

Prof. Rajendra Singh (Rajju Bhaiya) University

Curriculum Structure & Syllabus

Master of Computer Application (MCA)

[Two years Degree Course in Computer Application]



(2024-2025 Onwards)

Mirzapur Road, Naini, Prayagraj- 211010

www.prsuniv.ac.in

MCA - Semester wise Course Structure with Credit Distribution

MCA Semester - I

Course Code	Courses/ Papers	Course Title	Theory/ Practical	Credits			Total Credit	CIE	ETE
				L	T	P			
B230701T	Core	Digital Logic and Computer Architecture	T	3	1	-	4	25	75
B230702T	Core	Computer Programming in C & Lab	T	3	-	1	4	25	75
B230703T	Core	Research Methodology	T	3	1	-	4	25	75
B230704T	Core	Data Structures & Algorithm & Lab	T	3	-	1	4	25	75
B230705T	Elective (Select Anyone)	Web Technology	T	3	1	-	4	25	75
B230706T		Mathematical Foundations of Computer							

MCA Semester - II

Course Code	Courses/ Papers	Course Title	Theory/ Practical	Credits			Total Credit	CIE	ETE
				L	T	P			
B230801T	Core	Data Communication and Computer Network	T	3	1	-	4	25	75
B230802T	Core	Object Oriented Programming using Python & Lab	T	3	-	1	4	25	75
B230803T	Elective (Select Anyone)	Principles of Cryptography and Cyber Security	T	3	1	-	4	25	75
B230804T		Software Engineering							
B230805T	Elective (Select Anyone)	Operating System	T	3	-	1	4	25	75
B230806T		Computer Graphics & Lab							
B230807R	Core	Industrial Training	R	-	-	4	4	-	100

MCA Semester - III

Course Code	Courses/ Papers	Course Title	Theory/ Practical	Credits			Total Credit	CIE	ETE
				L	T	P			
B230901T		Artificial Intelligence	T	3	1	-	4	25	75
B230902T		Database Management System & Lab	T	3	-	1	4	25	75
B230903T	Elective (Select Anyone)	Machine Learning & Lab	T	3	-	1	4	25	75
B230904T		Big Data Analytics & Lab							
B230905T	Elective (Select Anyone)	Distributed Systems	T	3	1	-	4	25	75
B230906T		Cloud computing							
B230907T	Elective (Select Anyone)	Mobile computing	T	3	1	-	4	25	75
B230908T		Soft Computing							

MCA Semester- IV

Course Code	Courses/ Papers	Course Title	Theory/ Practical	Credits			Total Credit	CIE	ETE
				L	T	P			
B231001R	MRP	Master Dissertation	R	-	-	20	20	-	100

MCA - Semester wise Course Structure (Credit & Grading System)

DETAILED SYLLABUS

SEMESTER - I

Sem- I	Code : B230701T	Digital Logic and Computer Architecture
---------------	------------------------	------------------------------------------------

Unit	Course Contents
I	Introduction to Digital Computer, Data Representation, Integer Representation, Boolean Algebra, Simplification of Boolean Expressions, Logic Gates, TTL circuits, Combinational Circuit, Design Procedures, Some commonly used combinational circuits, Binary Adder, Binary Subtractor 2's complement Adder Subtractor, designing with Multiplexers.
II	Sequential Circuits, Flip-Flop, RS-FF, JK FF, Master Slave JK FF, D-FF, T-FF, Buffer Register, Shift Register, Ripple counter, Synchronous counter, Controlled Counter, Ring counter.
III	Memory Device Characteristics, 2D & 3D Memories, Memory Hierarchy, Semiconductor Memories: RAM, ROM, DRAM, Flash Memory; High Speed Memories: Cache Memory, Associative Memory, Memory Interleaving.
IV	Input/Output Interface, I/O Bus and Interface modules, Data transfer modes (Programmed mode, Interrupt initiated I/O, DMA), Interrupt structure, Input-Output Processor (IOP), CPU-IOP Communication, Introduction to advanced computer Architectures, RISC vs CISC Architectures, Types of Parallel processors, Flynn's classification of computer systems, Pipelining, Arithmetic and instruction pipelining, Multiprocessor organizations (Loosely coupled vs Tightly coupled).
Referential Books:	<ol style="list-style-type: none">1. MANO, M., "Digital Logic and Computer Design"2. Malvino A.P., "Digital Computer Electronics"3. Bhujade M.R., "Digital Computer Design Principles"4. Raja Raman V. and Radha Krishnan T., "An introduction to digital computer design"5. MANO, M., "Computer System Architecture"6. Stallings, W., "Computer Organization & Architecture"7. B. Ram, "Computer System Organization & Architecture"

Sem- I	Code : B230702T	Computer Programming in C
---------------	------------------------	----------------------------------

