

Department of Computer Applications

MCA (Master of Computer Applications) Syllabus

FIRST SEMESTER

MAS6001: BASIC MATHEMATICS FOR COMPUTER APPLICATIONS (BRIDGE COURSE) [0 0 0 0]

Set Theory: sets, subsets, set operation, Cartesian product, relation (properties, equivalence relation, and partition) and Function: Definition, domain and range of function, types of functions (into, onto, one to one), composite function. Special Functions: Trigonometric functions and their properties, exponential functions, logarithmic functions, hyperbolic functions, inverse circular functions and related properties, simple problems. Rational functions, partial fraction and simple problems. Principal of inclusion and exclusions (statement only and simple problems), Generating Functions recurrence relation.

References:

1. Shanti Narayan, "Differential calculus", S. Chand & Co, Delhi, 2012.
2. M.D. Raisinghania, et.al, "Differential calculus", Delhi, 2010.
3. N. Piskunov, "Differential and integral calculus", Vol I & Vol II, CBS, 2000.

CAP6100: FUNDAMENTALS OF IT & PROGRAMMING (BRIDGE COURSE) [0 0 0 0]

Introduction to Computers: Computer - Definitions, The Evolution of Computers, Characteristics of Computers, Organization of a Computer, Generation of Computer, Classification of Computers, Distributed Computer System, Parallel Computers. Computer & mathematics: Decimal, Binary, Octal, Hexadecimal Number Systems, Converting Techniques in Number Systems, One's Complements, Two's Complements, Rules and Laws of Boolean Algebra, Basic Gates (NOT, AND & OR). Logic Gates: Introduction, Definition of Combinational Circuits & Sequential Circuits, Flip Flops, Shift Registers and their types, Counters, Types of FLIP FLOPS. Central Processing Units: Introduction, CPU Essentials, Architectural Performance, Processors, CPU Overclocking. Computer Memory: Introduction, Memory Systems and Cells, Memory Arrays, RAM, ROM, External Memory (Secondary Memory), Floppy Disk Drives, Compact Disk Read Only Memory, Magnetic Storage Drives, Physical Devices Used to Construct Memories. Components: Connecting the Computer Components, Types of BUS, Industry Standard Architecture (ISA), Peripheral Component Interconnect (PCI), Accelerated Graphics Port (AGP), Front Side Bus (FSB), Dual Independent Bus (DIB), Troubleshooting. Data Storage: Introduction, Hard Drive, CD-ROM Drive, DVD Drive, Blue-Ray Disc Drive, Flash Memory Drive. Input & Output Devices: Introduction, Input Devices, Output Devices. Computer Software: Introduction, System Software and Application Software, Open Source Technology, Software Development, Software analysis and design, Software testing, programming methods, software applications. Operating System: Introduction, Operating System Concepts, Functions, Development, Components, Services. Computer Communication: Concept of computer communication, Basic Elements, Data communication, Network Type, OSI Model, Transmission Control Protocol/Internet Protocol Model, Internet. Computer Networks: Introduction, TCP/IP Protocol Suite, History of Internet, Concepts of Internet, How Internet Works, Requirements of Internet, Uses of Internet, Internet Explorer, Internet Applications

References:

1. Sinha, Pradeep K., and Priti Sinha. Computer fundamentals. BPB publications, 2010.
2. Kaye, Barbara K., and Norman J. Medoff. World Wide Web: a mass communication perspective. McGraw-Hill Higher Education, 2001.
3. Bartee, Thomas C. Digital computer fundamentals. No. 04; QA76. 5, B37 1977.

MA6105: DISCRETE MATHEMATICAL STRUCTURES WITH GRAPH THEORY [3 1 0 4]

POSET, Lattices, distributive, and complemented lattices, Boolean Lattice, Uniqueness of Boolean Lattices Boolean expression & function. Mathematical Logic: Statement and notations, connectives, normal forms, well-formed formulas, implication, Tautology, Predicate calculus. Graphs: Introduction, Isomorphism, Sub graphs, Walks, Paths, Circuits, Connectedness, Components, Euler graphs, Hamiltonian paths and circuits, Trees, Properties of trees, Distance and canters in tree, Rooted and binary trees. Trees, Connectivity & Planarity Spanning trees, Fundamental circuits, spanning trees in a weighted graph, cut sets, Properties of cut set, all cut sets, Fundamental circuits and cut sets, Connectivity and separability, Network flows: Isomorphism, Combinational and geometric graphs, Planer graphs, Different representation of a planer graph. Matrices, Coloring and Directed Graph. Chromatic number, Chromatic partitioning, Chromatic polynomial, Matching, Covering, Four color problem, Directed graphs, Types of directed graphs, Digraphs and binary relations, Directed paths and connectedness, Euler graphs.

References:

1. C.L. Lui, Elements of Discrete Mathematics, (4e) Houghton Mifflin, 2017
2. N. Deo, Graph Theory: With Application to Engineering and Computer Science, (New Edition) Prentice Hall of India, 2003.
3. R.P. Grimald Discrete and Combinatorial Mathematics: An Applied Introduction, (5e) Addison Wesley, 2003.

CAP6101: WEB TECHNOLOGIES [3 1 0 4]

Introduction: Concept of WWW, Internet and WWW, HTTP Protocol: Request and response, Web browser and Web servers, Features of Web 2.0, Web Design: Concepts of effective web design, Introduction to CSS, CSS Selectors and Properties, CSS Box Model, Styling Text and Fonts, Colors and Backgrounds, CSS Layout Techniques, Responsive Design. JavaScript : Client side scripting with JavaScript, variables, functions, conditions, loops and repetition, Pop up boxes, Advance JavaScript: JavaScript and objects, JavaScript own objects, the DOM and web browser environments, Manipulation using DOM, forms and validations, DHTML : Combining HTML, CSS and JavaScript, Events and buttons, PHP : Introduction and basic syntax of PHP, decision and looping with examples, PHP and HTML, Arrays, Functions, Browser control and detection, string, Form processing, Files, Advance Features: Cookies and Sessions, Object Oriented Programming with PHP, PHP and MySQL : Basic commands with PHP examples, Connection to server, creating database, selecting a database, listing database, listing table names, creating a table, inserting data, altering tables, queries, deleting database, deleting data and tables, PHP myadmin and database bugs.

References:

1. R. Moseley & M. T. Savaliya, Developing Web Applications, (2e) Wiley-India, 2013.
2. J. Sklar, Web Design Principles, (5e) Cengage Learning, 2012.
3. Harwani, Developing Web Applications in PHP and AJAX, (1e) McGrawHill, 2010.

