MASTER OF COMPUTER APPLICATION

Syllabus w.e.f. the Academic Session 2021-2022

MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY
WEST BENGAL

First Year: Semester-II

Code: MCAN-201	Paper: Data Structure with Python	
Contacts Hours / Week: 4	Total Contact Hours 40	Credit: 4

Course Outcome:

After successful completion of this course, students will be able to:
- ✓ Understand the concept of abstract data type such as stack, queue, linked list, and trees
- ✓ Chose appropriate data structure to design algorithm to solve the problem.
- ✓ Analyze the algorithms in the context of efficiency.
- ✓ Apply the knowledge of stack and queue to design algorithm
- ✓ Design application using sorting, searching and the concept of tree.

UNITS	COURSE CONTENT
1	**Introduction** (6L) Basic Terminologies: Elementary Data Organizations, Data Structure Operations: insertion, deletion, traversal etc.; Analysis of an Algorithm, Asymptotic Notations, Time-Space trade off. Searching: Linear Search and Binary Search Techniques and their complexity
2	**Stacks and Queues** (8L) ADT Stack and its operations: Algorithms and their complexity analysis, Applications of Stacks: Expression Conversion and evaluation – corresponding algorithms and complexity analysis. ADT, queue, Types of Queue: Simple Queue, Circular Queue, Priority Queue; Operations on each type of Queue: Algorithms and their analysis.
3	**Linked Lists** (6L) Singly linked lists: Representation in memory, Algorithms of several operations: Traversing, Searching, Insertion into, Deletion from linked list; Linked representation of Stack and Queue, Header nodes, Doubly linked list: operations on it and algorithmic analysis; Circular Linked Lists: all operations their algorithms and the complexity analysis.
4	**Trees** (6L) Basic Tree Terminologies, Different types of Trees: Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree; Tree operations on each of the trees and their algorithms with complexity analysis. Applications of Binary Trees. B Tree, B+ Tree: definitions, algorithms and analysis.
5	**Graph** (6L) Graph Terminology, Representation of graphs, Path Matrix, Graph Traversal, BFS, DFS, Minimum Spanning Tree, Kruskal's Algorithm and Prim's Algorithm.
6	**Sorting** (6L) Objective and properties of different sorting algorithms: Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort; Performance and Comparison among all the methods.
7	**Hashing** (2L) Review of Hashing, Hash Function, Collision Resolution Techniques in Hashing, Separate Chaining, Open Addressing, Linear Probing, Quadratic Probing, Double Hashing, Rehashing, Extendible Hashing.

Reference Books:
- Taming Python by Programming, Jeeva Jose, Khanna Publishing (AICTE Recommended)
- Fundamentals of Data Structures of C, Ellis Horowitz, SartajSahni, Susan Anderson-freed
- Python Programming A modular approach, Taneja Sheetal, Kumar Naveen Pearson Ed
- Data Structure and Algorithmic Thinking with Python, Narasimha Karumanchi, Career Monk Publications
- Data Structures and Algorithms in Python, Michael T. Goodrich, R.Tamassia, Michael H. Goldwasser, WILEY
- Python Data Structures and Algorithms, Dr. Basant Agarwal & Benjamin Baka, Packt
- Data Structures and Algorithms Using Python, Rance D. Necaise, Wiley

Code: MCAN-202	Paper: Operating System	
Contacts Hours / Week: 4	Total Contact Hours: 40	Credit: 4

Course Outcome:

After successful completion of this course, students will be able to:
- ✓ Describe the main components of OS and their working
- ✓ Explain the concepts of process and thread and their scheduling policies
- ✓ Explain the various memory management techniques
- ✓ Compare the different techniques for managing memory, I/O, disk and files
- ✓ Explains the security and protection features of an Operating System

