Programme Structure

MCA I - Level 6.0 - Semester I

Code	Course Title	Credits	Contact Hours	Internal Marks	Practical Marks	EOS Marks	Total Marks
MCA101	Data and File Structures	4	60		40	60	100
MCA102	Web Application Development	4	60		40	60	100
MCA103	Software Engineering & Agile Methods	4	60	40		60	100
MCA104	Relational Database Management System	4	60	40		60	100
MCA105	Operating Systems	4	60	40		60	100
MCA106	Computer Networks	4	60	40		60	100
MCA107	Elective-1 a. Software Project Management b. Foundations of Cyber Security c. Introduction to Data Science	2	30	20		30	50
		26					**550**

MCA I - Level 6.0 - Semester II

Code	Course Title	Credits	Contact Hours	Internal Marks	Practical Marks	EOS Marks	Total Marks
MCA201	Java Programming	4	60		40	60	100
MCA202	.NET Programming	4	60		40	60	100
MCA203	Mobile Application Development	4	60	40		60	100
MCA204	Cloud Computing	4	60	40		60	100
MCA205	Design and Analysis of Algorithms	4	60	40		60	100
MCA206	Blockchain Technology	4	60	40		60	100

MCA207	Elective-II a. Software Testing and Quality Assurance b. Web Security c. Data Visualization and Business Intelligence	2	30	20		30	50
MCA208	Mini Project I	2	30	20		30	50
		28					**700**

MCA II - Level 6.5 - Semester III

Code	Course Title	Credits	Contact Hours	Internal Marks	Practical Marks	EOS Marks	Total Marks
MCA301	Advanced Java	4	60		40	60	100
MCA302	MERN Stack Development	4	60		40	60	100
MCA303	AI and Machine Learning	4	60		40	60	100
MCA304	Large Language Models	4	60	40		60	100
MCA305	Linux Administration	4	60	40		60	100
MCA306	DevOps Technology	4	60	40		60	100
MCA307	Elective-III a. Internet of Things b. Penetration Testing c. Big Data Analytics	2	30	20		30	50
MCA308	Mini Project II	2	30	20		30	50
		28					**700**

MCA II - Level 6.5 - Semester IV

Code	Course Title	Credits	Contact Hours	Internal	EOS Marks	Marks
MCS401	**Industry Project**	18	16 weeks			
	Project Documentation				100	100

	Presentation				100	100
	Evaluation by Industry				100	100
	Viva-Voce				100	100
MCS402	MOOC I	4	-	40	60	100
		22				**500**

Semester	**Credits**	**Internal**	**End of Semester**	**Total Marks**
I	26	260	390	650
II	28	280	420	700
III	28	280	420	700
IV	22	40	510	550
Total	**104**	**660**	**1740**	**2600**

Master of Computer Application (MCA)
Detailed Syllabus

MCA I Semester I		
MCA101 Data and File Structures		
Total Credits - 04	Credit Pattern L-3, T-1, P-0	
Course Outcomes: CO1: Select and use appropriate data structure to solve computing problem. CO2: Analyze and choose data type and data structure. CO3: Design appropriate data structure for data manipulation. CO4: Organize data to manage it efficiently and effectively.		
Unit	**Contents**	**Sessions**
I	Data types – primitive and non-primitive, Array: Representation of arrays, Applications of arrays, Sorting & Searching: Sorting – Bubble Sort, Selection Sort, Quick Sort, Merge Sort Searching – Sequential Search and Binary Search	15
II	Stack: Stack-Definitions & Concepts, Operations On Stacks, Stack implementation using array and linked list, Applications of Stacks Queue: Representation Of Queue, Operations On Queue, Circular Queue, Priority Queue, Priority Queue, Double Ended Queue, Applications of Queue	15
III	Linked List: List and operations performed on it. Singly Linked List, Doubly Linked list, Circular linked list, Applications of list. Tree-Definitions and Concepts, Representation of binary tree, Binary tree traversal (Inorder, postorder, preorder), Threaded binary tree, Binary search trees, Applications Of Trees Some balanced tree mechanism, eg. AVL trees, 2-3 trees, Huffman tree.	15
IV	Hashing: The symbol table, Hashing Functions, Collision Resolution Techniques, File Structure: Concepts of fields, records and files, Sequential, Indexed and Relative/Random File Organization, Indexing structure for index files, hashing for direct files, Multi-Key file organization and access methods.	15
Text Books: 1. A Textbook of Data Structures and Algorithms 1: Mastering Linear Data Structures, G A Vijayalakshmi Pai, Wiley 2. Theory and Problems of Data Structures, Seymour Lipchutz, Tata Mc Graw Hill 3. Data Structure and Programming in C, Robert Kruse, C.L Tondo and Bruce Leung, Pearson 4. Education.		
References: 1. Data Structure using C and C++, Yedidyah Langsam, Moshe J. Augenstein, and Aaron M. Tenenbaum, Pearson Education 2. Data Structures through C Language, Samiran Chattopadhyay, Debabrata Ghosh Dastidar and Matagini Chattopadhyay, BPB Publication.		

CO-PO-PSO Mapping Table

	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4
CO1	3			3	1	2		2

CO2	3	1		3	2	1		2
CO3	3	1		2	3	1		2
CO4	3			2	2	2		2

MCA I Semester I		
MCA102 Web Application Development		
Total Credits - 04	Credit Pattern L-3, T-0, P-2	
Course Outcomes: After completing this course, students will be able to: CO1: Understand the basic concepts of web design and development CO2: Develop interactive client-side applications using JavaScript and jQuery CO3: Create dynamic web applications using PHP CO4: Integrate databases with PHP to build web applications		
Unit	**Contents**	**Sessions**
I	**HTML5 and CSS3:** Introduction to Web Technologies - Basics of Internet and Web Client-server architecture Overview of web browsers, Structure of HTML documents, HTML elements, attributes, lists, tables, Image Mapping, Hyperlinks and navigation, Forms and input controls, HTML5 Features, HTML5 semantic elements, audio and video elements, HTML5 form elements and attributes. CSS Fundamentals : Introduction to CSS, advantages Methods of CSS (inline, internal, external), Selectors methods, font, text, background and border properties, Box model, CSS positioning and layouts, Flexbox and Grid, Responsive design and media queries.Web Design Principles: UI/UX basics, Accessibility and usability,Cross-browser compatibility	15
II	**JavaScript and jQuery:** Introduction to JavaScript: Basics of scripting languages, Variables, Data types, Operators, Control structures (Conditional Statements, looping statements), User defined and Predefined Functions, Event handling, Form validation, Document Object Model (DOM), Selecting and modifying elements, Dialog boxes in JavaScript, , JavaScript Regular Expression, Dynamic content creation, Advanced JavaScript: Arrays and objects, Error handling Introduction to jQuery: Features of jQuery, Syntax and selectors, Event handling using jQuery, Effects – fading, toggle, sliding, hide and show, stop, chaining, animations and DOM manipulation methods - get/set contents: text(), html(), attr() and val(), jQuery selector methods, AJAX basics	15
III	**Concepts of PHP:** Introduction to PHP: Basics of server-side scripting, PHP syntax and structure, Embedding PHP in HTML, PHP Programming Concepts: Variables, data types, operators, Control statements, Functions and arrays, Form Handling in PHP: GET and POST methods, Form validation, File handling, State Management: Cookies and sessions, Maintaining user state Error Handling and Debugging: Error types, Debugging techniques	15

IV	**PHP & MySQL** Database Concepts :Introduction to DBMS, Relational database basics, SQL fundamentals (DDL, DML, DCL),Introduction to MySQL : Creating databases and tables, Data types and constraints, PHP with MySQL Integration: Connecting PHP with MySQL, CRUD operations (Create, Read, Update, Delete)	15

Text Books:

1. Robbins, J. N. (2018). Learning web design: A beginner's guide to HTML, CSS, JavaScript, and web graphics (5th ed.). O'Reilly Media.
2. Harris, R. (2020). Murach's JavaScript and jQuery (4th ed.). Mike Murach & Associates.
3. Flanagan, D. (2020). JavaScript: The definitive guide (7th ed.). O'Reilly Media.
4. Tatroe, K., MacIntyre, P., & Lerdorf, R. (2020). Programming PHP: Creating dynamic web pages (4th ed.). O'Reilly Media.
5. Welling, L., & Thomson, L. (2017). PHP and MySQL web development (5th ed.). Addison-Wesley

References:

1. Ruvalcaba, Z., Boehm, A., & Delamater, M. (2024). Murach's HTML and CSS: Training & reference (6th ed.). Mike Murach & Associates.
2. Ruvalcaba, Z., & Delamater, M. (2020). Murach's JavaScript and jQuery (4th ed.). Mike Murach & Associates.
3. Bramer, M. (2026). Web programming with PHP and MySQL: A practical guide (2nd ed.). Springer Cham.
   (A modern textbook covering PHP (including PHP 8+) and MySQL with detailed examples and exercises.)
4. Duckett, J. (2022). PHP & MySQL: Server-side web development. Wiley.