4. P.J. Deitel & H.M. Deitel, Internet and World Wide Web How to program, (4e) Pearson, 2007.

CAP6105: PROGRAMMING & PROBLEM-SOLVING USING C [3 1 0 4]

An overview: Algorithms & flowcharts; Characteristics of a good program. Rules/conventions of coding, documentation, naming variables; Top-down design; Bottom-up design. Fundamentals of C Programming: History of C; Structure of a C Program; Data types; Constant & Variable, naming variables; Operators & expressions; Control Constructs - if-else, for, while, do-while; Case switch statement; Arrays; Formatted & unformatted I/O; Type modifiers & storage classes; Ternary operator; Type conversion & type casting; Priority & associativity of operators. Modular Programming: Functions; Arguments; Return value; Parameter passing - call by value, call by reference; Return statement; Scope, visibility and life-time rules for various types of variables, static variable; Calling a function; Recursion - basics, comparison with iteration, types of recursions, when to avoid recursion, examples. Advanced Programming Techniques: Special constructs - Break, continue, exit(), goto & labels; Pointers - & and * operators, pointer expression, pointer arithmetic, dynamic memory management functions like malloc(), calloc(), free(); String; Pointer v/s array; Pointer to pointer; Array of pointer & its limitation; Function returning pointers; Pointer to function, Function as parameter; Structure - basic, declaration, membership operator, pointer to structure. Introduction to Data Structures: Contiguous implementations of stack & queues, various operations on stack & queues.

References:

1. Kerninghan & Ritchie "The C programming language", PHI.
2. Schildt "C: The Complete reference" 4th ed TMH.
3. Cooper Mullish "The Spirit of C", Jaico Publishing House, Delhi.
4. Kanetkar Y. "Let us C", BPB.
5. Tennenbaum A.M. & others: Data Structures using C & C++; PHI.

CAP6106: RELATIONAL DATABASE MANAGEMENT DATABASE MANAGEMENT SYSTEMS [3 1 0 4]

Introduction: Database-System Applications, Relational Databases, Database Design, Data Storage and Querying, Transaction Management, Database Architecture; Relational Algebra: Fundamental Relational- Algebra Operations, Extended Relational-Algebra Operations, Null Values, Modification of the Database; SQL: Data Definition Language, Data manipulation language, SQL Data Types and Schemas, Integrity Constraints, Basic Structure of SQL Queries, Set Operations, Aggregate Functions, Null Values, Nested Sub-queries, Complex Queries, Views, Modification of the Database, Joined Relations, Authorization, Overview of the Design Process; The Entity-Relationship Model: Constraints, Entity-Relationship Diagrams, Entity-Relationship Design Issues, Weak Entity Sets, Extended E-R Features; Normalization: Anomalies, Referential integrity, 1NF, Functional Dependency, 2NF, 3NF, BCNF; Hashing Techniques: Dynamic Hashing; Transactions: Transaction State, Implementation of Atomicity and Durability, Concurrent Executions, Serializability, Recoverability, Implementation of Isolation, Testing for Serializability, Lock-Based Protocols, Log-Based Recovery, Recovery algorithms.

References:

1. S. Korth, Database System Concept, Mc-GrawHill, (6e), 2011.
2. R. Elmasri and S. Navathe, Fundamentals of Database Systems, (6e) Pearson Education, 2006.
3. T. Connolly, C. Begg, Database Systems-A Practical Approach to Design, Implementation and Management, (3e) Pearson Education, 2002.

CAP6108: DATA VISUALIZATION [3 1 0 4]

Introduction to data visualization, importance of data visualization, data types, different tools for data visualization, Pie Chart, Bar Chart, Histogram, Gantt Chart, Heat Map, Box and Whisker Plot, Waterfall Chart, Area Chart, Scatter Plot, Pictogram Chart, Timeline, Highlight Table, Bullet Graph, Choropleth Map, Word Cloud, Network Diagram, Correlation Matrices, geographical plots, Density Maps, Bubble Chart, Tree maps. Text Table, Applying Filters, Time Series and trend analysis, working with dates, 3-D Scatter Plots, 3-D Mash, Dashboard development process, dashboard architecture, story development.

References:

1. Engebretsen, Martin, and Helen Kennedy, Data visualization in society, 2020.
2. Anuncia, S. Margret, Hardik A. Gohel, and Subbiah Vairamuthu, Data Visualization, Springer Verlag, Singapore, 2020.

CAP6130: WEB TECHNOLOGY LAB [0 0 2 1]

Implement forms using HTML, Frames and CSS. Use of XML Tags, PHP : Use of basic syntax of PHP, decision and looping with examples, PHP and HTML, Arrays, Functions, Browser control and detection, string, Form processing, Files, Advance Features: Cookies and Sessions, Object Oriented Programming with PHP, PHP and MySQL : Basic commands with PHP examples, Connection to server, creating database, selecting a database, listing database, listing table names, creating a table, inserting data, altering tables, queries, deleting database, deleting data and tables, PHP myadmin and database bugs.

References:

1. R. Moseley & M. T. Savaliya, Developing Web Applications, (2e) Wiley-India, 2013.
2. Team at Kogent Learning Solutions Inc., Web Technologies, Black Book, (1e) Dreamtech Press, 2009.
3. Team at Kogent Learning Solutions Inc., HTML 5, Black Book, (2e) Dreamtech Press, 2011.
4. J. Sklar, Web Design Principles, (5e) Cengage Learning, 2012.
5. Harwani, Developing Web Applications in PHP and AJAX, (1e) McGrawHill, 2010.
6. P.J. Deitel& H.M. Deitel, Internet and World Wide Web How to program, (4e) Pearson, 2007.

CAP6133: PROGRAMMING & PROBLEM-SOLVING USING C LAB [0 0 2 1]

Simple C Programs (expression-oriented operations); Programs to illustrate various operators in C. Programs using branching constructs (if, if-else-if, switch-case); Programs using looping constructs (for, while, do-while, continue, break); Programs on 1D Arrays; Programs on 2D

Arrays; Programs on strings; Programs using functions (with and without recursion), passing parameters by value and reference. Operations on Stacks: Push, Pop, Queues.

References:

1. Kerninghan & Ritchie "The C programming language", PHI.
2. Schildt "C: The Complete reference" 4th ed TMH.
3. Cooper Mullah "The Spirit of C", Jaico Publishing House, Delhi.
4. Kanetkar Y. "Let us C", BPB.
5. Tennen Baum A.M. & others: Data Structures using C & C++; PHI.

CAP6134: RELATIONAL DATABASE MANAGEMENT SYSTEMS LAB [0 0 2 1]

Experiments on DDL and Basic SQL, Advanced SQL, ER diagrams using DIA tool, Data Integrity Constraints and Built-in Functions, Design and Implementing the data requirements of a simple DB application, Experiments on Basic PL/SQL, PL/SQL Exceptions and Transactions, PL/SQL Cursors, PL/SQL Procedures, Functions and Packages, Project (DB application development with Java as front end).

References:

1. S. Korth, Database System Concepts, (6e) Mc-GrawHill, 2011.
2. R. Elmasri and S. Navathe, Fundamentals of Database Systems, (6e) Pearson Education, 2009.