Unit	Course Contents
I	History, Introduction to C, Structure of C programs, Compilation & execution of C programs, Data types & sizes, Declaration of variables, Modifiers, Identifiers, Identifiers & keywords, Symbolic, C Pre-processor, Unary operators, Arithmetic & Logical operators, Bit-wise operators, Assignment operators, and expressions, Conditional expression, Precedence & order of evaluation.
II	If-else, Switch, Break, Continue, Comma operator, Go-to statement, For, While, Do-while, Linear arrays, Multi-dimensional arrays, Passing arrays to functions, Arrays & Strings
III	Built-in & User-defined Function declaration, Definition & function call, Parameter passing: Call by value, Call by reference, Recursive function, Multi-file programs, Command line parameters, macros
IV	Structures & Union, Self-referential structure, Pointers, Pointer to pointer, Dynamic memory allocation, Calloc & Malloc functions, Array of pointers, Function of pointers, Structures and pointers, Linked list: Single, Double, File Handling in C: Opening, Closing and creating a data file, Read and Writing functions, Unformatted data files.
Referential Books:	<ol style="list-style-type: none"> 1. Programming in C, Schaum series, TMH - Gottfried 2. Let us C, BPB - Yashwant Kanitkar. 3. Computer Science A Structured Programming Approach using C – Forouzan. 4. Programming in C - Ashok N. Kamthene, Pearson Education, 2nd edition. 5. Programming in ANSI C - E.Balaguruswamy, McGrawhill
<p>E – resources :-</p> <ul style="list-style-type: none"> • https://ocw.mit.edu/courses/6-087-practical-programming-in-c-january-iap-2010/pages/lecture-notes/ • https://ocw.mit.edu/courses/6-087-practical-programming-in-c-january-iap-2010/pages/assignments/ • https://learn-c.org/ • https://en.wikibooks.org/wiki/C_Programming • https://ocw.mit.edu/courses/6-088-introduction-to-c-memory-management-and-c-object-oriented-programming-january-iap-2010/pages/lecture-notes/ • https://ocw.mit.edu/courses/6-088-introduction-to-c-memory-management-and-c-object-oriented-programming-january-iap-2010/pages/assignments/ • https://ocw.mit.edu/courses/6-s096-effective-programming-in-c-and-c-january-iap-2014/pages/lecture-notes/ <p>Video Lectures :-</p> <ul style="list-style-type: none"> • https://www.youtube.com/watch?v=ix5jPkxsr7M • https://www.youtube.com/playlist?list=PLEAYkSg4uSQ2k6GwNhpGSHodGT8wfvvgwu • https://www.youtube.com/playlist?list=PLJ5C_6qdAvBFzL9su5J-FX8x80BMhkPy1 • https://www.youtube.com/playlist?list=PLyqSpQzTE6M8O9Oy9t-yhiAUXOi-rmTp 	

Sem- I	B230703T	Research Methodology
---------------	-----------------	-----------------------------

Unit	Course Contents
I	Research Methodology : Introduction, Objectives of Research, Types of Research, Research Approaches, Research Process, Defining the Research Problem, Literature Survey, Hypothesis Testing.
II	Methods of Data Collection, Data Analysis and Statistical Techniques, Sampling Theory : Introduction, Basic Principles, Sampling Plan, Sample Design, Sampling Techniques, Questionnaire Designing.
III	Examining Relationships and Trends using Statistics, Selecting an Appropriate Statistical Technique, Analysis of Data, Use of SPSS and other Statistical Software Packages, Advanced Techniques for Data Analysis, ANOVA, Factor Analysis, Scaling Techniques, Probable Errors, Testing of Hypothesis (Z- Test, T-Test, etc.)
IV	Research Report Writing, Significance, Steps in Research Report Writing, Layout of Research Report, Types of Research Report, Mechanics of writing a Research Report, Presentations.
Referential Books:	<ol style="list-style-type: none"> 1. Kothari, C.R, "Research Methodology : Methods & Techniques", New Age International Publishers, New Delhi. 2. Gupta S.P, " Statistical Methods", Sultan Chand & Sons.

Sem- I	B230704T	Data Structures & Algorithm
---------------	-----------------	----------------------------------------

Unit	Course Contents
I	Data structures Abstract definition of data structures , Array implementation and addressing, Array applications and representation, Sparse matrices, Singly linked lists, circular list, doubly linked lists, orthogonal lists, generalized (recursive) lists, applications, array and linked representation of stacks and queue, Prefix/ infix / postfix expressions and their inter-conversion, Priority queues and simulation, Recursion
II	Trees and Graphs : Definition, terminologies and properties , Binary tree representation traversals and applications, Threaded binary trees, Binary Search trees ,AVL Trees, Definition ,terminologies and properties, Graph representations, Minimum spanning trees , Depth-first search , Breadth-first search , Networks
III	Asymptotic Notation, Time requirements and Complexity of algorithms, Space requirements of algorithms, Recurrence, Sorting and order Statistics - Shell sort, Quick sort, Merge sort, Heap sort, Comparison of sorting algorithms, Sorting in linear time: Count Sort.
IV	Divide and Conquer: Matrix Multiplication, Convex hull. Greedy methods: Assignment Problem, Knapsack (Fractional), Minimum Spanning trees – Prim’s and Kruskal’s algorithms, Single source shortest paths - Dijkstra’s and Bellman Ford algorithms.
V	Unit 5: Dynamic programming: Knapsack (0/1) problem, multi-stage graphmatrix-chain multiplication, All pair shortest paths – Warshal’s and Floyd’s algorithms, Resource allocation problem, Traveling salesperson, Longest Common Subsequence. Backtracking & Branch and Bound : Travelling Salesman Problem, Graph Coloring, n-Queen Problem, Hamiltonian Cycles and Sum of subsets.
Referential Books:	<ol style="list-style-type: none"> 1. Data Structures through C- A. Tennenbaum 2. The Design and Analysis of Computer Algorithms – Aho, Hopcraft and Ullaman 3. The art of Computer Programming – Donald Knuth 4. Data Structures- Horowitz and Sahni

Sem- I	B230705T	Web Technology
---------------	-----------------	-----------------------