CO-PO-PSO Mapping Table

	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4
CO1	4	1	3	3	3	1	3	2
CO2	4	2	3	4	3	2	3	3
CO3	4	4	3	4	3	2	4	4
CO4	4	4	3	4	3	2	4	4

MCA I Semester I		
MCA103 Software Engineering and Agile methods		
Total Credits - 04	Credit Pattern L-3, T-1, P-0	

Course Outcomes:

CO1: Select and use appropriate model for software development
CO2: Analyze and evaluate software requirements
CO3: Design the software as per user requirements
CO4: Construct a model for software to fulfill user requirements

Unit	Contents	Sessions
I	Software process models Software and software engineering definitions, The need for software engineering, The software process models- Waterfall, prototyping, spiral, incremental, iterative, V, RAD, Requirement engineering - Requirement types, Requirements Elicitation –	15

	Interviews, Surveys, Focus Groups, Observation, Historical documents	
II	Requirements Specification – DFD, ERD, USE CASES, Software Modelling - Diagrams and notations - Use case, Class, Dynamic model – State, sequence, collaboration, activity. Component and deployment diagram	15
III	Fundamentals of Agile Process - Agile Manifesto and Principles, Stakeholders and Challenges Introduction to Scrum: Agile Scrum Framework, Scrum Artifacts, Meetings, Activities and Roles, Scrum Team Simulation, Scrum Planning Principles, Product and Release Planning, Sprinting - Planning, Execution, Review and Retrospective; User story definition and Characteristics, Acceptance tests and Verifying stories, Burn down chart, Daily scrum	15
IV	Introduction to Extreme Programming (XP): XP Lifecycle, The XP Team, XP Concepts - Refactoring, Technical Debt, Timeboxing, Stories, Velocity; Adopting XP: Pre-requisites, Challenges, Applying XP - Thinking- Pair Programming, Collaborating, Release, Planning, Development.	15

Text Books:

1. Software Engineering A PRACTITIONER ' S APPROACH , Roger S. Pressman, Bruce R. Maxim, McGraw Hill
2. UML Tollkit 2.0, Hans-Erik Eriksson,Magnus Penker,Brian Lyons,David Fado, Wiley Publishing
3. Agile Software Development, Cockburn, Alistair, UNKNO
4. Agile Software Development, CRC Press

References:

1. Software Engineering: A Modern Approach, Marco Tulio Valente, E-book, https://softengbook.org/
2. Software Engineering Handbook: From Theory To Practice, Kaushik Sinha, Notion Press
3. Agile Software Development with SCRUM, Pearson Education

CO-PO-PSO Mapping Table

	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4
CO1	3		1	2	3	3		1
CO2	3	1		2	3		1	1
CO3	3	1	1	2	3	3		2
CO4	3			3	3	3		3

MCA I Semester I	
MCA104 Relational Database Management System	
Total Credits - 04	Credit Pattern L-3, T-1, P-0

Course Outcomes:

CO1: The learners will study various database designing and which further enhances powerful and user friendly application development.

CO2: Analyse and Evaluate Database Models and their applications.

CO3: Design and develop different Database Schemas by solving case study problems.
CO4: Analyse various normalization phases in DB design apply real word problems.

Unit	Contents	Sessions
I	Database Systems Concepts And Architecture: (12) Introduction and definition of , data, Information & Database, Advantages, schemas and instance; three-schema architecture and data independence; the database system environment; centralized and client/server architecture of DBMSs.	15
II	Data Modeling : (12) Meaning & Concept, High- level conceptual data models for database design; Entity types, entity sets, attributes and keys; relationship types, relationship sets, ER diagrams, Hierarchical Data Model(HDM), Network Data Model (NDM), The Relational Data Model and Relational Database Constraints; Relational model concepts; Relational Database Design.	15
III	Database Normalization : (09) Normalization: Meaning & Functional Dependencies And Normalization for Relational Databases: functional dependencies; normal forms based on primarykeys-1NF with example; general definitions of 2nd and 3rd normal forms; Boyce-Codd normal (BCNF) forms, 3NF Normal Form.	15
IV	Transaction Processing Concepts & Database Recovery : (12) Introduction to transaction processing; Transaction Problems, Locking techniques, characteristics schedule based on serializability. Two phase locking techniques for concurrency control; concurrency control based on timestamp ordering; Database Recovery Techniques: Recovery concepts; Techniques ; Introduction SQL, Components DML, DDL, DCL Quries.	15

Text Books:

1. Fundamentals of Database Systems Ramez Elmasri and Shamkant B. Navathe, Pearson Education.
2. 2. Database Concepts, Abraham Silberschatz, Henry F Korth, S. Sudarshan, McGraw-Hill

References:

1. C.J. Date, " An introduction to database systems", (3rd edNarosa publishers, 1985), 1997(reprint)
2. Ullman, "Principles of database systems", (2nd ed. Galgotia, 1984).
3. D. Kroenke, " Database Processing", (Galgotia, 1987)
4. Naveen Prakash, Introduction to database management", TMH, 1993.
5. Bobrowski, " client server architecture and introdu

CO-PO-PSO Mapping Table

	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4
CO1	1			4	1	1		
CO2		1	2			2		
CO3		1	2	2			3	
CO4		1		4				4

MCA I Semester I		
MCA105 Operating Systems		
Total Credits - 04	Credit Pattern L-3, T-1, P-0	

Course Outcomes:

CO1: Evaluate fundamental operating system concepts such as processes, threads, files, semaphores, IPC, shared memory regions, etc.

CO2: Analyze important algorithms: Process scheduling, Deadlock avoidance and memory management algorithms

CO3: Examine and discuss different memory management techniques and file Systems

CO4: Assess theories of secure operating system in resolving security and access control related real time problems

Unit	Contents	Sessions
I	Operating system structures, Process Management: Process and thread concept, Process scheduling, Scheduling Criteria, Scheduling Algorithms, performance evaluation of scheduling algorithm. Process Synchronization: The critical–Section problem, semaphore, classic problems of synchronization (Producer consumer problem), inter-process communication.	15
II	Deadlock: Deadlock modelling, Methods for Handling Deadlock, Deadlock Prevention, Deadlock Avoidance (Bankers Algorithm), Deadlock Detection. Memory Management: Concept, Memory Management Techniques, Swapping, Contiguous Memory Allocation, Memory Protection, Memory Allocation, Fragmentation, Paging, Basic Method, Segmentation with Paging, Virtual Memory Concept, Demand Paging, Page Replacement algorithm.	15
III	File System, File Structure, Unix File System, Log Structured File System, Andrew File System (AFS), Cryptographic File Systems, Server less Network File Systems, Coda File System, File System Mounting and Sharing, File layout, File System implementation and Allocation Methods. Device management - Disk Structure, Disk scheduling I/O Hardware and Kernel I/O Subsystem.	15
IV	Security in Operating System: Introduction, Secure Operating System Definition, Security Goals, Trust Model, Threat Model, Multics, Access Control Fundamentals, Lampson's Access Matrix, Mandatory Protection Systems, Reference Monitor, Assessment Criteria, Security in Ordinary Operating Systems, Security Analysis and Vulnerabilities, Security Kernels Nessus Tool, OpenVas Tool, Snort Tool, NPM Audit Tool, ClamAV, Malwarebytes Tools.	15

Text Books:

1. Tanenbaum, A. and Bos, H. (2023), "Modern Operating Systems", Global Edition. 5th ed. London, England: Pearson Education.
2. Barbuddhe, V., Zanjat, S. N. and Karmore, B. S. (2020), "Modern Operating Systems", LAP Lambert Academic Publishing.
3. Blokdyk, G. (2018), "Secure operating system a clear and concise reference", 5starcooks.

References:

1. Jones, P. (2018), “Principles of modern operating systems”, North Charleston, SC: Createspace Independent Publishing Platform.
2. Laursen, E. (2021), “The operating system the operating system: An anarchist theory of the modern state”, Edinburgh, Scotland: AK Press.
3. Lister, A. (2013), “Fundamentals of operating systems”, 1993rd ed. New York, NY: Springer.
4. Summers, K. (ed.) (2018), “Modern Operating Systems”, Willford Press

CO-PO-PSO Mapping Table

	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4
CO1	1			4	1	1		
CO2		2	3			2		
CO3		3	4	2			3	
CO4		1		4				4

MCA I Semester I		
MCA106 Computer Networks		
Total Credits - 04	Credit Pattern L-4, T-0, P-0	
Course Outcomes: CO1: Explain the fundamental concepts, architectures, and models of computer networks. CO2: Analyze data communication techniques and protocols used in network layers. CO3: Evaluate network routing, congestion control, and transport protocols. CO4: Apply networking concepts in modern networks including wireless and network security.		
Unit	**Contents**	**Sessions**
I	Introduction to Computer Networks Basics of data communication, network components, types of networks, network topologies, network architecture, TCP/IP model, transmission media – guided and unguided, switching techniques – circuit switching, packet switching, performance metrics of networks.	15
II	Data Link Layer and Medium Access Control Data link layer design issues, framing techniques, error detection and correction, flow control, sliding window protocols, MAC protocols, channel allocation problems, Ethernet, wireless LAN basics, switching and VLAN concepts.	15
III	Network Layer Network layer design issues, logical addressing (IPv4 and IPv6), subnetting and supernetting, routing algorithms – distance vector and link state routing, routing protocols, congestion control, Internet architecture and addressing.	15
IV	Transport Layer and Application Layer Transport layer services, UDP and TCP protocols, congestion control mechanisms, quality of service (QoS), application layer protocols – HTTP, FTP, SMTP, DNS, introduction to network security concepts, wireless and mobile networks overview.	15
Text Books:		

1. Tanenbaum, A. S., & Wetherall, D. J., 2011, *Computer Networks*, 5th Edition, Pearson.
2. Kurose, J. F., & Ross, K. W., 2021, *Computer Networking: A Top-Down Approach*, 8th Edition, Pearson.
3. Forouzan, B. A., 2017, *Data Communications and Networking*, 5th Edition, McGraw Hill.
4. Stallings, W., 2013, *Data and Computer Communications*, 10th Edition, Pearson.

References:

1. Peterson, L. L., & Davie, B. S., 2021, Computer Networks: A Systems Approach, 6th Edition, Morgan Kaufmann.
2. Comer, D. E., 2018, Internetworking with TCP/IP: Principles, Protocols and Architecture, Pearson.
3. NIST, 2020, Guide to Network Security.
4. RFC Documents – Internet Engineering Task Force (IETF)..

CO-PO-PSO Mapping Table

	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4
CO1	3			1		3		
CO2	3	2		2	2	3		
CO3	2	2		3	2	2	1	
CO4	2		1	3	3	2	2	2

MCA I Semester I

MCA107 a) Software Project Management

Total Credits - 02	Credit Pattern L-2, T-0, P-0

Course Outcomes:

CO1: Understand the tasks and concepts in project management..
CO2: Apply correct software project management strategy.