SECOND SEMESTER

CAP6203: COMPUTER NETWORKS AND PROTOCOLS [3 1 0 4]

Network introduction: Classful addressing, other issues, Subnetting Classless addressing, variable length blocks, Subnetting, address allocation, Network Address Translation. Encapsulation, operation Data Link Layer: ARP package & RARP- Introduction, packet format Encapsulation, RARP server datagram, fragmentation, options, checksum, Network Layer: IP Package Types of messages, message format, error reporting, Query, Checksum, Debugging tools; Transport Layer: Process to process communication, User datagram, checksum, UDP operation UDP package Introduction, TCP services, TCP features, segment, TCP connection, State transition diagram, Flow control, Error control, Congestion control, TCP timers, options, TCP package; TCP Variants: SCTP services, SCTP features, packet format, association, state transition diagram, flow control, error control, congestion control, TCP RENO, Dynamic routing protocols : RIP,OSCF & BGP; Domain name Space (Application Layer): Name space, distribution of name space, DNS in the internet, resolution, DNS messages, controlling the server, out of band signaling, escape character. Transition from IPv4 to IPv6. Introduction to VLAN concept, Wireless Network protocols: WAP Architecture introduction. Introduction to MANET & VANET

References:

1. W. R Stevens, TCP/IP Illustrated, Volume 1: The Protocols, (2e) Addison-Wesley, 1994.
2. P. Loshin, IPV6 Clearly Explained, (4e) Morgan Kauffman, 2003.
3. B. A. Forouzan, TCP/IP Protocol Suite, (2e) TMH, 2005.

CAP6204: OBJECT ORIENTED PROGRAMMING USING JAVA [3 1 0 4]

Introduction to Object Oriented Programming. Overview of Core Java, AWT: Components and class hierarchy, Event Handling, Layouts Manager, Container. Swing: Concepts of Swing, Java Foundation Class (JFC), Swing Packages and Classes, Working with Swing, Swing Components. Overview of JavaFX. JSP and Servlets: Java Server Pages (JSP) - Introduction, what is needed to write JSP based web application? How does JSP look? How to test a JSP? Servlets - Introduction, History of Web Application, Web Architecture, Servlet Life Cycle. JDBC: Database Management; Mechanism for connecting to a back-end database; Loading the ODBC driver. Networking: Networking in Java; URL Objects.

Reference:

1. H. Schildt, The Complete Reference Java Eight Edition, (8e) Tata McGraw-Hill, reprint 2011.
2. S. Holzner, Java 2 programming black book, (5e) Dream Tech, New Delhi, reprint: 2005.

CAP6205: OPERATING SYSTEM [3 1 0 4]

Introduction to System Programs & Operating Systems, Evolution of Operating System (mainframe, desktop, multiprocessor, Distributed, Network Operating System, Clustered & Handheld System), Operating system services, Operating system structure, System Call & System Boots, Operating system design & Implementations, System protection, Buffering & Spooling. Types of Operating System: Bare machine, Batch Processing, Real Time, Multitasking & Multiprogramming, time-sharing system. Process: Concept, Process Control Blocks (PCB), Scheduling criteria Preemptive & non-Preemptive process scheduling, Scheduling algorithms, algorithm evaluation, multiple processor scheduling, real time scheduling, operations on processes, threads, inter process communication, precedence graphs, critical section problem, semaphores, classical problems of synchronization. Deadlock: Characterization, Methods for deadlock handling, deadlock prevention, deadlock avoidance, deadlock detection, recovery from deadlock, Process Management in Linux. Memory Hierarchy, Concepts of memory management, MFT & MVT, logical and physical address space, swapping, contiguous and non-contiguous allocation, paging, segmentation, and paging combined with segmentation. Structure & implementation of page table. Concepts of virtual memory, Applications of Virtual Memory, Cache Memory Organization, demand paging, page replacement algorithms, allocation of frames, thrashing, demand segmentation. Distributed operating system: Types, Design issues, File system, Remote file access, RPC, RMI, Distributed Shared Memory (DSM), Basic Concept of Parallel processing & concurrent programming. Case study of Unix, Linux & Windows.

References:

1. Silberschatz, "Operating system", Willey Pub.
2. Stuart, "Operating System Principles, Design & Applications", Cengage Learning.
3. Tannanbaum, "Modern operating system", PHI Learning.
4. Dhamdhare, "Operating System", TMH.
5. William stalling, "operating system" Pearson Edu.
6. Deitel & Deitel, "Operating Systems", Pearson Edu.
7. Flynn & Mchoes, "Operating Systems", Cengage Learning.

8. Halder, "Operating System", Pearson Edu.

CAP6212: DATA STRUCTURES [3 1 0 4]

Introduction: Definitions, Concept of Data Structures, Abstract Data type, Overview of Data Structures. Linear and Non-Linear Data Structures, Memory allocation. Definition, Array, 2D and 3D Array, Address Calculation in array, Stack: Array representation of stack, operations on Stack, Applications of Stack (Prefix and Postfix Expression Evaluation). Queues: Definition, Array and linked-list representation of Queue. Operations on Queue. Types of Queues Circular Queue, Priority Queue. Insertion, Deletion operations on a Circular Queue and Priority Queue. Circular Linked List, Double Linked Lists: Definition, Single Linked List: Representation in memory, operations (insertion, deletion, modify etc.), List, Operations on Linked List. Sorting and Searching: Bubble Sort, Quick Sort, Merge Sort, Selection Sort, Insertion Sort, Linear Search, Binary Search. Tree: Definitions and Concepts, Representation of binary tree, Binary tree traversal, Binary search trees, Applications of Trees- AVL trees, Height Balanced, B Tree, B+ Tree, Graph: Matrix Representation of Graphs, Linked List Representation of Graph. Graph Traversals.

Reference Books:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, Introduction to Algorithms, 4th Edition, MIT Press, 2022
2. Mark Allen Weiss, Data Structures & Algorithm Analysis in C++, 4th Edition, Pearson Education, 2013
3. Reema Thareja, Data Structures and Algorithms, 1st Edition, Oxford University Press (India), 2025
4. Rajesh K. Shukla, Data Structures Using C & C++, 1st Edition, Wiley India, 2009
5. Udit Agarwal – S.K. Kataria & Sons, Data Structures Using C (5th Edition), 2024

CAP6233: OBJECT ORIENTED PROGRAMMING USING JAVA LAB [0 0 2 1]

Core java concept implementation, AWT components and their classes, Events handling and Layout manager, Graphical user interface, Swing components and their classes, JDBC and ODBC implementation, JSP and Servlets, Client server applications.

References:

1. P. Radhak, Object Oriented Programming Through Java, (1e), Universities Press, 2006
2. H. Schildt, The Complete Reference Java Eight Edition, (8e) Tata McGraw-Hill, reprint 2011.
3. S. Holzner, Java 2 programming black book, (5e) Dream Tech, New Delhi, reprint: 2005.