Unit	Course Contents
I	<p>Web Page Designing: Introduction and Web Development Strategies, History of Web and Internet, Protocols Governing Web, HTML-Introduction, HTML Tags, HTML-Grouping Using Div & Span, HTML-Lists, HTML-Images, HTMLHyperlink, HTML-Table, HTML-Iframe, HTML-Form, Introduction of CSS, CSS Syntax, External Style Sheet using < link >, Multiple Style Sheets, Value Lengths and Percentages, CSS-Selectors, CSS-Box Model, Floats, Clear, Introduction to Bootstrap.</p> <p>Scripting: Introduction to JavaScript, Creating Variables in JavaScript, Creating Functions in JavaScript, UI Events, Returning Data from Functions, Working with Conditions, looping in JavaScript, Block Scope Variables, Working with Objects, Creating Object using Object Literals, Manipulating DOM Elements with JavaScript</p>
II	<p>Web Application development using JSP & Servlets: Servlet Overview and Architecture, Interface Servlet and the Servlet Life Cycle, Handling HTTP get Requests, Handling HTTP post Requests, Redirecting Requests to Other Resources, Session Tracking, Cookies, Session Tracking with Http Session. Java Server Pages (JSP): Introduction, Java Server Pages Overview, A First Java Server Page Example, Implicit Objects, Scripting, Standard Actions, Directives, Custom Tag Libraries.</p>
III	<p>Spring: Spring Core Basics-Spring Dependency Injection concepts, Introduction to Design patterns, Factory Design Pattern, Strategy Design pattern, Spring Inversion of Control, AOP, Bean Scopes- Singleton, Prototype, Request, Session, Application, WebSocket, Auto wiring, Annotations, Life Cycle Call backs, Bean Configuration styles</p>
IV	<p>Spring Boot: Spring Boot- Spring Boot Configuration, Spring Boot Annotations, Spring Boot Actuator, Spring Boot Build Systems, Spring Boot Code Structure, Spring Boot Runners, Logger, BUILDING RESTFUL WEB SERVICES, Rest Controller, Request Mapping, Request Body, Path Variable, Request Parameter, GET, POST, PUT, DELETE APIs, Build Web Applications</p>
Referential Books:	<ol style="list-style-type: none"> 1. Burdman, Jessica, "Collaborative Web Development" Addison Wesley 2. Xavier, C, "Web Technology and Design" , New Age International 3. Ivan Bayross," HTML, DHTML, Java Script, Perl & CGI", BPB Publication 4. Bhave, "Programming with Java", Pearson Education 6. Hans Bergsten, "Java Server Pages", SPD O'Reilly 7. Naughton, Schildt, "The Complete Reference JAVA2", TMH 8. Craig Walls, "Spring Boot in Action"
<p>E – resources :-</p> <ul style="list-style-type: none"> • https://en.wikibooks.org/wiki/Introduction_to_Information_Technology/Web_Technologies • https://en.wikibooks.org/wiki/Category:Shelf:Information_technology • https://ocw.mit.edu/courses/6-170-software-studio-spring-2013/pages/lecture-notes/ • https://onlinecourses.swayam2.ac.in/nou20_cs05/preview • https://developer.mozilla.org/en-US/docs/Web • https://www.w3schools.in/html/tutorials/ • https://www.w3schools.in/jsp/intro • https://www.theodinproject.com/ • https://www.khanacademy.org/computing/computer-programming 	

Sem- I	B230706T	Mathematical Foundations of Computer
---------------	-----------------	---------------------------------------------

Unit	Course Contents
I	<p>Set Theory and Probability Sets and Subsets, Set Operations and the Laws of Set Theory, Counting and Venn Diagrams. Set theory approach to basic probability- Addition and Multiplication theorems-problems (SLE: results associated with mutually exclusive and independent events)</p>
II	<p>Relations , functions and Recurrence relations Binary relations, Matrix and Digraph representation of a relation, Operations on binary relations, Properties of relations, Equivalence relations. First order linear recurrence relation. The second order linear homogeneous recurrence relation with constant coefficients. Types of functions, composition of functions, Inverse of a function. (SLE:Counting functions).</p>
III	<p>Linear algebra & Probability and Statistics Elementary transformations of a matrix. Rank of a matrix by elementary row transformations, Consistency of a system of linear non homogeneous algebraic equations. Eigen values and Eigen vectors of a square matrix, Diagonalisation of a square matrix of order 2 (SLE: Gauss elimination method, Gauss Jordan method). Random variables – Discrete random variables, Binomial and Poisson Distributions. Measures of central tendency- mean, median for grouped data, Measures of dispersion, Mean deviation and Standard deviation. Simple application problems (SLE: Mode).</p>
IV	<p>Formal Logic Basics of propositional logic with truth table, logical equivalence, laws of logic, min term, max term, Normal forms-Principal disjunctive and Principal Conjunctive normal forms. (SLE: Logical equivalence using Laws of logic). Graph Theory Graphs, Subgraphs, Isomorphic graphs, Walk, Path, Cycle and Circuits in a graph. Connected graphs. Euler’s and Hamiltonian graphs. The Konigsberg Bridge problem. Trees, Minimal Spanning Tree, Kruskal’s algorithm</p>
Referential Books:	<ol style="list-style-type: none"> 1. Discrete Mathematics and its Applications, Kenneth H. Rosen, 7th Edition, Tata McGraw Hill Publications, 2003. 2. Discrete Mathematics with Graph Theory, Edgar G Goodaire, and Michael M Paramenter, 3rd Edition, Pearson Education, 2002. 3. Discrete Mathematics, Semyour Lipschutz, Marc Lipson, 3nd Edition, Tata McGraw-Hill, 2006. 4. Discrete Mathematical Structures: Bernad Kolman, Robert C Busby, 6th Edition, Pearson Education, 2000. 5. Graph Theory with Applications to Engineering and Computer Science – Narsingh Deo, Prentice – Hall of India Pvt Ltd New Delhi, 1999

SEMESTER - II

Sem- II	B230801T	Data Communication and Computer Network
----------------	-----------------	------------------------------------------------

Unit	Course Contents
I	Introduction Concepts: Goals and Applications of Networks, Network structure and architecture, The OSI reference model, services, Network Topology Design – Delay Analysis, Back Bone Design, Local Access Network Design, Physical Layer: Transmission Media, Switching methods.
II	Medium Access sub layer: Medium Access sub layer - Channel Allocations, LAN protocols - ALOHA protocols - Overview of IEEE standards - FDDI. Data Link Layer - Elementary Data Link Protocols, Sliding Window protocols, Error Handling.
III	Network Layer: Network Layer - Point - to Pont Networks, routing, Congestion control, Internetworking -TCP / IP, IP packet, IP address, IPv6.
IV	Transport Layer: Transport Layer - Design issues, connection management, UDP and TCP, ATM, Session Layer-Design issues, remote procedure call. Presentation Layer-Design issues, Data compression techniques, Cryptography - TCP - Window Management.
V	Application Layer: Application Layer: File Transfer, Access and Management, Electronicmail, Virtual Terminals, Other applications. Example Networks - Internet and Public Networks.
Referential Books:	<ol style="list-style-type: none"> 1. Computer Networks :Tanenbaum, A.S 2. Data and Computer communication :Stallings, William 3. Inter Networking With TCP/IP Vol I, II,III: Comer, D.E. and Stevens D.L. 4. Computer Network and Distributed Data Processing :Martin.J. 5. Local Networks : Stalling, William 6. Data Communication and Networking :Forouzan, B.A