UNITS	COURSE CONTENT
1	**Introduction** (6L) Generations Concept of Operating systems, Systems, Types of Operating Systems, OS Services, System Calls, Structure of an OS - Layered, Monolithic, Microkernel Operating Systems, Concept of Virtual Machine. Real Time Operating Systems, Distributed Operating Systems, Multiprocessor Operating System. **Case Study:** Architecture of Unix and Windows Operating Systems
2	**Process Management** (14L) **Processes and Threads**: 7 state process model, Process scheduling, Operations on processes, Inter-process communication, Threads overview, Benefits of threads, User and kernel threads. **CPU Scheduling:** Scheduling criteria, Preemptive & non-preemptive scheduling, Scheduling algorithms (FCFS, SJF, RR, Priority, Multi-level queue, Multi-level feedback queue), Comparative study of the algorithms, Multi-processor scheduling. **Process Synchronization**: Background, Critical section problem, Software solution – Peterson and Bakery algorithm, Synchronization hardware, Semaphores, Classical problems of synchronization. **Deadlocks:** System model, Deadlock characterization, Methods for handling Deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from deadlock. **Case Study:** Scheduling on Unix and Windows Operating Systems
3	**Memory Management** (9L) Basic concept, Logical and Physical address map, Memory allocation: Contiguous Memory allocation– Fixed and variable partition– Internal and External fragmentation and Compaction; Paging: Principle of operation – Page allocation Hardware support for paging, 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(Optimal, FIFO, SC, NRU and LRU), Thrashing **Case Study:** Unix Virtual Memory, Windows Virtual Memory
4	**File Systems and I/O Management** (7L) File concept, Fundamental File System Organization and Access Methods, Directory structure, File system structure, Allocation methods (Contiguous, Linked, Indexed), Free-space management (Bit vector, Linked list, Grouping), Directory Implementation (Linear list, Hash table), Efficiency and Performance. PC Bus Structure, I/O connections, Data transfer techniques (Programmed, Interrupt driven, DMA), Bus arbitration (Daisy chain, Polling, Independent request), Blocking and non-blocking I/O, Kernel I/O subsystem (Scheduling, Buffering, Caching, Spooling and device reservation, Error handling). **Case Study:** UnixFile System, Windows File System
5	**Security and Protection:** (4L) Overview of Security and Protection, Goals of Security and Protection, Security Attacks, Formal and Practical aspects of Security, Encryption, Authentication and Password Security, Access Descriptors and the Access Control Matrix, Protection Structures, Capabilities, **Case Study:** Unix Security, Windows Security.

Reference Books:
- Operating System Concepts Essentials, 10th Edition by Avi Silberschatz, Peter Galvin, Greg Gagne, Wiley Asia Student Edition.
- Operating Systems: Internals and Design Principles, 5th Edition, William Stallings, Prentice Hall of India.
- Operating System Concepts, Ekta Walia, Khanna Publishing House (AICTE Recommended Textbook – 2018)
- Operating System: A Design-oriented Approach, 1st Edition by Charles Crowley, Irwin Publishing
- Operating Systems: A Modern Perspective, 2nd Edition by Gary J. Nutt, Addison- Wesley
- Design of the Unix Operating Systems, 8th Edition by Maurice Bach, Prentice-Hall of India
- Understanding the Linux Kernel, 3rd Edition, Daniel P. Bovet, Marco Cesati, O'Reilly and Associates

Code: MCAN-203	Paper: Object Oriented Programming with JAVA	
Contacts Hours / Week: 4	Total Contact Hours: 40	Credit: 4

Course Outcome:

After successful completion of this course, students will be able to:

- ✓ Use the characteristics of Java language in a program. Use variables and data types in program development.
- ✓ Identify and implement arrays, String and Selection Statements.
- ✓ Write Java programs using object-oriented programming techniques including classes, objects, methods, instance variables, interface.
- ✓ Design and implementation programs of Exception handling, Packages, Multithreading Programming, Window based programs.

