resolution, First Order Logic.

Unit 2

Uncertainty: Probability, Conditional Probability, Random Variables, Bayes' Rule, Bayesian Networks, Inference, Sampling, Likelihood Weighting, Markov Models, Hidden Markov Models. Optimization: Local Search, Hill Climbing, Simulated Annealing, Traveling Salesman Problem, Linear Programming, Constraint Satisfaction, Backtracking Search.

Unit 3

Machine Learning : Definition and overview, Regression, Simple Linear Regression, Multiple Regression, Assessing Performance, Ridge Regression, Feature Selection & Lasso, Nearest Neighbors & Kernel Regression.

Unit 4

Machine Learning : Classification, Linear Classifiers & Logistic Regression, Learning Linear Classifiers, Overfitting & Regularization in Logistic Regression, Decision Trees, Handling Missing Data, Boosting.

Unit 5

Neural Networks: Activation Functions, Neural Network Structure, Gradient Descent, Multilayer Neural Networks, Backpropagation, Overfitting, Computer Vision, Image Convolution, Convolutional Neural Networks, Recurrent Neural Networks.

Text Book(s)

[1] Artificial Intelligence: A Modern Approach (3rdedition), Russell and Norvig.

[2] Tom Mitchell, Machine Learning, First Edition, McGraw Hill, 1997.

Reference Material(s)

CS50 's Introduction to Artificial Intelligence with Python mooc of Harvard.

Course Name: **MCA 3rd Semester**

Subject Code: **CS-5615**

Subject Name: **Information Security**

Aim of the Subject

The main aim of this course is to provide students with a background, foundation, and insight into the many dimensions of information security.

Learning Outcomes

The students are expected to learn following after completion of the course:

- Basic security concepts as confidentiality, integrity, and availability, which are used frequently in the field of information security.
- Symmetric and public-key based asymmetric algorithms for encryption-based security of information.
- The access control mechanism used for user authentication and authorization.

Unit 1

Computer Security Concepts: Introduction to Information Security, Confidentiality, Integrity; Attacks and Threats: Attacks Threatening Confidentiality, Attacks Threatening Integrity, Attacks Threatening Availability; Active versus Passive attacks; Security Services, Security Mechanisms etc.

Unit 2

Symmetric Cipher Model: Cryptography, Cryptanalysis and Brute-Force Attack; Substitution Techniques: Caesar Cipher, Monoalphabetic Ciphers, Playfair Cipher, Hill Cipher; Polyalphabetic Ciphers, One-Time Pad; Transposition ciphers: keyless transposition ciphers, keyed transposition ciphers, combining two approaches; Steganography etc.

Unit 3

Stream Ciphers and Block Ciphers, Synchronous and Non-synchronous Stream Ciphers, Attacks on Block Ciphers, Substitution and Transposition, P-Boxes and S-Boxes, Diffusion and Confusion, Feistel Cipher, DES Encryption and Decryption, Double and Triple DES, Strength and weakness of DES etc

Unit 4

AES General Structure, AES-128, AES-192 and AES-256, AES Transformation Functions: Substitute Bytes Transformation, Shift Rows Transformation, Mix Columns Transformation, Add Round Key Transformation, Strength and weakness of AES; Use of modern block ciphers:

Electronic Codebook (ECB) Mode, Cipher Block Chaining (CBC) Mode, Cipher Feedback (CFB) Mode, Output Feedback (OFB) Mode and Counter (CTR) Mode; Use of stream ciphers: RC4 238 and A5/1

Unit 5

Public-Key Encryption, Introduction to Public-Key Cryptography, Public-Key Encryption Algorithms, RSA Public-Key Algorithm, Diffie-Hellman Algorithm; Access Control Mechanisms, Authentication, Access Control and Authorization, Security Protocols and Solutions, Internet Protocol Security, Firewalls, Intrusion Detection, and Intrusion Prevention.

Text Book(s)

William Stallings,"Cryptography and Network Security: Principles and Practice", 6th Edition, Pearson/Prentice- Hall.

Reference Material(s)

1. Behrouz A. Forouzan "Introduction to Cryptography and Network Security", McGraw-Hill Higher Education, 2008

2. Atul Kahate; "Cryptography and Network Security"; Tata McGraw-Hill

3. Mathew Bishop; Computer Security; Art and Science; Addison-Wisley Oct.

Course Name: **MCA 3rd Semester**

Subject Code: **CS-6630**

Subject Name: **Internet of Things**

Aim of the Subject

To impart knowledge with a solid theoretical foundation, and strong practical skills in the fields of computer technology, communications networks and IT, that are required to develop a wide range of IoT applications.

Learning Outcomes

The students are expected to learn following after completion of the course:

- Understand IoT concepts, Its software, hardware components and communication technologies involved in IoT.
- Challenges of IoT application deployment in secured cloud environments.
- Exposure to real life projects and applications.
- Handling voluminous data through Data Analytics techniques.

Unit 1

Introduction to IoT: Definition, Characteristics, IoT design principles, Physical Design of IoT - Hardware and Software components; Logical Design of IoT- functional blocks, IoT communication models, Communication APIs; IoT network architecture, IoT enabling technologies, Introduction to cloud computing in IoT, advantages and disadvantages of IoT, IoT implementation challenges.

Unit 2

Domain specific IoTs: Introduction, home automation, cities, environment, energy, retail, logistics, agriculture, industry, health and lifestyle.

IoT and M2M: Introduction, machine-to-machine Communication, difference between IoT and M2M; SDN and NFV for IoT - Software Defined Networking, Network Function Virtualization.

Unit 3

Data Acquiring, Organizing and Processing: Introduction, data generation, data acquisition, data validation; Data categorization for storage, various types of data stores, organizing the

data, transactions, business processes, integration; Online transactions and processing, stream processing, real-time processing, event stream processing, business process, business intelligence, distributed business process, enterprise systems, service oriented architecture(SOA).

Unit 4

Data Analytics and Machine Learning for IoT: Analytics phases - descriptive, predictive, and prescriptive analytics; Online analytical processing; Introduction to statistical and machine learning tools for data analytics; Introduction to Big data, Big data characteristics, Big data analytics.

Role of the cloud in IoT: Cloud Storage models and communication APIs for IoT,

Security in IoT: Security challenges for IoT, IoT security practices.

Unit 5

Introduction to Arduino Programming: Familiarizing with Arduino Interfacing Board, configuration and architecture, Arduino IDE installation, program structure, data types, variables and constants, operators, control statements and loops, functions, strings, time, arrays, function libraries: I/O functions, Character functions, Math library, Interrupts, Communications. Integration of Sensors and Actuators with Arduino;

Text Book(s)

1. Arshdeep Bahga and Vijay Madisetti, “Internet of Things - A Hands-On Approach”, Universities Press (India) Private Limited, First edition, 2015.

2. Mayur Rangir, "Internet of Things - Architecture, Implementation and Security", Pearson India Education Services Pvt. Ltd. First edition, 2020.

3. Raj Kamal, “Internet of Things: Architecture and Design Principles”, McGraw Hill Education, India, First Edition, 2017.

4. Simon Monk, “Programming Arduino: Getting Started with Sketches”, McGraw Hill Publication; 1st edition, 2012.

Reference Material(s)

1. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, “From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence”, 1st Edition, Academic Press Inc., 2014.

2. Dr. Ovidiu Ve