Unit	Contents	Sessions
I	**Project Management Concepts, Project Metrics and Planning:** The Management Spectrum, People, Product, Process, Project, The W5HH Principle, Metrics in the Process and Project Domains (FP & LOC), Software Measurement, Metrics for Project and Software Quality, McCall's Quality Factors. Project Planning Objectives, Software Project Estimation using COCOMO Model, Software Scope and Resources, Empirical Estimation Models, Automated Estimation Tools	15
II	**Software Project Scheduling and Tracking and Maintenance:** Basic Concepts and Relationship Between People and Effort, Defining a Task Set for the Software Project, Selecting Software Engineering Tasks, Defining a Task Network and Scheduling, Earned Value Analysis and Error Tracking. Reactive versus Proactive Risk Strategies, Software Risks (Risk identification, Risk Projection, Risk Refinement, Risk Mitigation), Risks Monitoring and Management. Definition of maintenance, Maintenance characteristics, maintainability, maintenance tasks, maintenance side effects	15

Text Books:

1. Software Project Management: Bob Hughes and Mike Cotterell-Tata McGraw Hill
2. Software Engineering a Practitioner's approach – Roger S Pressman Tata McGraw Hill,
3. Introduction to Software Project Management & Quality Assurance: By Ince, Dorrel,Helen
4. Sharp & Mark Woodman

References:

1. Software Engineering – Ian Sommerville, Addison Wesley
2. Norman E. Fenton and Shari Lawrence Pfleeger, "Software Metrics" Thomson
3. Mordechai Ben – Menachem and Garry S.Marliss, "Software Quality", Thomson Asia Ltd
4. Mary Beth Chrissis, Mike Konrad and Sandy Shrum, "CMMI", Pearson Education (Singapore) Pte Ltd.
5. ISO 9000-3 "Notes for the application of the ISO 9001 Standard to software development".

Websites:

- https://www.kandasoft.com/home/softwaredevelopment/project-management.html
- https://www.gurock.com/testrail/fogbugz-test-management
- https://kruschecompany.com/quality-assurance-in-projects/

MCA I Semester I		
MCA107 b) Foundations of Cyber Security		
Total Credits - 02	Credit Pattern L-2, T-0, P-0	

Course Outcomes:

CO1: Analyze various cyber threats, attacks, and vulnerabilities in digital systems, Apply suitable cybersecurity mechanisms and best practices for system protection.

CO2: Evaluate data security, privacy issues, and risk management strategies ,Understand cyber laws, IT Act provisions, and organizational cybersecurity planning

Unit	Contents	Sessions
I	**Introduction to Cybersecurity** Defining Cyberspace and Overview of Computer and Web-technology, Architecture of cyberspace, Communication and web technology, Internet, World wide web, Advent of internet, Internet infrastructure for data transfer and governance, Internet society, Regulation of cyberspace, Concept of cyber security, Issues and challenges of cyber security, Classification of cyber crimes, Common cyber crimes- cyber crime targeting computers and mobiles, cyber crime against women and children, financial frauds, social engineering attacks, malware and ransomware attacks, zero day and zero click attacks, Online scams and frauds- email scams, Phishing, Vishing, Smishing, Online job fraud, Online sextortion, Debit/ credit card fraud, Online payment fraud, Cyberbullying, website defacement, Cybersquatting, Pharming, Cyber espionage, Crypto jacking, Darknet- illegal trades, drug trafficking, human trafficking., Social Media Scams & Frauds- impersonation, identity theft, job scams, misinformation, fake news, cyber crime against persons - cyber	L-15

	grooming, child pornography, cyber stalking., Social Engineering attacks,	
II	**Data Security and Cybersecurity Management** Defining data, meta-data, big data, non-personal data. Data protection, Data privacy and data security, Personal Data Protection Bill and its compliance, Data protection principles, Big data security issues and challenges, Cyber Security best practices, Significance of host firewall and Ant-virus, Management of host firewall and Anti-virus, Wi-Fi security, Configuration of basic security policy and permissions, Data protection regulations of other countries- General Data protection Regulations(GDPR),2016 Personal Information Protection and Electronic Documents Act (PIPEDA)., IT Act 2000 and its amendment, Cyber security Plan- cyber security policy, cyber crises management plan., Business continuity, Risk assessment, Types of security controls and their goals, Cyber security audit and compliance, National cyber security policy and strategy	L-15

Text Books:

1. Cyber Security: Understanding Cyber Crimes, Computer Forensic and Legal Perspectives : Nina Godbole and Sunit Belapure, Wiley Publication, ISBN-10:**9788126521791, SBN-13:978-8126521791**
2. Introduction to Cyber Security : Guide to the World of Cyber Security Paperback, Anand Shinde, Publisher : **: Notion Press, ISBN-10 : ISBN-13 ,1637816421** 978-1637816424
3. Practical Cyber Threat Intelligence: Gather, Process, and Analyze Threat Actor Motives, Targets, and Attacks with Cyber Intelligence Practices, Erdal Ozkaya, BPB Publications, ISBN-10 : **: 9355510292, ISBN-139355510297-978** .
4. Cybersecurity Fundamentals, Rajesh Kumar Goutam, BPB Publications, ISBN-10 : **: 9390684730, ISBN-139390684731-978** .
5. Information Systems Security: Security Management, Metrics, Frameworks and Best Practices, 2ed, Nina Godbole, Wiley; Second edition, ISBN-10 : **: ISBN-13 ,8126564059812656405978-978** .

CO-PO-PSO Mapping Table

	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4
CO1	3	2	-	2	2	2	1	1
CO2	2	2	1	3	1	2	2	2

MCA I Semester I	
MCA-26107E Introduction to Data Science	
Total Credits - 02	Credit Pattern L-2, T-0, P-0

Course Outcomes:

CO1: Analyze fundamental concepts, workflows, and applications of Data Science to evaluate and solve real-world problems.

CO2: Apply Python programming techniques to perform data preprocessing, exploratory data analysis, and implement visualization strategies using libraries such as NumPy, Pandas, and Matplotlib.

Unit	Contents	Sessions
I	**Foundations of Data Science and Python Basics (15 Hours)** Definition and importance of Data Science, data science lifecycle, types of data (structured, semi-structured and unstructured), applications in business, healthcare, finance and social media, and the role of a data scientist. Introduction to Python programming for data analysis: installation of Python and Anaconda, basic syntax, variables, data types, input–output operations and operators. Control structures: conditional and looping statements. Python data structures: lists, tuples, dictionaries and sets. Functions, parameters, return values and use of modules and packages.	15
II	**Data Handling and Visualization** Introduction to data analysis: data collection, data preprocessing, data cleaning and handling missing data, data transformation, data integration, normalization and data sampling. Numerical computing using NumPy: arrays, array operations, mathematical operations, indexing and slicing. Data manipulation using Pandas: Series and DataFrames, reading data from CSV and Excel files, data selection and filtering, aggregation and grouping. Exploratory data analysis: summary statistics, data distribution analysis and correlation analysis.Data visualization: importance of visualization and visualization using Matplotlib, bar charts, line graphs, pie charts, scatter plots and histograms. Introduction to Machine Learning concepts: supervised and unsupervised learning, classification and regression, overview of machine learning libraries.	15

Text Books:

1. McKinney, W., *Python for Data Analysis: Data Wrangling with Pandas, NumPy, and Jupyter*, 3rd Edition, O'Reilly Media, 2022, ISBN: 978-1098104030.
2. Provost, F., Fawcett, T., *Data Science for Business: What You Need to Know about Data Mining and Data-Analytic Thinking*, O'Reilly Media, 2013, ISBN: 978-1449361327.

References:

1. Stanton, J. M., Saltz, J., *An Introduction to Data Science*, SAGE Publications, 2017, ISBN: 978-1506377537.
2. O'Neil, C., Schutt, R., *Doing Data Science: Straight Talk from the Frontline*, O'Reilly Media, 2013, ISBN: 978-1449358655.
3. VanderPlas, J., *Python Data Science Handbook: Essential Tools for Working with Data*, O'Reilly Media, 2016, ISBN: 978-1491912058.
4. Igual, L., Seguí, S., *Introduction to Data Science: A Python Approach to Concepts, Techniques and Applications*, Springer, 2nd Edition, 2024, ISBN: 978-3031489556.
5. James, G., Witten, D., Hastie, T., Tibshirani, R., Taylor, J., *An Introduction to Statistical Learning with Applications in Python*, Springer, 2023, ISBN: 978-3031387463.

CO-PO-PSO Mapping Table

	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4
CO1	2	2		2		2	2	
CO2	2			2	3	2	2	2

MCA I Semester II		
MCA201 Java Programming		
Total Credits - 04	Credit Pattern L-45, T-7, P-8	

Course Outcomes: students will be able to

CO1: Apply object-oriented programming principles and core Java concepts to design modular and reusable applications.

CO2: Implement advanced Java features including I/O streams, multithreading, and lambda expressions for efficient program execution.

CO3: Develop database-driven and network-enabled applications using JDBC and Java networking APIs.

CO4: Design user-friendly applications using JavaFX and integrate modern technologies such as REST APIs and JSON.