UNITS	COURSE CONTENT
1	**Object-Oriented Languages** (10L) Java's History, Creation of Java, Internet & Java, Byte-code, Its Features, Java Program Structure and Java's Class Library, Data Types, Variables, and Operators, Operator Precedence; Selection Statements, Scope of Variable, Iterative Statement; Defining Classes & Methods, Creating Objects of a Class, Defining and Using a Class, Automatic Garbage Collection. **Arrays and Strings:** Arrays, Arrays of Characters, String Handling Using String Class, Operations on String Handling Using, String Buffer Class.
2	**Classes and Inheritance** (10L) Using Existing Classes, Class Inheritance, Choosing Base Class, Multiple Levels of Inheritance, Abstraction through Abstract Classes, Using Final Modifier, Packages: Understanding Packages, Defining a Package, Packaging up Your Classes, Adding Classes from a Package to Your Program, Understanding CLASSPATH, Standard Packages, Access Protection in Packages, Concept of Interface. **Exception Handling:** The concept of Exceptions, Types of Exceptions, Dealing with Exceptions, Exception Objects, Defining Your Own Exceptions.
3	**Multithreading Programming** (10L) The Java Thread Model, Understanding Threads, The Main Thread, creating a Thread, Creating Multiple Threads, Thread Priorities, Synchronization. **Input / Output in Java:** I/O Basic, Byte and Character Structures, I/O Classes, Reading Console Input, Writing Console Output, Reading and Writing on Files, Random Access Files, Storing and Retrieving Objects from File, Stream Benefits. **Creating Applets in Java:** Applet Basics, Applet Architecture, Applet Life Cycle, Simple Applet Display Methods, The HTML Applet Tag Passing Parameters to Applets.
4	**Working with Windows** (10L) AWT Classes, Window Fundamentals, Working with Frame, Creating a Frame Window in an Applet; Displaying Information within a Window. **Working with Graphics and Texts**: Working with Graphics, Working with Color, Setting the Paint Mode, Working with Fonts, Managing Text Output; Using Font Metrics, Exploring Text and Graphics, Working with AWT Controls, Layout Managers and Menus.

Reference Books:

- The Complete Reference JAVA, Herbert Schildt, TMH Publication.
- JAVA and Object-Oriented Programming Paradigm, Debasish Jana, Prentice Hall of India
- Beginning JAVA, Ivor Horton, WROX Publication.
- Core JAVA, Tanweer Alam, AICTE Recommended (Khanna Publishing)
- JAVA 2 UNLEASHED, Tech Media Publications.
- JAVA 2 (1.3) API Documentations.

Code: MCAN-204	Paper: Networking	
Contacts Hours / Week: 4	Total Contact Hours: 40	Credit: 4

Course Outcome:

After successful completion of this course, students will be able to:
- ✓ Understand the purpose of network layered models, network communication using the layered concept and able to compare and contrast OSI and TCP/IP model.
- ✓ Differentiate among and discuss the four level of address (physical, logical, port and url) used by the internet TCP/IP protocols.
- ✓ Understand the routing principals and algorithm such as distance vector routing and link state.
- ✓ Judge the efficiency of the connection oriented and connectionless protocol.
- ✓ Familiar with the routing techniques, protocols and quality of service.
- ✓ Explain the concept of network security and cryptography.

UNITS	COURSE CONTENT
1	**Introduction** (4L) Direction of data flow (simplex, half duplex, full duplex), Network topology, categories of network (LAN, MAN, WAN).
2	**Protocol and Standard** (4L) Layered Task, The OSI model, TCP/IP protocol suite, Addressing
3	**Internetworking** (10L) Internetworking concept, IPv4 and IPv6 Addressing, IPv4 protocol, IPv6 protocol, transition from IPV4 to IPV6, transition from IPv4 to IPv6, Address Mapping, Error Reporting, Multicasting, Unicast Routing Protocols, Distance Vector routing, Link state routing, Path vector routing, Multicasting Routing Protocols, Transmission Control Protocol(TCP), User Datagram Protocol(UDP)
4	**Quality of Service** (6L) Data traffic, Congestion, congestion control, Quality of service, Techniques to improve QoS, Integrated services, Differentiated service, QoS in Frame Relay, QoS in ATM
5	**DNS and Web** (8L) Name Space, Domain Name System, Distribution of Name Space, Remote Logging, Electronic Mail and File Transfer, WWW, Web document and HTTP, Network Management, Simple Network Management Protocol (SNMP)
6	**Network Security** (8L) Symmetric Key Cryptography, DES, AES, Asymmetric Key Cryptography, RSA, Diffie-Hellman, Security Services, Digital Signature, Key Management, IP Security, SSL/TLS, PGP, Firewalls

Reference Books:
- Computer Networks, Andrew S. Tanenbaum, Pearson Education, Fourth edition.
- Data and Computer Communication, William Stallings, Prentice hall, Seventh edition.
- An Integrated Approach to Computer Networks, Bhavneet Sidhu, Khanna Publishing House.
- High speed Networks and Internets, William Stallings, Pearson education, Second edition.
- Behrouz A Forouzan, - Data communication & Networking , TMH
- Behrouz A Forouzan, - TCP/IP Protocol Suite , TMH
- Kelvin R Fall, W. Richard Stevens- TCP/IP Illustrated Volume 1, Addison Wesley

Code: MCAN-E205A	Paper: Numerical and Statistical Analysis	
Contacts Hours / Week: 3	Total Contact Hours: 30	Credit: 3

Course Outcome:

After successful completion of this course, students will be able to:
- ✓ To understand approximation and propagation error.
- ✓ To understand and implement different interpolation techniques.
- ✓ To understand and implement integration techniques.
- ✓ To understand and implement solutions for linear and algebraic and differential equations.

