MITS Kochi
Muthoot Institute of Technology and Science (Autonomous)

MCA

(MASTER OF COMPUTER APPLICATION)

CURRICULUM G SYLLABUS

SEMESTER 1 - 3

2025 REGULATION

MASTER OF COMPUTER APPLICATIONS

(MCA)

2025 REGULATION

CURRICULUM & SYLLABUS

CONTENTS

CURRICULUM STRUCTURE

SEM	SLOT	COURSE CATEGORY	COURSE CODE	COURSE NAME	L	T	J	P	S	C	CREDIT / SEM
I	A	PC	A250201/MA100A	Mathematical Foundations for Computing	3	1	0	0	4	4	22
	B	PC	A250201/CA100B	Digital Fundamentals and Computer Architecture	3	1	0	0	4	4	
	C	PC	A250201/CA100C	Advanced Data Structures	3	1	0	0	4	4	
	D	PC	A250201/CA100D	Advanced Software Engineering	3	1	0	0	4	4	
	T	PC	A250201/CA130T	Programming Lab	1	0	0	3	0	2	
	U	PC	A250201/CA130U	Web Programming Lab	1	0	1	2	0	2	
	V	PC	A250201/CA130V	Data Structures Lab	0	1	0	3	0	2	
	K	SE	A250201/CA130K	Skill Enhancement Course-I	0	0	0	1	0	0	
II	A	PC	A250201/CA200A	Advanced Database Management Systems	3	1	0	0	4	4	23
	B	PC	A250201/CA200B	Advanced Computer Networks	3	1	0	0	4	4	
	C	PE	A250201/CA21*C	Program Elective I	3	1	0	0	4	4	
	D	PE	A250201/CA21*D	Program Elective II	3	1	0	0	4	4	
	T	PC	A250201/CA230T	Object Oriented Programming Lab	1	0	0	3	0	2	
	U	PC	A250201/CA230U	Advanced DBMS Lab	0	1	1	2	0	2	
	V	PC	A250201/CA230V	Networking and System Administration Lab	1	0	0	3	0	2	
	L		A250201/CA230L	First NPTEL course						1	
III	A	PC	A250201/CA300A	Data Science and Machine Learning	3	1	0	0	4	4	22
	B	PC	A250201/CA300B	Design & Analysis of Algorithms	3	1	0	0	4	4	
	C	PE	A250201/CA31*C	Program Elective I	3	1	0	0	4	4	
	D	PE	A250201/CA31*D	Program Elective II	3	1	0	0	4	4	
	T	PC	A250201/CA330T	Data Science Lab	0	1	0	3	0	2	
	U	PC	A250201/CA330U	Mobile Application Development Lab	1	0	1	2	0	2	
	V	PS	A250201/CA330V	Mini Project	0	0	4	0	0	2	
	K	SE	A250201/CA330K	Skill Enhancement Course-II	0	0	0	1	0	0	
IV	A	PS	A250201/CA430A	Comprehensive Viva	0	0	0	0	4	4	19
	B	PS	A250201/CA430B	Main Project	0	0	0	27	12	12	
	K	PS	A250201/CA430K	Research Seminar	0	0	0	2	2	2	
	L		A250201/CA430L	Second NPTEL course						1	
Total Earned Credits											86

Program Elective I		
Sem	Course Code	Course Name
2	A250201/MA211C	Applied Statistics
2	A250201/CA212C	Block Chain Technology
2	A250201/CA213C	Organizational Behaviour
2	A250201/CA214C	Advanced Operating Systems
3	A250201/CA311C	Operations Research
3	A250201/CA312C	Cyber Security & Cryptography
3	A250201/CA313C	Cloud Computing
3	A250201/CA314C	Compiler Design

Program Elective II		
Sem	Course Code	Course Name
2	A250201/CA211D	IPR & Cyber Laws
2	A250201/CA212D	Business Management
2	A250201/CA213D	Cyber Forensics
2	A250201/CA214D	Artificial Intelligence
3	A250201/CA311D	Internet of Things
3	A250201/CA312D	Deep Learning
3	A250201/CA313D	Digital Image Processing
3	A250201/CA314D	Bioinformatics

SEMESTER I

SEMESTER 1

CURRICULUM

SLOT	COURSE CATEGORY	COURSE CODE	COURSE NAME	L	T	J	P	SS	C
A	PC	A250201/MA100A	Mathematical Foundations for Computing	3	1	0	0	4	4
B	PC	A250201/CA100B	Digital Fundamentals and Computer Architecture	3	1	0	0	4	4
C	PC	A250201/CA100C	Advanced Data Structures	3	1	0	0	4	4
D	PC	A250201/CA100D	Advanced Software Engineering	3	1	0	0	4	4
T	PC	A250201/CA130T	Programming Lab	1	0	0	3	0	2
U	PC	A250201/CA130U	Web Programming Lab	1	0	1	2	0	2
V	PC	A250201/CA130V	Data Structures Lab	0	1	0	3	0	2
K	SE	A250201/CA130K	Entrepreneurship and Innovations in Technology	0	1	0	0	0	0
				14	**6**	**1**	**8**		**22**

(L- Lecture, T-Tutorial, J-Project, P-Practical, S-Self-learning & Team Work, C- Credit)

(PC- Programme Core, SE- Skill Enhancement Course)

COURSE DESCRIPTION							
REGULATION	**2025**	**L-T-J-P-S**	**3-1-0-0-4**	**Version**	**25/0**	**Credits**	**4**
(L- Lecture, T-Tutorial, J-Project, P-Practical, S-Self-learning & Team Work)							

Course Code	Course Name	Course Category
A250201/MA100A	**MATHEMATICAL FOUNDATIONS FOR COMPUTING**	**PC**
Pre-requisite		
A basic knowledge in set theory and statistics.		

TEACHING AND ASSESSMENT SCHEME									
Teaching Scheme / Week					**Credit**	**Hours / Semester**	**Examination Scheme**		
							Theory		
L	**T**	**J**	**P**	**S**	**C**		**CIA**	**ESE**	**Total**
3	1	0	0	4	4	120	40	60	100

***L**: Lecture (One unit is of one-hour duration), **T**: Tutorial (One unit is of one-hour duration), **P**: Practical (One unit is of one-hour duration), **J**: Project (One unit is of one-hour duration), **S**: Self-Learning & Team Work (One unit is of one-hour duration), **CIA**: Continuous Internal Assessment, **ESE**: End Semester Examination*

SYLLABUS (Major Topics)			
Module	Title	Major Topics	Hrs
1	Sets, Relations and Functions	Sets, Relations, Equivalence Relations, Partial Ordering, Functions.	**9**
2	Number Theory and Recurrence Relations	Division Algorithm, GCD, Primes, Euclidean Algorithm, Congruences, Solutions of Linear Congruences, Chinese Remainder Theorem, Recurrence Relations.	**10**
3	Graph Theory	Graph Terminology, Graph Models, Representing Graphs and Graph Isomorphism, Connectivity, Shortest-Path Problems, Planar Graphs.	**9**
4	Linear Algebra	Linear system of equations, Gauss elimination method, Determination of eigenvalues and eigenvectors, Diagonalization of matrix, Quadratic forms.	**9**
5	Statistics	Bivariate data – Scatter Diagram, Linear correlation and regression, Principle of least squares, Curve fitting.	**8**

SUGGESTED LEARNING RESOURCES

Text Book			
Sl. No.	Title of Book	Author	Publication
1	Discrete mathematics and its applications	Kenneth H. Rosen	McGraw-Hill, (7th Edition),
2	Elementary Number Theory	David M. Burton	McGraw-Hill, 7th Edition
2	Advanced Engineering Mathematics	Erwin Kreyszig	10th ed., Wiley
3	Fundamentals of Mathematical Statistics	Gupta S.C and Kapoor V. K	Sultan Chand and Sons 11th edition.

Reference			
Sl. No.	Title of Book	Author	Publication
1	Discrete and Combinatorial Mathematics: An applied introduction	Ralph P Grimaldi	Pearson Education, 5th Edition
2	Elementary Number Theory	David M. Burton	McGraw-Hill, 7th Edition
3	Linear Algebra and its Applications	Gilbert Strang	S. Chand Company Ltd,4th edition

COURSE DESCRIPTION							
REGULATION	**2025**	**L-T-J-P-S**	**3-1-0-0-4**	**VERSION**	**25/0**	**CREDITS**	**4**
(L- Lecture, T-Tutorial, J-Project, P-Practical, S-Self-learning & Team Work)							

COURSE CODE	COURSE NAME	COURSE CATEGORY
A250201|CA100B	**DIGITAL FUNDAMENTALS & COMPUTER ARCHITECTURE**	**PC**
Pre-requisite		
Understanding number systems and binary arithmetic.		

TEACHING AND ASSESSMENT SCHEME									
Teaching Scheme / Week					**Credit**	**Hours / Semester**	**Examination Scheme**		
							Theory		
L	**T**	**J**	**P**	**S**	**C**		**CIA**	**ESE**	**Total**
3	1	0	0	4	4	120	40	60	100
***L**: Lecture (One unit is of one-hour duration), **T**: Tutorial (One unit is of one-hour duration), **P**: Practical (One unit is of one-hour duration), **J**: Project (One unit is of one-hour duration), **S**: Self-Learning & Team Work (One unit is of one-hour duration), **CIA**: Continuous Internal Assessment, **ESE**: End Semester Examination*									

SYLLABUS (Major Topics)			
Module	Title	Major Topics	Hrs
1	Logic Gates, Boolean Algebra & Combinational Circuits	Representation of signed numbers – 1's complement and 2's complement, Logic gates – AND OR – NOT - NAND-NOR - XOR , Boolean algebra - Basic laws and theorems , Boolean functions - truth table, Standard forms of Boolean Expressions – Sum of Products and Product of Sums - minimization of Boolean function using Karnaugh map method - Realization using logic gates, Floating point numbers Combinational Circuits - Half adder - Full Adder- Decoder -Encoder- Multiplexer – Demultiplexer	11
2	Sequential Circuits, Counters & Registers	Sequential circuit - Clocking, Flip flops - SR – JK- D -T flip flops, Counters - Synchronous and asynchronous counters - UP/DOWN counters, Registers - Serial in serial out - Serial in parallel out - Parallel in serial out - Parallel in parallel out registers	10
3	Computer Architecture	Computer abstractions and technology - Introduction, Computer architecture -8 Design features, Application program - layers of abstraction, Five key components of a computer, Technologies for building processors and memory, Performance, Instruction set principles – Introduction, Classifying instruction set architectures, Memory addressing, Encoding an instruction set.	10
4	Processor and I/O	The Processor - Introduction, Logic design conventions, Building a data path, A simple implementation scheme, An overview of pipelining - Pipelined data path and control - Structural hazards - Data hazards - Control hazards I/O organization - Accessing I/O devices, interrupts - handling multiple devices, Direct memory access	10
5	Memory	The Memory System – basic concepts, semiconductor RAM memories - organization – static and dynamic RAM, Structure of larger memories, semiconductor ROM memories, Speed, Size and cost, Cache memory – mapping functions – replacement algorithms, Virtual memory – paging and segmentation.	9

SUGGESTED LEARNING RESOURCES

Text Book			
Sl. No.	Title of Book	Author	Publication
1	Digital Fundamentals	Thomas L Floyd	Pearson Education, 11th edition, 2018
2	Fundamentals of Digital Circuits	A Anand Kumar	PHI, 4th edition, 2016
3	Computer Organization and Design: The Hardware/Software Interface	David A. Patterson, John L. Hennessy	Elsevier (India) Pvt. Ltd., New Delhi, 6th edition, 2021
4	Computer Organization	Hamacher, Vranesic & Zaky	5th Edition, McGraw Hill

Reference			
Sl. No.	Title of Book	Author	Publication
1	Computer Organization and Architecture: Designing for Performance	William Stallings	Pearson Education 11th edition, 2022
2	Modern Digital Electronics	R. P. Jain, Kishore Sarawadekar	McGraw Hill., 5 th Edition, 2022
3	Digital Design: With an Introduction to Verilog HDL	M Morris Mano, Michael D Ciletti	Pearson Education, 6th Edition, 2018

COURSE DESCRIPTION							
REGULATION	**2025**	**L-T-J-P-S**	**3-1-0-0-4**	**VERSION**	**25/0**	**CREDITS**	**4**
(L- Lecture, T-Tutorial, J-Project, P-Practical, S-Self-learning & Team Work)							

COURSE CODE	**COURSE NAME**	**COURSE CATEGORY**
A250201/CA100C	**ADVANCED DATA STRUCTURES**	**PC**
Pre-requisite		
A solid understanding of basic data structures and fundamentals of programming in C		

TEACHING AND ASSESSMENT SCHEME

Teaching Scheme / Week					Credit	Hours / Semester	Examination Scheme		
							Theory		
L	**T**	**J**	**P**	**S**	**C**		**CIA**	**ESE**	**Total**
3	1`	0	0	4	4	120	40	60	100

***L**: Lecture (One unit is of one-hour duration), **T**: Tutorial (One unit is of one-hour duration), **P**: Practical (One unit is of one-hour duration), **J**: Project (One unit is of one-hour duration), **S**: Self-Learning & Team Work (One unit is of one-hour duration), **CIA**: Continuous Internal Assessment, **ESE**: End Semester Examination*

SYLLABUS (Major Topics)

Module	Title	Major Topics	Hrs
1	Basic Data Structures	Basic Data Structures: - Arrays and Its representation, Stack, Queue and its Applications, Circular Queue, Priority Queue, Linked List- Singly LL, DLL, CLL., Header Linked List, Linked Stack and Linked Queue, Introduction to Tree	**12**
2	Hashing and Set Data Structure	Hashing: - Simple hash functions, Collision and Collision Resolution techniques Set Data Structure: - Representation of sets, Set implementation using bit string. Amortised Analysis - Aggregate, Accounting and Potential Methods (using the examples Multipop Stack and Incrementing Binary Counter only) Disjoint sets- representations, Union, Find algorithms	**8**
3	Advanced Tree Structures	Advanced Tree Structures: - Balanced Binary Search trees, Red-Black trees- Properties of Red Black trees, Rotations, Insertion, Deletion. B-Trees- Basic operations on B-Trees – Insertion and Deletion, Introduction to Splay Trees and Suffix Trees.	**12**
4	Advanced Heap Structures	Advanced Heap Structures: - Mergeable Heaps and operations on Mergeable Heaps. Binomial Heaps, Binomial Heap operations and Analysis, Fibonacci Heaps, Fibonacci Heap operations and Analysis.	**10**
5	Advanced Graph Structures	Advanced Graph Structures: - Representation of graphs, Depth First and Breadth First Traversals, Topological Sorting, Strongly connected Components and Biconnected Components Minimum Cost Spanning Tree algorithms- Prim's Algorithm, Kruskal' Algorithm, Shortest Path Finding algorithms – Dijikstra's single source shortest paths algorithm.	**9**

SUGGESTED LEARNING RESOURCES

Text Book			
Sl. No.	Title of Book	Author	Publication
1	Introduction to Algorithms	Cormen T.H., Leiserson C.E, Rivest R.L. and Stein C	Prentice Hall India, New Delhi, 4th edition, 2022
2	Classic Data structures	D.Samantha	Prentice Hall India, New Delhi,2009

Reference			
Sl. No.	Title of Book	Author	Publication
1	Data Structures – a pseudocode approach with C	Richard F Gilberg, Behrouz A Forouzan	Thomson Learning, 2nd Edition, Cengage Learning C, 2005, ISBN-13: 9780534390808
2	Fundamentals of Data Structures In C	Ellis Horowitz and Sartaj Sahni	Orient Blackswan,2008, ISBN: 9788173716058, 8173716056
3	Data Structures, Algorithms, and Applications in C++	Sahni S	Mc Graw Hill, 2000, ISBN-13: 978-0072362268
4	Data Structures and Algorithms	Aho A.V., Hopcroft J.E., and Ullman J.D.	Pearson Education, New Delhi, 1983, ISBN 13: 9780201000238

COURSE DESCRIPTION							
REGULATION	**2025**	**L-T-J-P-S**	**3-1-0-0-4**	**VERSION**	**25/0**	**CREDITS**	**4**
(L- LECTURE, T-TUTORIAL, J-PROJECT, P-PRACTICAL, S-SELF-LEARNING & TEAM WORK)							

COURSE CODE	COURSE NAME	COURSE CATEGORY
A250201/CA100D	**ADVANCED SOFTWARE ENGINEERING**	**PC**
Pre-requisite		
Programming proficiency in at least one of C, C++, Java, Python or PHP programming languages. Basic understanding of the software life cycle.		