CAP6239: DATA STRUCTURES LAB [0 0 2 1]

Arrays Implementation 1D and 2D Array, stacks Operations (Push, POP and Peek). Queue structures: linear, circular, and priority forms. Linked lists—singly, circular, and doubly linked (insertion, deletion). Classic sorting (bubble, selection, insertion, merge, quick) and searching (linear, binary), binary trees, traversals, binary search trees, Graphs: matrix and linked representations, Graph traversal methods.

Reference Books:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, Introduction to Algorithms, 4th Edition, *MIT Press*, 2022
2. Mark Allen Weiss, Data Structures & Algorithm Analysis in C++, 4th Edition, *Pearson Education*, 2013
3. Reema Thareja, Data Structures and Algorithms, 1st Edition, *Oxford University Press (India)*, 2025
4. Rajesh K. Shukla, Data Structures Using C & C++, 1st Edition, *Wiley India*, 2009
5. Udit Agarwal – S.K. Kataria & Sons, Data Structures Using C (5th Edition), 2024

CAP6235: PRAGMATIC LEARNING [0 0 2 1]

Introduction: Experiential learning (Minor Project) is learning through doing. The aim of this course is to encourage students designing small projects in a multidisciplinary environment. In this course students are challenged to move from problem to solution through a series of task-oriented steps. This collaborative process creates lifelong learners by igniting a curiosity about the world around them. In the experiential learning, students are inspired to build a small project which will enables them to acquire skills to position them for success in both academics and industry. The students will acquire practical knowledge within the chosen area of technology for project development and identify, analyse, formulate, and handle programming projects with a comprehensive and systematic approach.

Course Outcome: At the end of the course, the students will be able to:

-  To design, implement and evaluate a project.
-  Gain project management skills.
-  To learn to work effectively and ethically in a team towards project development.
-  To demonstrate the ability to produce a technical document.

Syllabus: There will be general meetings, group discussion and mid-term presentation to track the progress of the project and term-end presentation to evaluate project. In the examination student must demonstrate the project. A team of maximum two students can develop the project. However, during the examination, each student must demonstrate the project individually. Finally, student/team must submit a short project report/summary that must include the following:

-  Problem Statement
-  Objectives
-  Requirement Analysis
-  Software Requirement Specification
-  Methodology - How you build the project?
-  Conclusion
-  References

CAP6210: APTITUDE AND TECHNICAL DEVELOPMENT [1 1 0 2]

Section I: Quantitative: Number System, Percentage, Time & Distance, Profit & Loss, Time & Work, Average, Permutation & Combinations, Game Based. Verbal: Sentence Improvement, Sentence Rearrangement, Fill in the Blanks. Logical: Coding & Decoding, Direction, Blood Relation, Puzzle, Series, Statement & Arguments. Mock Interview Preparation and Group Discussion.

Section II: C Programming: C Fundamentals, Function, Array, Pointers, Structure and File Handling. Object Oriented Concepts. Data Structure: Types of Data Structure and their implementation. Program Logic Development and MCQ Solving. DBMS; SQL Queries. Software Engineering: Use case preparation and Implementation. Overview of Operating Systems and Computer Networks.

Program Electives - I

CAP6245: CRYPTOGRAPHY AND NETWORK SECURITY [3 0 0 3]

Elements of Number Theory : Euclid Algorithm, Prime Number Theorem, Euler's, Fermat's Little theorems, Entropy ; Classical Cipher Techniques: Caesar, Affine, Mono-alphabetic, Transposition, Polyalphabetic Ciphers; Security Attacks: Active V/S Passive, Security Services; Symmetric Encryption: Fiestel Cipher, Confusion and Diffusion, DES Algorithm; Asymmetric Encryption: Principles of Public Key Cryptosystems, RSA Algorithm; Message Authentication & Hashing; Digital Signatures: RSA Based, El-Gamal Signatures; Key distribution; User Authentication Protocols; E-Mail Security: PGP, S/MIME; IPsec: AH & ESP; SSL; TLS; Intrusion Detection: Statistical Anomaly Detection, Rule based detection, honeypots; Password Protection.

References:

1. S. Williams, Cryptography and Network Security: Principles and Practices, (6e) Pearson Education, 2013.
2. Kahate, Cryptography and Network Security, (4e) Tata Mc-Graw Hill, 2019
3. K. Charlie, Network Security: Private Communication in a Public World, (2e), Pearson Education, 2016.
4. V. Bagad, I. Dhotre, Cryptography and Network Security, (2e), Technical Publications, 2008.
5. B.A. Forouzan, Network Security, (3e), Tata Mc-Graw Hill, 20011.

CAP6246: ARTIFICIAL INTELLIGENCE [3 0 0 3]

General Issues and Overview of AI: The AI problems, what is an AI technique, Characteristics of AI applications

Scope and Area of AI Techniques: Intelligent agents and environments

Python fundamentals for AI: syntax, variables, data types, and control structures. Core data structures (lists, tuples, dictionaries, sets) Conceptual mapping of classical AI problem-solving techniques using Python. General problem-solving methods. Production systems and rule-based reasoning. Control strategies: forward chaining and backward chaining. Uninformed search techniques: Depth-First Search (DFS) and Breadth-First Search (BFS). Heuristic Search Techniques Hill climbing, branch and bound technique, best first search & A* algorithm, AND / OR graphs, problem reduction & AO* algorithm,

constraint satisfaction problems. Foundations of NLP. Knowledge Representations: First order Logic, predicate Logic, horn's clauses, semantic networks, frame systems and value inheritance, scripts, conceptual dependency. Introduction to Generative AI, Explainable AI (XAI), Introduction to Large Language Models (LLMs), Use cases.

References:

1. Artificial Intelligence: A Modern Approach, 4th Edition Authors: Stuart Russell, Peter Norvig – Pearson Education, 2021
2. Artificial Intelligence: A Textbook, 1st Edition, Charu C. Aggarwal – Springer, 2021
3. Foundations of Artificial Intelligence, 2nd Edition Authors: David L. Poole, Alan K. Mackworth – Cambridge University Press, 2017
4. Artificial Intelligence with Python, 1st Edition Author: Prateek Joshi – Packt Publishing, 2017
5. Python Artificial Intelligence Projects for Beginners, 2nd Edition Author: Joshua Eckroth – Packt Publishing, 2020

CAP6247: INTERNET OF THINGS [3 0 0 3]

Internet of Things: An overview, System Architecture, Design Principles for Connected Devices, Design Principles for Web connectivity for Connected Devices, Internet Connectivity Principles, Data Acquiring, Organizing and Analytics in IoT, data Collection, Storage & Computing Using Cloud Platform, Sensors and Actuators, Radio Frequency Identification, Wireless Sensor Networks and Participatory Sensing Technology, Prototyping of Embedded Devices for IoT, Gateways, Internet and Web/Cloud Services Software Component, IoT Privacy, Security and governance. IoT based Case studies.