UNITS	COURSE CONTENT	
1	**Approximation in numerical computation** Truncation and rounding errors, Fixed and floating point arithmetic, Propagation of errors.	(2L)
2	**Interpolation** Newton forward/backward interpolation, Lagrange's and Newton's divided difference Interpolation	(3L)
3	**Numerical integration** Trapezoidal rule, Simpson's1/3 rule, Romberg's Integration, Expression for corresponding error terms.	(3L)
4	**Numerical solution of Linear equations** Gauss elimination method, Matrix inversion, LU Factorization method, Gauss-Seidel iterative method.	(3L)
5	**Numerical solution of Algebraic equation** Bisection method, Regula-Falsi method, Newton-Raphson method, Iteration Method, Secant Method.	(5L)
6	**Numerical solution of ordinary differential equation** Euler's method, Runge-Kutta methods, Taylor's series, method, Predictor Corrector methods and Finite Difference method.	(4L)
7	**Least Square Curve fitting** Linear & non-linear curve fitting	(2L)
8	**Introduction to Statistics& Probability** Basic Statistics-measure of central tendency, dispersion. Probability, distribution introduction to mass function, density function, distribution function (Binomial, Poisson, Normal).	(8L)

Reference Books:
- R.S. Salaria: Computer Oriented Numerical Methods, Khanna Publishing House (AICTE)
- C.Xavier: C Language and Numerical Methods.
- Dutta & Jana: Introductory Numerical Analysis.
- J.B.Scarborough: Numerical Mathematical Analysis.
- Jain, Iyengar, & Jain: Numerical Methods (Problems and Solution).
- Balagurusamy: Numerical Methods, Scitech.
- Baburam: Numerical Methods, Pearson Education.
- N. Dutta: Computer Programming & Numerical Analysis, Universities Press

Code: MCAN-E205B	Paper: Computer Graphics	
Contacts Hours / Week: 3	Total Contact Hours: 30	Credit: 3

Course Outcome:

After successful completion of this course, students will be able to:
- ✓ Identify the basic terminologies of Computer Graphics and interpret the mathematical foundation of the concepts of computer graphics.
- ✓ Apply mathematics to draw basic primitives.
- ✓ Illustrate the concepts of windowing and clipping and apply various algorithms to fill and clip polygons.
- ✓ Understand and apply the core concepts of computer graphics, including transformation in two and three dimensions, viewing and projection.
- ✓ Create effective programs using concepts of curves.
- ✓ Understand the concepts of color models, lighting, shading models and hidden surface elimination.

UNITS	COURSE CONTENT
1	**Introduction** (6L) Overview of computer graphics, representing pictures, preparing, presenting & interacting with pictures for presentations; Visualization & image processing; RGB color model, direct coding, lookup table; storage tube graphics display, Raster scan display, 3D viewing devices, Plotters, printers, digitizers, Light pens etc.; Active & Passive graphics devices; Computer graphics software.
2	**Graphics Primitives:** (6L) Points, Lines andCircles as primitives, Scan conversion algorithms for primitives, Fill area primitives including scan-line polygon filling, inside-outside test, Boundary and Flood-fill, Character generation, line attributes, area-fill attributes, character attributers.
3	**2D Transformation and Viewing:** (6L) Transformations (translation, rotation, scaling), matrix representation, homogeneous coordinates, composite transformations, reflection and shearing, viewing pipeline and coordinates system, window-to-viewport transformation, clipping including point clipping, line clipping (Cohen-Sutherland, Liang-Bersky), Polygon clipping
4	**3D Transformations:** (4L) Translation, rotation, scaling & other transformations. Rotation about an arbitrary axis in space, Reflection through an arbitrary plane; General parallel projection transformation; clipping, viewport clipping, 3D viewing.
5	**Curve:** (3L) Curve representation, surfaces, designs, Bezier curves, B-spline curves, end conditions for periodic B-spline curves, rational B-spline curves.
6	**Hidden surfaces** (3L) Depth comparison, Z-buffer algorithm, Back face detection, BSP tree method, The Painter's algorithm, scan-line algorithm; Hidden line elimination.
7	**Color & shading models** (2L) Light &Color Model; Interpolative Shading Models; Texture;