TEACHING AND ASSESSMENT SCHEME

Teaching Scheme / Week					Credit	Hours / Semester	Examination Scheme		
							Theory		
L	**T**	**J**	**P**	**S**	**C**		**CIA**	**ESE**	**Total**
3	1	0	0	4	4	120	40	60	100

***L**: Lecture (One unit is of one-hour duration), **T**: Tutorial (One unit is of one-hour duration), **P**: Practical (One unit is of one-hour duration), **J**: Project (One unit is of one-hour duration), **S**: Self-Learning & Team Work (One unit is of one-hour duration), **CIA**: Continuous Internal Assessment, **ESE**: End Semester Examination*

SYLLABUS (Major Topics)

Module	Title	Major Topics	Hrs
1	Software Engineering	Introduction to Software Engineering, Life cycle of a software system, Project planning phase, Software Engineering models, Software requirements specification	10
2	Industry Best Practices	Programming Style Guides and Coding Standards, GIT Version Control System, Software Quality	10
3	System Design Methodologies and Software Testing Principles.	OOP Concepts, Design Patterns, Unit Testing and Unit Testing frameworks, Software Testing Principles, Testing Automation	15
4	Agile Development Methodology	Concepts of Agile Development Methodology, Agile Development Models, Scrum Framework	10
5	Continuous Integration / Continuous Delivery and Deployment	Software Configuration Management, Continuous Integration, Continuous Delivery, Build and deployment automation	10

SUGGESTED LEARNING RESOURCES

Text Book

Sl. No.	Title of Book	Author	Publication
1	What Every Engineer Should Know about Software Engineering	Philip A. Laplante	CRC Press, 2nd Edition, 2022
2	Mastering Software Quality Assurance: Best Practices, Tools and Technique for Software Developers	Murali Chemuturi	J Ross Publishing, 2010
3	Design Patterns: Elements of Reusable Object-Oriented Software	Erich Gamma et. al.	Addison-Wesley, 1st Edition, 1994
4	Agile Software Development with Scrum	Ken Schwaber	Pearson, 1st Edition, 2002
5	Unit Test Frameworks	Paul Hamill	O'Reilly Media, 2005
6	Continuous Delivery: Reliable Software Releases through Build, Test, and Deployment Automation	Jez Humble and David Farley	Pearson Education, 2010

Reference			
Sl. No.	Title of Book	Author	Publication
1	Pro Git, 2nd Edition	Ben Straub, Scott Chacon	Apress, 2nd Edition, 2014
2	Java Design Patterns: A Hands-On Experience with Real-World Examples	Vaskaran Sarcar	Apress, 2nd Edition, 2018
3	Agile Software Development: The Cooperative Game (2nd edition)	Alistair Cockburn and Robert Cecil Martin	Addition Wesley, 2nd Edition, 2006
4	Agile Testing: A Practical Guide for Testers and Agile Teams	Lisa Crispin	Adison Wesley, 1st Edition, 2009
5	The Art of Software Testing	Glenford J. Myers, et. al.,	Wiley, 3rd Edition, 2011
6	A Practitioner's Guide to Software Test Design	Lee Copeland	Artech House Publishers, Illustrated, 2003

COURSE DESCRIPTION							
REGULATION	**2025**	**L-T-J-P-S**	**1-0-0-3-0**	**VERSION**	**25/0**	**CREDITS**	**2**
(L- LECTURE, T-TUTORIAL, J-PROJECT, P-PRACTICAL, S-SELF-LEARNING & TEAM WORK)							

COURSE CODE	**COURSE NAME**	**COURSE CATEGORY**
A250201/CA130T	**PROGRAMMING LAB**	**PC**
Pre-requisite		
. Basics of programming.		

TEACHING AND ASSESSMENT SCHEME

Teaching Scheme / Week					Credit	Hours / Semester	Examination Scheme		
							Practical		
L	**T**	**J**	**P**	**S**	**C**		**CIA**	**ESE**	**Total**
1	0	0	3	0	2	60	50	50	100

***L**: Lecture (One unit is of one-hour duration), **T**: Tutorial (One unit is of one-hour duration), **P**: Practical (One unit is of one-hour duration), **J**: Project (One unit is of one-hour duration), **S**: Self-Learning & Team Work (One unit is of one-hour duration), **CIA**: Continuous Internal Assessment, **ESE**: End Semester Examination*

SYLLABUS (Major Topics)

Module	Title	Major Topics	Hrs
1	Introduction	Basics of Python Programming, Data types, Operators, Input/Output, Built-in Functions	10
2	Control Structures and Functions	Decision making, Looping, User defined functions Recursion	10
3	Packages	Modules, Package	5
4	Object Oriented Programming	Objects, Class in Python, Constructors, Inheritance, Polymorphism, Exception Handling	10
5	Files	Creation, Reading, Writing files	10

PRACTICAL SYLLABUS

Objective	Topic	COs	Learning Domain Level (C)	Hrs
To familiarize with Python basics, input/output operations, operators, and different data types to write simple programs	Introduction	CO1	A	10
To implement problem-solving using conditional statements, loops, and user-defined functions	Control Structures and Functions	CO2	A	10
To organize programs using built-in and user-defined modules/packages for modularity and reusability	Packages	CO3	A	5
To design and implement Python programs using OOP principles and operator overloading	Object Oriented Programming	CO4	A	10
To perform file operations (text, binary, CSV) and apply regular expressions for data validation and processing	Files	CO5	A	10

SUGGESTED LEARNING RESOURCES

Text Book

Sl. No.	Title of Book	Author	Publication
1	Core Python Applications Programming, 3rd Edition	Wesley J. Chun	Pearson Education,2016
2	Introduction to Computer Science using Python	Charles Dierbach	Wiley,2015

Reference			
Sl. No.	Title of Book	Author	Publication
1	Taming Python by Programming	Jeeva Jose	Khanna Publishers, New Delhi,2018
2	How to Think Like a Computer Scientist: Learning with Python	Downey, A. et al.	John Wiley, 2015

COURSE DESCRIPTION							
REGULATION	**2025**	**L-T-J-P-S**	**1-0-1-2-0**	**VERSION**	**25/0**	**CREDITS**	**2**
(L- Lecture, T-Tutorial, J-Project, P-Practical, S-Self-learning & Team Work)							

COURSE CODE	**COURSE NAME**	**COURSE CATEGORY**
A250201/CA130U	**WEB PROGRAMMING LAB**	**PC**
Pre-requisite		
Basic understanding of computer programming, Internet and, Database will be very helpful.		

TEACHING AND ASSESSMENT SCHEME

Teaching Scheme / Week					Credit	Hours / Semester	Examination Scheme		
							Practical		
L	**T**	**J**	**P**	**S**	**C**		**CIA**	**ESE**	**Total**
1	0	1	2	0	2	60	50	50	100

***L**: Lecture (One unit is of one-hour duration), **T**: Tutorial (One unit is of one-hour duration), **P**: Practical (One unit is of one-hour duration), **J**: Project (One unit is of one-hour duration), **S**: Self-Learning & Team Work (One unit is of one-hour duration), **CIA**: Continuous Internal Assessment, **ESE**: End Semester Examination*

SYLLABUS (Major Topics)

Module	Title	Major Topics	Hrs
1	Introduction to Web, HTML and CSS	Introduction to Web: Client/Server concepts, Components of Web Application, Types of Web Content, Overview of HTTP - HTTP request – response, Generation of dynamic web pages, Application Servers, Web Security. Markup Language (HTML): Formatting and Fonts, Commenting Code, Anchors, Backgrounds, Images, Hyperlinks, Lists, Tables, Frames, HTML Forms. Cascading Style Sheet (CSS): The need for CSS, Basic syntax and structure, Inline Styles, Embedding Style Sheets, Linking External Style Sheets, Backgrounds, manipulating text, Margins and Padding, Positioning using CSS.	**18**
2	Client-Side Scripting Using Javascript	Client-Side Scripting using JavaScript: Core features, Data types and Variables, Operators-Expressions and Statements, Functions, Objects, Array, String - Date and Math related Objects, Document Object Model, Event Handling, Form handling and validations.	**12**
3	Relational Database Design	An overview of Relational Database Design: Tables, Attributes, Tuples, Primary keys, Foreign keys, Indexes, DDL Commands – CREATE, ALTER, DROP and TRUNCATE; DML Commands – SELECT, INSERT, UPDATE and DELETE.	**10**
4	Server-Side Scripting Using PHP	Server-Side Scripting using PHP: Setting up the environment (Example - XAMP server), PHP Programming basics - Print/echo, Variables and constants, Strings and Arrays, Operators, Control structures and looping structures, Functions, Reading Data in Web Pages, Embedding PHP within HTML, establishing connectivity with database, Debugging with phpdbg.	**12**

5	Web Application Development in Any PHP Framework and Debugging Web Apps	Web Application development in any PHP framework (Laravel, CodeIgniter, Symfony, CakePHP, etc.), Naming convention, MVC model, Connectivity with Database, Database interaction. Debugging web apps: Browser debugging tools (Any browser web developer tools) – View and change the DOM and CSS, Console, Debug JavaScript, View and debug network activity, Performance tools, etc.	**8**

PRACTICAL SYLLABUS				
Objective	Topic	CO	Learning Domain Level	Hrs
To provide foundational knowledge of markup languages and their features for creating interactive and well-structured web pages.	**Introduction to Web and HTML**: Simple HTML file creation to demonstrate the use of different tags.	CO 1	C	2
	HTML Links and Tags: HTML file creation to link to different HTML pages that contain images, Lists, Tables, and also links within a page.	CO 1	C	3
	HTML Frames: HTML page creation with different types of frames like floating frame, navigation frame & mixed frame.	CO 1	C	3
	Introduction to CSS: HTML file creation by applying the different styles using inline, external & internal style sheets.	CO 1	C	3
	HTML Forms Creation: Registration form creation using HTML.	CO 1	C	3
To develop skills in client-side scripting for implementing validation and enhancing user interaction.	**Introduction to JavaScript**: HTML page creation to explain the use of various predefined functions in a string and math object in java script.	CO 2	C	2
	Client Side Scripting using JavaScript: Calendar generation using JavaScript code by getting the year from the user.	CO 2	C	2
	Registration form Validation using JavaScript HTML registration form creation and validation of the form using JavaScript code.	CO 2	C	2
	JavaScript Event Handling: HTML page creation to change the background color for every click of a button using JavaScript Event Handling.	CO 2	C	1
	JavaScript Event Handling: HTML page creation to display a new image and text when the mouse comes over the existing content in the page using JavaScript Event Handling.	CO 2	C	1
	JavaScript Script Application: HTML page creation to show an online exam using JavaScript.	CO 2	C	1
To impart practical experience in both client-side and server-side scripting for building functional web components.	**Introduction to PHP**: Registration form creation using PHP and performing necessary validations.	CO 3	C	2
	Server-Side Scripting using PHP: Electricity bill generation from user input based on a given tariff using PHP.	CO 3	C	2
	PHP Array Functions: PHP code building to store name of students in an array and display it using print_r function. Sort and display the same using asort & arsort functions.	CO 3	C	1
	PHP Array: PHP code generation to store names of Indian Cricket players in an array and display the same in HTML table.	CO 3	C	1
To enable students to design and integrate front-end web interfaces with back-end databases for dynamic data-driven applications.	**Relational Database Design with MySQL**: Tables, Attributes, Tuples, Primary keys, Foreign keys, Indexes, MySQL DDL, DML, DQL commands	CO 4	C	4
	PHP-MySQL Connectivity: PHP program development to connect to a MySQL database, retrieve data from a table, and show the details in a neat format.	CO 4	C	4

To train students in the development of complete web applications that demonstrate usability, scalability, and maintainability.	**PHP Web Applications**: Web applications development using HTML and PHP and deploy.	CO 5	C	1
	PHP and MySQL: PHP and MySQL program development to accept book information viz. Accession number, title, authors, edition and publisher from a web page and store the information in a database and search function.	CO 5	C	1
	Web Application Development Micro Project: Design and development of a functional web application within a team environment using modern web technologies—including HTML, CSS, JavaScript, PHP, and MySQL—while following structured development practices.	CO 5	C	4

SUGGESTED LEARNING RESOURCES

Text Book			
Sl. No.	Title of Book	Author	Publication
1	*The Internet Book: Everything You Need to Know About Computer Networking and How the Internet Works*	Douglas E Comer	5th Edition, Chapman and Hall/CRC, 2018
2	*Database System Concepts*	Abraham Silberschatz, Henry F. Korth, S. Sudarshan	McGraw Hill Education ISBN: 9780078022159, 7th Edition (2019),

Reference			
Sl. No.	Title of Book	Author	Publication
1	JavaScript: The Definitive Guide	David Flanagan	7th Edition, O'Reilly Media, 2020
2	Internet and World Wide Web - How To Program	Harvey Deitel and Abbey Deitel	Fifth Edition, published in 2018, Pearson Education
3	PHP6 and MySQL 6 Bible	Steve Suehring, Tim Converse, and Joyce Park	Wiley India Pvt Ltd (2022)
4	PHP-The Complete Reference	Steven Holzner	McGraw Hill Education, Indian Edition (2017)
5	JavaScript: The Complete Reference	Thomas A Powell, Fritz Schneider	3rd Edition, Tata McGraw Hill, 2012

COURSE DESCRIPTION							
REGULATION	**2025**	**L-T-J-P-S**	**0-1-0-3-0**	**VERSION**	**25/0**	**CREDITS**	**2**
(L- Lecture, T-Tutorial, J-Project, P-Practical, S-Self-learning & Team Work)							

COURSE CODE	**COURSE NAME**	**COURSE CATEGORY**
A250201/CA130V	**DATA STRUCTURES LAB**	**PC**
Pre-requisite		
Basic understanding of C programming		

TEACHING AND ASSESSMENT SCHEME									
Teaching Scheme / Week					**Credit**	**Hours / Semester**	**Examination Scheme**		
							Practical		
L	**T**	**J**	**P**	**S**	**C**		**CIA**	**ESE**	**Total**
0	1	0	3	0	2	60	50	50	100
***L**: Lecture (One unit is of one-hour duration), **T**: Tutorial (One unit is of one-hour duration), **P**: Practical (One unit is of one-hour duration), **J**: Project (One unit is of one-hour duration), **S**: Self-Learning & Team Work (One unit is of one-hour duration), **CIA**: Continuous Internal Assessment, **ESE**: End Semester Examination*									

PRACTICAL SYLLABUS				
Objectives	Topic	COs	Learning Domain Level (C)	Hrs
To equip students with the ability to use important GCC compiler options.	Advanced use of gcc: Important Options - o, -c, -D, -l, -I, -g, -O, -save- temps, -pg	CO1	A	2
To enable students to apply essential GDB commands for effective debugging and error analysis in C program	Familiarisation with gdb: Important Commands - break, run, next, print, display, help	CO1	A	2
To develop skills in profiling applications with gprof for performance measurement and optimization.	Using gprof: Compile, Execute and Profile	CO1	A	1
To strengthen students' understanding of fundamental data structures by enabling them to implement and manipulate arrays, stacks, queues, and linked lists through different operations	Review of Basic Data Structures (Array, List, Stack, Queue) • Merge two sorted arrays and store in a third array • Circular Queue - Add, Delete, Search • Singly Linked Stack - Push, Pop, Linear Search • Doubly linked list - Insertion, Deletion, Search	CO2	A	12
To develop the ability to implement set and disjoint set operations for efficient data representation and manipulation.	Set Data Structure and set operations (Union, Intersection and Difference) using Bit String.	CO3	A	3
	Disjoint Sets and the associated operations (create, union, find)	CO3	A	4
To develop practical skills in implementing and manipulating advanced tree structures for efficient data storage and retrieval	Binary Search Trees- Insertion, Deletion, Search	CO4	A	4
	Red Black Trees and its operations	CO4	A	4
	B Trees and its operations	CO4	A	4
To enable students to understand the structure of binomial heaps	Binomial Heaps and operations (Create, Insert, Delete, Extract-min, Decrease key)	CO5		4

and to gain practical skills in implementing core operations				
To develop the ability to apply graph traversal, connectivity, spanning tree, and shortest path algorithms for efficient problem-solving in graphs.	Graph Traversal techniques (DFS and BFS) and Topological Sorting	CO6	A	4
	Finding the Strongly connected Components in a directed graph	CO6	A	3
	Prim's Algorithm for finding the minimum cost spanning tree	CO6	A	3
	Kruskal's algorithm using the Disjoint set data structure	CO6	A	3
	Single Source shortest path algorithm using any heap structure that supports mergeable heap operations	CO6	A	3

SUGGESTED LEARNING RESOURCES

Text Book			
Sl. No.	Title of Book	Author	Publication
1	Introduction to Algorithms	Cormen T.H., Leiserson C.E, Rivest R.L. and Stein C.	Prentice Hall India, New Delhi, 2004

Reference			
Sl. No.	Title of Book	Author	Publication
1	Algorithm design	Kleinberg, Jon, and Eva Tardos	Pearson Education India, 2006.
2	Data Structures and Algorithms,	Aho A.V., Hopcroft J.E., and Ullman J.D.,	Pearson Education, New Delhi, 1983.
3	Data Structures, Algorithms, and Applications in C++,	Sahni S	Mc Graw Hill, Singapore, 1998.