Sem- II	B230802T	Object Oriented Programming using Python
----------------	-----------------	-------------------------------------------------

Unit	Course Contents
I	Object oriented programming paradigm - Basic concepts of object oriented programming, Benefits of OOP: Object-oriented features, Applications of OOP. Algorithms and programming. A simple Python program, Structure of python program, assignment statements, data types in python, Control Flow in python, variables, operators in python, control flow - conditionals, loops.
II	Introduction to Python Data structures - Types, expressions, strings, lists, tuples, Python memory model: names, mutable and immutable values, List operations: slices, Binary search, Inductive function definitions, Elementary inductive sorting: selection and insertion sort, In-place sorting. List- (Slicing, Indexing, Concatenation, other operations on Sequence data type), concept of mutability, Examples to include finding the maximum, minimum, mean; linear search on list/tuple of numbers.
III	Class, objects and user defined Data type: Abstract Data type, class, objects, classes and objects in python, abstract class, Features of OOPs in python (abstraction, encapsulation, inheritance and polymorphism), Scope in Python: local, global, nonlocal names. Multithreading: Is it supported by python?
IV	Dictionaries, Python functions: Dictionary basics and counting the frequency of elements in a list using a dictionary. Functions, optional arguments, default values, passing functions as arguments, higher order functions on lists: map, lambda, and list comprehension, basic input/output Handlingfiles String processing. Regular Expressions: Introduction, Special Symbols and Characters, Res and Python.
V	NumPy and Pandas basics Introduction to NumPy ,ndarray, datatypes, array attributes, array creation routines, Array From Existing Data, Array From Numerical Ranges, Indexing & Slicing. Pandas for ML: Pandas Data Structures: Series, DataFrame, Panel Creating Series and Data Frames: Creating Series from ndarray, Creating Series from Dictionary, Creating Series from scalar, Creating Data Frame from List, Manipulating Data Frames in Pandas: Renaming Columns in a data frame, Deleting rows and columns in a data frame, Deleting columns from Data Frame. Dealing with Missing Values: Finding missing values, Replacing missing values, Drop missing values.
Referential Books:	<ol style="list-style-type: none"> 1. Gowrishankar S, Veena A, "Introduction to Python Programming", 1st Edition, CRC Press/Taylor & Francis, 2018. 2. Jake VanderPlas, "Python Data Science Handbook: Essential Tools for Working with Data", 1st Edition, O'Reilly Media, 2016. 3. Aurelien Geron, "Hands-On Machine Learning with Scikit-Learn and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems", 2nd Edition, O'Reilly Media, 2019.

Sem- II	B230803T	Principles of Cryptography and Cyber Security
----------------	-----------------	------------------------------------------------------

Unit	Course Contents
I	Introduction to information systems, Types of information Systems, Development of Information Systems, Introduction to information security, Need for Information security, Threats to Information Systems, Information Assurance, Cyber Security, and Security Risk Analysis. Introduction to Cryptography, Symmetric key Cryptography, Asymmetric key Cryptography, Message Authentication, Principles Public key crypto Systems, Diffie Hellman, Key Exchange, the RSA algorithm, Key Management, Symmetric Cipher Modes, Substitute Techniques, Transposition Techniques. Block Cipher And Data Encryption Standards: Block Cipher Principles, Data Encryption Standards, the Strength of DES, Differential and Linear Crypt Analysis, Block Cipher Design Principles.
II	Application security (Database, E-mail and Internet), Data Security Considerations-Backups, Archival Storage and Disposal of Data, Security Technology-Firewall and VPNs, Intrusion Detection, Access Control. Security Threats - Viruses, Worms, Trojan Horse, Bombs, Trapdoors, Spoofs, E-mail viruses, Macro viruses, Malicious Software, Network and Denial of Services Attack, Security Threats to ECommerce- Electronic Payment System, e-Cash, Credit/Debit Cards. Digital Signature, public Key Cryptography.
III	Developing Secure Information Systems, Application Development Security, Information Security Governance & Risk Management, Security Architecture & Design Security Issues in Hardware, Data Storage & Downloadable Devices, Physical Security of IT Assets, Access Control, CCTV and intrusion Detection Systems, Backup Security Measures.
IV	Security Policies, Why Policies should be developed, WWW policies, Email Security policies, Policy Review Process-Corporate policies-Sample Security Policies, Publishing and Notification Requirement of the Policies. Information Security Standards-ISO, IT Act, Copyright Act, Patent Law, IPR. Cyber Laws in India; IT Act 2000 Provisions, Intellectual Property Law: Copy Right Law, Software License, Semiconductor Law and Patent Law.
Referential Books:	1. Cryptography & Network Security - Brijendra Singh, PHI. 2. Cryptography and Information Security - Pachghare, V.K., PHI.

E – Resources :-

- <https://www.cse.iitb.ac.in/~mp/teach/crypto/s21/>
- <https://cse.iitkgp.ac.in/~abhij/cryptoIntro.pdf>
- <https://www.cse.iitk.ac.in/users/nitin/courses/WS2010-ref1.pdf>
- <https://archive.nptel.ac.in/courses/106/105/106105162/>
- https://cse.iitkgp.ac.in/~debdeep/courses_iitkgp/Crypto/index.htm
- <https://ocw.mit.edu/courses/6-857-network-and-computer-security-spring-2014/pages/lecture-notes-and-readings/>
- <https://ocw.mit.edu/courses/6-875-cryptography-and-cryptanalysis-spring-2005/pages/readings/>
- <https://mitocw.ups.edu.ec/courses/electrical-engineering-and-computer-science/6-876j-advanced-topics-in-cryptography-spring-2003/lecture-notes/>
- https://onlinecourses.nptel.ac.in/noc22_cs90/preview

Video Lectures :-

- <https://youtube.com/playlist?list=PLgMDNELGJ1CbdGLyn7OrVAP-IKg-0q2U2&si=cFEKO2mHhDW8eTGh>
- https://youtube.com/playlist?list=PLJ5C_6qdAvBFauGoLC2wFGruY_E2gYtev&si=5FNb5T6vW-nm-uSU
- <https://youtube.com/playlist?list=PL71FE85723FD414D7&si=2w8Frf-7I16d64Xz>
- <https://youtube.com/playlist?list=PLYqSpQzTE6M-jkJEzbS5oHJUUp2GWPsq6e&si=xRJEXUTFBITWeaX>