Unit	Contents	Sessions
I	**Core Java & OOP Foundations:** Java Basics (JVM, JDK, JRE OOP Concepts: Class, Object, Constructor, Inheritance, Polymorphism, Encapsulation, Abstraction, Method Overloading & Overriding, Packages, Access Modifiers, Exception Handling (try-catch, throw, throws), Collections Framework (List, Set, Map, Iterator, Comparators)	L=11, T=2, P=2
II	**I/O Streams and Multi threading in Java :** Significance of streams, various types of Input & Output streams, accessing the file through streams, object serialization. Random Access File. Multithreading - Thread lifecycle, synchronization basics Inter thread communication Introduction to Lambda Expressions & Streams	L=10, T=2, P=3
III	**Java Database Connectivity and Networking in Java** JDBC overview , JDBC Architecture , Types of JDBC Drivers, DriverManager class, database connection statements , Resultset, CRUD operations, PreparedStatement, callable statements. Socket, DatagramSocket and DatagramPacket classes, IP address classes. InetAddress, URL and URLConnection classes.	L=9, T=1, P=5
IV	**JavaFX GUI Development and Web Integration**: JavaFX architecture: Stage, Scene, Controls Layout managers: VBox, HBox, GridPane , Event handling and UI controls. JavaFX with JDBC (simple form-based application), REST APIs (GET, POST, PUT, DELETE), Introduction to JSON handling, Spring Boot overview	L=9, T=1, P=5

Text Books:

1. Herbert Schildt, Danny Coward – Java: The Complete Reference, 13th Edition, McGraw Hill, 2024.
2. Cay S. Horstmann – Core Java Volume I – Fundamentals, Latest Edition (Java SE 17/21 compatible), Pearson

References:

1. Joshua Bloch – Effective Java, 3rd Edition, Addison-Wesley
2. Deitel & Deitel – Java How to Program, 11th Edition, Pearson
3. Oracle Java Documentation (Official) : https://docs.oracle.com/en/java/
4. Dev.Java Official Learning Portal : https://dev.java/
5. GeeksforGeeks Java Tutorial: https://www.geeksforgeeks.org/java/

6. TutorialsPoint Java Tutorial: https://www.tutorialspoint.com/java/
7. NPTEL Java Programming Course: https://nptel.ac.in/courses/106105191

CO-PO-PSO Mapping Table

	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4
CO1	3	1	2	2	3	3		2
CO2	2	3		3	2	3	3	1
CO3	2	3	1	3	3	2	3	3
CO4		3	2	3	3	1	3	3

MCA I Semester II

MCA202 .NET Programming

Total Credits - 04	Credit Pattern L-3, T-0, P-2

Course Outcomes:

CO1: Explain and Uderstand the architecture and components of the .NET platform
CO2: Apply C# programming constructs and object-oriented principles to develop applications.
CO3: Develop database-driven applications using ADO.NET and LINQ
CO4: Design basic web applications using ASP.NET technologies

Unit	Contents	Sessions
I	Evolution and overview of the .NET platform,.NET architecture,Common Language Runtime (CLR),Common Type System (CTS),Common Language Specification (CLS),Microsoft Intermediate Language (MSIL) and Metadata,.NET Base Class Library (BCL),Assemblies and deployment (Private and Shared Assemblies),Introduction to Visual Studio IDE,Building and running a simple .NET application	15
II	Basics of C# programming,Data types, variables, operators and expressions,Conditional statements and looping constructs,Methods and parameter passing,Classes and Objects,Constructors and Object Initialization,Properties and Indexers,Inheritance and Polymorphism,Interfaces,Delegates and Events,Exception Handling,Introduction to LINQ	15
III	Introduction to ADO.NET,ADO.NET architecture,Connected architecture: Connection, Command, DataReader,Disconnected architecture: DataAdapter, DataSet, DataTable,Transactions in ADO.NET,Data binding concepts,Introduction to LINQ for querying data	15
IV	Introduction to ASP.NET,ASP.NET request processing pipeline Page life cycle,Web server controls,Validation controls,Navigation controls,State management: View State, Session State, Application State,Configuration files:Web.config and Global.asax,Master pages and content pages,Introduction to ASP.NET MVC / Web API concepts,Introduction to Web API and RESTful Services	15

Text Books:

1. Programming C# – Jesse Liberty
2. Pro ASP.NET 4.5 in C# – Adam Freeman

3. ADO.NET in a Nutshell – Bill Hamilton

References:

1. C# 7.0 in a Nutshell – Joseph Albahari
2. ASP.NET Unleashed – Stephen Walther

CO-PO-PSO Mapping Table

COs	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4
CO1	3	1	1	2	2	3	1	1
CO2	3	2	2	3	3	2	2	3
CO3	3	2	1	3	3	2	3	3
CO4	3	3	2	3	3	2	3	3

MCA I Semester II

MCA203 Mobile Application Development

Total Credits - 04	Credit Pattern L-3, T-0, P-2

Course Outcomes:

CO1: Explain the Android architecture and develop basic programs using Kotlin.
CO2: Design user interfaces using Android layouts and UI components.
CO3: Implement data storage and event handling in Android applications.
CO4: Develop complete Android applications using advanced features and deployment techniques.

Unit	Contents	Sessions
I	Overview of mobile application development, Android architecture and application components, Introduction to Android Studio IDE, Introduction to Kotlin programming, Variables, data types, operators, Control structures (if, when, loops), Functions and classes in Kotlin, Kotlin collections and null safety	15
II	Android project structure, Activities and activity lifecycle, Layouts (LinearLayout, RelativeLayout, ConstraintLayout), UI controls: TextView, EditText, Button, ImageView, Event handling and listeners, Menus and navigation ,RecyclerView and ListView basics	15
III	Intents and data passing between activities, Shared Preferences File storage in Android, Introduction to SQLite database, CRUD operations in SQLite.	15
IV	Fragments and fragment lifecycle, Working with web services and APIs, JSON data parsing, Notifications and background services ,Application testing and debugging, APK generation and application deployment	15

Text Books:

1. Android Programming: The Big Nerd Ranch Guide – Bill Phillips, Chris Stewart & Kristin Marsicano
2. Android Programming with Kotlin for Beginners – John Horton
3. Head First Kotlin – Dawn Griffiths & David Griffiths.

References:

1. Android Studio Development Essentials – Kotlin Edition – Neil Smyth
2. Kotlin for Android Developers – Antonio Leiva

3. Android Development with Kotlin – Marcin Moskala & Igor Wojda

CO-PO-PSO Mapping Table

COs	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4
CO1	3	1	1	2	3	2	1	1
CO2	3	2	2	3	2	2	3	3
CO3	3	2	1	3	3	3	3	3
CO4	3	3	2	3	3	3	3	3

MCA I Semester II		
MCA204 Cloud Computing		
Total Credits - 04	Credit Pattern L-48, T-12, P-0	
Course Outcomes: CO1: Understand cloud computing concepts, models, and web services. CO2: Analyze cloud architecture, models, and cloud services. CO3: Apply virtualization and resource management techniques. CO4: Evaluate cloud infrastructure, distributed computing, MapReduce, and security mechanisms.		
Unit	**Contents**	**Sessions**
I	**Introduction to cloud computing:** Cloud computing definition, evolution, characteristics and principles of cloud computing; cloud architecture, layers and types of clouds (public, private, hybrid, community); cloud service models (IaaS, PaaS, SaaS); cloud storage, virtualization, types of virtualization, hypervisors and live migration; comparison of cloud computing with traditional computing, advantages, opportunities and challenges of cloud computing including security, privacy, vendor lock-in and compliance issues; introduction to web services and technologies required for deploying web services; Service Oriented Architecture (SOA), its concepts and components; WSDL structure; protocols used in SOA (SOAP, REST, HTTP); web service integration and service catalogs; Service Level Agreement (SLA); basic cloud security concepts including authentication and authorization.	15
II	**Cloud Computing Architecture**: Cloud computing architecture, components and layered architecture; cloud interoperability and standards; scalability and fault tolerance in cloud systems; system models for distributed and cloud computing; NIST cloud computing reference model; cloud cube model; cloud reference model; cloud service models (Infrastructure as a Service – IaaS, Platform as a Service – PaaS, Software as a Service – SaaS); cloud deployment models (public, private, hybrid, community); comparison and use cases of different cloud models.Overview of major cloud service providers including Amazon Web Services (AWS), Microsoft Azure and Google Cloud Platform (GCP); cloud offerings such as compute services (EC2, Virtual Machines, Compute Engine),	15

	storage services (S3, Blob Storage, Cloud Storage), database services and networking services	
III	**Virtualization** Introduction to virtualization, characteristics of virtualization, relationship between virtualization and cloud computing; advantages and disadvantages of virtualization; types of virtualization and implementation levels of virtualization; virtualization structures, tools and mechanisms; virtualization of CPU, memory and I/O devices; fundamental concepts of compute, storage, networking, desktop and application virtualization; server virtualization and its benefits; infrastructure requirements for virtualization; virtual networking concepts including Virtual LAN (VLAN) and Virtual SAN (VSAN) and their benefits; load balancing concepts, benefits and load balancing algorithms; hypervisor (virtual machine monitor), types of hypervisors (Type 1 and Type 2); Introduction to simple cloud APIs.	15
IV	**Cloud Infrastructure:** Overview of cloud infrastructure, infrastructure and logical organization; cloud deployment models (private, public, hybrid); resource provisioning and inter-cloud resource management; layered cloud architecture; fundamentals of distributed and parallel computing; task scheduling and load balancing techniques; MapReduce programming model and its applications; basics of big data processing in cloud environments; cloud security concepts, OSI security model; role-based and rule-based access control, access control lists (ACL).	15

Text Books:

1. Kumar Saurabh,"Cloud Computing", Wiley Pub
2. Buyya Selvi,"Mastering Cloud Computing", TMH pub.
3. Soninky, "Cloud Computing", Wiley Pub.
4. Kurtz, Vines, "Cloud Security", Wiley Pub.

References:

1. John W.Rittinghouse and James F.Ransome, "Cloud Computing: Implementation, Management, and Security", CRC Press, 2010.
2. Kumar Saurabh, "Cloud Computing – insights into New-Era Infrastructure", Wiley India, 2011.
3. George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud" O'Reilly
4. Katarina Stanoevska-Slabeva, Thomas Wozniak, Santi Ristol, "Grid and Cloud Computing – A Business Perspective on Technology and Applications", Springer.
5. James E. Smith, Ravi Nair, "Virtual Machines: Versatile Platforms for Systems and Processes", Elsevier/Morgan Kaufmann.

CO-PO-PSO Mapping Table

	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4
CO1	3	2	1	2	3	2	1	1
CO2	2	3	1	3	2	3	2	2
CO3	2	2	2	3	2	3	3	2
CO4	3	3	2	3	2	2	2	3

MCA I Semester II		
MCA205 Design and analysis of Algorithms		
Total Credits - 04	Credit Pattern L-48, T-12, P-0	

Course Outcomes: students will be able to

CO1: Analyze the time and space complexity of algorithms using asymptotic notations and performance measures.

CO2: Apply algorithm design paradigms such as divide-and-conquer and greedy methods to solve computational problems.