References:

1. Theoleyre, Fabrice, and Ai-Chun Pang, eds,” Internet of Things and M2M Communications”, River Publishers, (1e), 2013.
2. Delsing, Jerker, ed, “IoT automation: Arrowhead framework. CRC Press”, (1e), 2017.
3. Raj Kamal, “Internet of Things”, (1e), McGraw-Hill, 2017.

THIRD SEMESTER

CAP7110: MACHINE LEARNING TECHNIQUES [3 1 0 4]

Introduction to Machine Learning - definition, scope, and applications. Types of learning: Supervised, Unsupervised, and Reinforcement Learning. Overview of tools and platforms for ML (Python, Scikit-learn). Data preprocessing: data cleaning, normalization, train-test split, feature selection. Introduction to basic algorithms: Linear Regression, Logistic Regression, K-Nearest Neighbors (KNN), Naive Bayes Classifier, SVM (support Vector Machine), and Decision Trees. Introduction to clustering: K-Means and Hierarchical Clustering. Evaluation metrics: confusion matrix, accuracy, precision, recall, F1-score. Overfitting and underfitting, bias-variance tradeoff. Basic understanding of model validation using cross-validation.

References:

1. Tom M. Mitchell, Machine Learning, McGraw-Hill Education, 1997.
2. Andreas C. Müller & Sarah Guido, Introduction to Machine Learning with Python: A Guide for Data Scientists, O'Reilly Media, 2016.
3. Aurélien Géron, Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, 2nd Edition, O'Reilly Media, 2019.
4. Ethem Alpaydin, Introduction to Machine Learning, MIT Press, 3rd Edition, 2014.

CAP7105: ANDROID APPLICATION DEVELOPMENT [3 1 0 4]

Basic Concept of Mobile Operating Systems Introduction, Design Principal, Kotlin Fundamentals, Basics of Kotlin Programming, Object-Oriented Programming in Kotlin, Android Studio and Project Structure, UI Design and Layouts, Activities and Intents, Fragments and Navigation, Event Handling and User Interaction, Data Storage and Persistence, Networking and APIs, Background Tasks. Advanced UI, Firebase Integration, Location and Maps, App Monetization and Publishing.

References:

1. John Horton, “Android Programming for Beginner”, Packt Publishing, (2e), 2018.
2. Dawn Griffiths, David Griffiths, “Head First Android Development: A Brain-Friendly”, O'Reilly Media, (2e), 2017.
3. Pradeep kothari, “Android Application Development (With Kitkat Support), Black Book”, WILEY, (1e) (May 20, 2014).

CAP7106: SOFTWARE ENGINEERING & PROJECT MANAGEMENT [3 1 0 4]

Introduction to Software Engineering: Software Components, Software Characteristics, Software Crisis, Software Engineering Processes; Software Development Life Cycle (SDLC) Models: Water Fall Model, Prototype Model, Spiral Model, Agile; Requirement Engineering Process: Analysis, Documentation, Review and Management of User Needs, Data Flow Diagrams, Decision Tables, SRS Document, IEEE Standards for SRS; Basic Concept of Software Design, Architectural Design, Low Level Design Modularization, Design Structure Charts, Pseudo Codes, Flow Charts, Coupling and Cohesion Measures; Design Strategies: Function Oriented Design, Object Oriented Design, Top-Down and Bottom-Up Design; Software Testing: Manual testing : White box testing, Black box testing, Gray box testing, Functional Testing: Smoke testing, Regression Testing, Retesting, Database Testing, Ad-hoc Testing, Recovery Testing, Static Testing, Non-Functional Testing: Performance testing, Load Testing, Security Testing, Portability Testing, Accountability Testing, Reliability Testing, Efficiency Testing, Levels of testing, Categories of Maintenance: Preventive, Corrective and Perfective Maintenance, Cost of Maintenance, Software Re-Engineering, Reverse Engineering; The Management spectrum- (The people, the product, the process, the project), Estimation of Various Parameters such as Cost, Efforts, Schedule/Duration, Constructive Cost Models (COCOMO) and its types, SEI capability maturity model, Verification and Validation, Basics of Project Management: Introduction, Need for Project Management, The Project Life Cycle, The Project Manager (PM), Phases of Project Management Life Cycle

References:

1. R. S. Pressman, Software Engineering: A Practitioners Approach, (3e) McGraw Hill, 2009.
2. R. Mall, Fundamentals of Software Engineering, (4e) PHI Publication, 2014.
3. K. K. Aggarwal and Y. Singh, Software Engineering, (3e) New Age International Publishers, 2008.
4. P. Jalote, Software Engineering, Wiley, (1e) 2010.
5. Sommerville, Software Engineering, Addison Wesley, (10e) 2013.

CAP7111: DESIGN AND ANALYSIS OF ALGORITHMS [3 1 0 3]

Introduction to Data structures: Linked list, Trees, Graphs and operations on it, Algorithm Analysis: A priori and a posteriori Analysis, Time Space Tradeoff, Asymptotic Notations, Properties of asymptotic notations, Recurrence equations, Solving recurrence equations using Substitution method and Master's method, Divide and Conquer: Binary Search, Merge Sort, Quick Sort, Matrix Multiplication, Greedy Algorithms: Knapsack Problem, Job Sequencing with deadline, Optimal Merge Pattern, Single Source Shortest Path, Minimum Cost Spanning tree; Dynamic Programming: Multistage Graphs, Matrix Chain Multiplication, All-Pair shortest paths, Optimal binary search trees, 0/1 Knapsack, Travelling salesperson problem, Graph Traversals, Connected Components, Bi-connected components.

References:

1. E. Horowitz, S. Sahni and S. Rajasekaran, Computer Algorithms, (2e), University Press, 2007.
2. T. H. Cormen, C. E. Leiserson, R. L. Rivest, and C. Stein, Introduction to Algorithms, (3e), MIT press, 2009.
3. Horowitz and Sahni, Fundamental of Computer Algorithms, (2e) Galgotia Publications, 2008

CAP7131: MINOR PROJECT [0 0 4 2]

Introduction: The goal of the mini project is to provide students the practical skills and knowledge they need to address issues that arise in the workplace, in educational settings, and in computer science research. The course's mini-project entails doing hands-on work to comprehend and address issues in the field of computers. An information system or subsystem, like a piece of software, is typically analysed, designed, coded or otherwise implemented, and tested as part of any computer science project. A design document might be the proper outcome of a design study instead of a computer programme being the subsystem. However, in this course, we expect a software system or subsystem. The design and implementation of a hardware system/subsystem would also be a suitable project.