Reference Books:
- D. Hearn and M.P. Baker, Computer Graphics, Pearson Eduction.
- D.P. Mukherjee, D. *Jana*, Computer Graphics: Algorithms and Implementations, Pentice Hall of India.
- J. Foley, V. Dam, S. Feiner, J. Hughes, "Computer Graphics Principles and Practice", Pearson Education.
- D. Rogers, Procedural Elements for Computer Graphics, TataMcGraw-Hill Publications.
- D.Rogers,J.Adams,MathematicalElementsforComputerGraphics,TataMcGraw Hill Publication.
- R. Anand, Computer Graphics, Khanna Publishing House.

Code: MCAN-E205C	Paper: Probability and Statistics	
Contacts Hours / Week: 3	Total Contact Hours: 30	Credit: 3

Course Outcome:

After successful completion of this course, students will be able to:

- ✓ Explain the concept of probability and its feature in terms of random event, sample space, favorable event.
- ✓ Describe the idea of random variable and the probability distribution.
- ✓ Calculate the expectation, standard deviation and moments.
- ✓ Critically evaluate the underlying assumptions of analysis tools.
- ✓ Carry out basic statistical analysis of data.

UNITS	COURSE CONTENT
1	**Probability** (3L) Sample Space, Probability Axioms, Combinatorics: probability of finite sample space, Conditional probability and Bayes Theorem, Independence of Events,
2	**Random Variables** (5L) Discrete, continuous and mixed random variables, probability mass, probability density and cumulative distribution functions, mathematical expectation, moments, probability and moment generating function, median and quantiles, Markov inequality, Chebyshev's inequality, problems
3	**Special Distributions** (6L) Discrete uniform, binomial, geometric, negative binomial, hypergeometric, Poisson, continuous uniform, exponential, gamma, Pareto, beta, normal
4	**Joint Distributions** (3L) Joint, marginal and conditional distributions, product moments, correlation and regression, independence of random variables, bivariate normal distribution, problems.
5	**Sampling Distributions** (2L) The Central Limit Theorem, distributions of the sample mean and the sample variance for a normal population, Chi-Square, t and F distributions, problems.
6	**Descriptive Statistics** (2L) Graphical representation, measures of locations and variability.
7	**Estimation** (3L) Unbiasedness, consistency, the method of moments and the method of maximum likelihood estimation, confidence intervals for parameters in one sample and two sample problems of normal populations, confidence intervals for proportions, problems.
8	**Testing of Hypotheses** (6L) Null and alternative hypotheses, the critical and acceptance regions, two types of error, power of the test, the most powerful test and Neyman-Pearson Fundamental Lemma, tests for one sample and two sample problems for normal populations, tests for proportions, Chi-square goodness of fit test and its applications, problems.

Reference Books:

- Vijay K. Rohatgi, A. K. Md. Ehsanes Saleh- An Introduction To probability And statistics, John Wiley &Sons
- V.K.Rohatgi& A.K. Md. E. Saleh - An Introduction to Probability and Statistics
- J.S. Milton &J.C. Arnold- Introduction to Probability and Statistics
- H.J. Larson -Introduction to Probability Theory and Statistical Inference.
- S.M. Ross - Introduction to Probability and Statistics for Engineers and Scientists
- The Practice of Business Statistics, Gupta & Gupta, Khanna Book Publishing.

Code:MCAN-E205D	Paper: Introduction to Cyber Security	
Contacts Hours / Week: 3	Total Contact Hours: 30	Credit: 3

Course Outcome:

After successful completion of this course, students will be able to:

- ✓ Know Fundamental knowledge in Cyber Security
- ✓ Understand the security challenges as well as the best practices that are essential to protect one from becoming the victims of cybercrimes.
- ✓ Understand the current status of cyber world.
- ✓ To safe-guard the individual, society, organization and the government from the dangers of cyber frauds, scams, threats and attacks.
- ✓ Able to further exploration in Cyber Security Domain.