COURSE DESCRIPTION							
REGULATION	**2025**	**L-T-J-P-S**	**0-1-0-0-0**	**VERSION**	**25/0**	**CREDITS**	**-**
(L- Lecture, T-Tutorial, J-Project, P-Practical, S-Self-learning & Team Work)							

COURSE CODE	**COURSE NAME**	**COURSE CATEGORY**
A250201/CA130K	**ENTREPRENEURSHIP AND INNOVATIONS IN TECHNOLOGY**	**SE**
Pre-requisite		
NIL		

TEACHING AND ASSESSMENT SCHEME

Teaching Scheme / Week					Credit	Hours / Semester	Examination Scheme		
							Theory		
L	**T**	**J**	**P**	**S**	**C**		**CIA**	**ESE**	**Total**
0	1`	0	0	0	-	15	50	-	50

***L**: Lecture (One unit is of one-hour duration), **T**: Tutorial (One unit is of one-hour duration), **P**: Practical (One unit is of one-hour duration), **J**: Project (One unit is of one-hour duration), **S**: Self-Learning & Team Work (One unit is of one-hour duration), **CIA**: Continuous Internal Assessment, **ESE**: End Semester Examination*

SYLLABUS (Major Topics)

Module	Title	Major Topics	Hrs
1	Practice of Innovation and Entrepreneurship	Systematic Entrepreneurship and Purposeful Innovation, Sources of Innovative Opportunity, Entrepreneurial Management, Types of Innovations, Activity: Identify recent Indian innovations and classify them under innovation types.	4
2	Social Innovation and Social Entrepreneurship	Differences between Social Innovation and other Innovations, Sources and Types of Social Innovation, Business Models of Social Enterprises Activity: Case study analysis of SELCO/Aravind Eye Care/Akshaya Patra.	4
3	Technology-Based Business Models	Technology-driven business models, Objectives and contents of business plans, Tools and methods for assessing and analysing new ideas Activity: Team-based one-page business plan presentation.	4

SUGGESTED LEARNING RESOURCES

Text Book

Sl. No.	Title of Book	Author	Publication
1	Social Innovation and Social Entrepreneurship: Fundamentals, Concepts, and Tools	Luis Portales	Springer, 2nd Edition, 2022
2	Entrepreneurship	Robert D. Hisrich, Michael P. Peters, Dean A. Shepherd	McGraw-Hill, 12th Edition, 2020
3	Business Model Generation	Alexander Osterwalder, Yves Pigneur	Wiley, Updated Reprint, 2020

Reference

Sl. No.	Title of Book	Author	Publication
1	The Art of the Start 2.0, Penguin	Guy Kawasaki	2021 Reprint Edition
2	Entrepreneurship Development	Sangeeta Sharma	PHI Learning, 3rd Edition, 2023

SEMESTER II

SEMESTER II

CURRICULUM

SLOT	COURSE CATEGORY	COURSE CODE	COURSE NAME	L	T	J	P	S	C
A	PC	A250201/CA200A	Advanced Database Management Systems	3	1	0	0	4	4
B	PC	A250201/CA200B	Advanced Computer Networks	3	1	0	0	4	4
C	PE	A250201/CA21*C	Program Elective I	3	1	0	0	4	4
D	PE	A250201/CA21*D	Program Elective II	3	1	0	0	4	4
T	PC	A250201/CA230T	Object Oriented Programming Lab	1	0	0	3	0	2
U	PC	A250201/CA230U	Advanced DBMS Lab	0	1	1	2	0	2
V	PC	A250201/CA230V	Networking and System Administration Lab	1	0	0	3	0	2
		A250201/CA230L	First NPTEL course						1
				14	**5**	**1**	**8**		**23**

(L- Lecture, T-Tutorial, J-Project, P-Practical, S-Self-learning & Team Work, C- Credit)

(PC- Programme Core, SE- Skill Enhancement Course)

COURSE DESCRIPTION							
REGULATION	**2025**	**L-T-J-P-S**	**3-1-0-0-4**	**VERSION**	**25/0**	**CREDITS**	**4**
(L- Lecture, T-Tutorial, J-Project, P-Practical, S-Self-learning & Team Work)							

COURSE CODE	COURSE NAME	COURSE CATEGORY
A250201/CA200A	**ADVANCED DATABASE MANAGEMENT SYSTEMS**	**PC**
Pre-requisite		
Basic knowledge of Database Management Systems (DBMS), SQL, and data modeling and Familiarity with relational algebra and normalisation concepts.		

TEACHING AND ASSESSMENT SCHEME									
Teaching Scheme / Week					**Credit**	**Hours / Semester**	**Examination Scheme**		
							Theory		
L	**T**	**J**	**P**	**S**	**C**		**CIA**	**ESE**	**Total**
3	1`	0	0	4	4	120	40	60	100

***L**: Lecture (One unit is of one-hour duration), **T**: Tutorial (One unit is of one-hour duration), **P**: Practical (One unit is of one-hour duration), **J**: Project (One unit is of one-hour duration), **S**: Self-Learning & Team Work (One unit is of one-hour duration), **CIA**: Continuous Internal Assessment, **ESE**: End Semester Examination*

SYLLABUS (Major Topics)			
Module	**Title**	**Major Topics**	**Hrs**
1	Relational Databases	Data Models, DB Architecture, ER Modelling, Relational Algebra	15
2	Database Design	Functional Dependencies, Normalization (1NF–5NF), BCNF	10
3	Transaction Management & Concurrency Control	Transaction Properties, Locking, Deadlock, Recovery	10
4	Data Storage & Querying	RAID, Indexing, B+ Trees, Hashing, Query Processing	10
5	Advanced Databases	Distributed Databases, Object-oriented Databases, XML, NoSQL, CAP Theorem	15

SUGGESTED LEARNING RESOURCES

Text Book			
Sl. No.	**Title of Book**	**Author**	**Publication**
1	*Principles of Distributed Database Systems* (4th Edition)	M. Tamer Özsu, Patrick Valduriez	Springer, 2020
2	*Database System Concepts* (7th Edition)	Abraham Silberschatz, Henry F. Korth, S. Sudarshan	McGraw-Hill, 2020

Reference			
Sl. No.	**Title of Book**	**Author**	**Publication**
1	Fundamentals of Database Systems (7th Edition)	Ramez Elmasri, Shamkant B. Navathe	Pearson, 2016
2	Distributed Databases: Principles and Systems	Stefano Ceri, Giuseppe Pelagatti	McGraw-Hill, 2008
3	NoSQL Distilled	Pramod J. Sadalage, Martin Fowler	Addison-Wesley, 2013

COURSE DESCRIPTION							
REGULATION	**2025**	**L-T-J-P-S**	**3-1-0-0-4**	**VERSION**	**25/0**	**CREDITS**	**4**
(L- Lecture, T-Tutorial, J-Project, P-Practical, S-Self-learning & Team Work)							

COURSE CODE	**COURSE NAME**	**COURSE CATEGORY**
A250201/CA200B	**ADVANCED COMPUTER NETWORKS**	**PC**
Pre-requisite		
Fundamentals of Computer Networks and Operating Systems		

TEACHING AND ASSESSMENT SCHEME									
Teaching Scheme / Week					**Credit**	**Hours / Semester**	**Examination Scheme**		
							Theory		
L	**T**	**J**	**P**	**S**	**C**		**CIA**	**ESE**	**Total**
3	1`	0	0	4	4	120	40	60	100

***L**: Lecture (One unit is of one-hour duration), **T**: Tutorial (One unit is of one-hour duration), **P**: Practical (One unit is of one-hour duration), **J**: Project (One unit is of one-hour duration), **S**: Self-Learning & Team Work (One unit is of one-hour duration), **CIA**: Continuous Internal Assessment, **ESE**: End Semester Examination*

SYLLABUS (Major Topics)			
Module	Title	Major Topics	Hrs
1	Network Architectures and Performance Fundamentals	Overview of Networks and Internet Evolution; Protocol Architecture and Layered Models; Switched Networks and Performance Concepts	10
2	Transport Layer Mechanisms	Introduction to Transport Layer; Multiplexing and Demultiplexing; Reliable Data Transfer Mechanisms; Transmission Control Protocol (TCP) and User Datagram Protocol (UDP); Flow and Congestion Control.	10
3	Network Layer and Routing	Network Layer functions and services; Virtual circuits and datagram switching; Internet Protocol (IPv4): addressing, subnetting, and CIDR; Routing principles and algorithms: Link State and Distance Vector routing; Internet routing protocols: RIP, OSPF, BGP.	10
4	Link and Physical Layer Technologies	Error Detection Techniques; Multiple Access Protocols; IEEE 802.3 Ethernet and Switching.	10
5	Emerging Networks and Security	Wireless and Mobile Network Technologies; Network Security Fundamentals; Network Protection Mechanisms; Network Management with SNMP.	10

SUGGESTED LEARNING RESOURCES

Text Book			
Sl. No.	Title of Book	Author	Publication
1	Computer Networks: A Top-Down Approach	Behrouz A. Forouzan, Firouz Mosharraf	McGraw Hill Education, 1st Edition, 2023
2	Computer Networks	Andrew S. Tanenbaum, David J. Wetherall, Nick Feamster	Pearson Education, 6th Edition, 2022
3	Data Communications and Networking	Behrouz A. Forouzan	McGraw Hill Education, 6th Edition, 2022
4	Foundations of Modern Networking: SDN, NFV, QoE, IoT and Cloud	William Stallings	Pearson Education, 1st Edition (2022)
5	Computer Networks: Protocols, Standards and Interface	Uyless Black	Prentice Hall India Learning Private Limited, 8th Edition (2015).

Reference			
Sl. No.	Title of Book	Author	Publication
1	Computer Networking: A Top-Down Approach	James F. Kurose, Keith W. Ross	Pearson Education, 8th Edition, 2021
2	Computer Networks: A Systems Approach	Larry L. Peterson, Bruce S. Davie	Morgan Kaufmann Publishers, 6th Edition, 2020
3	The Illustrated Network: How TCP/IP Works in a Modern Network	Walter Goralski	Morgan Kaufmann Publications, 2nd Edition, 2017
4	TCP/IP Illustrated, Volume 1 – The Protocols	Kevin R. Fall, W. Richard Stevens	Pearson Education, 2nd Edition (2014)

PROGRAM ELECTIVE I

COURSE DESCRIPTION							
REGULATION	**2025**	**L-T-J-P-S**	**3-1-0-0-4**	**VERSION**	**25/0**	**CREDITS**	**4**
(L- Lecture, T-Tutorial, J-Project, P-Practical, S-Self-learning & Team Work)							

COURSE CODE	COURSE NAME	COURSE CATEGORY
A250201/MA211C	**APPLIED STATISTICS**	**PC**
Pre-requisite		
A basic knowledge in probability and statistics.		

TEACHING AND ASSESSMENT SCHEME

Teaching Scheme / Week					Credit	Hours / Semester	Examination Scheme		
							Theory		
L	**T**	**J**	**P**	**S**	**C**		**CIA**	**ESE**	**Total**
3	1	0	0	4	4	120	40	60	100

***L**: Lecture (One unit is of one-hour duration), **T**: Tutorial (One unit is of one-hour duration), **P**: Practical (One unit is of one-hour duration), **J**: Project (One unit is of one-hour duration), **S**: Self-Learning & Team Work (One unit is of one-hour duration), **CIA**: Continuous Internal Assessment, **ESE**: End Semester Examination*

SYLLABUS (Major Topics)

Module	Title	Major Topics	Hrs
1	Discrete Probability Distributions	Introduction – Random Experiment, Random Variables, Discrete Random Variables, Probability Distributions and Probability Mass Functions, Mean and Variance of a Discrete Random Variable, Discrete Uniform Distribution - Mean and Variance, Binomial Distribution - Mean and Variance, Geometric Distribution – Mean and Variance, Poisson Distribution - Mean and Variance	10
2	Continuous Probability Distributions	Continuous Random Variables, Probability Density Functions, Mean and Variance of a Continuous Random Variable, Continuous Uniform Distribution- Mean and Variance, Normal Distribution-Mean and Variance (Proof not required), Standard Normal Distribution, Exponential Distribution.	10
3	Statistics	Curve fitting – Principle of least squares – fitting a straight line – fitting a parabola – linear correlation and regression – Karl's Pearson's Coefficient of Correlation. Joint and marginal probability distribution - Conditional probability distribution - independent random variable (discrete case only).	8
4	Sampling Distribution	Sampling distribution – Introduction to sampling – random sampling – sampling distribution –standard error – estimation – interval estimates and confidence interval – estimation of population mean and proportions (small and large samples).	8
5	Testing Of Hypothesis	Testing of hypothesis – introduction – basic concepts – Hypothesis concerning a mean – equality of means – Hypothesis concerning one proportion – difference of two proportions.	9

SUGGESTED LEARNING RESOURCES

Text Book

Sl. No.	Title of Book	Author	Publication
1	Probability and Random Process	Veerarajan T	3rd Edition, Tata McGraw-Hill (2002)
2	Fundamentals of Mathematical Statistics	Gupta S.C and Kapoor V. K	Sultan Chand and Sons (2014)

Reference

Sl. No.	Title of Book	Author	Publication
1	Introduction to practice of statistics	David S. Moore and George P. McCabe	W.H. Freeman & Company, 5th Edition (2005)

2	Introduction to Probability and Statistics Using R	G. Jay Kerns	Chapman & Hall (2010)
3	Applied Statistics and Probability for Engineers	Douglas C. Montgomery and George C. Runger	Wiley India, 5th Edition (2012)

COURSE DESCRIPTION							
REGULATION	**2025**	**L-T-J-P-S**	**3-1-0-0-4**	**VERSION**	**25/0**	**CREDITS**	4
(L- Lecture, T-Tutorial, J-Project, P-Practical, S-Self-learning & Team Work)							

COURSE CODE	**COURSE NAME**	**COURSE CATEGORY**
A250201/CA212C	**BLOCK CHAIN TECHNOLOGY**	**PE**
Pre-requisite		
Basics of centralised and distributed database and network technologies.		