CO3: Design and implement efficient algorithms for string matching and graph-based problems.

CO4: Evaluate advanced algorithmic techniques such as dynamic programming, backtracking, and complexity classes for solving optimization problems.

Unit	Contents	Sessions
I	**Algorithm Analysis and Performance Evaluation:** Introduction to algorithms and complexity, Time and space complexity, Asymptotic notations: Big-O, Omega, Theta Best, worst, and average case analysis.	L-12, T-3, P-0
II	**Divide and Conquer and Greedy Algorithmic Paradigms** Divide and Conquer: Concept and applications, Merge Sort, Quick Sort. Greedy Algorithms: Concept and applications Fractional Knapsack, Activity Selection, Huffman Coding	L-12, T-3, P-0
III	**String Matching and Graph Algorithms**: String Matching Algorithms: Introduction to string matching problem, Naïve String Matching Algorithm, Knuth-Morris-Pratt (KMP) Algorithm, Rabin-Karp Algorithm Graph Algorithms: BFS, DFS, Dijkstra's shortest path Algorithm, Minimum Spanning Tree (Prim's, Kruskal's)	L-12, T-3, P-0
IV	**Advanced Algorithmic Techniques and Complexity Classes** Backtracking - N-Queens problem, Branch and Bound Introduction, Traveling salesman problem, Dynamic Programming: Concept, 0/1 Knapsack, Longest Common Subsequence, P, NP, NP-Complete problem classification	L-12, T-3, P-0

Text Books:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, Introduction to Algorithms, 4th Edition, MIT Press, 2022.
2. Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran, Fundamentals of Computer Algorithms, Universities Press, 2008

References:

1. Anany Levitin, Introduction to the Design and Analysis of Algorithms, 3rd Edition, Pearson, 2012.
2. Kleinberg & Tardos,Algorithm Design, Pearson, 2005
3. NPTEL – Design and Analysis of Algorithms,https://nptel.ac.in/courses/106101060
4. GeeksforGeeks – DSA, https://www.geeksforgeeks.org/dsa/
5. MIT OpenCourseWare Algorithms, https://ocw.mit.edu

CO-PO-PSO Mapping Table

	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4

CO1	3	2		3		3		
CO2	2	3	1	3	2	3		
CO3	2	3		3	3	2	2	2
CO4		3	2	3	2		2	3

MCA I Semester II		
MCA206 Blockchain Technology		
Total Credits - 04	Credit Pattern L-3, T-0, P-2	
Course Outcomes: CO1: Understand fundamental concepts of blockchain, distributed systems, and cryptographic principles. CO2: Analyze blockchain architectures, consensus mechanisms, and platforms like Ethereum. CO3: Design and develop smart contracts and decentralized applications (DApps). CO4: Evaluate blockchain applications, challenges, and emerging trends in real-world scenarios.		
Unit	**Contents**	**Sessions**
I	**Introduction to Blockchain:** Introduction to Blockchain Evolution, Distributed Systems, Cryptography, Types of Blockchain, Consensus Basics and Trust Mechanisms, Blockchain vs Traditional Databases	15
II	**Architecture & Consensus:** Architecture & Consensus PoW, PoS, PBFT, Attacks, Platforms, Node Types and Roles, Transaction Lifecycle and Block Formation	15
III	**Smart Contracts & Dapps EVM:** Solidity, Deployment, Tools, Gas Mechanism and Transaction Costs, Testing and Debugging of Smart Contracts	15
IV	**Applications & Trends:** Use Cases, Security, NFTs, Web3,Decentralized Finance (DeFi), Regulatory and Legal Challenges	15
Text Books: 1. Melanie Swan, Blockchain: Blueprint for a New Economy, O'Reilly 2. Andreas M. Antonopoulos, Mastering Bitcoin, O'Reilly 3. Imran Bashir, Mastering Blockchain, Packt		
References: 1. Ethereum Documentation – https://ethereum.org 2. Hyperledger – https://hyperledger.org 3. Bitcoin Whitepaper – Satoshi Nakamoto		

CO-PO-PSO Mapping Table

	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4
CO1	F	-	-	P	P	F	-	-
CO2	F	P	-	F	F	P	P	-
CO3	F	P	P	F	F	P	P	F
CO4	P	F	P	F	P	P	F	P

MCA I Semester II		
MCA207 a) Software Testing and Quality Assurance		
Total Credits - 02	Credit Pattern L-2, T-0, P-0	
Course Outcomes: CO1: Construct software testing strategies and techniques. CO2: Plan and implement quality assurance activities.		
Unit	**Contents**	**Sessions**
I	Software Testing: Introduction, Software testing strategies – Unit test, Integration test, User acceptance test, System test. Software testing techniques – White box and black box testing, Grey Box Testing, Debugging User Interface Testing: Effective UI, Testing for Disabled. Data Coverage & Code Coverage. Security Testing: Threat Modelling, Buffer Overrun, Safe String Functions, Computer Forensics Web Site Testing	15
II	Software quality – People‘s Quality Expectations, Frameworks and ISO-9126, McCall‘s Quality Factors and Criteria – Relationship. Quality Metrics. Quality Characteristics ISO 9000:2000 Software Quality Standard. Quality Assurance – Root Cause Analysis, modeling, technologies, standards and methodologies for defect prevention. Fault Tolerance and Failure Containment – Safety Assurance and Damage Control, Hazard analysis using fault-trees and event-trees. Comparing Quality Assurance Techniques and Activities. QA Monitoring and Measurement, Risk Identification for Quantifiable Quality Improvement.	15
Text Books: 1. Software Engineering : A practitiners approach, Roger Pressman, McGraw Hill 2. Software Engineering by Rajib Mall, PHI 3. Software Testing: A Craftsman's Approach, by Paul C. Jorgensen,		
References: 1. An Integrated Approach to Software Engineering, Second Edition Pankaj Jalote Narosa 2. Software Engineering: Theory and Practice, Second Edition S.L. Pfleeger, J.M. Atlee Pearson Education		

CO-PO-PSO Mapping Table

	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4
CO1	2			3		2		1
CO2	3			3		1		
CO3	3			2		1		1
CO4	2			2		1		2

MCA I Semester II
MCA207 b) Web Security

Total Credits - 02	Credit Pattern L-2, T-0, P-0

Course Outcomes:

CO1: Explain web application architecture, common web security vulnerabilities, and security mechanisms.

CO2: Apply secure coding practices, authentication mechanisms, and web security controls to protect web applications.

Unit	Contents	Sessions
I	**Unit I – Fundamentals of Web Security** Introduction to web applications and web architecture, HTTP/HTTPS protocol, Client-server architecture, Cookies, Sessions and Web Authentication, Web Application Attack Surface, OWASP Top 10 overview, Common Web Vulnerabilities: SQL Injection, Cross-Site Scripting (XSS), Cross-Site Request Forgery (CSRF), Broken Authentication, Security Misconfiguration, Secure Coding Principles, Introduction to Web Security Testing	15
II	**Unit II – Secure Web Applications and Defence Mechanisms** Authentication and Authorization Mechanisms, Session Management and Secure Cookies, Input Validation and Output Encoding, Secure Password Storage and Multi-Factor Authentication, HTTPS, SSL/TLS and Certificate Management, Web Application Firewall (WAF), Secure API Concepts, Security Testing using OWASP ZAP and Burp Suite (Overview), Web Security Best Practices, Case Studies on Web Application Attacks.	15

Text Books:

1. Stuttard, D. and Pinto, M., 2024. *The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws*. 3rd ed. Wiley.
2. Hoffman, A., 2024. *Web Application Security: Exploitation and Countermeasures for Modern Web Applications*. O'Reilly Media.
3. Kim, D. and Solomon, M.G., 2023. *Fundamentals of Information Systems Security*. 4th ed. Jones & Bartlett Learning.
4. Stallings, W. and Brown, L., 2024. *Computer Security: Principles and Practice*. 5th ed. Pearson.
5. McDonald, M., 2023. *Pro ASP.NET Core Security*. Apress.

References:

1. OWASP Foundation, 2021. *OWASP Top 10: The Ten Most Critical Web Application Security Risks.*
2. OWASP Foundation, 2024. *OWASP Web Security Testing Guide (WSTG).*
3. National Institute of Standards and Technology (NIST), 2022. *Secure Software Development Framework (SP 800-218).*
4. OWASP Foundation, 2023. *Application Security Verification Standard (ASVS) Version 4.0.3.*
5. PortSwigger, 2024. *Web Security Academy.*

CO-PO-PSO Mapping Table

COs	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4
CO1	3	1	-	-	1	-	-	-
CO2	3	2	2	1	2	1	1	1

MCA I Semester II
MCA207 c) Data visualization and Business Intelligence

Total Credits - 02	Credit Pattern L-2, T-0, P-0

Course Outcomes:

CO1: Explain the concepts and components of Business Intelligence systems.

CO2: Create basic data visualizations and dashboards to support business decision-making.

Unit	Contents	Sessions
I	Introduction to Business Intelligence,Importance of BI in organizations,Components of BI systems,Data sources and data collection,Data warehousing concepts,ETL (Extract, Transform, Load) process,Introduction to data analytics ,Overview of BI tools (e.g., Microsoft Power BI, Tableau, Microsoft Excel)	15
II	Introduction to data visualization,Principles of effective visualization,Types of charts and graphs (Bar chart,Line chart,Pie chart,Scatter plot,Histogram), Dashboard concepts, Creating dashboards and reports, Interactive visualization,Introduction to BI Tools & Applications	15

Text Books:

1. Data Visualization: Storytelling Using Data – Sharada Sringeswara, Purvi Tiwari & U. Dinesh Kumar
2. Fundamentals of Business Intelligence – by Cindi Howson

References:

1. Microsoft Power BI official tutorials
2. Tableau learning resources
3. Microsoft Excel for basic data visualization

CO-PO-PSO Mapping Table

COs	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4
CO1	3	1	-	2	2	2	1	1
CO2	3	2	2	3	3	2	2	3

MCA II Semester III

MCA301 Advanced Java

Total Credits - 04	Credit Pattern L-43, T-7, P-10

Course Outcomes: students will be able to

CO1: Apply advanced Java concepts such as servlets and JSP to develop dynamic web applications.