Course Outcome

-  CAP7131.1 To demonstrate a depth of knowledge of modern technology.
-  CAP7131.2 Design Understand about project organization and feasibility analysis in Project Management.
-  CAP7131.3 To complete an independent project using Software Development Life Cycle.
-  CAP7131.4 To acquire the skills to communicate effectively and to present ideas clearly and coherently to specific audience in both the written and oral forms.

- 🚦 CAP7131.5 To reflect learning and take appropriate actions to improve entrepreneur skills.

Syllabus: The Mini Project is not just a component of the coursework; it also serves as a way for you to highlight your skills and areas of expertise. It gives you the chance to show off your creativity, cooperation, inspiration, planning, and organizational skills in a software project.

Textbook(s):

1. Prasanna Chandra; Projects- Planning, Analysis, Selection, Financing, Implementation and Review', VI Edition, Tata Mc Graw Hill.

Reference Book(s):

1. Chaudhary S.; Project Management, Tata Mc Graw Hill
2. Kerzner H.; Project Management, II Edition, CBS Publishers

Project Guidelines

- 🚦 Each student should submit a unique project title unless/otherwise in a team project.
- 🚦 Project work should include software development.
- 🚦 Only two students can work on one project as a team. However, their contribution should be clearly specified and reported.
- 🚦 The project should focus on solving some real-life problems, though it is not mandatory. However, the project idea should be creative, and it can be a fresh take on an old idea which is often worth as much as a brand-new idea.
- 🚦 The project work may be done internally in the university campus or in any external organizations/institutes approved by the head of the department/university authority.
- 🚦 Prior to starting project work, a student must get his/her project idea/problem statement approved by the supervisor.
- 🚦 The student must submit a project synopsis, presenting his idea. The student may start working on project only if the synopsis is approved.
- 🚦 The student should present the progress of the project works as per the timeline specified by the department /project coordinator/ supervisor.

Project Synopsis Format

The project synopsis must be prepared and approved with the supervisor's input. The synopsis should include a detailed description of the proposed project and objectives. The synopsis should be prepared as per the following format.

- 🚦 Title of the project
- 🚦 Name of the supervisor/project guide
- 🚦 Project Introduction
- 🚦 Objectives of the project
- 🚦 DFD, ER Diagrams
- 🚦 Project Timeline
- 🚦 Tools / platform, hardware and software requirement specifications
- 🚦 References

Project Report Format

The final project report should describe the detailed work completed by the student. The report must be prepared as per the following format.

General Guidelines

- ✚ Project Report to be minimum 35 pages. Reports less than 35 pages will be rejected.
- ✚ Project report to be maximum 50 - 60 pages (preferred but not mandatory).
- ✚ Paper Size: A4; Left = Right = Top = Bottom Margins = 0.7".
- ✚ Page Numbering Position: Bottom with right justified and continuous numbering from the Introduction Chapter.
- ✚ Use Times New Roman Font with Normal Style, paragraph justified and 1.15 line spacing.
- ✚ Paragraph Heading: Times New Roman Font, Bold, Font Size 14; Paragraph Matter: Times New Roman Font, Normal, Font Size 12.
- ✚ Sub-paragraphs be appropriately numbered as in 1.1, 1.2, 1.3 etc; Sub-paragraph Heading: Times New Roman Font, Italics, Font Size 12; Sub-paragraph Matter: Times New Roman Font, Normal, Font Size 12.
- ✚ Figure captions below Figure with chapter wise numbering.
- ✚ Tables captions above Table with chapter wise numbering.
- ✚ All references must be listed in the order in which they appear in the report (follow IEEE format for referencing).
- ✚ Only hard bound reports will be accepted, colour of the front cover to be in mustard yellow.
- ✚ Note: The Cover page color as mentioned above has CMYK Values are C: 00 M:20 Y:75 K:00 & Hex is: FFCC00

Project Report Structure

The following structure should be followed while preparing the final project report.

1. Title Page
2. Certificate of Completion (internal/External)
3. Acknowledgement
4. Table of contents / index with page numbering
5. List of tables
6. List of figures
7. Introduction / objectives of the project
8. System analysis
9. Feasibility study
10. Software and hardware requirement specifications
11. System design (DFD, ER Diagram, Class diagram etc.)
12. Database Schema
13. Project code
14. Screenshot of the project
15. Implementation/deployment details
16. Testing (testing techniques and testing strategies used along with the test data and the errors listed for each test case).
17. Conclusion
18. Future scope and further enhancement of the project
19. Bibliography/ references

20. Appendices (if required)

Note: Reports, tables figures should be properly numbered/labelled. Two hard copies of the project report should be submitted. The soft copy of the project report in PDF should also be submitted along with the hard copy.

CAP7138: MACHINE LEARNING LAB [0 0 2 1]

Introduction to Python and Jupyter Notebook environment. Loading datasets using pandas and NumPy. Data preprocessing techniques: handling missing values, normalization, label encoding. Implementing Linear Regression and evaluating performance using Mean Squared Error. Logistic Regression for binary classification problems. K-Nearest Neighbors (KNN) classifier and hyperparameter tuning. Decision Tree and Random Forest classifiers. Naive Bayes classification on text data. Clustering using K-Means algorithm. SVM (support Vector Machine). Principal Component Analysis (PCA) for dimensionality reduction. Model evaluation using confusion matrix, accuracy, precision, recall, and F1-score. Cross-validation and performance comparison. Introduction to simple neural networks using Scikit-learn or TensorFlow/Keras (optional). Case studies using real-world datasets (e.g., Iris, Titanic, MNIST). Mini project on building and evaluating an end-to-end ML pipeline.

References:

1. Andreas C. Müller & Sarah Guido, Introduction to Machine Learning with Python: A Guide for Data Scientists, O'Reilly Media, 2016.
2. Aurélien Géron, Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, 2nd Edition, O'Reilly Media, 2019.
3. V.K. Jain, Machine Learning: Algorithms, Practical Applications and Case Studies, Khanna Publishing, 2019.
4. Rajaraman V. & Tamal Dey, Introduction to Machine Learning, PHI Learning, 2021.

CAP7133: ANDROID APPLICATION DEVELOPMENT LAB [0 0 2 1]

Basic Concept of Mobile Operating Systems, setting up development environment, Dalvik Virtual Machine & .apk file extension, AndroidManifest.xml, Resources & R.java, Activities and Activity lifecycle, Launching emulator, Hello World App, switching between activities, Form widgets, Text Fields, Layouts, Option menu, Context menu, Explicit Intents, Implicit intents, Time and Date, Images, Media, ListView, ListActivity, Custom listview, Threads handling, SQLite Programming, SQLiteOpenHelper, SQLiteDatabase, XML Parsing, JSON Parsing, Using Orientation and Accelerometer sensors, Monitoring and managing Internet connectivity, Taking pictures, Media Recorder.