TEACHING AND ASSESSMENT SCHEME

Teaching Scheme / Week					**Credit**	**Hours / Semester**	**Examination Scheme**		
							Theory		
L	**T**	**J**	**P**	**S**	**C**		**CIA**	**ESE**	**Total**
3	1	0	0	4	4	120	40	60	100

***L**: Lecture (One unit is of one-hour duration), **T**: Tutorial (One unit is of one-hour duration), **P**: Practical (One unit is of one-hour duration), **J**: Project (One unit is of one-hour duration), **S**: Self-Learning & Team Work (One unit is of one-hour duration), **CIA**: Continuous Internal Assessment, **ESE**: End Semester Examination*

SYLLABUS (Major Topics)

Module	Title	Major Topics	Hrs
1	Introduction to Blockchain	Introduction to Blockchain, How Blockchain works, Blockchain vs Bitcoin, Practical applications, public and private key basics, Distributed systems, History of blockchain and Bitcoin, Types of blockchain. Pros and Cons of Blockchain, Myths about Bitcoin.	10
2	Blockchain Architecture	Blockchain Architecture, versions, variants, Use cases, Life use cases of blockchain, Blockchain vs Shared Database, Introduction to Cryptocurrencies, Types, Applications.	10
3	Blockchain Mechanisms for Secure Transactions	Concept of Double Spending, Hashing, Mining, Proof of Work (PoW). Introduction to Merkel tree, Privacy, Payment verification, Resolving Conflicts, Creation of Blocks	10
4	Introduction to Bitcoin	Introduction to Bitcoin, key concepts of Bitcoin, Merits and Demerits, Fork and Segwits, Sending and Receiving Bitcoins, choosing a Bitcoin wallet, Converting Bitcoins to Fiat Currency, Bitcoin digital keys and addresses, Transactions, Blockchain mining. Alternative Coins. Limitations of Bitcoin.	12
5	Introduction to Blockchain Platforms	Introduction to Blockchain Platforms: Ethereum, Hyperledger, IOTA, EOS, Multichain, Bigchain, etc., Advantages and Disadvantages, Ethereum vs Bitcoin, Introduction to Smart contracts, usage, application, working principle, Law and Regulations. Case Study, Blockchain applications.	12

SUGGESTED LEARNING RESOURCES

Text Book

Sl. No.	Title of Book	Author	Publication
1	Beginning Blockchain: A Beginner's Guide to Building Blockchain Solutions.	Arshdeep Bikramaditya Singhal, Gautam Dhameja, Priyansu Sekhar Panda	APress, 2018
2	Blockchain Applications: A Hands-On Approach	Bahga, Vijay Madisetti	VPT, 2018
3	Blockchain: Blueprint for a New Economy	Melanie Swan	O'Reilly, 2015

Reference			
Sl. No.	Title of Book	Author	Publication
1	Bitcoin and Cryptocurrency Technologies	Aravind Narayan. Joseph Bonneau	Princeton, 2016
2	Bitcoin and Blockchain Basics: A non-technical introduction for beginners on Blockchain Technology, Cryptocurrency, Bitcoin, Altcoins, Ethereum, Ripple, Investing, Mining, Wallets and Smart Contracts	Arthur T Brooks	WonderBook, 2019

COURSE DESCRIPTION							
REGULATION	**2025**	**L-T-J-P-S**	**3-1-0-0-4**	**VERSION**	**25/0**	**CREDITS**	**4**
(L- Lecture, T-Tutorial, J-Project, P-Practical, S-Self-learning & Team Work)							

COURSE CODE	**COURSE NAME**	**COURSE CATEGORY**
A250201/CA213C	**ORGANIZATIONAL BEHAVIOUR**	**PE**
Pre-requisite		
NIL		

TEACHING AND ASSESSMENT SCHEME									
Teaching Scheme / Week					**Credit**	**Hours / Semester**	**Examination Scheme**		
							Theory		
L	**T**	**J**	**P**	**S**	**C**		**CIA**	**ESE**	**Total**
3	1`	0	0	4	4	120	40	60	100

***L**: Lecture (One unit is of one-hour duration), **T**: Tutorial (One unit is of one-hour duration), **P**: Practical (One unit is of one-hour duration), **J**: Project (One unit is of one-hour duration), **S**: Self-Learning & Team Work (One unit is of one-hour duration), **CIA**: Continuous Internal Assessment, **ESE**: End Semester Examination*

SYLLABUS (Major Topics)			
Module	Title	Major Topics	Hrs
1	Introduction to Organizational Behaviour (Ob) And Management	Organisations and Organisational Behaviour (OB), Nature of OB, Management and Managers, Challenges in OB	9
2	Foundations of Individual Behaviour	Individual Behaviour, Intelligence, Perception and Attribution, Learning	10
3	Motivation, Attitudes, and Work Behaviour	Attitudes and Values, Motivation, Applied Motivational Practices, Work Stress	9
4	Group and Leadership Dynamics	Group Dynamics, Team Dynamics, Leadership, Communication	12
5	Organisational Structure, Culture, Innovation and Change	Organisational Structure, Organisational Culture, Creativity and Innovation in Organisations, Organisational Change and Development	10

SUGGESTED LEARNING RESOURCES

Text Book			
Sl. No.	Title of Book	Author	Publication
1	Organizational Behaviour	K Aswathappa	Himalaya Publishing House, 13th edition, 2018
2	Organizational Behavior (Indian edition)	Stephen P. Robbins; Timothy A. Judge; Neharika Vohra	Pearson Education, 18th edition, 2019 ISBN: 978-9353067038

Reference			
Sl. No.	Title of Book	Author	Publication
1	Organizational Behaviour	Steven McShane & Mary Ann Von Glinow	McGraw-Hill Education, 10th Edition (Feb 2023)
2	Management and Organizational Behaviour	Laurie J. Mullins	Pearson Education, 13th Edition (2023)

COURSE DESCRIPTION							
REGULATION	**2025**	**L-T-J-P-S**	**3-1-0-0-4**	**VERSION**	**25/0**	**CREDITS**	**4**
(L- Lecture, T-Tutorial, J-Project, P-Practical, S-Self-learning & Team Work)							

COURSE CODE	COURSE NAME	COURSE CATEGORY
A250201/CA214C	**ADVANCED OPERATING SYSTEMS**	**PE**
Pre-requisite		
Basic concepts of computer operating systems.		

TEACHING AND ASSESSMENT SCHEME									
Teaching Scheme / Week					**Credit**	**Hours / Semester**	**Examination Scheme**		
							Theory		
L	**T**	**J**	**P**	**S**	**C**		**CIA**	**ESE**	**Total**
3	1`	0	0	4	4	120	40	60	100

***L**: Lecture (One unit is of one-hour duration), **T**: Tutorial (One unit is of one-hour duration), **P**: Practical (One unit is of one-hour duration), **J**: Project (One unit is of one-hour duration), **S**: Self-Learning & Team Work (One unit is of one-hour duration), **CIA**: Continuous Internal Assessment, **ESE**: End Semester Examination*

SYLLABUS (Major Topics)			
Module	Title	Major Topics	Hrs
1	Overview of Operating Systems	Introduction to Operating Systems (OS), Synchronization Mechanisms, Advanced Synchronization Concepts, Distributed Operating Systems	10
2	Distributed Mutual Exclusion and Security	Distributed Mutual Exclusion, Security in OS	10
3	Resource And Load Management in Distributed Systems	Resource Management, Distributed Shared Memory, Load Management	10
4	Multiprocessor and Virtualized Operating Systems	Multiprocessor Operating Systems, Virtualization in Operating Systems	10
5	Concurrency Control in Database Systems	Fundamentals of Concurrency Control, Concurrency Control Algorithms	10

SUGGESTED LEARNING RESOURCES

Text Book			
Sl. No.	Title of Book	Author	Publication
1	Advanced Concepts in Operating Systems: Distributed, Database, and Multiprocessor Operating Systems	Mukesh Singhal, Niranjan G. Shivaratri	McGraw-Hill Education, 1st edition, 2017
2	Modern Operating Systems	Andrew S. Tanenbaum, Herbert Bos	Pearson Education, 5th edition, 2022
3	Operating System Concepts	Abraham Silberschatz, Peter B. Galvin, Greg Gagne	Wiley India Pvt. Ltd, 10th Edition, 2019

Reference			
Sl. No.	Title of Book	Author	Publication
1	Distributed Operating Systems: Concepts and Design	Pradeep K. Sinha	PHI Learning Pvt. Ltd., 1st edition, 2014
2	Distributed Systems, Concepts and Design	George Coulouris, Jean Dollimore, Tim Kindberg	Pearson,5th Edition,2019.

PROGRAM ELECTIVE II

COURSE DESCRIPTION							
REGULATION	**2025**	**L-T-J-P-S**	**3-1-0-0-4**	**VERSION**	**25/0**	**CREDITS**	**4**
(L- Lecture, T-Tutorial, J-Project, P-Practical, S-Self-learning & Team Work)							

COURSE CODE	**COURSE NAME**	**COURSE CATEGORY**
A250201/CA211D	**IPR AND CYBER LAWS**	PE
Pre-requisite		
General awareness on internet essentials, web technologies and e-commerce		

TEACHING AND ASSESSMENT SCHEME									
Teaching Scheme / Week					**Credit**	**Hours / Semester**	**Examination Scheme**		
							Theory		
L	**T**	**J**	**P**	**S**	**C**		**CIA**	**ESE**	**Total**
3	1`	0	0	4	4	120	40	60	100

***L**: Lecture (One unit is of one-hour duration), **T**: Tutorial (One unit is of one-hour duration), **P**: Practical (One unit is of one-hour duration), **J**: Project (One unit is of one-hour duration), **S**: Self-Learning & Team Work (One unit is of one-hour duration), **CIA**: Continuous Internal Assessment, **ESE**: End Semester Examination*

SYLLABUS (Major Topics)			
Module	Title	Major Topics	Hrs
1	Fundamentals of IPR and Patents	**Fundamentals of IPR**- Introduction– Intellectual property– Need for protection of intellectual property– **WIPO**– Intellectual property rights and development – Rationale of protection– TRIPS Agreement- **Patents**– Introduction – Patentable and Non-patentable Invention– Types of patent applications– Guidelines for registration of patent– patent filing – grant of patent– types of patent documents.	10
2	Trademarks and Copyright	**Trademarks**– Introduction– Guidelines for registration- Requirements for filing trademarks– Trademark Infringement– Protection of trademarks– **Copyright**– Introduction– Rights conferred by copyright– registration– ownerships– terms– transfer of copyrights– copyright infringement– databases and copyright- **Software Copyright**–Introduction – Need of software copyright classification of software according to copyright – software auditing – copyright notice – transfer of copyright.	10
3	Industrial Designs and Trade Secret	**Industrial Designs**- Introduction – Need for protection of design – requirements for registration of designs – Design Act,2000 – Duration of registration of design – application procedure – **Geographic Indications** –Introduction – Filing – **Granting** – Protection of geographic indications. **Trade Secret** – definition – discovering and protecting of trade secret.	10
4	Cyber Law	Need for cyber laws - Historical perspective - cyberspace - deception by squatting in cyberspace - protection of copyright on cyberspace - infringement of copyright on cyberspace – linking, hyperlinking and framing - ISP in cyberspace - cyberspace and protection of patents in India.	8
5	Information Technology Act and Punishments	Introduction to IT Act 2000- Amendments on IT Act - Violation of the right of privacy in cyberspace/internet-punishment for violation of privacy, breach of confidentiality and privacy under IT act-Terrorism on cyberspace Overview of cybercrimes-offences by intermediaries-offences related to protected system- offences of misrepresentation punishment for Abetment and Attempt to commit offences under the IT act.	10

SUGGESTED LEARNING RESOURCES

Text Book			
Sl. No.	Title of Book	Author	Publication
1	Intellectual Property Rights: Text and Cases	Dr. R. Radhakrishnan and Dr. S. Balasubramanian	Excel Books
2	Cyber Law and IT Protection	Harish Chander,	PHI Learning Pvt.Ltd.

Reference			
Sl. No.	Title of Book	Author	Publication
1	Introduction to Computer Law	D.Bainbridge	Pearson Education
2	Cyber Crime & Corporate Liability	RohasNagpal,	CCH, 2008

COURSE DESCRIPTION							
REGULATION	**2025**	**L-T-J-P-S**	**3-1-0-0-4**	**VERSION**	**25/0**	**CREDITS**	**4**
(L- Lecture, T-Tutorial, J-Project, P-Practical, S-Self-learning & Team Work)							

COURSE CODE	**COURSE NAME**	**COURSE CATEGORY**
A250201/CA212D	**BUSINESS MANAGEMENT**	PET
Pre-requisite		
NIL		

TEACHING AND ASSESSMENT SCHEME									
Teaching Scheme / Week					**Credit**	**Hours / Semester**	**Examination Scheme**		
							Theory		
L	**T**	**J**	**P**	**S**	**C**		**CIA**	**ESE**	**Total**
3	1`	0	0	4	4	120	40	60	100

***L**: Lecture (One unit is of one-hour duration), **T**: Tutorial (One unit is of one-hour duration), **P**: Practical (One unit is of one-hour duration), **J**: Project (One unit is of one-hour duration), **S**: Self-Learning & Team Work (One unit is of one-hour duration), **CIA**: Continuous Internal Assessment, **ESE**: End Semester Examination*

SYLLABUS (Major Topics)			
Module	Title	Major Topics	Hrs
1	Introduction to Management and Early Contributions in Management	Basic Managerial Concepts, Levels of management, Managerial Skills, Managerial role. Management functions- Planning, Organising, Staffing, leading and Controlling. Management thought - Classical approach, scientific management, contributions of Taylor, Gilbreths, Fayol's 14 principles of management. Human relation approach - contribution of Elton Mayo Systems approach - organization as an open system and Contingency approach	10
2	Planning And Organising	Nature and importance of planning, types of plans - Steps in planning, Levels of planning - The Planning Process - MBO definition and process, SWOT Analysis, importance. Nature of organizing,-span of control in management, factors affecting span of control- Authority and responsibility. Organisation structure - Formal and informal, Types of organization structure line, line and staff, functional, divisional, project, matrix, virtual form of organisations.	8
3	Staffing And Related HR Functions	Meaning, nature, staffing process, Job analysis and manpower planning, job description and job specification, Recruitment & selection, selection process, Tests and interviews. Training and development - concept and methods, Performance, appraisal-concept and methods.	9
4	Managerial Decision Making and Controlling	Decision making –types of decisions, decision making process, Decision Making Tools, Importance of controlling, Techniques of controlling- Break Even Analysis, Budgetary Control - Benchmarking –importance and limitations of benchmarking, Six Sigma importance, limitations and process of six sigma, Total Quality Management- Introduction to marketing management- Marketing mix- product life cycle	12
5	Book- Keeping and Accountancy	Elements of Double Entry -Book- Keeping - rules for journalizing -Ledger accounts –Cash book- – Trial Balance- Method of Balancing accounts- the journal proper (simple problems). Final accounts: Preparation of trading and profit and loss Account- Balance sheet (with simple problems) - Introduction to Accounting packages (Description only)	10

SUGGESTED LEARNING RESOURCES

Text Book			
Sl. No.	Title of Book	Author	Publication
1	Principles of Management	L M Prasad	Sultan Chand & Sons, 8th Edition (2010)
2	The Practice of Management	Peter F Drucker	Butterworth-Heinemann Publication, 2nd Edition (2007)

Reference			
Sl. No.	Title of Book	Author	Publication
1	Essentials of Management	Harold Koontz and Heinz Weihrich 10th Edition (2015).	McGraw Hill Education
2	Management	Robbins and Coulter 13th Edition, 2016	Pearson Education

COURSE DESCRIPTION							
REGULATION	**2025**	**L-T-J-P-S**	**3-1-0-0-4**	**VERSION**	**25/0**	**CREDITS**	**4**
(L- Lecture, T-Tutorial, J-Project, P-Practical, S-Self-learning & Team Work)							

COURSE CODE	COURSE NAME	COURSE CATEGORY
A250201/CA213D	**CYBER FORENSICS**	**PE**
Pre-requisite		
Basic knowledge in operating systems and computer networks.		