Unit	Course Contents
I	Evolution and Scope of Software Engineering: Introduction to Software Engineering: Definitions, Software development and life-cycle models, Introduction to SEI-CMM
II	Software Project Management: Project Planning, Cost and Resource Estimation, Project Scheduling, Project Control, Risk Management
III	Software Requirement Analysis: Principles, Tasks, Techniques, Software prototyping, Requirements specifications - Principles and Representation, Structured analysis
IV	Software Design Process: Fundamental principles, Design Techniques, Structured Design, User Interface Design
V	Software Testing and Debugging: Software verification and validation fundamentals, Testing principles- White box and Black box testing, Static analysis, Symbolic execution, Testing strategies, Debugging.
Referential Books:	1 Software Engineering: Ian Sommerville, Pearson Education 2 Software Engineering: R. S. Pressman, McGraw Hill 3 An Integrated Approach to Software Engineering: Pankaj Jalote
E – Resources:-	
<ul style="list-style-type: none"> • https://en.wikibooks.org/wiki/Software_Engineering • https://en.wikibooks.org/wiki/Introduction_to_Software_Engineering • http://philip.greenspun.com/seia/ • https://ocw.mit.edu/courses/16-355j-software-engineering-concepts-fall-2005/pages/lecture-notes/ <p>Video Lectures :-</p> <ul style="list-style-type: none"> • https://www.youtube.com/playlist?list=PLbRMhDVUMngf8oZR3DpKMvYhZKga90JVt • https://www.youtube.com/playlist?list=PL8751DA481F0F0D17 	

Sem- II	B230805T	Operating System
----------------	-----------------	-------------------------

Unit	Course Contents
I	Overview: Introduction to OS – its functional behavior and responsibilities, Need for some of monitor/command interpreter, Types of operating systems, System structure, Hierarchical and layered organization of OS, Review of I/O and interrupt structure.
II	Process Management: Operating system kernel, Data structures for processes and resources, Context switching, Process control primitives, Process scheduling.
III	Memory Management: Memory management concepts, Relocation, Linking, Multiprogramming with fixed partitions, Swapping, Variable partitions, Overlays, Virtual memory, Segmentation, Paging, Storage allocation strategies, Load control and thrashing.
IV	File and I/O Management: Organization of file and I/O subsystems, Directory management, Basic file system, file descriptors, File manipulation, File organization methods, Management of auxiliary storage space, Command language and file system utilities, I/O subsystems, Programmed I/O, DMA, Interrupt driven I/O, Recovery procedures.
V	Unit 5: Protection and Security: Protection vs. Security, Safeguards, , Protection problems, Formal models of protection.
Referential Books:	1 Introduction to Operating Systems: Deitel 2 Operating System Concepts: Peterson and Silbershatz 3 Modern Operating Systems: Andrew S Tanenbaum

Sem- II	B230806T	Computer Graphics
----------------	-----------------	--------------------------

Unit	Course Contents
I	Introduction to Computer Graphics: Introduction, Graphics display devices, Graphics Input & Output devices, Raster scan graphics, Line and Circle generation techniques, Scan conversion, Frame buffer, Filling algorithms.
II	Geometrical Transformation: Two dimensional transformations, Clipping and windowing methods for 2D images, Three dimensional transformations, Parallel and perspective projections, Viewing transformations and viewing systems.
III	Curves Parametric and non-parametric curves and their representations, Cubic splines, Bezier and Bsplines
IV	Surfaces Parametric surfaces, Surfaces of revolution, Sweep surfaces, Quadric surfaces, Bilinear surfaces, B-spline and Bezier surfaces, Generalized cylinders and cones, Polygon mesh and wire-frames.
V	Realism in 3-D Graphics: Hidden lines and hidden surfaces, Floating horizon algorithm, Roberts algorithm, Phong reflection model, Incremental shading techniques, Gouraud and Phong shading, Rendering process, z-buffer algorithm, Scan line and area coherence methods. Introduction to Ray tracing
Referential Books:	1 Computer Graphics: Principles and Practice: Foley et al. 2 Computer Graphics: Hern and Baker 3 Procedural elements in Computer Graphics: David F. Rogers 4 Computer Graphics: A. Plastock and Gordon Kelley 5 Computer Graphics for IBM PC: J. Mcgregger and Alan Watt 6 Mathematical Elements for Computer Graphics: David F. Rogers and J.A.Adams 7 Three-Dimensional Computer Graphics: Allan Watt
<p>E – resources :-</p> <ul style="list-style-type: none"> • https://legends2k.github.io/2d-transforms-101/ • https://www.glprogramming.com/red/ • https://ocw.mit.edu/courses/6-837-computer-graphics-fall-2012/pages/lecture-notes/ • https://learnopengl.com/ • https://www.cse.iitb.ac.in/~paragc/course/2022-02-cs475/ <p>Video Lectures :-</p> <ul style="list-style-type: none"> • https://www.youtube.com/playlist?list=PLwdnzlV3ogoWaYiowRtJ8t8FeR-ODfSV1 • https://www.youtube.com/playlist?list=PL338D19C40D6D1732 • https://www.youtube.com/playlist?list=PL112A527F83F7A5E4 • https://www.youtube.com/playlist?list=PLZ-hNAJx7IggOITFuzqQR3s8MTAd1IZLR • https://www.youtube.com/playlist?list=PL_w_qWAOZtAZhtzPI5pkAtcUVgmzdAP8g • https://www.youtube.com/playlist?list=PLDFA8FCF0017504DE 	

SEMESTER - III

Sem- III	B230901T	Artificial Intelligence
-----------------	-----------------	--------------------------------