References:

1. John Horton, "Android Programming for Beginner", Packt Publishing, (2e), 2018.
2. Dawn Griffiths, David Griffiths, "Head First Android Development: A Brain-Friendly", O'Reilly Media, (2e), 2017.
3. Pradeep kothari, "Android Application Development (With Kitkat Support), Black Book", WILEY, (1e) (May 20, 2014).

CAP7152: DATA MINING TECHNIQUES [3 0 0 3]

Introduction: Databases, Data Warehouses, Transactional databases, advanced database system and its applications, Data mining Functionalities: Class description, Association Analysis classification & Prediction, Cluster Analysis, Outlier Analysis, Evolution Analysis, Classification of Data Mining Systems, Major Issues in Data Mining. Data Warehouse and OLAP Technology for Data Mining: Differences between Operational Database Systems and Data Warehouses, a multidimensional Data Model, Data Warehouse Architecture, Data Warehouse Architecture, Data Warehouse Implementation, Data Cube Technology. Data Pre-processing: Data Cleaning, Data Integration and Transformation, Data Reduction, Discretization and Concept Hierarchy Generation. Data Mining Primitives, Languages, and System Architectures, Concept Description: Characterization and Comparison, Analytical Characterization. Mining Association Rules in Large Databases: Association Rule Mining, Market Basket Analysis, Basic Concepts, Mining Single-Dimensional Boolean Association Rules from Transactional Databases: the Apriori algorithm, Generating Association rules from frequent items, Multidimensional Association Rules, Constraint-Based Association Mining. Classification & Prediction and Cluster Analysis: Issues regarding classification & prediction, Different Classification Methods, Prediction, Cluster Analysis.

References:

1. Kamber and Han, "Data Mining Concepts and Techniques", Hartcourt India P. Ltd.,2001.
2. Paul Raj Poonia, "Fundamentals of Data Warehousing", John Wiley & Sons, 2003.
3. Efrem O, Mallach, "Decision Support and Data Warehousing Systems", Mcgraw-Hill International Edition, 2000.
4. W.H. Inmon "Building the Datawarehouse, (3e), Wiley India, 2016.
5. Anahory, "Data Warehousing in Real World", (2e), Pearson Education, 2017.

CAP7153: CLOUD COMPUTING & INFRASTRUCTURE SERVICES [3 0 0 3]

Introduction to Clouds and Cloud Computing: Basic Concepts, Cloud Classifications, and Types of Services, deployment models; Classic Data Center (CDC): DBMS concepts, CDC drawbacks and need of Cloud Resources, CDC Management and case studies; Virtualized Data Center (VDC): Compute and Storage, Compute virtualization overview, Compute virtualization techniques, Virtual Machines, VM Resource management techniques.

Physical to virtual conversion, Hypervisor Management Software, Virtual Infrastructure Requirements; Storage: Storage virtualization overview, Virtual Machine Storage, Block level and File level virtualization, Virtual provisioning and automated storage tiering; Networking: VDC networking overview, VDC networking components , VLAN and VSAN technologies, Network traffic management Desktop and Application: Desktop virtualization , Application virtualization, Business Continuity in VDC, Fault tolerance mechanism in VDC, Backup in VDC, Replication and migration in VDC, Cloud Security: Security basics, Cloud security concerns and threats, Cloud security mechanisms, Access control and identity management in Cloud.

References:

1. Miller M, Cloud Computing, (8e), Que Publishers 2008.
2. Buyya R K, Cloud Computing: Principles and Paradigms, Wiley Press, (1e), 2011.
3. K Saurabh, Cloud Computing, (2e), Wiley India, 2017

4. V Joysula, M Orr, G Page, Cloud Computing: Automating the Virtualized Data Center: Cisco Press, (1e), 2012.
5. Mei- Ling Liu, "Distributed Computing: Principles and Application", Pearson Education, Inc. New Delhi, (1e), 2004.

CAP7154: ADVANCED COMPUTER NETWORKS [3 0 0 3]

Overview of Third Generation (3G) in wireless Universal Mobile Telecommunication Service (UMTS), UMTS Service and Air interface, 3GPP network architecture, CDMA2000, TD- CDMA and TDSCDMA Technologies. Evolution of 2.5G: Enhancement over 2G, GPRS and EDGE network services and architectures, traffic dimensioning, CDMA2000 (1XRTT), WAP and SMS, migration path from 2G to 2.5G to 3G, UMTS, UMTS basics, WCDMA interface, UTRAN architecture, high speed packet data handover and UMTS core network evolution. Introduction to 4G and 5G technology. MAC Protocols for high speed and wireless networks -IEEE 802.3 standards for fast Ethernet, gigabit Ethernet, 10G, and 100VG-AnyLAN, IEEE 802.11, 802.15, and 802.16 standards for Wireless PAN, LAN, and MAN. IPv6: IPv4 versus IPv6, basic protocol, Header-extensions and options, support for QoS, security, etc., neighbour discovery, auto-configuration, DHCPv6, IPv6 Routers and Routing. Mobility in networks - Mobility Management: Cellular architecture, Mobility: handoff, types of handoffs; location management, HLR-VLR scheme, Mobile IP and IPv6. Network security at various layers. Security related issues in mobility. Secure-HTTP, SSL, Message digests, Key distribution protocols. Digital signatures and digital certificates.

References:

1. Computer Networking: A Top-Down Approach Featuring the Internet, James F. Kurose, Keith W. Ross, Fifth Edition, Pearson Education, 2012.
2. Essentials of UMTS (The Cambridge Wireless Essentials Series), Christopher Cox, 1st edition, 2008
3. High-Speed Networks and Internets: Performance and Quality of Service, William Stallings, 2nd edition, 2001
4. Wireless Communications and Networks, William Stallings, 2nd Edition, 2005

Program Electives - III

CAP7155: ADVANCES IN MACHINE LEARNING [3 0 0 3]

Introduction of Machine Learning, types of data, tools for machine learning, types of machines learning techniques- Classification and Regression Techniques. Neural Network: Neural network: Perceptron, multilayer network, backpropagation, RBF Neural Network, Applications. Introduction to Deep Learning, Convolutional Neural Networks (CNN), Vanishing and Exploding Gradients in Deep Neural Networks. ResNet. Introduction to RNN: Recurrent Neuron and RNN Unfolding, Types Of RNN, Recurrent Neural Network Architecture, Backpropagation Through Time (BPTT) Advantages and Disadvantages of Recurrent Neural Network

References:

1. Burkov, Andriy. The hundred-page machine learning book. Vol. 1. Quebec City, QC, Canada: Andriy Burkov, 2019.

2. Burkoy, Andriy. Machine learning engineering. Vol. 1. True Positive Incorporated, 2020.
3. Bonaccorso, Giuseppe. Machine learning algorithms. Packt Publishing Ltd, 2017.