UNITS	COURSE CONTENT	
1	**Introduction** Introduction to Cyber Space, Information Systems, Need for Cyber Security	(2L)
2	**Cyber Attacks** Introduction to Cyber Attacks, Classification of Cyber Attacks, Classification of Malware, Threats	(3L)
3	**Intrusion Detection and Prevention** Vulnerability Assessment Intrusion Detection Systems Intrusion Prevention Systems	(2L)
4	**Authentication Methods** Introduction to User Authentication Methods Biometric Authentication Methods, Biometric Systems	(2L)
5	**Security Models** Different Security Models and Security Mechanisms Information Security and Network Security Operating System Security	(3L)
6	**Online Security** Web Security Email Security Mobile Device Security, Cloud Security	(2L)
7	**IoT & Social Media Security** IoT Security Cyber Physical System Security Social Media Security	(3L)
8	**Security and Virtual Currency** Virtual Currency Block Chain Technology Security Auditing	(3L)
9	**Cyber Crimes** Introduction, Different Types of Cyber Crimes, Scams and Frauds, Analysis of Crimes, Human Behavior, Stylometry, Incident Handling, Investigation Methods, Criminal Profiling, Cyber Trails	(4L)
10	**Digital Forensics** Digital Forensics, History, Challenges, Branches of Digital Forensics, Digital Forensic Investigation Methods, Reporting, Management of Evidence	(3L)
11	**Cyber Law** Cyber laws, Cyber terrorism, Information Technology Act 2000 and Amendments,Evidentiary value of Email/SMS, Cybercrimes and Offenses dealt with IPC, RBI Act and IPR Act in India, Jurisdiction of Cyber Crime, Cyber Security Awareness Tips	(3L)

Reference Books:

- Fundamentals of Cyber Security By MayankBhushan, BPB Publications
- https://heimdalsecurity.com/pdf/cyber_security_for_beginners_ebook.pdf
- Information Security & Cyber Laws, Gupta & Gupta, Khanna Publishing House
- Certified Ethical Hacker Certification Exam by William Manning
- Data communication and Networking by Behrouz A. Forouzan, McGraw Hill Education (India) Pvt. Ltd.
- http://larose.staff.ub.ac.id/files/2011/12/Cyber-Criminology-Exploring-Internet-Crimes-and-Criminal-Behavior.pdf

Code:MCAN-E205E	Paper: Introduction to IoT	
Contacts Hours / Week: 3	Total Contact Hours: 30	Credit: 3

Course Outcome:

After successful completion of this course, students will be able to:

- ✓ Explain what Internet of Thins is
- ✓ Describe key technologies in Internet of Things.
- ✓ Understand wireless sensor network architecture and its framework along with WSN applications.
- ✓ Explain resource management in the Internet of Things.
- ✓ Understand business models for the Internet of Things.

UNITS	COURSE CONTENT
1	**Introduction:** (6L) What is the Internet of Things? : History of IoT, About IoT, Overview and Motivations, Examples of Applications, Internet of Things Definitions and Frameworks : IoT Definitions, IoT Architecture, General Observations, ITU-T Views, Working Definition, IoT Frameworks, Basic Nodal Capabilities
2	**Fundamental IoT Mechanisms And Key Technologies** (6L) Identification of IoT Objects and Services, Structural Aspects of the IoT, Environment Characteristics, Traffic Characteristics, Scalability, Interoperability, Security and Privacy, Open Architecture, Key IoT Technologies, Device Intelligence, Communication Capabilities, Mobility Support, Device Power, Sensor Technology, RFID Technology, Satellite Technology,
3	**Radio Frequency Identification Technology** (6L) RFID: Introduction, Principle of RFID, Components of an RFID system, Issues EPCGlobal Architecture Framework: EPCIS & ONS, Design issues, Technological challenges, Security challenges, IP for IoT, Web of Things. Wireless Sensor Networks: History and context, WSN Architecture, the node, Connecting nodes, Networking Nodes, Securing Communication WSN specific IoT applications, challenges: Security, QoS, Configuration, Various integration approaches, Data link layer protocols, routing protocols and infrastructure establishment.
4	**Resource Management In The Internet Of Things** (6L) Clustering, Software Agents, Clustering Principles in an Internet of Things, Architecture, Design Guidelines, and Software Agents for Object Representation, Data Synchronization. Identity portrayal, Identity management, various identity management models: Local, Network, Federated and global web identity, user-centric identity management, device centric identity management and hybrid-identity management, Identity and trust.
5	**Internet Of Things Privacy, Security And Governance** (6L) Vulnerabilities of IoT, Security requirements, Threat analysis, Use cases and misuse cases, IoT security tomography and layered attacker model, Identity establishment, Access control, Message integrity, Non-repudiation and availability, Security model for IoT.