TEACHING AND ASSESSMENT SCHEME									
Teaching Scheme / Week					**Credit**	**Hours / Semester**	**Examination Scheme**		
							Theory		
L	**T**	**J**	**P**	**S**	**C**		**CIA**	**ESE**	**Total**
3	1`	0	0	4	4	120	40	60	100
***L**: Lecture (One unit is of one-hour duration), **T**: Tutorial (One unit is of one-hour duration), **P**: Practical (One unit is of one-hour duration), **J**: Project (One unit is of one-hour duration), **S**: Self-Learning & Team Work (One unit is of one-hour duration), **CIA**: Continuous Internal Assessment, **ESE**: End Semester Examination*									

SYLLABUS (Major Topics)			
Module	Title	Major Topics	Hrs
1	Fundamentals of Cyber Forensics	Overview of computer crimes, policy violations, evidence handling, case preparation, evidence formats (Raw, AFF), acquisition tools, digital evidence validation, introduction to Autopsy.	13
2	File Systems and Digital Evidence	Digital storage, boot sequence, FAT/NTFS/ReFS systems, BitLocker encryption, Windows Registry, data acquisition, and validation.	14
3	Linux and Macos Forensics	Linux file structures (Ext4), macOS HFS/APFS, Autopsy/Sleuth Kit case study, write blockers, dd/dcfldd, data validation, introduction to memory forensics using Volatility.	15
4	Mobile and Network Forensics	Mobile device evidence acquisition, SIM and data extraction, tools (Cellebrite, MOBILedit), network traffic analysis using Wireshark, basics of cloud forensics (AWS/Azure).	14
5	Forensic Reporting and Ethics	Forensic report writing, court admissibility, expert witness role, Autopsy report generation, ethics, and forensic readiness planning.	12

SUGGESTED LEARNING RESOURCES

Text Book			
Sl. No.	Title of Book	Author	Publication
1	Guide to Computer Forensics and Investigations, 7th Edition, 2024	Bill Nelson, Amelia Phillips, Christopher Steuart	Information Security

Reference			
Sl. No.	Title of Book	Author	Publication
1	Computer Forensics and Cyber Crime An Introduction 3rd Edition Digital Version 2025	Marjie T. Britz	Pearson
2	Computer Forensics: Cybercriminals, Laws, and Evidence, 2015	Marie - Helen Maras	Jones & Bartlett Learning

COURSE DESCRIPTION							
REGULATION	**2025**	**L-T-J-P-S**	**3-1-0-0-4**	**VERSION**	**25/0**	**CREDITS**	**4**
(L- Lecture, T-Tutorial, J-Project, P-Practical, S-Self-learning & Team Work)							

COURSE CODE	COURSE NAME	COURSE CATEGORY
A250201/CA214D	**ARTIFICIAL INTELLIGENCE**	**PE**
Pre-requisite		
Mathematical Foundations for Computing, Advanced Data structures		

TEACHING AND ASSESSMENT SCHEME									
Teaching Scheme / Week					**Credit**	**Hours / Semester**	**Examination Scheme**		
							Theory		
L	**T**	**J**	**P**	**S**	**C**		**CIA**	**ESE**	**Total**
3	1`	0	0	4	4	120	40	60	100

***L**: Lecture (One unit is of one-hour duration), **T**: Tutorial (One unit is of one-hour duration), **P**: Practical (One unit is of one-hour duration), **J**: Project (One unit is of one-hour duration), **S**: Self-Learning & Team Work (One unit is of one-hour duration), **CIA**: Continuous Internal Assessment, **ESE**: End Semester Examination*

SYLLABUS (Major Topics)			
Module	Title	Major Topics	Hrs
1	Artificial Intelligence and Production Systems	Artificial Intelligence, Intelligent Agents, Problem Solving, Production System	8
2	Search Strategies	Preliminaries of searching, Uninformed (Blind) Search strategies, Informed (Heuristic) Search strategies	10
3	Adversarial Search	Game Theory, Minimax algorithm, Alpha-beta Pruning	9
4	Knowledge Representation	Knowledge in AI, Knowledge Representation, Using Logic, Knowledge Representation Systems	8
5	Knowledge Based Systems and Modern Trends in AI	Expert Systems, Fuzzy Logic, Modern trends in AI, Ethics in AI	10

SUGGESTED LEARNING RESOURCES

Text Book			
Sl. No.	Title of Book	Author	Publication
1	Artificial Intelligence: A Modern Approach	Stuart Russell and Peter Norvig	Pearson Education 4th Edition

Reference			
Sl. No.	Title of Book	Author	Publication
1	Artificial Intelligence	Elaine Rich, Kevin Knight, Shivashankar B. Nair	Tata McGraw Hill
2	Artificial Intelligence: Structures and Strategies for Complex Problem Solving	George F. Luger	Pearson Education
3	Principles of Artificial Intelligence	Nils J. Nilsson	Narosa Publishing

COURSE DESCRIPTION							
REGULATION	**2025**	**L-T-J-P-S**	**1-0-0-3-0**	**VERSION**	**25/0**	**CREDITS**	**2**
(L- Lecture, T-Tutorial, J-Project, P-Practical, S-Self-learning & Team Work)							

COURSE CODE	COURSE NAME	COURSE CATEGORY
A250201/CA230T	**OBJECT ORIENTED PROGRAMMING LAB**	**PC**
Pre-requisite		
Knowledge of OOPs concepts		

TEACHING AND ASSESSMENT SCHEME									
Teaching Scheme / Week					**Credit**	**Hours / Semester**	**Examination Scheme**		
							Practical		
L	**T**	**J**	**P**	**S**	**C**		**CIA**	**ESE**	**Total**
1	0	0	3	0	2	60	50	50	100
***L**: Lecture (One unit is of one-hour duration), **T**: Tutorial (One unit is of one-hour duration), **P**: Practical (One unit is of one-hour duration), **J**: Project (One unit is of one-hour duration), **S**: Self-Learning & Team Work (One unit is of one-hour duration), **CIA**: Continuous Internal Assessment, **ESE**: End Semester Examination*									

SYLLABUS (Major Topics)			
Module	Title	Major Topics	Hrs
1	Object Oriented Concepts	Java Basics, classes, objects, constructors, Access Specifiers (public, private, protected, friendly), Access Modifiers, overloading methods, recursion, nested and inner classes	**12**
2	Inheritance and Arrays	Inheritance, Polymorphism- method overriding, dynamic method dispatch, abstract and final classes. Interfaces. Arrays and Strings: One dimensional arrays, Multidimensional arrays, exploring String class and methods.	**10**
3	Packages and Exception Handling	Packages-Built-in and User-defined, Introduction to java.util package – Vector, Scanner, StringTokenizer, Collections Framework- Introduction to Collections, ArrayList, LinkedList, HashMap, HashSet, Exception Handling- try-catch blocks, multiple catches, finally, throw, throws and custom exceptions.	**12**
4	Multithreading and Data Handling	Input / Output Basics – Streams – Byte streams and Character streams – Reading and Writing Console – Reading and Writing Files. Multithreading: Creating threads via Thread class and Runnable Interface, Synchronization and Inter-thread communication.	**12**
5	Gui Programming with Java	GUI Programming with Java: The AWT class hierarchy, introduction to Swing, Swing Vs AWT, hierarchy for swing components. Containers: JFrame, JApplet, JDialog, JPanel, overview of some swing components: JButton, JLabel, JTextField, JTextArea, simple applications. Layout management: Layout manager types, border, grid and flow.	**12**

PRACTICAL SYLLABUS				
Objective	Topic	CO	Learning Domain Level	Hrs
To understand Java program structure and implement basic programs using Java syntax	Writing simple Java programs demonstrating Java basics and program structure.	CO1	A	2
	Creating Java programs using classes and objects.		A	2

To design and develop programs using classes, objects, and constructors.	Implementing default and parameterized constructors		A	
To apply access specifiers, access modifiers, and method overloading in Java programs	Programs demonstrating access specifiers (public, private, protected, default).		An	2
	Programs illustrating access modifiers.		An	
	Implementing method overloading with different parameter lists.		An	
To implement recursive methods and nested/inner classes to solve programming problems.	Writing Java programs using recursion (factorial, Fibonacci, etc.).		An	2
	Developing programs using nested classes.		An	
	Implementing programs using inner classes.		An	
To implement inheritance, method overriding, and dynamic method dispatch in Java programs.	Programs demonstrating single and multilevel inheritance.	CO2	A	2
	Implementation of method overriding.		A	
	Programs illustrating dynamic method dispatch.		A	
To design Java programs using abstract classes, final classes, and interfaces.	Developing programs using abstract classes.		A	2
	Programs demonstrating final classes and final methods.		A	
	Implementing interfaces and multiple inheritance using interfaces.		A	
To develop programs using one-dimensional and multidimensional arrays.	Programs using one-dimensional arrays (searching, sorting, aggregation).		A	2
	Programs using multidimensional arrays (matrix operations).		A	
To explore and apply Java String class methods in problem-solving.	Programs exploring the String class and commonly used String methods.		A	
To create and use built-in and user-defined packages in Java programs.	Programs using built-in packages	CO3	A	2
	Creation and use of user-defined packages		A	
To apply classes from the java.util package for input handling and data processing.	Programs using Vector, Scanner, and StringTokenizer		A	2
To implement collection classes for efficient data storage and manipulation.	Introduction to Collections Framework		A	2
	Programs using ArrayList and LinkedList		A	
	Programs using HashMap and HashSet		A	
To handle runtime errors using Java exception handling mechanisms, including custom exceptions.	Programs using try–catch and multiple catch blocks		A	2
	Programs using finally, throw, and throws		A	
	Creation and use of custom exceptions		A	
To understand Java I/O stream hierarchy and perform console input and output operations.	Programs demonstrating basic input and output streams	CO4	A	2
	Reading and writing data through console		A	
To implement file handling using byte streams and character streams.	Programs using byte streams for file input and output		A	2
	Programs using character streams for file reading and writing		A	
To create and manage multiple threads using the Thread class and Runnable interface.	Creating threads using Thread class		A	2
	Creating threads using Runnable interface		A	
To apply synchronization and inter-thread communication mechanisms in multithreaded programs.	Programs demonstrating thread synchronization		A	2
	Programs illustrating inter-thread communication		A	
To understand the AWT and Swing class hierarchies and distinguish between AWT and Swing.	Study of AWT class hierarchy.	CO5	C	3
	Introduction to Swing		C	
	Comparison of Swing vs AWT		C	
	Swing component hierarchy		C	

To design GUI applications using Swing containers, components, and layout managers.	Programs using containers: JFrame, JApplet, JDialog, JPanel		C	3
	Programs using components: JButton, JLabel, JTextField, JTextArea		C	
	Programs using Flow, Border, and Grid layout managers		C	
To develop simple event-driven GUI applications for effective user interaction.	Simple GUI applications with event handling- Minor project		C	3

SUGGESTED LEARNING RESOURCES

Text Book			
Sl. No.	Title of Book	Author	Publication
1	Java: The Complete Reference	Herbert Schildt.	Tata McGraw-Hill Edition, 13th Edition, 2024.
2	An introduction to Object-oriented programming with Java	C. Thomas Wu	Tata McGraw-Hill Publishing company Ltd.

Reference			
Sl. No.	Title of Book	Author	Publication
1	Java 2 Programming Black Book",	Steven Holzner.	
2	The JAVA programming language	K. Arnold and J. Gosling	Pearson Education.
3	Core Java: An Integrated Approach	Dr. R. Nageswara Rao.	

COURSE DESCRIPTION							
REGULATION	**2025**	**L-T-J-P-S**	**0-1-1-2-0**	**VERSION**	**25/0**	**CREDITS**	**2**
(L- Lecture, T-Tutorial, J-Project, P-Practical, S-Self-learning & Team Work)							

COURSE CODE	**COURSE NAME**	**COURSE CATEGORY**
A250201/CA230U	**ADVANCED DBMS LAB**	**PC**
Pre-requisite		
Basic knowledge of Database Management Systems (DBMS), SQL concepts, and fundamentals of programming.		

TEACHING AND ASSESSMENT SCHEME									
Teaching Scheme / Week					**Credit**	**Hours / Semester**	**Examination Scheme**		
							Practical		
L	**T**	**J**	**P**	**S**	**C**		**CIA**	**ESE**	**Total**
0	1	1	2	0	2	60	50	50	100

***L**: Lecture (One unit is of one-hour duration), **T**: Tutorial (One unit is of one-hour duration), **P**: Practical (One unit is of one-hour duration), **J**: Project (One unit is of one-hour duration), **S**: Self-Learning & Team Work (One unit is of one-hour duration), **CIA**: Continuous Internal Assessment, **ESE**: End Semester Examination*

PRACTICAL SYLLABUS				
Objectives	Topic	COs	Learning Domain Level (C)	Hrs
SQL Database Design	1. Creation of a database using DDL commands, including integrity constraints. 2. Create an application to apply Data Manipulation Language (DML) commands to modify the database. 3. Apply DCL and TCL commands to impose restrictions on databases. 4. Create an application to retrieve data from databases using SELECT and VIEWS. 5. Create an application to use JOIN for query optimisation.	CO1	C	10
PL/SQL Programming	Construct PL/SQL code for sample databases using: 1. Cursors 2. Triggers 3. Stored Procedures 4. Functions	CO2	C	10
NoSQL Fundamentals	1. Compare relational and non-relational databases. 2. Understand the installation and configuration of NoSQL Databases.	CO3	C	6
NoSQL Data Design	1. Creating and managing collections, CRUD operations, aggregation, and indexing 2. Build sample collections/documents to perform query operations.	CO4	C	10
NoSQL Administration	1. Backup, security, monitoring, user and role management. 2. Build sample collections/documents to perform the shell commands like replica set, indexing etc.	CO5	C	6
Cloud Deployment	Deploying NoSQL in AWS DynamoDB / Google Bigtable / Azure CosmosDB	CO6	A	8

Project Work	Develop sample applications using any of the front-end tools and NoSQL: 1. Group micro project to develop an application using any database and front-end integration.	CO4, CO5	C	10

SUGGESTED LEARNING RESOURCES

Text Book			
Sl. No.	Title of Book	Author	Publication
1	Database System Concepts	Abraham Silberschatz, Henry F. Korth, S. Sudarshan	McGraw-Hill, 6th Edition, 2011
2	Next Generation Databases: NoSQL, NewSQL, and Big Data	Guy Harrison	Apress, 2015

Reference			
Sl. No.	Title of Book	Author	Publication
1	Database Management Systems	Raghu Ramakrishnan, Johannes Gehrke	McGraw-Hill, 3rd Edition, 2014
2	HBase: The Definitive Guide	Lars George	O'Reilly Media, 2011
3	Professional NoSQL	Shashank Tiwari	Wiley, 2011
4	MongoDB Administrator's Guide	Cyrus Dasadia	Packt Publishing, 2017
5	Cassandra: The Definitive Guide	Eben Hewitt, Jeff Carpenter	O'Reilly Media, 2010

COURSE DESCRIPTION							
REGULATION	**2025**	**L-T-J-P-S**	**1-0-0-3-0**	**VERSION**	**25/0**	**CREDITS**	**2**
(L- Lecture, T-Tutorial, J-Project, P-Practical, S-Self-learning & Team Work)							

COURSE CODE	**COURSE NAME**	**COURSE CATEGORY**
A250201/CA230V	**NETWORKING AND SYSTEM ADMINISTRATION LAB**	**PC**
Pre-requisite		
NIL		