CAP7156: BLOCKCHAIN TECHNOLOGIES [3 0 0 3]

Introduction - basic ideas behind blockchain, how it is changing the landscape of digitalization, introduction to cryptographic concepts required; Hashing, public key cryptosystems, private vs public blockchain and use cases, Hash Puzzles, Introduction to Bitcoin Blockchain; Bitcoin Blockchain and scripts, Use cases of Bitcoin Blockchain scripting language in micropayment, escrow etc, Downside of Bitcoin - mining; Alternative coins - Ethereum and Smart contracts; Alternative coins - Ethereum continued, IOTA; The real need for mining - consensus - Byzantine Generals Problem, and Consensus as a distributed coordination problem - Coming to private or permissioned blockchains - Introduction to Hyperledger; Permissioned Blockchain and use cases - Hyperledger, Corda; Uses of Blockchain in E-Governance, Land Registration, Medical Information Systems, and others.

References:

1. Kumar Saurabh, Ashutosh Saxena, Blockchain Technology: Concepts and Applications, Wiley, 2020.
2. Daniel Drescher, Blockchain Basics, A Non-Technical introduction in 25 steps, Apress, 2017.

CAP7157: DATA SCIENCE [3 0 0 3]

Data Science Introduction: Introduction to data, types of data (quantitative and qualitative). Level of data: Nominal, Ordinal, Scale, Interval. Introduction data science, data science process, role of data scientist, different tools for data science (R, Python, Excel, Tableau, Power BI). Handling Missing Data, Decoding of Data. Treatment of Outliers. Data visualization: scatter plot, line plot, Box plot, bar plot, stem and leaf plot. Data Distribution: Normal, Binomial, Poisson. Measures of central tendencies, measures of variations. Data correlation, data classifications and prediction, regression analysis, Decision Tree, Naïve Bayes, Boosting and Bagging, Support Vector Machine, Introduction to deep learning, RNN, CNN, ANN.

References:

1. Andrew Wolf, Machine Learning Simplified: A Gentle Introduction to Supervised Learning, themlsbook.com, 2022.
2. Peter Bruce and Andrew Bruce, Practical Statistics for Data Scientists, Publisher(s): O'Reilly Media, Inc., 2017.

FOURTH SEMESTER

CAP7270: MAJOR PROJECT [0 0 0 16]

Introduction: Each student shall carry out an industry level project in this semester. The project will be carried out under the supervision of a teacher of the department. When the

project is carried out in an external organization (academic institution/ industry), a supervisor will also be appointed from the external organization.

Course Outcome

- ✚ CAP7270.1 To demonstrate in-depth knowledge and application of development technology.
- ✚ CAP7270.2 Understand about project organization and project management.
- ✚ CAP7270.3 To complete an independent project using software development life cycle.
- ✚ CAP7270.4 To acquire the skills to communicate effectively and to present ideas clearly and coherently to specific audience in both written and oral forms.
- ✚ CAP7270.5 To reflect learning and take appropriate actions to improve entrepreneurship skills.

Project Guidelines

- ✚ Each student should submit a unique project title unless/otherwise in a team project.
- ✚ Project work should include software development.
- ✚ Only two students can work on one project as a team. However, their contribution should be clearly specified and reported.
- ✚ The project should focus on solving some real-life problems, though it is not mandatory. However, the project idea should be creative, and it can be a fresh take on an old idea which is often worth as much as a brand-new idea.
- ✚ The project work may be done internally in the university campus or in any external organizations/institutes approved by the head of the department/university authority.
- ✚ Prior to starting project work, a student must get his/her project idea/problem statement approved by the supervisor.
- ✚ The student must submit a project synopsis, presenting his idea. The student may start working on project only if the synopsis is approved.
- ✚ The student should present the progress of the project works as per the timeline specified by the department /project coordinator/ supervisor.

Project Synopsis Format

The project synopsis must be prepared and approved with the supervisor's input. The synopsis should include a detailed description of the proposed project and objectives. The synopsis should be prepared as per the following format.

- ✚ Title of the project
- ✚ Name of the supervisor/project guide
- ✚ Project Introduction
- ✚ Objectives of the project
- ✚ DFD, ER Diagrams
- ✚ Project Timeline
- ✚ Tools / platform, hardware and software requirement specifications
- ✚ References

Project Report Format

The final project report should describe the detailed work completed by the student. The report must be prepared as per the following format.

General Guidelines

- ✚ Project Report to be minimum 35 pages. Reports less than 35 pages will be rejected.
- ✚ Project report to be maximum 50 - 60 pages (preferred but not mandatory).
- ✚ Paper Size: A4; Left = Right = Top = Bottom Margins = 0.7".
- ✚ Number of hard bound copies - Two (2)
- ✚ Page Numbering Position: Bottom with right justified and continuous numbering from the Introduction Chapter.
- ✚ Use Times New Roman Font with Normal Style, paragraph justified and 1.15 line spacing.
- ✚ Paragraph Heading: Times New Roman Font, Bold, Font Size 14; Paragraph Matter: Times New Roman Font, Normal, Font Size 12.
- ✚ Sub-paragraphs be appropriately numbered as in 1.1, 1.2, 1.3 etc; Sub-paragraph Heading: Times New Roman Font, Italics, Font Size 12; Sub-paragraph Matter: Times New Roman Font, Normal, Font Size 12.
- ✚ Figure captions below Figure with chapter wise numbering.
- ✚ Tables captions above Table with chapter wise numbering.
- ✚ All references must be listed in the order in which they appear in the report (follow IEEE format for referencing).
- ✚ Only hard bound reports will be accepted, colour of the front cover to be in mustard yellow (refer format).
- ✚ Note: The Cover page color as mentioned above has CMYK Values are C:00 M:20 Y:75 K:00 & Hex is: FFCC00

Project Report Structure

The following structure should be followed, to whatever extent possible, while preparing the final project report.

- ✚ Title Page
- ✚ Certificate of Completion (Internal/External)
- ✚ Abstract
- ✚ Acknowledgement
- ✚ List of tables
- ✚ List of figures
- ✚ Table of contents (with page numbering)
- ✚ Introduction
 - Company Profile
 - Existing System and Need for System
 - Scope of Work
 - Operating Environment - Hardware and Software
- ✚ System Analysis and Design
 - Feasibility study
 - Software and hardware requirement specifications
 - Data Flow Diagram (DFD)
 - Functional Decomposition Diagram (FDD)
 - Entity Relationship Diagram (ERD)

- Data Dictionary
- Table Design
- Code Design
- Menu Tree
- Menu Screens
- Input Screens
- Test Procedures and Implementation
- ✚ Project code
- ✚ Screenshots of the project
- ✚ Implementation/deployment details
- ✚ Conclusion
- ✚ Future scope of the project
- ✚ Drawbacks and Limitations
- ✚ Bibliography/ References
- ✚ Annexures (if required)

Note: Reports, tables figures should be properly numbered/labelled. Two hard copies of the project report should be submitted. The soft copy of the project report in PDF should also be submitted along with the hard copy.