Unit	Course Contents
I	Introduction: Objective, scope and outcome of the course Meaning and definition of artificial intelligence, Physical Symbol System Hypothesis, production systems, Characteristics of production systems; Breadth first search and depth first search techniques. Heuristic search Techniques: Hill Climbing, Iterative deepening DFS, bidirectional search. Analysis of search methods. A* algorithm, and their analysis. Introduction to Genetic Algorithms.
II	Knowledge Representation, Problems in representing knowledge, knowledge representation using propositional and predicate logic, logical consequences, syntax and semantics of an expression, semantic Tableau. Forward and backward reasoning. Proof methods, substitution and unification, conversion to clausal form, normal forms, resolution, refutation, deduction, theorem proving, in refencing, monotonic and non-monotonic reasoning. Introduction to prolog.
III	Network-based representation and reasoning, Semantic networks, Conceptual Graphs, frames. Description logic (DL), concept language, reasoning using DL. Conceptual dependencies (CD), scripts, reasoning using CD. Introduction to natural language processing
IV	Reasoning in uncertain environments, Fuzzy logic, fuzzy composition relation, operations on fuzzy sets. Probabilistic reasoning, Bayes theorem, construction of Bayesian networks, belief propagation. Markov processes and Hidden Markov models
Referential Books:	<ol style="list-style-type: none"> 1. Artificial Intelligence: Elaine Rich, Kevin Knight, Mc-GrawHill. 2. Introduction to AI & Expert System: Dan W.Patterson, PHI. 3. Artificial Intelligence by Luger (Pearson Education) 4. Russel & Norvig, Artificial Intelligence: A Modern Approach, Pearson Education.

Sem- III	B230902T	Database Management System
-----------------	-----------------	-----------------------------------

Unit	Course Contents
I	<p>Introduction:</p> <p>Data, information and knowledge, Characteristics of database approach, Data independence, Architecture of database system, Data dictionary, Types of database language, database system life cycle, Overview of hierarchical, network and relational model. Relations and Codd's rules, Concepts of keys, Relation Algebra – Select, Project, Joins, Set operations, Update operations – tuple relational calculus, Relational Calculus vs. relational algebra. Data definition, data manipulation, view definition, nested queries, updation, Embedded SQL, Handling of nulls and cursors.</p>
II	<p>Data Models:</p> <p>Conceptual, Logical and Physical design, ER models, ER diagrams, Strong and weak entity sets, Generalization, Specialization and Aggregation, Conversion of ER model into relational schemas,</p>
III	<p>Normalization:</p> <p>Normalization concepts, Functional dependencies and dependency preservations, Normal forms – 1NF, 2NF, 3NF, BCNF, 4NF, 5NF, DKNF, Indexing, File organization, De-normalization, Clustering of tables and indexes.</p>
IV	<p>Transaction Handling:</p> <p>Transaction recovery, System recovery, Two phase commit, concurrency problems, locking, deadlocks, security, discretionary and mandatory access control, data encryption</p>
V	<p>Distributed databases:</p> <p>Overview of query processing, concurrency control and recovery in distributed databases, overview of client/server architecture and its relationship with distributed databases, performance benchmark and performance tuning of databases.</p>
Referential Books:	<p>5. Introduction to Database System – C.J. Date 6. Database Systems – Mcfadden et.al. 7. Database Concepts – Navathe et.al 8. Database Structured Techniques for Design Performance – S. Atre</p>

E – resources :-

- <https://ocw.mit.edu/courses/6-830-database-systems-fall-2010/pages/lecture-notes/>
- <https://ocw.mit.edu/courses/6-830-database-systems-fall-2010/pages/assignments/>
- <https://dsg.csail.mit.edu/6.5830/assign.php>
- <https://en.wikibooks.org/wiki/DBMS>

Video Lectures :-

- <https://www.youtube.com/playlist?list=PLIwC9bZ0rmjSkm1VRJROX4vP2YMI4Ebh>
- <https://www.youtube.com/playlist?list=PLyqSpQzTE6M-xymXgqewlzcC3U4cdRoSu>
- https://www.youtube.com/playlist?list=PLZ2ps_7DhBYc4jkUk_yQAjYEVFzVzhdU
- <https://www.youtube.com/playlist?list=PL9426FE14B809CC41>
- <https://raw.githubusercontent.com/pforpallav/school/master/CPSC404/Ramakrishnan%20-%20Database%20Management%20Systems%203rd%20Edition.pdf>

Sem- III	B230903T	Machine Learning
-----------------	-----------------	-------------------------

Unit	Course Contents
I	Introduction to Machine Learning Classical machine vs Adaptive Machine, Different Learning strategies, Supervised, Unsupervised, Semi Supervised, Reinforcement learning, Transfer learning (TL). Basic of Training and Testing Phase Training and testing data, Over fitting and Under fitting
II	Feature Selection Techniques Filter Methods- Information gain, Chi-Square test, Correlation and coefficient. Wrapper methods- Recursive feature elimination, Genetic Algorithm. Embedded method- Decision trees Principal Component Analysis (PCA)
III	Regression Analysis Dependent vs Independent variable. Introduction, Confusion Matrix, Curse of Dimensionality, Managing Missing Features, Managing Categorical Data. Explain Linear regression, Logistic regression, Polynomial regression, Ridge regression, Lasso regression, Elastic Net regression
IV	Classification Binary vs Multiclass Classification, K Nearest Neighbor (kNN), Conditional Probability, Bayes Theorem. Naive Bayes Classifier. Naive Bayes Variants: Bernoulli Naive Bayes, Multinomial Naive Bayes, Gaussian Naive Bayes. Support Vector Machine (SVM), Non-Linear Support Vector Machine (SVM) And Kernel Function. Decision Tree Algorithm, Random Forest (RF), ROC Curve.
V	Clustering K means Clustering, DBSCAN, Hierarchical Clustering: Agglomerative Clustering and Divisive Clustering Gradient Descent Algorithm, Introduction of Back Propagation Algorithm. Artificial Neural Network, Recurrent Neural Network (RNN)
Referential Books:	<ol style="list-style-type: none"> 1. Tom M. Mitchell, Machine Learning, McGraw Hill Education. 2. Jeeva Jose, Introduction to Machine Learning, Khanna Book Publishing. 3. Saikat Dutta, Subramanian Chandramouli, Machine Learning, Pearson Education. 4. Shai Shalev-Shwartz, Shai Ben-David, Understanding Machine Learning: From Theory To Algorithms, Cambridge University Press. 5. S. Rogers and M. Girolami, A first course in Machine Learning, CRC Press, 2011.