CO2: Implement enterprise-level features using frameworks like Spring and Hibernate.

CO3: Design and develop RESTful web services and integrate them with applications.

CO4: Build full-stack Java-based applications using modern tools and best practices.

Unit	Contents	Sessions
I	**Java Web Fundamentals (Servlets & JSP) :**Web basics: HTTP, Client-Server Architecture,Servlets: Lifecycle, Request & Response handling,Session Management (Cookies, HttpSession),JSP: Basics, Directives, Expression Language (EL) Introduction to MVC architecture	L=11, T=2, P=2
II	**Enterprise Java & ORM (Hibernate):** Introduction to ORM Hibernate Architecture,Mapping (Annotations/XML)	L=11, T=2, P=2

	CRUD operations using Hibernate,HQL (Hibernate Query Language)	
III	**Spring Framework & REST APIs :**Spring Core (IoC, Dependency Injection), Spring Boot basics, RESTful Web Services, JSON handling,Building simple REST APIs	L=11, T=1, P=3
IV	**Integrating Frontend (HTML/CSS/JS) with Java backend** Spring Boot + Database integration, Basic security concepts (Authentication overview),API testing tools (Postman),Deployment basics	L=10, T=2, P=3

Text Books:

1. Herbert Schildt, Danny Coward – Java: The Complete Reference, 13th Edition, McGraw Hill, 2024.
2. **Cay S. Horstmann,** *Core Java Volume I – Fundamentals***, 12th Edition,** Pearson Education**, 2021.**

References:

1. Joshua Bloch – Effective Java, 3rd Edition, Addison-Wesley, 2018
2. Deitel & Deitel – Java How to Program, 11th Edition, Pearson
3. Craig Walls, Spring in Action, 6th Edition,Manning Publications, 2022.
4. Hibernate in Action, Christian Bauer, Gavin King, Manning Publications
5. Spring Framework Documentation : https://spring.io/projects/spring-boot Dev.Java Official Learning Portal : https://dev.java/
6. GeeksforGeeks Java Tutorial: https://www.geeksforgeeks.org/java/
7. TutorialsPoint Java Tutorial: https://www.tutorialspoint.com/java/
8. NPTEL Java Programming Course: https://nptel.ac.in/courses/106105191

CO-PO-PSO Mapping Table

	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4
CO1	3	1	2	2	3	3		
CO2	2	3	1	3	2	3	3	
CO3	2	3		3	3	2	3	2
CO4		3	2	3	3	1	3	3

MCA II Semester III	
MCA302 MERN Stack Development	
Total Credits - 04	Credit Pattern L-3, T-0, P-2

Course Outcomes:

CO1: Analyze and evaluate different full stack architectures and select appropriate technologies for developing scalable web applications.

CO2: Design and implement server-side applications and RESTful APIs using Node.js and Express.js following modular programming and asynchronous execution models.

CO3: Develop and optimize dynamic and responsive user interfaces using React by applying component-based architecture, state management and event-driven programming.

CO4: Construct and integrate complete MERN stack applications by connecting React front-end, Node.js backend and MongoDB database, and evaluate application performance, scalability and maintainability.

Unit	**Contents**	**Sessions**

I	**Node.js Fundamentals and Server-Side Programming** Introduction to server-side web development and the role of JavaScript in full stack applications. Overview of Node.js and its architecture, event-driven and non-blocking I/O model, advantages of Node.js for scalable applications and comparison with traditional server technologies. Installation and setup of Node.js development environment. Working with Node.js modules including CommonJS modules, require() function, exports and module organization. File system operations and handling files using built-in modules. Asynchronous programming concepts including callbacks, promises and async–await. Event-driven programming using event emitters. Introduction to package management using npm, installing and managing dependencies, and creating simple server applications.	15
II	**Web Application Development using Express.js** Introduction to Express.js and its role in developing web applications and RESTful APIs. Creating web servers using Express.js and understanding application structure. Routing and handling HTTP requests and responses including GET, POST, PUT and DELETE methods. Middleware concepts and middleware stack, implementation of built-in and custom middleware for logging, authentication and validation. Handling request parameters, query strings and form data. Error handling and response management in Express.js applications. Introduction to RESTful API design principles and building APIs for web applications. Introduction to database connectivity and integrating Express.js with databases. Implementation of CRUD operations and handling database responses.	15
III	**Front-End Development using React.js** Introduction to modern front-end development and the role of React in building interactive user interfaces. Understanding component-based architecture and advantages of reusable UI components. Working with JSX syntax for declarative UI development. Creating functional and class components and structuring React applications. Managing data using props and component state. Event handling and user interaction in React applications. Conditional rendering and rendering lists using map() and keys. Component lifecycle concepts and hooks for managing state and side effects. Form handling and controlled components for managing user input. Basic routing concepts in React applications using routing libraries.	15
IV	**MongoDB Integration and MERN Stack Application Development** Introduction to NoSQL databases and the role of MongoDB in modern web applications. Understanding document-oriented database concepts including collections, documents and schema flexibility. Performing database operations including create, read, update and delete operations using MongoDB query language. Designing database schemas and implementing validation. Integrating Node.js and Express.js with MongoDB	15

	using database drivers or object data modeling libraries. Developing REST APIs that interact with the database layer. Connecting React front-end applications with backend APIs using HTTP requests. Managing data flow between client and server, handling asynchronous requests and displaying dynamic data in user interfaces. Overview of MERN stack architecture and development of simple full stack applications combining MongoDB, Express.js, React and Node.js.	

Text Books:

1. MERN Quick Start Guide
   Iriarte Koroliova, E. W., *MERN Quick Start Guide: Build Web Applications with MongoDB, Express.js, React, and Node*, Packt Publishing, 1st Edition, 2018, ISBN: **978-1787281080**.
2. Learning MERN
   McDowell, G. L., Deshpande, M., *Learning MERN: Create Web Applications Using MongoDB, Express.js, React, and Node.js*, Packt Publishing, 2020, ISBN: **978-1838984841**.
3. MEAN Web Development
   Haviv, A. Q., *MEAN Web Development: Expert Full Stack JavaScript*, Apress, 2021, ISBN: **978-1484270597**.

References:

1. Pro MERN Stack, Subramanian, V., *Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node*, Apress, 2nd Edition, 2019, ISBN: 978-1484230034.
2. Learning React, Banks, A., Porcello, E., *Learning React: Modern Patterns for Developing React Apps*, 2nd Edition, O'Reilly Media, 2020, ISBN: 978-1492051725.
3. Web Development with Node and Express, Brown, E., *Web Development with Node and Express: Leveraging the JavaScript Stack*, 2nd Edition, O'Reilly Media, 2019, ISBN: 978-1492053514.
4. MongoDB: The Definitive Guide, Chodorow, K., *MongoDB: The Definitive Guide*, 3rd Edition, O'Reilly Media, 2019, ISBN: 978-1491954461.
5. Full Stack React Projects, Hoque, S., Full Stack React Projects: Learn MERN Stack Development by Building Modern Web Applications, Packt Publishing, 1st Edition, 2020, ISBN: 978-1839215414.

CO-PO-PSO Mapping Table

	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4
CO1	2			2		2		
CO2	3			2	3			
CO3	3			2	3			3
CO4	3			3	3		2	3

MCA II Semester III	
MCA303 AI and Machine Learning	
Total Credits - 04	Credit Pattern L-4, T-0, P-0

Course Outcomes:

CO1: Explain the fundamental concepts, applications, learning paradigms of AI and ML.
CO2: Apply machine learning techniques for solving real-world problems.
CO3: Analyze supervised, unsupervised, and neural network-based learning models.

CO4: Demonstrate the use of AI/ML tools and frameworks for intelligent system development.		
Unit	**Contents**	**Sessions**
I	Foundations of Artificial Intelligence Introduction to AI, applications and domains of AI, key milestones, Turing Test, knowledge representation basics, intelligent agents, problem solving concepts, state space search, uninformed search techniques, heuristic search, Best First Search, Branch and Bound, A* Algorithm, overview of Machine Learning and learning paradigms	15
II	Machine Learning Fundamentals and Supervised Learning Introduction to Machine Learning, supervised, unsupervised and reinforcement learning, data preprocessing and feature engineering, model evaluation concepts, Linear Regression, Logistic Regression, Decision Trees, k-NN algorithm, overfitting and underfitting, performance measures: accuracy, precision, recall	15
III	Unsupervised Learning and Deep Learning Clustering techniques: k-Means and Hierarchical Clustering, probabilistic learning basics, Naïve Bayes classifier, Artificial Neural Networks, Perceptron model, activation functions, multilayer perceptron, introduction to Deep Learning, deep neural networks, Convolutional Neural Networks (CNN), Recurrent Neural Networks (RNN), basics of model training and backpropagation	15
IV	AI Applications and Tools Natural Language Processing basics, tokenization, stemming, lemmatization, word embeddings overview, computer vision and robotics overview, reinforcement learning and transfer learning concepts, ethics in AI, introduction to Python libraries for AI/ML: NumPy, Pandas, Matplotlib, Scikit-learn, TensorFlow/Keras	15

Text Books:

1. Russell, S., and Norvig, P., 2021, *Artificial Intelligence: A Modern Approach*, 4th Edition, Pearson.
2. Geron, A., 2022, *Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow*, 3rd Edition, O'Reilly.
3. Mitchell, T. M., 2017, *Machine Learning*, McGraw-Hill Education.
4. Goodfellow, I., Bengio, Y., & Courville, A., 2016, *Deep Learning*, MIT Press.

References:

1. Bishop, C. M., 2006, *Pattern Recognition and Machine Learning*, Springer.
2. Murphy, K. P., 2022, *Probabilistic Machine Learning: An Introduction*, MIT Press.
3. Chollet, F., 2021, *Deep Learning with Python*, 2nd Edition, Manning Publications.
4. Scikit-learn Documentation, TensorFlow Documentation, and Keras Documentation.