Reference Books:

- Jeeva Jose, Internet of Things, Khanna Book Publishing House, (AICTE Recommended).
- Pethuru Raj and Anupama C Raman, The Internet of Things – Enabling Technologies, Platforms, and use cases, CRC Press, Taylor and Francis
- Internet of Things - A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, Universities Press.
- Yasuura, H., Kyung, C.M., Liu, Y., Lin, Y.-L., Smart Sensors at the IoT Frontier, Springer International Publishing.
- David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things, 1stEdition, Pearson Education (Cisco Press Indian Reprint).
- Srinivasa K G, Internet of Things,CENGAGE Leaning India.

Code: MCAN-E205F	Paper: Automata Theory & Computational Complexity	
Contacts Hours / Week: 3	Total Contact Hours: 30	Credit: 3

Course Outcome:

After successful completion of this course, students will be able to:
- ✓ Understand the formal notation for strings, languages and machines.
- ✓ Design and Implement Finite automata to accept a string of a language.
- ✓ For a given language determine whether the given language is regular or not.
- ✓ Design context free grammars to generate strings of context free language.
- ✓ Determine equivalence of languages accepted by Push Down Automata and languages generated by context free grammars
- ✓ Understand and analyze the hierarchy of formal languages, grammars and machines.
- ✓ Distinguish between computability and non-computability and Decidability and un-decidability.

UNITS	COURSE CONTENT	
1	**Introduction** **(2L)** Introduction: Alphabet, languages and grammars, productions and derivation, Chomsky hierarchy of languages.	
2	**Regular languages and finite automata:** **(6L)** Regular expressions and languages, deterministic finite automata (DFA) and equivalence with regular expressions, nondeterministic finite automata (NFA) and equivalence with DFA, regular grammars and equivalence with finite automata, properties of regular languages, pumping lemma for regular languages, minimization of finite automata)	
3	**Context-free languages and pushdown automata:** **(6L)** Context-free grammars (CFG) and languages (CFL), Chomsky and Greibach normal forms, nondeterministic pushdown automata (PDA) and equivalence with CFG, parse trees, ambiguity in CFG, pumping lemma for context-free languages, deterministic push down automata, closure properties of CFLs.	
4	**Turing machines:** **(8L)** The basic model for Turing machines (TM), Turing recognizable(recursively enumerable) and Turing-decidable (recursive) languages and their closure properties, variants of Turing machines, nondeterministic TMsand equivalence with deterministic TMs, unrestricted grammars and equivalence with Turing machines, TMsasenumerators.Context Sensitive Language, The model of Linear Bounded Automaton, relation between LBA and context sensitive language	
5	**Decidability:** **(4L)** Decidability, decidable language and undecidable language, Halting problem of TM, Halting problem of TM	
6	**Complexity** **(4L)** Growth rate of functions, The classes P and NP, Polynomial time reduction and NP completeness, SAT is NP complete, Cook's theorem, Church-Turing Thesis	

Reference Books:
- Introduction to Automata Theory, Languages, and Computation, John E. Hopcroft, Rajeev Motwani and Jeffrey D. Ullman, Pearson Education Asia.
- Theory of Computation, R.B. Patel & Prem Nath, Khanna Publishing House.
- Elements of the Theory of Computation, Harry R. Lewis and Christos H. Papadimitriou, Pearson Education Asia.
- Theory of Computer Science, Automata Languages and computation, Mishra and Chandra shekaran, 2nd edition, PHI.
- Automata and Computability, Dexter C. Kozen, Undergraduate Texts in Computer Science, Springer.
- Introduction to the Theory of Computation, Michael Sipser, PWS Publishing.
- Introduction to Languages and The Theory of Computation, John Martin, Tata Mc Graw Hill., PEARSON.