Sem- III	B230904T	Big Data Analytics
-----------------	-----------------	---------------------------

Unit	Course Contents
I	Introduction: Data Science, Big Data and its importance, Prediction vs. Inference, Statistical learning, Unsupervised and Supervised learning, Drivers for Big data, Big data analytics, Big data applications, Basic R concepts, Data transformation and data visualization in R.
II	Hadoop: Introduction to Hadoop and Hadoop Architecture, Apache Hadoop & Hadoop EcoSystem, Moving Data in and out of Hadoop, Understanding inputs and outputs of MapReduce.
III	Querying in Big Data: HDFS Overview, Hive Architecture, Comparison with Traditional Database, HiveQL Querying Data, Sorting and Aggregating, Map Reduce Scripts, Joins & Sub queries, HBase concepts, Advanced Usage, Schema Design, Advance Indexing, PIG, Zookeeper, HBase uses Zookeeper.
IV	Data Base for the Modern Web: Introduction to Mongo DB key features, Core Server tools, Mongo DB through the JavaScript's Shell, Creating and Querying through Indexes, Document-Oriented, principles of schema design, Constructing queries on Databases, collections and Documents, MongoDB Query Language.
V	Big Data Security: Big Data Privacy, Ethics and Security, Steps to secure big data, Cloud security, Hadoop Security Design, Hadoop Kerberos Security Implementation & Configuration, Audit logging in Hadoop cluster, Data security and event logging.
Referential Books:	1. Boris lublinsky, Kevin t. Smith, Alexey Yakubovich, "Professional Hadoop Solutions", Wiley 2. Chris Eaton, Dirk Derooset. al. , "Understanding Big data ", McGraw Hill 3. Kyle Banker, Piter Bakkum, Shaun Verch, "MongoDB in Action", Dream tech Press 4. Tom White, "HADOOP: The definitive Guide", O Reilly 5. Vignesh Prajapati, "Big Data Analytics with R and Hadoop", Packet Publishing.
<p>E – Resources :-</p> <ul style="list-style-type: none"> • https://ocw.mit.edu/courses/res-ll-005-mathematics-of-big-data-and-machine-learning-january-iap-2020/pages/lecture-notes/ • https://cwiki.apache.org/confluence/plugins/servlet/mobile?contentId=27362054#content/view/27362054 • https://en.m.wikibooks.org/wiki/Data_Science:_An_Introduction • https://en.m.wikipedia.org/wiki/Big_data • https://onlinecourses.nptel.ac.in/noc20_cs92/preview • https://archive.nptel.ac.in/courses/106/104/106104189/ • <p>Video Lectures :-</p> <ul style="list-style-type: none"> • https://youtube.com/playlist?list=PLZ2ps_7DhBZYtBcr1ERnw7Y1QG7bI3y&si=Ad7pCAzpYxtQxcU2 • https://youtube.com/playlist?list=PLFW6lRTa1g813IyYHLRP_bWJEKQDeEcSP&si=SyBDnLrdipujF_at • https://youtube.com/playlist?list=PLRueFtKLR0QN7MmQ8pdpQerOe_s8vGJG4&si=PNbSofjX5tYsgWHm • https://youtube.com/playlist?list=PLU14u3cNGP62uI_DWNdWoIMsgPcLGOx-V&si=DECChmZhdwhWcBGb • https://youtube.com/playlist?list=PLbRMhDVUMngekIHylt8b_3jQR7C0KUCul&si=kHdCIBhE8oG0mlib 	

Sem- III	B230905T	Distributed Systems
-----------------	-----------------	----------------------------

Unit	Course Contents
I	INTRODUCTION Distributed data processing; What is a DDBS; Advantages and disadvantages of DDBS; Problem areas; Overview of database and computer network concepts DISTRIBUTED DATABASE MANAGEMENT SYSTEM ARCHITECTURE Transparencies in a distributed DBMS; Distributed DBMS architecture; Global directory issues
II	DISTRIBUTED DATABASE DESIGN Alternative design strategies; Distributed design issues; Fragmentation; Data allocation SEMANTICS DATA CONTROL View management; Data security; Semantic Integrity Control QUERY PROCESSING ISSUES Objectives of query processing; Characterization of query processors; Layers of query processing; Query decomposition; Localization of distributed data
III	DISTRIBUTED QUERY OPTIMIZATION Factors governing query optimization; Centralized query optimization; Ordering of fragment queries; Distributed query optimization algorithms TRANSACTION MANAGEMENT The transaction concept; Goals of transaction management; Characteristics of transactions; Taxonomy of transaction models CONCURRENCY CONTROL Concurrency control in centralized database systems; Concurrency control in DDBSs; Distributed concurrency control algorithms; Deadlock management
IV	Reliability issues in DDBSs; Types of failures; Reliability techniques; Commit protocols; Recovery protocols Algorithm
V	PARALLEL DATABASE SYSTEMS Parallel architectures; parallel query processing
Referential Books:	1. Principles of Distributed Database Systems, M.T. Ozsu and PValduriez, Prentice-Hall, 1991. 2. Distributed Database Systems, D. Bell and J. Grimson, AddisonWesley, 1992.