CO-PO-PSO Mapping Table

	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4
CO1	3			1		2		

CO2	3	1		2	2	2	1	
CO3	2	2		3	2	1	2	1
CO4	2	1	1	2	3	2	2	2

MCA II Semester III		
MCA304 Large Language Models		
Total Credits - 04	Credit Pattern L-3, T-1, P-0	
Course Outcomes: CO1: Explain the basic concepts of NLP, deep learning, transformer architecture, and Large Language Models. CO2: Apply prompt engineering and fine-tuning techniques to perform text generation and NLP tasks using modern AI tools. CO3: Develop simple AI applications using Retrieval-Augmented Generation (RAG), embeddings, and conversational AI frameworks. CO4: Analyze Agentic AI systems, applications, optimization methods, and future trends associated with Large Language Models and generative AI technologies.		
Unit	**Contents**	**Sessions**
I	**Introduction to Natural Language Processing and Deep Learning Basics.** Introduction to Artificial Intelligence, Machine Learning, Deep Learning, and Natural Language Processing (NLP). Applications of NLP in real-world systems. Text preprocessing techniques including tokenization, stop-word removal, stemming, and lemmatization. Text representation methods such as Bag-of-Words, TF-IDF, Word Embeddings, Word2Vec, and GloVe. Introduction to neural networks and deep learning concepts. Sequence models including Recurrent Neural Networks (RNN), Long Short-Term Memory (LSTM), and Gated Recurrent Units (GRU). Limitations of traditional sequence models. Overview of modern NLP evolution toward transformer-based architectures. Introduction to popular NLP libraries and tools.	15
II	**Transformers and Large Language Models.** Introduction to attention mechanism and self-attention, transformer architecture and its components including encoder, decoder, positional encoding, multi-head attention, feed-forward networks, residual connections, and layer normalization. Tokenization methods including Byte Pair Encoding (BPE) and WordPiece. Understanding pretrained language models. Overview of BERT, GPT, T5, LLaMA, and other popular LLMs. Autoregressive and bidirectional language modeling. Concept of scaling in LLMs. Introduction to open-source and commercial LLM platforms. Practical use of Hugging Face Transformers and APIs for text generation and NLP tasks.	15
III	**Prompt Engineering, Fine-Tuning, and Retrieval-Augmented Generation (RAG).** Introduction to prompt engineering, zero-shot, one-shot, and few-shot prompting techniques, chain-of-thought prompting and role-based prompting. Practical prompt design strategies. Introduction to fine-tuning and transfer learning concepts.	15

	Supervised fine-tuning and parameter-efficient fine-tuning methods including Low-Rank Adaptation (LoRA) and Parameter-Efficient Fine-Tuning (PEFT), Introduction to Retrieval-Augmented Generation (RAG). Embeddings and semantic search. Vector databases and document retrieval. Reducing hallucinations in LLMs. Introduction to conversational AI and chatbot development using LangChain and modern AI frameworks. Hands-on exposure to API-based LLM applications.	
IV	**Agentic AI, Applications, and Future Trends of LLMs.** Introduction to Agentic AI and autonomous AI systems. Difference between traditional LLMs and AI agents. Tool usage, function calling, memory mechanisms, task planning, and workflow automation using LLMs. Overview of AI agent frameworks such as LangChain, AutoGen, and CrewAI. Applications of Large Language Models in education, healthcare, finance, cybersecurity, software engineering, content generation, summarization, translation, recommendation systems, and research assistance. Introduction to multimodal AI systems. Evaluation of LLM performance using basic metrics and human evaluation. Model optimization concepts including quantization and efficient deployment. Overview of AI regulations and governance. Future directions of generative AI, autonomous agents, and next-generation intelligent systems.	15

Text Books:

1. Introduction to Large Language Models, Tanmoy Chakraborty, Wiley India Pvt. Ltd., 1st Edition, 2025, ISBN: 978-9363864740.
2. Transformers for Natural Language Processing and Computer Vision, Denis Rothman, Packt Publishing, 3rd Edition, 2024, ISBN: 978-1805128724.
3. Generative AI with LangChain, Ben Auffarth, Packt Publishing, 1st Edition, 2024, ISBN: 978-1835083468.

References:

1. Build a Large Language Model (From Scratch), Sebastian Raschka, Manning Publications, 1st Edition, 2024, ISBN: 978-1633437166.
2. Hands-On Large Language Models: Language Understanding and Generation, Jay Alammar and Maarten Grootendorst, O'Reilly Media, 1st Edition, 2024, ISBN: 978-1098150969.
3. LLM Engineer's Handbook, Paul Iusztin and Maxime Labonne, Packt Publishing, 1st Edition, 2024, ISBN: 978-1836200079.
4. Generative AI with LangChain, Ben Auffarth, Packt Publishing, 2nd Edition, 2025, ISBN: 978-1836647850.
5. Natural Language Processing with Transformers, Lewis Tunstall, Leandro von Werra, and Thomas Wolf, O'Reilly Media, 1st Edition, 2022, ISBN: 978-1098103248.NPTEL Java Programming Course: https://nptel.ac.in/courses/106105191

CO-PO-PSO Mapping Table

	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4
CO1	3			2	2	3		
CO2	3	2		3	3	2	2	

CO3	2	2	2	3	3		2	2
CO4	2	2	2	2	2	2	3	2

MCA II Semester III		
MCA305 Linux Administration		
Total Credits - 04	Credit Pattern L-3, T-0, P-2	
Course Outcomes: CO1: Write shell script programs in Linux CO2: Use various Filters and editors CO3: Create and manager file access permissions and Use various system calls CO4: Administration of Linux system		
Unit	Contents	Sessions
I	**Introduction of Linux Operating System** Overview of Operating System and Network, Types of Operating System, Introduction to Linux - History, Architecture. Comparison with UNIX, Comparison with Windows, Features and Facilities of Linux, Files and File Structure - Linux File System, Boot block, Super block, Inode table, Data blocks. Linux standard directories, File naming Conventions, Path in Linux, Types of file Names, Types of Users, file comparisons, Basic commands in Linux, File Commands in Linux, Directory Commands, System Monitoring and Performance,	15
II	**Ubuntu Linux Administration, File Security, Permissions** About Ubuntu, Installing and Configuring Ubuntu Linux Server and Desktops, Hard Disk Partition Management, Linux File System Management ,checklist for installation, Dual Boot Windows 7 and Ubuntu Installation, Creating USB booting, Installation of Linux using USB drive, Installation Methods and Classes, identifying administrative files configuration and log files, Role of system administrator, Managing user accounts, changing permissions and ownerships, Creating and managing groups, modifying group attributes, Disk quota management, Hiding Usernames Displayed on Login Screen, File security & Permissions, becoming super user using su. Locating Files, File Access Permissions [FAP], Viewing and Changing FAPs, Redirection(Input, Output & Error Redirection), Filters (grep, wc, tr, head, tail,) Getting system information with uname, host name, kernel, Run levels in Ubuntu.	15
III	**Communication in Linux:** Umask , Archive and Compression, Backup, restore and Compress - tar, cpio, dump, sync and restore, Communicating with other users in Linux - mesg, who- T, talk, write, wall, finger, chfn, SSH, Ping, FTP, Telnet traceroute utilities, Installation of software's on Linux, static and dynamic IP addressing, Administering Printers – Printing in Linux, Scanner, Installing and Configuring of servers on Ubuntu- Telnet, FTP Server, Samba DHCP Server setup Client setup, SSH Server ,XAMP, PHP, dosbox , Networking in Linux System.	15
IV	**Shell Programming**	15

	Text Editors-Functions of a Text Editor, vi Editor, leafpad editor., Basics of shell programming, various Types of shell available in Linux, comparisons between various shells, shell programming in bash - Conditional and looping statements, Iterations, Command Substitution - expr command, Modifying files Sed, awk command, arithmetic operations, Shell variables, system shell variables, shell keywords, Creating Shell programs for automating system tasks, handling files using command line argument. Introduction to system calls.	

Text Books:

1. Beginning Linux Programming: Neil Mathrew Richard Steve Wrox publication.
2. Design of Linux Operating Systems : Maurice Bach
3. Ubuntu on a Dime : James Floyd Kelly

References:

1. Operating System - Linux, NUT Press, PHI Publisher, 2016 Edition
2. Red Hat Linux Bible, Cristopher Negus, Wiley Dreamtech India
3. UNIX Shell Programming by YeswantKanetkar, BPB
4. Linux Administration Handbook, EviNemeth,Garth Snyder, Trent KHein - Pearson Education.
5. Beginning Linux Programming by Neil Mathew & Richard Stones, Wiley Dreamtech India

CO-PO-PSO Mapping Table

	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4
CO1	3	1	–	2	3	2	–	1
CO2	2	2	–	3	2	2	1	1
CO3	2	2	1	2	2	3	3	3
CO4	2	2	–	3	2	2	1	2

MCA II Semester III	
MCA306 DevOps Technology	
Total Credits - 04	Credit Pattern L-3, T-1, P-0

Course Outcomes:

CO1: Analyze version control requirements and evaluate Git workflows to optimize collaborative development and code management practices.

CO2: Design, implement, and manage advanced Git operations such as branching, merging, stashing, tagging, and remote repository synchronization for real-world project collaboration.

CO3: Construct containerized applications using Docker, integrating networking, volumes, multi-container architectures, and optimized Dockerfiles, and evaluate deployment strategies for performance and maintainability.

CO4: Create, implement, and manage Jenkins CI/CD pipelines to automate build, test, and deployment processes, critically evaluating and improving software delivery workflows for efficiency, reliability, and scalability.