Code: MCAN-291	Paper: Data Structure Lab with Python	
Contacts Hours / Week: 4	Total Contact Hours: 40	Credit: 2

Course Outcome:

After successful completion of this course, students will be able to:

- ✓ To understand linear and non-linear data structures.
- ✓ To understand different types of sorting and searching techniques.
- ✓ To know how to create an application specific data structure.
- ✓ To solve the faults / errors that may appear due to wrong choice of data structure.
- ✓ To analyze reliability of different data structures in solving different problems.

UNITS	COURSE CONTENT
1	Implementation of data structure operations (Insertion, deletion, traversing, searching) on array. Linear search, Binary search.
2	Implementation of stack, queue operation using array. Pop, Push, Insertion, deletion, Implementation of circular queue. Infix to postfix conversion, postfix expression evaluation
3	Implementation of linked lists: Single linked list, circular linked list, double linked list, doubly circular linked list. Implementation of stack and queue using linked list. Merging two linked list, Linked list representation of a polynomial, polynomial addition, polynomial multiplication.
4	Tree: creating Binary Search tree, recursive and non-recursive traversal of BST, deletion in BST, calculating height of a BST, building AVL tree.
5	Implementation of sorting techniques: selection, bubble, quick sort, insertion sort, merge sort, heap sot, implementation of priority queue. Hash table implementation.
6	Implementation of Graph: representation, searching, BFS, DFS

Code: MCAN-292	Paper: Operating System Lab (Unix)	
Contacts Hours / Week: 4	Total Contact Hours: 40	Credit: 2

Course Outcome:

After successful completion of this course, students will be able to:

- ✓ Do the use of basic UNIX Commands from the command line, and create Shell Scripts to customize their UNIX Working Environment.
- ✓ Organize and manage their processes within UNIX through system calls.
- ✓ Organize and manage their files within the UNIX through system calls.
- ✓ Provide a mechanism for handling asynchronous events through signals (Software Interrupt).
- ✓ Implement the Inter-process communication using FIFOs, Message Queues, Semaphores, and Shared Memory.
- ✓ Explain Socket programming to design Client-Server Environment.
- ✓ Understand and implement Multithreaded Programming Environment.

UNITS	COURSE CONTENT
1	**Shell programming** Creating a script, making a script executable, shell syntax (variables, Conditions, control structures, functions and commands).
2	**Process** Starting new process, replacing a process image, duplicating a process image, waiting for a process, Zombie Process, Orphan Process
3	**File Handling** Programming on files (use create(), open(), read(), write(), close(), lseek(), dup()).
4	**Signal** Signal Handling, Blocking, Suspending, Delivering Signals, Various Signal Related Functions.
5	**Inter-process communication** Pipes (use functions pipe(), popen(), pclose()), Named Pipes (FIFOs, accessing FIFO), Message Queues (use functions msgget(), msgsnd(), msgrcv(), msgctl()), Semaphores (use functions semctl(), semget(), semop()) Shared Memory (use functions shmget(), shmat(), shmdt(), shmctl())
6	**Sockets:** TCP Sockets, UDP Sockets, Socket Options, Cliient /Server Example, Name and Address Conversions
7	**POSIX Threads** Programming with pthread functions (viz. pthread_create(), pthread_join(), pthread_exit(), pthread_attr_init(), pthread_cancel())

Code: MCAN-293	Paper: Object Oriented Programming Lab using JAVA	
Contacts Hours / Week: 4	Total Contact Hours: 40	Credit: 2

Course Outcome:

After successful completion of this course, students will be able to:

- ✓ Apply object-oriented principles or features in software design process to develop Java programs for real life applications.
- ✓ Reduce the complexity of procedural language by employing different OOP technologiesfor developing robust and reusable software.
- ✓ Develop programs using stream classes for various I/O operations and design concurrent.
- ✓ Design graphical user interface to develop user interactive applications.

UNITS	COURSE CONTENT
1	Assignments on class, constructor, overloading, inheritance, overriding.
2	Assignments on wrapper class, arrays.
3	Assignments on developing interfaces- multiple inheritance, extending interfaces.
4	Assignments on creating and accessing packages.
5	Assignments on multithreaded programming
6	Assignments on applet programming