--

Sem- III	B230906T	Cloud computing
-----------------	-----------------	------------------------

Unit	Course Contents
I	Introduction: Cloud Computing – Definition of Cloud – Evolution of Cloud Computing – Underlying Principles of Parallel and Distributed, History of Cloud Computing - Cloud Architecture - Types of Clouds - Business models around Clouds – Major Players in Cloud Computing- issues in Clouds - Eucalyptus - Nimbus - Open Nebula, CloudSim.
II	Cloud Services: Types of Cloud services: Software as a Service Platform as a Service –Infrastructure as a Service - Database as a Service - Monitoring as a Service –Communication as services. Service providers- Google, Amazon, Microsoft Azure, IBM, Sales force.
III	Collaborating Using Cloud Services: Email Communication over the Cloud - CRM Management – Project Management-Event Management - Task Management – Calendar - Schedules - Word Processing – Presentation – Spreadsheet - Databases – Desktop - Social Networks and Groupware.
IV	Virtualization for Cloud: Need for Virtualization – Pros and cons of Virtualization – Types of Virtualization – System VM, Process VM, Virtual Machine monitor – Virtual machine properties - Interpretation and binary translation, HLL VM - supervisors – Xen, KVM, VMware, Virtual Box, Hyper-V.
V	Security, Standards and Applications: Security in Clouds: Cloud security challenges – Software as a Service Security, Common Standards: The Open Cloud Consortium – The Distributed management Task Force – Standards for application Developers – Standards for Messaging – Standards for Security, End user access to cloud computing, Mobile Internet devices and the cloud. Hadoop – MapReduce – Virtual Box — Google App Engine – Programming Environment for Google App Engine
Referential Books:	<ol style="list-style-type: none"> 1. David E.Y. Sarna, “Implementing and Developing Cloud Application”, CRC press 2011. 2. Lee Badger, Tim Grance, Robert Patt-Corner, Jeff Voas, NIST, Draft cloud computing synopsis and recommendation, May 2011. 3. Anthony T Velte, Toby J Velte, Robert Elsenpeter, “Cloud Computing : A Practical Approach”, Tata McGraw-Hill 2010. 4. Haley Beard, “Best Practices for Managing and Measuring Processes for On-demand Computing, Applications and Data Centers in the Cloud with SLAs”, Emereo Pty Limited, July 2008. 5. G. J. Popek, R.P. Goldberg, “Formal requirements for virtualizable third generation Architectures, Communications of the ACM”, No.7 Vol.17, July 1974

Sem- III	B230907T	Mobile Computing
-----------------	-----------------	-------------------------

Unit	Course Contents
I	Introduction, Issues in mobile computing, Overview of wireless telephony, Cellular concept, GSM- air interface, channel structure; Location management- HLR-VLR, hierarchical, handoffs; Channel allocation in cellular systems, CDMA, GPRS, MAC for cellular system.
II	Wireless Networking, Wireless LAN Overview- MAC issues, IEEE 802.11, Blue Tooth, Wireless multiple access protocols, TCP over wireless, Wireless applications, Data broadcasting, Mobile IP, WAP- architecture, protocol stack, application environment, applications.
III	Data management issues in mobile computing, data replication for mobile computers, adaptive clustering for mobile wireless networks, File system, Disconnected operations.
IV	Mobile Agents computing, Security and fault tolerance, Transaction processing in mobile computing environment.
V	Adhoc networks, Localization, MAC issues, Routing protocols, Global state routing (GSR), Destination sequenced distance vector routing (DSDV), Dynamic source routing (DSR), Adhoc on demand distance vector routing (AODV), Temporary ordered routing algorithm (TORA), QoS in Adhoc Networks, applications
Referential Books:	<ol style="list-style-type: none"> 1. "Mobile Communications", Pearson - Schiller J 2. "Mobile Computing", Springer - Upadhyaya S. and Chaudhury A., 3. "Mobile Computing", Oxford University Press - Kamal R., 4. "Mobile Computing Technology, Applications and Service Creation", McGraw Hill Education- Talukder A. K. and Ahmed H., 5. "Mobile Computing Theory and Practice", Pearson - Garg K., 6. "Wireless and Mobile Communication", New Age International Publishers - Kumar S., 7. "Wireless and Mobile Networks- Concepts and Protocols", Wiley India Pvt. Ltd - Manvi S. S. and Kakkasageri M. S.,

Sem- III	B230908T	Soft Computing
-----------------	-----------------	-----------------------

Unit	Course Contents
I	FUZZY SET THEORY Introduction to Neuro – Fuzzy and Soft Computing – Fuzzy Sets – Basic Definition and Terminology – Settheoretic Operations – Member Function Formulation and Parameterization – Fuzzy Rules and Fuzzy Reasoning – Extension Principle and Fuzzy Relations – Fuzzy If-Then Rules – Fuzzy Reasoning – Fuzzy Inference Systems – Mamdani Fuzzy Models – Sugeno Fuzzy Models – Tsukamoto Fuzzy Models – Input Space Partitioning and Fuzzy Modeling.
II	OPTIMIZATION Derivative-based Optimization – Descent Methods – The Method of Steepest Descent – Classical Newton’s Method – Step Size Determination – Derivative-free Optimization – Genetic Algorithms – Simulated Annealing – Random Search – Downhill Simplex Search.
III	NEURAL NETWORKS Supervised Learning Neural Networks – Perceptrons - Adaline – Backpropagation Mutilayer Perceptrons – Radial Basis Function Networks – Unsupervised Learning Neural Networks – Competitive Learning Networks – Kohonen Self-Organizing Networks – Learning Vector Quantization – Hebbian Learning.
IV	NEURO FUZZY MODELING Adaptive Neuro-Fuzzy Inference Systems – Architecture – Hybrid Learning Algorithm – Learning Methods that Cross-fertilize ANFIS and RBFN – Coactive Neuro Fuzzy Modeling – Framework Neuron Functions for Adaptive Networks – Neuro Fuzzy Spectrum.
V	APPLICATIONS OF COMPUTATIONAL INTELLIGENCE Printed Character Recognition – Inverse Kinematics Problems – Automobile Fuel Efficiency Prediction – Soft Computing for Color Recipe Prediction.
Referential Books:	<ol style="list-style-type: none"> 1. Timothy J.Ross, “Fuzzy Logic with Engineering Applications”, McGraw-Hill, 1997. 2. Davis E.Goldberg, “Genetic Algorithms: Search, Optimization and Machine Learning”, Addison Wesley, N.Y., 1989. 3. S. Rajasekaran and G.A.V.Pai, “Neural Networks, Fuzzy Logic and Genetic Algorithms”, PHI, 2003. 4. R.Eberhart, P.Simpson and R.Dobbins, “Computational Intelligence - PC Tools”, AP Professional, Boston, 1996

SEMESTER – IV

Sem- IV	B231001R	Master Dissertation
----------------	-----------------	----------------------------

In final Semester student must complete Master Dissertation under allotted faculty supervision.