TEACHING AND ASSESSMENT SCHEME									
Teaching Scheme / Week					**Credit**	**Hours / Semester**	**Examination Scheme**		
							Practical		
L	**T**	**J**	**P**	**S**	**C**		**CIA**	**ESE**	**Total**
1	0	0	3	0	2	60	50	50	100

***L**: Lecture (One unit is of one-hour duration), **T**: Tutorial (One unit is of one-hour duration), **P**: Practical (One unit is of one-hour duration), **J**: Project (One unit is of one-hour duration), **S**: Self-Learning & Team Work (One unit is of one-hour duration), **CIA**: Continuous Internal Assessment, **ESE**: End Semester Examination*

SYLLABUS (Major Topics)			
Module	Title	Major Topics	Hrs
1	System Setup and Configuration	Identify major hardware components, specification of desktop and server systems, install Linux (Ubuntu) on VirtualBox, user creation and permissions.	10
2	Linux Commands and File Management	Study of basic Linux commands, file hierarchy and permissions, system logs in /var/log.	10
3	Shell Scripting Fundamentals	Bash syntax, Variables, Control constructs, Command-line arguments, File backup and monitoring.	10
4	Networking Commands and Configuration	Network commands – ping, traceroute, nslookup, ip, netstat, arp, Configure static/dynamic IP, Subnet mask and CIDR.	10
5	Troubleshooting and Reporting	Troubleshoot connectivity issues, Analyze routing paths, maintain Git-based log of scripts and configurations.	10

PRACTICAL SYLLABUS				
Objective	Topic	CO	Learning Domain Level	Hrs
System setup and user management	Ubuntu installation on VirtualBox.	CO1	A	4
	User creation and permission management.	CO1	A	3
Linux file and command operations	Directory and file commands.	CO2	A	4
	File permissions and ownership.	CO2	A	3
Shell scripting and automation	Scripts using loops and conditions.	CO3	A	4
	File backup and monitoring.	CO3	A	4
Network configuration and testing	Network commands .	CO4	A	5
	Configure static IP and subnet mask.	CO4	A	3
Troubleshooting and documentation	Network issue identification and resolution.	CO5	A	5
	Git-based documentation and reporting.	CO5	A	3

SUGGESTED LEARNING RESOURCES

Text Book			
Sl. No.	Title of Book	Author	Publication
1	UNIX and Linux System Administration Handbook	Evi Nemeth, Garth Snyder, Trent R. Hein, Ben Whaley, and Dan Mackin	5th Edition Pearson/Addison-Wesley Professional.
2	Linux Command Reference Shell Commands from A to Z	Michael Kofler	ISBN 978-1-4932-2750-1
3	Unix Shell Programming	Yashavant P. Kanetkar	BPB Publications
4	Introduction to Linux and Shell Scripting	Amalorpavam G., K. R. Venugopal, M. T. Somashekara	Khanna Publishing House
5	A Textbook of Computer Network	Dr. Sanjay Sharma	S.K. Kataria & Sons
6	100 Shell programs in Unix	Suresh Kumar S.	PHI Learning Pvt. Ltd., New Delhi

Reference			
Sl. No.	Title of Book	Author	Publication
1	The Practice of System and Network Administration, Volume 1	Thomas A. Limoncelli, Christina J. Hogan, Strata Chalup	Addison-Wesley Professional
2	Network Warrior	Gary Donahue	O'Reilly
3	How Linux Works: What Every Superuser Should Know	Brian Ward	3rd Edition (April 2021) published by No Starch Press.

LIST OF APPROVED MOOC COURSES FOR FIRST YEAR

Sl. No	Course Name	MITS Course Code	Course Institute	Subject Matter Expert Name	Duration	Offering Platform	Start Date
1	Discrete Mathematics	A250201/CA230L	IIT, ROPAR	Prof. Sudarshan Iyengar	12 Weeks	NPTEL	Jan 19, 2026
2	Business Intelligence & Analytics	A250201/CA230L	IIT, Madras	Prof. Saji K Mathew	12 Weeks	NPTEL	Feb 16, 2026
3	Introduction to Internet of Things	A250201/CA230L	IIT, Kharagpur	Prof. Sudip Misra	12 Weeks	NPTEL	Jan 19, 2026
4	Introduction to Industry 4.0 And Industrial Internet of Things	A250201/CA230L	IIT, Kharagpur	Prof. Sudip Misra	12 Weeks	NPTEL	Jan 19, 2026
5	Discrete Mathematics	A250201/CA230L	IIT Ropar	Prof. Sudarshan Iyengar	12 Weeks	NPTEL	Jan 19, 2026

6	Introduction to Database Systems	A250201/CA230L	IIT, Madras	Prof. Sreenivasa Kumar	12 Weeks	NPTEL	Jan 19, 2026
7	Artificial Intelligence: Knowledge Representation and Reasoning	A250201/CA230L	IIT, Madras	Prof. Deepak Khemani	12 Weeks	NPTEL	Jan 19, 2026
8	Blockchain and Its Applications	A250201/CA230L	IIT, Kharagpur	Prof. Sandip Chakraborty, Prof. Shamik Sural	12 Weeks	NPTEL	Jan 19, 2026
9	Cloud Computing	A250201/CA230L	IIT, Kharagpur	Prof. Soumya Kanti Ghosh	12 Weeks	NPTEL	Jan 19, 2026
10	Theory of Computation	A250201/CA230L	IIT Hyderabad	Prof. Subrahmanyam Kalyanasundaram	12 Weeks	NPTEL	Jan 19, 2026
11	Introduction To Industry 4.0 And Industrial Internet of Things	A250201/CA230L	IIT, Kharagpur	Prof. Sudip Misra	12 Weeks	NPTEL	Jan 19, 2026
12	Object Oriented System Development Using Uml, Java and Patterns	A250201/CA230L	IIT, Kharagpur	Prof. Rajib Mall	12 Weeks	NPTEL	Jan 19, 2026
13	Getting Started with Competitive Programming	A250201/CA230L	IIT Gandhinagar	Prof. Neeldhara Misra	12 Weeks	NPTEL	Jan 19, 2026
14	Advanced Computer Architecture	A250201/CA230L	IIT Delhi	Prof. Smruti R.Sarangi	12 Weeks	NPTEL	Jan 19, 2026
15	Social Networks	A250201/CA230L	IIT Ropar	Prof. Sudarshan Iyengar	12 Weeks	NPTEL	Jan 19, 2026

SEMESTER III

SEMESTER III

CURRICULUM

SEM	SLOT	COURSE CATEGORY	COURSE CODE	COURSE NAME	L	T	J	P	S	C
III	A	PC	A250201/CA300A	Data Science and Machine Learning	3	1	0	0	4	4
	B	PC	A250201/CA300B	Design and Analysis of Algorithms	3	1	0	0	4	4
	C	PE	A250201/CA31*C	Program Elective I	3	1	0	0	4	4
	D	PE	A250201/CA31*D	Program Elective II	3	1	0	0	4	4
	T	PC	A250201/CA330T	Data Science Lab	0	1	0	3	0	2
	U	PC	A250201/CA330U	Mobile Application Development Lab	1	0	1	2	0	2
	V	PS	A250201/CA330V	Mini Project	0	0	4	0	0	2
	K	SE	A250201/CA330K	AI Tools for Software Development and Professional Productivity	0	0	0	1	0	0
					14	5	5	6		22

Program Elective I		
Sem	Course Code	Course Name
3	A250201/CA311C	Operations Research
3	A250201/CA312C	Cyber Security & Cryptography
3	A250201/CA313C	Cloud Computing
3	A250201/CA314C	Compiler Design

Program Elective II		
Sem	Course Code	Course Name
3	A250201/CA311D	Internet of Things
3	A250201/CA312D	Deep Learning
3	A250201/CA313D	Digital Image Processing
3	A250201/CA314D	Bioinformatics

COURSE DESCRIPTION							
REGULATION	**2025**	**L-T-J-P-S**	**3-1-0-0-4**	**VERSION**	**25/0**	**CREDITS**	**4**
(L- Lecture, T-Tutorial, J-Project, P-Practical, S-Self-learning & Team Work)							

COURSE CODE	COURSE NAME	COURSE CATEGORY
A250201/CA300A	**DATA SCIENCE AND MACHINE LEARNING**	**PC**
Pre-Requisite		
Probability and Statistics, Linear Algebra, Programming in Python/R.		

TEACHING AND ASSESSMENT SCHEME									
Teaching Scheme / Week					**Credit**	**Hours / Semester**	**Examination Scheme**		
							Theory		
L	**T**	**J**	**P**	**S**	**C**		**CIA**	**ESE**	**Total**
3	1	0	0	4	4	120	40	60	100
***L**: Lecture (One unit is of one-hour duration), **T**: Tutorial (One unit is of one-hour duration), **P**: Practical (One unit is of one-hour duration), **J**: Project (One unit is of one-hour duration), **S**: Self-Learning & Team Work (One unit is of one-hour duration), **CIA**: Continuous Internal Assessment, **ESE**: End Semester Examination*									

SYLLABUS (Major Topics)			
Module	Title	Major Topics	Hrs
1	Introduction to Data Science and Machine Learning	Introduction to data science, Data science classification, Data science process, Data preparation, Data exploration, Descriptive statistics, Data visualization techniques, Introduction to Machine Learning, Types of Machine Learning, Model Evaluation Concepts, Confusion Matrix, Precision, Recall, F-Measure, ROC Curves, Cross Validation.	12
2	Regression Techniques	Introduction to Regression, Correlation Analysis, Model Fitting, Linear Regression, Multiple Linear Regression, Regression Performance Measures - MAE, MSE, RMSE, R^2 Score, Applications of Regression.	10
3	Classification Techniques	Classification Concepts. Lazy learning - K-Nearest Neighbour (K-NN) Algorithm, Similarity Measures. Probabilistic learning- Naive Bayes Classification, Conditional Probability, Bayes Theorem. Divide and Conquer - Decision Tree Learning, Entropy, Information Gain, C5.0 Algorithm, Pruning, Classification Rules.	10
4	Clustering and Ensemble Learning	Unsupervised Learning, Clustering Concepts, K-Means Clustering, Cluster Evaluation, Introduction to Ensemble Learning, Bagging, Boosting, Random Forests, Applications of Clustering and Ensemble Methods	10
5	Support Vector Machines	Support Vector Machines (SVM), Hyperplanes, Maximum Margin Classifier, Kernel Methods, Applications of SVM	8

SUGGESTED LEARNING RESOURCES

Text Book			
Sl. No.	Title of Book	Author	Publication
1	Data Science Concepts and Practice	Vijay Kotu, Bala Deshpande	Morgan Kaufmann Publishers, 2018
2	Machine Learning with R	Brett Lantz	4th Edition, Packt Publishing, 2023
3	Data Science from Scratch	Joel Grus	2nd Edition, O'Reilly, 2019.

Reference			
Sl. No.	Title of Book	Author	Publication
1	Machine Learning in Action	Peter Harrington	Manning Publications
2	Applied Machine Learning	Dr. M. Gopal	McGraw Hill Education
3	Introduction to Machine Learning	Ethem Alpaydin	4th Edition, MIT Press, 2020
4	Machine Learning	Tom M. Mitchell	McGraw-Hill Education, 2017.

COURSE DESCRIPTION							
REGULATION	**2025**	**L-T-J-P-S**	**3-1-0-0-4**	**VERSION**	**25/0**	**CREDITS**	**4**
(L- Lecture, T-Tutorial, J-Project, P-Practical, S-Self-learning & Team Work)							

COURSE CODE	**COURSE NAME**	**COURSE CATEGORY**
A250201/CA300B	**DESIGN AND ANALYSIS OF ALGORITHMS**	PC
Pre-Requisite		
Knowledge in Data Structures		

TEACHING AND ASSESSMENT SCHEME

Teaching Scheme / Week					**Credit**	**Hours / Semester**	**Examination Scheme**		
							Theory		
L	**T**	**J**	**P**	**S**	**C**		**CIA**	**ESE**	**Total**
3	1	0	0	4	4	120	40	60	100

***L**: Lecture (One unit is of one-hour duration), **T**: Tutorial (One unit is of one-hour duration), **P**: Practical (One unit is of one-hour duration), **J**: Project (One unit is of one-hour duration), **S**: Self-Learning & Team Work (One unit is of one-hour duration), **CIA**: Continuous Internal Assessment, **ESE**: End Semester Examination*

SYLLABUS (Major Topics)

Module	Title	Major Topics	Hrs
1	Introduction to Algorithm Analysis	Characteristics of Algorithms, Criteria for Analysing Algorithms, Time and Space Complexity - Best, Worst and Average Case Complexities, Asymptotic Notations - Big-Oh (O), Big- Omega (Ω), Big-Theta (Θ), Little-oh (o) and Little- Omega (ω) and their properties Analysis of Recursive Algorithms: Recurrence Equations, Solving Recurrence Equations – Iteration Method, Recursion Tree Method, Substitution method	10
2	Divide and Conquer Techniques	General Method of Divide and Conquer- Binary Search, Merge Sort, Quick Sort Finding Maximum and Minimum Elements, Matrix Multiplication- Strassen's Algorithm for Matrix Multiplication- Analysis.	8
3	Greedy Strategy and Dynamic Programming:	Greedy Method- General Greedy Strategy Activity Selection Problem, Fractional Knapsack Problem, Job Sequencing with Deadlines, Huffman Coding - Single Source Shortest Path Algorithm Dynamic Programming- Principles of Dynamic Programming, Matrix Chain Multiplication, 0/1 Knapsack Problem, Floyd–Warshall Algorithm	10
4	Back Tracking Branch & Bound and Network Flows	Back Tracking- General Backtracking Technique, N-Queens Problem, Sum of Subsets Problem, Hamiltonian Cycle Problem Branch and Bound- General Branch and Bound Strategy, All Pairs Shortest Path Algorithm, Travelling Salesperson Problem (TSP) Network Flows- Flow Networks and Network Flow, Max- Flow Min Cut Theorem, Ford Fulkerson method, Bipartite matching	10
5	Introduction to Complexity Theory and Approximation algorithms	Tractable and Intractable Problems, Complexity Classes – P, NP, NP-Hard and NP-Complete Classes- NP Completeness proof of Clique Problem and Vertex Cover Problem-Polynomial Time Reduction Approximation algorithms- Bin Packing, Graph Coloring. Randomized Algorithms- Definitions of Monte Carlo and Las Vegas algorithms.	10

SUGGESTED LEARNING RESOURCES

Text Book			
Sl. No.	Title of Book	Author	Publication
1	Introduction to Algorithms	Thomas H. Cormen	Jones and Bartlett Publishers, Inc, 4th Edition 2011.
2	Computer Algorithms: Introduction to Design and Analysis	Sara Baase, Allen Van Gelder	Pearson India, 3rd Edition 2002.

Reference			
Sl. No.	Title of Book	Author	Publication
1	Foundations of Algorithms	Richard Neapolitan	Bartlett Publishers
2	Introduction to Design and Analysis	Sara Baase, Allen Van Gelder	Pearson India, 3rd Edition 2002.
3	Introduction to the Design & Analysis of Algorithms	A. Levitin	Pearson Education, 3rd Edition 2008.