Unit	Contents	Sessions
I	**Version Control System and Basic Git Commands**	15

	Introduction to version control systems and the role of Git in managing software development projects. Overview of version control concepts, differences between centralized and distributed systems, and advantages of Git as a distributed VCS. Understanding the Git workflow from untracked to staged to committed files and evaluating the structure of local repositories. Installation and configuration of Git on Windows and Linux environments, setting user identity, and initializing repositories. Working with the staging area using git add, performing commits with git commit, and understanding commit storage and file status transitions. Exploring file restoration and undo operations using git restore and git checkout. Viewing commit history with git log and git diff, analyzing changes at different stages, and understanding the .git folder structure. Cloning repositories, understanding remote connections, and performing basic pull and push operations to synchronize local and remote repositories.	
II	**Advanced Git Commands and Collaboration** Advanced Git concepts for collaborative software development, including the use of reference logs to track and recover lost commits. Understanding tagging strategies for release management, including lightweight and annotated tags, and their application in version control. Branching concepts for feature development, naming conventions, and strategies for organizing work across multiple branches. Merging techniques, including fast-forward and merge commits, conflict detection, and resolution, along with safe revert operations for maintaining repository integrity. Remote repository management using GitHub, including creating repositories, adding collaborators, synchronizing local and remote changes, and managing access control. Practical implementation of workflows such as fork, clone, pull requests, and push operations to evaluate and optimize collaborative development practices.	15
III	**Introduction to Docker** Containerization concepts and the role of Docker in modern software development, highlighting differences between virtual machines and containers, including isolation, image management, and portability. Docker architecture, covering the daemon, client, registry, images, and containers. Installation and configuration of Docker on desktop and engine environments, along with verification of setup. Container operations such as running, stopping, restarting, and removing containers, as well as managing images using pull, remove, and proper naming conventions. Networking concepts including port mapping, exposing container ports, and container communication using bridge networks. Storage management using volumes, including bind mounts and named volumes, to achieve data persistence across container lifecycles. Creation of Dockerfiles, building custom images, deploying simple web applications, and	15

	leveraging Docker Compose to orchestrate multi-container applications for scalable, maintainable containerized solutions.	
IV	**Jenkins Pipeline and CI/CD** Continuous Integration and Continuous Deployment concepts using Jenkins, including the principles and benefits of automating build, test, and deployment processes. Jenkins architecture, the master/controller and agent roles in distributed environments, scaling considerations for large projects. Configuration of Jenkins with Git, creation of freestyle jobs, and implementation of build triggers such as manual execution and SCM polling. Construction of declarative Jenkins pipelines, incorporating steps for code checkout, build, testing, artifact archiving, and deployment. Integration of pipelines with Git repositories, automation of notifications, and management of post-build actions. Evaluation and optimization of CI/CD workflows to improve build reliability, testing coverage, and deployment efficiency, enabling students to design and implement automated DevOps pipelines for real-world software delivery.	15

Text Books:

1. Pro Git, Chacon, S., & Straub, B., Apress, 2nd Edition, 2014, ISBN: 978-1484200773.
2. Docker Deep Dive, Nigel Poulton, 3rd Edition, 2020, ISBN: 978-1521822804.
3. Jenkins 2: Up and Running, O'Reilly Media, 2nd Edition, 2018, ISBN: 978-1491979591.

References:

1. Git Pocket Guide, Richard E. Silverman, O'Reilly Media, 2nd Edition, 2013, ISBN: 978-1449325862.
2. Docker in Action, Jeffrey Nickoloff, 2nd Edition, Manning Publications, 2020, ISBN: 978-1617294769.
3. Learning Continuous Integration with Jenkins, Nikhil Pathania, Packt Publishing, 2018, ISBN: 978-1787126698.
4. The DevOps Handbook, Gene Kim et al., IT Revolution Press, 2016, ISBN: 978-1942788003.
5. **5. Continuous Delivery: Reliable Software Releases through Build, Test, and Deployment Automation**, Jez Humble & David Farley, Addison-Wesley, 1st Edition, 2010, ISBN: 978-0321601919.

CO-PO-PSO Mapping Table

	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4
CO1			3			3		
CO2	3		3		3	2		
CO3	3			3	3		3	2
CO4	3			3	3		3	3

MCA II Semester III	
MCA307 A) Internet of Things	
Total Credits - 02	Credit Pattern L-2, T-0, P-0
Course Outcomes:	

CO1: Understand IoT concepts, protocols, and applications.
CO2: Analyze IoT systems, technologies, and emerging trends.

Unit	Contents	Sessions
I	**IoT Foundations & Modern Technologies** Introduction to IoT, evolution, architecture and components; IoT frameworks and real-world applications (smart cities, healthcare, industry, agriculture, Internet of Medical Things (IoMT)); IoT communication models and protocols (MQTT, CoAP, REST, AMQP); overview of sensors and actuators, types of sensors and sensor characteristics; edge devices; introduction to edge and fog computing; basics of cloud integration in IoT; IoT data generation and lifecycle; overview of IoT platforms (AWS IoT, Azure IoT); introduction to IoT gateways and device management; security challenges in IoT including authentication, encryption, privacy issues and secure communication practices.	15
II	**IoT Systems, Analytics & Emerging Trends** IoT connectivity technologies (Zigbee, BLE, Wi-Fi, **Li-Fi**, LoRa, NB-IoT, LPWAN technologies); IPv6 and addressing in IoT; introduction to embedded systems using Arduino and Raspberry Pi; interfacing sensors and actuators; real-time data processing in IoT systems; basic IoT data analytics and visualization; introduction to AI/ML in IoT (smart predictions, anomaly detection); IoT application development and case studies (smart home, smart health, smart agriculture, **IoMT applications**); emerging trends in IoT including Industrial IoT (IIoT), Digital Twins, 5G-enabled IoT, blockchain in IoT and Green IoT.	15

Text Books:

1. Minoli, D., 2013. Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications. 1st ed. Hoboken: Wiley.
2. Bahga, A. and Madisetti, V., 2015. Internet of Things: A Hands-on Approach. 1st ed. Hyderabad: Universities Press.
3. Gondosubroto, R., 2024. Internet of Things from Scratch. Birmingham: Packt Publishing.
4. Chowdary, V., Sharma, A., Kumar, N. and Kaundal, V., 2023. Internet of Things in Modern Computing. Boca Raton: CRC Press.

References:

1. Correia, S. (ed.), 2024. The Internet of Things: Current Trends, Applications and Future Challenges. Basel: MDPI.
2. Hassan, Q.F. (ed.), 2025. Internet of Things A to Z: Technologies and Applications. 2nd ed. Hoboken: Wiley.
3. Ziegler, S. et al. (eds.), 2024. Springer Handbook of Internet of Things. Cham: Springer.
4. Yue, X., 2025. Internet of Things (IoT): An Engineering Approach. 1st ed. Amsterdam: Elsevier.
5. Sharma, T.K. et al., 2026. Understanding Internet of Things: Evolution, Enabling Technologies and Challenges. Cham: Springer.

CO-PO-PSO Mapping Table

	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4
CO1	3	2	1	2	3	2	1	1
CO2	2	3	1	3	2	2	2	2

MCA II Semester III

MCA307 b) Penetration Testing

Total Credits - 02	Credit Pattern L-2, T-0, P-0

Course Outcomes:

CO1: Explain the concepts, methodologies, ethical considerations of penetration testing.
CO2: Identify common system, network, and web application vulnerabilities.
CO3: Describe penetration testing tools and basic exploitation techniques.
CO4: Understand security assessment methods and mitigation strategies for improving system security.

Unit	Contents	Sessions
I	Introduction to Penetration Testing Fundamentals of ethical hacking and penetration testing, types of hackers and hacking methodologies, legal and ethical issues, penetration testing phases, reconnaissance and information gathering, footprinting and OSINT techniques, network scanning and enumeration basics, overview of penetration testing tools	15
II	Vulnerability Assessment and Security Measures Vulnerability assessment concepts, password attacks and authentication weaknesses, web application security basics, wireless security concepts, social engineering awareness, security controls and mitigation strategies, basics of security auditing and incident response, penetration testing reporting and documentation	15

Text Books:

1. Weidman, G., 2014. *Penetration Testing: A Hands-On Introduction to Hacking*. No Starch Press.
2. Whitman, M.E. and Mattord, H.J., 2021. *Principles of Information Security*. Cengage Learning.
3. Kim, D. and Solomon, M., 2016. *Fundamentals of Information Systems Security*. Jones & Bartlett Learning.
4. Stuttard, D. and Pinto, M., 2011. *The Web Application Hacker's Handbook*. Wiley.

References:

1. National Institute of Standards and Technology (NIST), *Technical Guide to Information Security Testing and Assessment (SP 800-115)*.
2. OWASP Foundation, *OWASP Web Security Testing Guide*.
3. MITRE Corporation, *MITRE ATT&CK Framework Documentation*.
4. EC-Council, *Ethical Hacking Guidelines and Documentation*.

CO-PO-PSO Mapping Table

	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4
CO1	3				1			
CO2	2	3			1			
CO3	2	2	1		1	1	1	
CO4	1	2		1	1	1	1	1

MCA I Semester III		
MCA307 c) Big Data Analytics		
Total Credits - 02	Credit Pattern L-2, T-0, P-0	
Course Outcomes: CO1: Understand fundamental concepts of big data and analytics techniques. CO2: Analyze big data processing frameworks and tools.		
Unit	**Contents**	**Sessions**
I	**Introduction to Big Data:** Characteristics (5Vs), Data Sources, Big Data vs Traditional Data, Applications, Big Data Lifecycle, Types of Data, Challenges in Big Data, Big Data Architecture Overview, Data Preprocessing, Visualization, Descriptive & Predictive Analytics, Data Cleaning and Transformation, Exploratory Data Analysis (EDA)	15
II	**Big Data Technologies:** Hadoop Ecosystem, HDFS, MapReduce, Spark Basics, YARN, Hive and Pig, Apache Kafka, NoSQL Databases, Significance of Cluster monitoring, Use Cases, Data Security, Privacy, Ethical Issues, Future Trends	15
Text Books: 1. Tom White, Hadoop: The Definitive Guide, O'Reilly 2. Seema Acharya & Subhashini Chellappan, Big Data Analytics, Wiley		
References: 1. Apache Hadoop Documentation – https://hadoop.apache.org 2. Apache Spark Documentation – https://spark.apache.org		

CO-PO-PSO Mapping Table

	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4
CO1								
CO2								
CO3								
CO4								