Programme Elective I

COURSE DESCRIPTION							
REGULATION	**2025**	**L-T-J-P-S**	**3-1-0-0-4**	**VERSION**	**25/0**	**CREDITS**	**4**
(L- Lecture, T-Tutorial, J-Project, P-Practical, S-Self-learning & Team Work)							

COURSE CODE	**COURSE NAME**	**COURSE CATEGORY**
A250201/CA311C	**OPERATIONS RESEARCH**	PE
Pre-Requisite		
Basics Mathematics		

TEACHING AND ASSESSMENT SCHEME									
Teaching Scheme / Week					**Credit**	**Hours / Semester**	**Examination Scheme**		
							Theory		
L	**T**	**J**	**P**	**S**	**C**		**CIA**	**ESE**	**Total**
3	1`	0	0	4	4	120	40	60	100
***L**: Lecture (One unit is of one-hour duration), **T**: Tutorial (One unit is of one-hour duration), **P**: Practical (One unit is of one-hour duration), **J**: Project (One unit is of one-hour duration), **S**: Self-Learning & Team Work (One unit is of one-hour duration), **CIA**: Continuous Internal Assessment, **ESE**: End Semester Examination*									

SYLLABUS (Major Topics)			
Module	Title	Major Topics	Hrs
1	Linear Programming	Slack & surplus variables, standard form, simplex method, Big-M method	9
2	Duality in LPP	Duality theorem, complementary slackness, primal-dual solutions, revised simplex	9
3	Transportation & Assignment Problems	NW corner, Matrix minima, Vogel's method, Modi method, Hungarian method	9
4	Network Analysis	Project scheduling, CPM, floats, PERT, expected completion times	9
5	Queuing Theory	Elements, Kendall's notation, Poisson process, exponential distribution, birth-death process, single & multi-server models	9

SUGGESTED LEARNING RESOURCES

Text Book			
Sl. No.	Title of Book	Author	Publication
1	Operations Research	Kanti Swarup, P.K. Gupta, Man Mohan	Sultan Chand, 2010

Reference			
Sl. No.	Title of Book	Author	Publication
1	Operations Research: An Introduction	Hamdy A. Taha	Prentice Hall of India
2	Operations Research	Ravindran, Philips, Solberg	Wiley, 2007

COURSE DESCRIPTION							
REGULATION	**2025**	**L-T-J-P-S**	**3-1-0-0-4**	**VERSION**	**25/0**	**CREDITS**	**4**
(L- Lecture, T-Tutorial, J-Project, P-Practical, S-Self-learning & Team Work)							

COURSE CODE	COURSE NAME	COURSE CATEGORY
A250201/CA312C	**CYBER SECURITY AND CRYPTOGRAPHY**	PE
Pre-Requisite		
Student is expected to have studied mathematics courses that cover Elementary Number Theory, Finite Field, Discrete Logarithm and Euclidean Algorithm.		

TEACHING AND ASSESSMENT SCHEME									
Teaching Scheme / Week					**Credit**	**Hours / Semester**	**Examination Scheme**		
							Theory		
L	**T**	**J**	**P**	**S**	**C**		**CIA**	**ESE**	**Total**
3	1`	0	0	4	4	120	40	60	100
***L**: Lecture (One unit is of one-hour duration), **T**: Tutorial (One unit is of one-hour duration), **P**: Practical (One unit is of one-hour duration), **J**: Project (One unit is of one-hour duration), **S**: Self-Learning & Team Work (One unit is of one-hour duration), **CIA**: Continuous Internal Assessment, **ESE**: End Semester Examination*									

SYLLABUS (Major Topics)			
Module	Title	Major Topics	Hrs
1	Fundamentals of Cryptography and Security Attacks	Introduction to Cryptography, OSI Security Architecture, Security Services, Mechanisms, and Attacks (Phishing, Ransomware, DoS). Network Security Model. Classical Encryption Techniques (Symmetric Cipher Model, Substitution, Transposition, Steganography).	9
2	Symmetric and Asymmetric Cryptography	Block and Stream Ciphers, Design Principles, Modes of Operation. DES, AES, Multiple Encryption, Triple DES. Public Key Cryptography Principles, RSA Algorithm, Key Management, Diffie-Hellman Key Exchange. Elliptic Curve Arithmetic and ECC.	11
3	Hash Functions and Digital Signatures	Properties of Hash Functions, Birthday Attack, Hashcash, MACs, HMAC, and CMAC Protocols. Digital Signature Schemes (RSA, DSS, ElGamal, Schnorr). One-Time and Blind Signatures, and attacks on signatures.	10
4	Network and Transport Layer Security	Cyber Security Intro, Email Security (PGP, S/MIME), Privacy, Authentication, Integrity, Non-repudiation. IPSec (IPv4/IPv6, AH, ESP, IKE). SSL/TLS Protocols, PKI, and Secure Electronic Transactions (SET).	10
5	Web Application Security	Common Vulnerabilities (Injection Flaws, Broken Authentication, Sensitive Data Exposure, XXE, Broken Access Control, Security Misconfiguration, XSS, Insecure Deserialization, Vulnerable Components). Logging/Monitoring Issues, Attack Scenarios, and Prevention Mechanisms.	10

SUGGESTED LEARNING RESOURCES

Text Book			
Sl. No.	Title of Book	Author	Publication
1	Cryptography and Network Security	William Stallings	Pearson Education, 6th Edition, March 2013
2	Introduction to Cryptography and Network Security	Behrouz A. Forouzan	Tata McGraw-Hill Publishing, 2nd Edition, 2011

Reference			
Sl. No.	Title of Book	Author	Publication
1	Network Security	Charlie Kaufman, Radia Perlman and Mike Speciner	Prentice Hall of India, 2002
2	Cryptography and Security Services – Mechanisms and Applications	Manuel Mogollon	Cybertech Publishing, 2008
3	Firewalls and Internet Security	William R. Cheswick, Steven M. Bellovin, Aviel D. Rubin	Addison-Wesley, 2003

COURSE DESCRIPTION							
REGULATION	**2025**	**L-T-J-P-S**	**3-1-0-0-4**	**VERSION**	**25/0**	**CREDITS**	**4**
(L- Lecture, T-Tutorial, J-Project, P-Practical, S-Self-learning & Team Work)							

COURSE CODE	**COURSE NAME**	**COURSE CATEGORY**
A250201/CA313C	**CLOUD COMPUTING**	PE
Pre-Requisite		
Awareness in networking concepts, virtualisation and containers is desirable.		

TEACHING AND ASSESSMENT SCHEME									
Teaching Scheme / Week					**Credit**	**Hours / Semester**	**Examination Scheme**		
							Theory		
L	**T**	**J**	**P**	**S**	**C**		**CIA**	**ESE**	**Total**
3	1`	0	0	4	4	120	40	60	100
***L**: Lecture (One unit is of one-hour duration), **T**: Tutorial (One unit is of one-hour duration), **P**: Practical (One unit is of one-hour duration), **J**: Project (One unit is of one-hour duration), **S**: Self-Learning & Team Work (One unit is of one-hour duration), **CIA**: Continuous Internal Assessment, **ESE**: End Semester Examination*									

SYLLABUS (Major Topics)			
Module	Title	Major Topics	Hrs
1	Overview of Cloud Computing and OpenStack architecture	Introduction to cloud computing, Introduction to OpenStack architecture	8
2	OpenStack Cluster and Common Services	OpenStack clustering, Common Services	8
3	OpenStack Compute and Storage	OpenStack compute service, OpenStack storage service	12
4	OpenStack Networking	OpenStack Networking Service, Virtual networks, Routing	12
5	OpenStack Orchestration	Orchestration using Heat, Orchestration using Terraform, High Availability (HA)	10

SUGGESTED LEARNING RESOURCES

Text Book			
Sl. No.	Title of Book	Author	Publication
1	Mastering OpenStack	Omar Khedher, Chandan Datta Chowdhury	2nd edition, Packt Publishing, 2017
2	Cloud Computing: Concepts, Technology, Security & Architecture	Thomas Erl, Eric Barcelo Monroy	2nd edition, Pearson, 2023

Reference			
Sl. No.	Title of Book	Author	Publication
1	OpenStack Operations Guide	Tom Fifield, Diane Fleming, Anne Gentle, Lorin Hochstein, Jonathan	1st edition, O'REILY, 2014

		Proulx, Everett Toews, and Joe Topjian	
2	Applied OpenStack Design Patterns	Uchit Vyas	1st edition, Apress, 2016
3	OpenStack in Action	V. K. Cody Bumgardner	1st edition, Manning Publications, 2016
4	Implementing Cloud Storage with OpenStack Swift	Amar Kapadia, Sreedhar Varma, Kris Rajana	1st edition, Packt Publishing, 2014

COURSE DESCRIPTION							
REGULATION	**2025**	**L-T-J-P-S**	**3-1-0-0-4**	**VERSION**	**25/0**	**CREDITS**	**4**
(L- Lecture, T-Tutorial, J-Project, P-Practical, S-Self-learning & Team Work)							

COURSE CODE	**COURSE NAME**	**COURSE CATEGORY**
A250201/CA314C	**COMPILER DESIGN**	PE
Pre-Requisite		
Basics of Programming in C, Data Structures, Discrete Mathematics, Formal Languages and Automata Theory.		

TEACHING AND ASSESSMENT SCHEME

Teaching Scheme / Week					**Credit**	**Hours / Semester**	**Examination Scheme**		
							Theory		
L	**T**	**J**	**P**	**S**	**C**		**CIA**	**ESE**	**Total**
3	1`	0	0	4	4	120	40	60	100

***L**: Lecture (One unit is of one-hour duration), **T**: Tutorial (One unit is of one-hour duration), **P**: Practical (One unit is of one-hour duration), **J**: Project (One unit is of one-hour duration), **S**: Self-Learning & Team Work (One unit is of one-hour duration), **CIA**: Continuous Internal Assessment, **ESE**: End Semester Examination*

SYLLABUS (Major Topics)

Module	Title	Major Topics	Hrs
1	Introduction to Compilers and Lexical Analysis	Analysis of source program, phases of compiler, grouping of phases, role of lexical analyser, input buffering, specification and recognition of tokens, deterministic and non-deterministic finite automata, regular expression to NFA and DFA	8
2	Syntax Analysis	Role of parser, context free grammars, recursive descent parsing, predictive parsing, LL(1) grammars, shift reduce parsing, operator precedence parsing, SLR parsing tables, canonical LR parsing tables, LALR parsing tables	12
3	Syntax Directed Translation and Type Checking	Syntax directed definitions, S-attributed definitions, L-attributed definitions, top-down translation, inherited attributes, type systems, simple type checker specification	8
4	Intermediate Code Generation	Graphical representations, three address code, quadruples, triples, indirect triples, assignment statements, Boolean expressions, control flow statements	7
5	Code Optimization and Code Generation	Principal sources of optimization, optimization of basic blocks, global data flow analysis, design issues of code generator, target machine, basic blocks and flow graphs, simple code generator, peephole optimization	10

SUGGESTED LEARNING RESOURCES

Text Book			
Sl. No.	Title of Book	Author	Publication
1	Compilers – Principles, Techniques and Tools	Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman	Addison Wesley, 2nd Edition, 2006

Reference			
Sl. No.	Title of Book	Author	Publication
1	Principles of Compiler Design	V Raghavan	Tata McGraw Hill, 2nd Edition, 2011
2	The Theory and Practice of Compiler Writing	Jean Paul Tremblay and Sorenson	McGraw Hill, 2nd Edition, 2006
3	Principles of Compiler Design	Nandini Prasad	Elsevier, 2nd Edition, 2012
4	Compiler Construction-Principles and Practice	Kenneth C. Louden	Cengage, 2nd Edition, 2010
5	Engineering a Compiler	Keith Cooper and Linda Torczon	Elsevier, 2nd Edition, 2011

Programme Elective II

COURSE DESCRIPTION							
REGULATION	**2025**	**L-T-J-P-S**	**3-1-0-0-4**	**VERSION**	**25/0**	**CREDITS**	**4**
(L- Lecture, T-Tutorial, J-Project, P-Practical, S-Self-learning & Team Work)							

COURSE CODE	**COURSE NAME**	**COURSE CATEGORY**
A250201/CA311D	**INTERNET OF THINGS**	PE
Pre-Requisite		
Basic concepts of Information Technology and Internet.		

TEACHING AND ASSESSMENT SCHEME									
Teaching Scheme / Week					**Credit**	**Hours / Semester**	**Examination Scheme**		
							Theory		
L	**T**	**J**	**P**	**S**	**C**		**CIA**	**ESE**	**Total**
3	1`	0	0	4	4	120	40	60	100
***L**: Lecture (One unit is of one-hour duration), **T**: Tutorial (One unit is of one-hour duration), **P**: Practical (One unit is of one-hour duration), **J**: Project (One unit is of one-hour duration), **S**: Self-Learning & Team Work (One unit is of one-hour duration), **CIA**: Continuous Internal Assessment, **ESE**: End Semester Examination*									

SYLLABUS (Major Topics)			
Module	**Title**	**Major Topics**	**Hrs**
1	Introduction to Internet of Things	Overview of IoT, Open IoT architecture, Device-cloud collaboration	9
2	IoT Programming Frameworks and Fog Computing	Fog Computing, TinyOS, nesC, REST, CoAP, IoT frameworks	11
3	IoT Data Management Techniques	Stream processing, DSMS, CEP, anomaly detection	10
4	IoT Security and Privacy	IoT security, privacy, TinyTO authentication	10
5	IoT Implementation and Applications	IoT implementation using Raspberry Pi and sensors	10

SUGGESTED LEARNING RESOURCES

Text Book			
Sl. No.	Title of Book	Author	Publication
1	Internet of Things	Rajkumar Buyya, Amir Vahid Dastjerdi	Morgan Kaufmann, 2016
2	Learning Internet of Things	Peter Waher	Packt Publishing, 2015

Reference			
Sl. No.	Title of Book	Author	Publication
1	Learning Internet of Things	Peter Waher	Packt Publishing, 2015
2	Fundamentals of Sensor Network Programming: Applications and Technology	S. Sitharama Iyengar, Nandan Parameswaran, Vir V. Phoha, N. Balakrishnan, Chuka Okoye	Wiley, 2010
3	Big Data and The Internet of Things: Enterprise Information Architecture for A New Age	Robert Stackowiak, Art Licht, Venu Mantha, Louis Nagode	Apress, 2015

COURSE DESCRIPTION							
REGULATION	**2025**	**L-T-J-P-S**	**3-1-0-0-4**	**VERSION**	**25/0**	**CREDITS**	**4**
(L- Lecture, T-Tutorial, J-Project, P-Practical, S-Self-learning & Team Work)							

COURSE CODE	COURSE NAME	COURSE CATEGORY
A250201/CA312D	**DEEP LEARNING**	PE
Pre-Requisite		
Basics of Machine Learning, Probability and Statistics, Python Programming,		

TEACHING AND ASSESSMENT SCHEME									
Teaching Scheme / Week					**Credit**	**Hours / Semester**	**Examination Scheme**		
							Theory		
L	**T**	**J**	**P**	**S**	**C**		**CIA**	**ESE**	**Total**
3	1`	0	0	4	4	120	40	60	100
***L**: Lecture (One unit is of one-hour duration), **T**: Tutorial (One unit is of one-hour duration), **P**: Practical (One unit is of one-hour duration), **J**: Project (One unit is of one-hour duration), **S**: Self-Learning & Team Work (One unit is of one-hour duration), **CIA**: Continuous Internal Assessment, **ESE**: End Semester Examination*									

SYLLABUS (Major Topics)			
Module	Title	Major Topics	Hrs
1	Introduction to Deep Learning	Basics of neural networks, perceptron, activation functions, gradient descent, feedforward networks	8
2	Training Deep Networks	Backpropagation, optimization, regularization, dropout, batch normalization, TensorFlow and Keras basics	10
3	Convolutional Neural Networks	CNN architecture, convolution, pooling, fully connected layers, image recognition applications	10
4	Recurrent Neural Networks	RNN, LSTM, GRU, sequence modelling, NLP applications	8
5	Generative Deep Learning Models	Autoencoders, Variational Autoencoders, Generative Adversarial Networks (GANs)	9

SUGGESTED LEARNING RESOURCES

Text Book			
Sl. No.	Title of Book	Author	Publication
1	Deep Learning	Ian Goodfellow, Yoshua Bengio, Aaron Courville	MIT Press
2	Neural Networks and Deep Learning	Michael Nielsen	Online Book

Reference			
Sl. No.	Title of Book	Author	Publication
1	Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow	Aurélien Géron	O'Reilly
2	Deep Learning with Python	François Chollet	Manning
3	Pattern Recognition and Machine Learning	Christopher Bishop	Springer

COURSE DESCRIPTION							
REGULATION	**2025**	**L-T-J-P-S**	**3-1-0-0-4**	**VERSION**	**25/0**	**CREDITS**	**4**
(L- Lecture, T-Tutorial, J-Project, P-Practical, S-Self-learning & Team Work)							

COURSE CODE	**COURSE NAME**	**COURSE CATEGORY**
A250201/CA313D	**DIGITAL IMAGE PROCESSING**	PE
Pre-Requisite		
Basics of Digital Electronics, Linear Algebra, Signals and Systems, Programming in Python/C, and Fundamentals of Image Processing.		

TEACHING AND ASSESSMENT SCHEME									
Teaching Scheme / Week					**Credit**	**Hours / Semester**	**Examination Scheme**		
							Theory		
L	**T**	**J**	**P**	**S**	**C**		**CIA**	**ESE**	**Total**
3	1`	0	0	4	4	120	40	60	100
***L**: Lecture (One unit is of one-hour duration), **T**: Tutorial (One unit is of one-hour duration), **P**: Practical (One unit is of one-hour duration), **J**: Project (One unit is of one-hour duration), **S**: Self-Learning & Team Work (One unit is of one-hour duration), **CIA**: Continuous Internal Assessment, **ESE**: End Semester Examination*									

SYLLABUS (Major Topics)			
Module	Title	Major Topics	Hrs
1	Overview of Digital Image Processing	Concepts, Image processing vs computer vision, Components, Applications, Mathematical preliminaries, Visual perception, Image types, Sampling & Quantization, Color models	9
2	Image Enhancement & Spatial Filtering	Grey level transformations, Histogram equalization, Spatial filtering, Smoothing & Sharpening filters (Laplacian, Unsharp masking, High-boost, Gradient operators)	10
3	Image Transform & Frequency Domain Filtering	Image transforms (DFT, DCT), Properties, Frequency domain filtering, Smoothing & sharpening	8
4	Image Restoration & Compression	Restoration models, Noise models, Point Spread Function, Inverse & Wiener filtering, Compression schemes, JPEG, Watermarking	8
5	Morphological Image Processing & Segmentation	Erosion, dilation, opening, closing, Hit-or-Miss, Edge detection (Hough, Marr-Hildreth, Canny), Thresholding (Global, Otsu), Region-based segmentation	10

SUGGESTED LEARNING RESOURCES

Text Book			
Sl. No.	Title of Book	Author	Publication
1	Digital Image Processing	Rafael C. Gonzalez & Woods R.E.	Pearson Education
2	Fundamentals of Digital Image Processing	A.K. Jain	Prentice Hall, Eaglewood Cliffs, NJ

Reference			
Sl. No.	Title of Book	Author	Publication
1	Digital Image Processing and Computer Vision	R.J. Schalkoff	John Wiley
2	Handbook of Image and Video Processing	Al Bovik	Academic Press, 2000
3	Digital Image Processing	W.K. Pratt	John Wiley

COURSE DESCRIPTION							
REGULATION	**2025**	**L-T-J-P-S**	**3-1-0-0-4**	**VERSION**	**25/0**	**CREDITS**	**4**
(L- Lecture, T-Tutorial, J-Project, P-Practical, S-Self-learning & Team Work)							

COURSE CODE	**COURSE NAME**	**COURSE CATEGORY**
A250201/CA314D	**BIOINFORMATICS**	PE
Pre-Requisite		
Basics of Biology, Genetics, Molecular Biology, Database Management Systems, Statistics and Python Programming.		

TEACHING AND ASSESSMENT SCHEME									
Teaching Scheme / Week					**Credit**	**Hours / Semester**	**Examination Scheme**		
							Theory		
L	**T**	**J**	**P**	**S**	**C**		**CIA**	**ESE**	**Total**
3	1`	0	0	4	4	120	40	60	100
***L**: Lecture (One unit is of one-hour duration), **T**: Tutorial (One unit is of one-hour duration), **P**: Practical (One unit is of one-hour duration), **J**: Project (One unit is of one-hour duration), **S**: Self-Learning & Team Work (One unit is of one-hour duration), **CIA**: Continuous Internal Assessment, **ESE**: End Semester Examination*									

SYLLABUS (Major Topics)			
Module	Title	Major Topics	Hours
1	Computational Biology & Bioinformatics	Cell, Central Dogma, DNA, RNA, Protein Structure, Coding & Non-coding RNAs (mRNA, tRNA, miRNA, siRNA), Scope & Importance of Bioinformatics, Genome Projects, Pattern Recognition & Prediction, Folding Problem, Sequence Analysis, Homology & Analogy	7
2	Biological Databases	Biological Databases, Primary Databases, Composite Databases, Secondary Databases, Protein Pattern Databases, Structure Classification Databases, PIR, MIPS, SWISS-PROT, TrEMBL, Prosite, Prints, Pfam, Blocks	8
3	Data Searches & Pairwise Alignment	Dot Plots, Simple Alignment, Gap Penalties, PAM, BLOSUM, Needleman-Wunsch, Smith-Waterman, Global, Local & Semiglobal Alignment, Statistical Significance, Multiple Sequence Alignment, BLAST, FastA	10
4	Genomics & Gene Recognition	Gene Expression in Prokaryotes, Prokaryotic Gene Structure, Eukaryotic Gene Structure, ORF, GC Content, Gene Density, cDNA, EST, SAGE, Microarrays	10
5	Data Visualization, Data Mining & Machine Learning	Sequence Visualization, Structure Visualization, User Interface Design, Animation vs Simulation, Data Mining Methods & Infrastructure, Pattern Recognition & Discovery, Genetic Algorithms, Neural Networks, Statistical Methods, Hidden Markov Models, Text Mining	10

SUGGESTED LEARNING RESOURCES

Text Book			
Sl. No.	Title of Book	Author	Publication
1	Fundamental Concepts of Bioinformatics	Dan E. Krane & M. L. Raymer	Pearson Education, 2003
2	Bioinformatics Computing	Bryan Bergeron	Pearson Education, 2015
3	Introduction to Bioinformatics	Attwood T. K. & D. J. Parry-Smith	Pearson Education, 2003
4	An Introduction to Bioinformatics Algorithms	Neil C. Jones & Pavel A. Pevzner	MIT Press, 2004

Reference			
Sl. No.	Title of Book	Author	Publication
1	Bioinformatics For Dummies	Jean-Michel Claverie & Cedric Notredame	Wiley Publishing
2	Bioinformatics: Sequence and Genome Analysis	David W. Mount	Cold Spring Harbor Laboratory Press
3	Bioinformatics for Dummies	J. Claverie & C. Notredame	Wiley India

COURSE DESCRIPTION							
REGULATION	**2025**	**L-T-J-P-S**	**0-1-0-3-0**	**VERSION**	**25/0**	**CREDITS**	**2**
(L- Lecture, T-Tutorial, J-Project, P-Practical, S-Self-learning & Team Work)							

COURSE CODE	COURSE NAME	COURSE CATEGORY
A250201/CA330T	**DATA SCIENCE LAB**	PC
Pre-requisite		
Basic programming knowledge, Python programming fundamentals, fundamentals of machine learning, and basic understanding of web technologies.		

TEACHING AND ASSESSMENT SCHEME									
Teaching Scheme / Week					**Credit**	**Hours / Semester**	**Examination Scheme**		
							Practical		
L	**T**	**J**	**P**	**S**	**C**		**CIA**	**ESE**	**Total**
0	1	0	3	0	2	60	50	50	100

***L**: Lecture (One unit is of one-hour duration), **T**: Tutorial (One unit is of one-hour duration), **P**: Practical (One unit is of one-hour duration), **J**: Project (One unit is of one-hour duration), **S**: Self-Learning & Team Work (One unit is of one-hour duration), **CIA**: Continuous Internal Assessment, **ESE**: End Semester Examination*

LAB COMPONENT DESIGN				
Objectives	Topic	COs	Learning Domain (C)	Hrs
Familiarize students with Python scientific libraries and visualization tools	Python review, NumPy fundamentals	CO1	A	3
	Matrix operations using NumPy		A	3
	Data visualization using Matplotlib, Seaborn, Plotly		A	3
Develop machine learning models for classification and regression	k-NN Classification	CO2	A	4
	Naïve Bayes Classification		A	4
	Simple Linear Regression		A	3
	Multiple Linear Regression		A	3
Implement advanced machine learning algorithms for prediction and clustering	Support Vector Machine (SVM)	CO3	A	3
	Decision Tree Classification		A	4
	k-Means Clustering		A	4
Build deep learning models using neural networks	Feedforward Neural Networks using Keras	CO4	A	3
	Convolutional Neural Networks using Keras		A	3
Perform web mining and NLP tasks using Python libraries	Web Scraping using Python	CO5	A	3
	POS Tagging using NLTK		A	2
	N-Grams using NLTK		A	2
	Text Chunking using NLTK		A	3

SUGGESTED LEARNING RESOURCES

Text Book			
Sl. No.	Title of Book	Author	Publication
1	Python for Data Analysis (3rd Edition)	Wes McKinney	O'Reilly Media, 2022
2	Hands-On Machine Learning with Scikit-Learn, Keras & TensorFlow (3rd Edition)	Aurélien Géron	O'Reilly Media, 2022
3	Practical Statistics for Data Scientists (2nd Edition)	Peter Bruce, Andrew Bruce, Peter Gedeck	O'Reilly Media, 2020
4	Pattern Recognition and Machine Learning	Christopher M. Bishop	Springer, 2006
5	Introduction to Machine Learning	Ethem Alpaydin	Prentice Hall of India, 2005

Reference			
Sl. No.	Title of Book	Author	Publication
1	Data Science from Scratch (2nd Edition)	Joel Grus	O'Reilly Media, 2019
2	Deep Learning with Python (2nd Edition)	François Chollet	Manning Publications, 2021
3	The Elements of Statistical Learning	Trevor Hastie, Robert Tibshirani, Jerome Friedman	Springer, 2001
4	Natural Language Processing in Action (2nd Edition)	Hobson Lane, Cole Howard, Hannes Hapke	Manning Publications, 2022

COURSE DESCRIPTION							
REGULATION	**2025**	**L-T-J-P-S**	**1-0-1-2-0**	**VERSION**	**25/0**	**CREDITS**	**2**
(L- Lecture, T-Tutorial, J-Project, P-Practical, S-Self-learning & Team Work)							

COURSE CODE	**COURSE NAME**	**COURSE CATEGORY**
A250201/CA330U	**MOBILE APPLICATION DEVELOPMENT LAB**	PC
Pre-requisite		
Basic Java programming and database concepts		

TEACHING AND ASSESSMENT SCHEME

Teaching Scheme / Week					**Credit**	**Hours / Semester**	**Examination Scheme**		
							Practical		
L	**T**	**J**	**P**	**S**	**C**		**CIA**	**ESE**	**Total**
1	0	1	2	0	2	60	50	50	100

***L**: Lecture (One unit is of one-hour duration), **T**: Tutorial (One unit is of one-hour duration), **P**: Practical (One unit is of one-hour duration), **J**: Project (One unit is of one-hour duration), **S**: Self-Learning & Team Work (One unit is of one-hour duration), **CIA**: Continuous Internal Assessment, **ESE**: End Semester Examination*

SYLLABUS (Major Topics)

Module	Title	Major Topics	Hrs
1	Android Fundamentals & Development Environment	Android Studio setup, Activities, Services, Broadcast Receivers, Content Providers, Android Virtual Device (AVD), Emulator settings, Logcat, DDMS	5
2	Application Structure & Activity Lifecycle	AndroidManifest.xml, User Permissions, SDK, Resources and R.java, Assets, Drawable Resources, Activity Lifecycle	7
3	Basic UI Design & Layouts	Form Widgets, Text Fields, EditText Validation, Layouts, dp/sp/px units, Toast, Alert Dialogs, Images	10
4	Menus, Intents & Navigation	Explicit and Implicit Intents, Intent Filters, Option Menu, Context Menu, Navigation Drawer	10
5	Advanced UI Design, Styles & Data Storage	ListView, Adapters, Composite UI, Drawable Resources, Selectors, Shared Preferences, SQLite Database, Reading and Updating, Deleting.	18

LAB COMPONENT DESIGN

Objectives	Topic	CO	Learning Domain (C)	Hrs
Set up Android development environment and debugging tools	Android Studio installation, Emulator configuration, Logcat and DDMS exercises	CO1	A	3
Develop Android applications using application components and lifecycle management	Android components, AndroidManifest.xml, Resources, Activity Lifecycle implementation	CO2	A	3
Design user interfaces using Android widgets, layouts and validation mechanisms	Form Widgets, Validation, Layouts, Toast, Alert Dialogs, Images	CO3	A	7
Implement navigation and communication mechanisms in Android applications	Explicit & Implicit Intents, Menus, Intent Filters, Navigation Drawer	CO4	A	7
Develop database-driven Android applications and complete a micro project	ListView, Adapters, Composite UI, Shared Preferences, SQLite Database, CRUD Operations,	CO5	A	5
	Micro Project Development, Integration, Testing and Final Presentation			10

SUGGESTED LEARNING RESOURCES

Text Book			
Sl. No.	Title of Book	Author	Publication
1	Advanced Android Application Development, Developers Library	Joseph Annuzzi Jr, Lauren Darcey, Shane Condor	Pearson Education, 4th Edition (2015)
2	Android, Wireless Application Development	Lauren Darcey, Shane Condor	Pearson Education, 3rd Edition

Reference			
Sl. No.	Title of Book	Author	Publication
3	Android 6 for Programmers: An App-Driven Approach	Paul Deitel, Harvey Deitel, Alexander Wald	Pearson Education
4	Beginning App Development with Flutter: Create Cross-Platform Mobile Apps	Rap Payne	Apress (2019)

COURSE DESCRIPTION							
REGULATION	**2025**	**L-T-J-P-S**	**0-0-4-0-0**	**VERSION**	**25/0**	**CREDITS**	**2**
(L- Lecture, T-Tutorial, J-Project, P-Practical, S-Self-learning & Team Work)							

COURSE CODE	COURSE NAME	COURSE CATEGORY
A250201/CA330V	**MINI PROJECT**	PS
Pre-Requisite		
Students should have completed core courses in Programming, Database Management Systems, Software Engineering, Web Technologies, and Data Structures. They should possess basic knowledge of software development tools, problem-solving techniques, documentation practices, and teamwork.		

TEACHING AND ASSESSMENT SCHEME									
Teaching Scheme / Week					**Credit**	**Hours / Semester**	**Examination Scheme**		
							Practical		
L	**T**	**J**	**P**	**S**	**C**		**CIA**	**ESE**	**Total**
0	0`	4	0	0	2	60	100	-	100
***L**: Lecture (One unit is of one-hour duration), **T**: Tutorial (One unit is of one-hour duration), **P**: Practical (One unit is of one-hour duration), **J**: Project (One unit is of one-hour duration), **S**: Self-Learning & Team Work (One unit is of one-hour duration), **CIA**: Continuous Internal Assessment, **ESE**: End Semester Examination*									

GUIDELINES FOR IMPLEMENTATION		
Sl. No.	Aspect	Guidelines
1	Objective	To provide students with an opportunity to apply the knowledge and skills acquired during the MCA programme to solve practical real-world problems and develop technical, project management, and communication skills.
2	Project Selection	Students shall identify practical real-world projects relevant to industry, society, research, or emerging technologies. The project shall be carried out individually and completed within one semester.
3	Project Approval	Students shall submit a Project Synopsis containing the problem statement, objectives, proposed solution, methodology, and technology stack. Project work shall commence only after approval from the Project Guide and Department.
4	Project Supervision	Each student shall be assigned a faculty member as Project Guide. Industry experts or external mentors may be associated wherever applicable.
5	Development Practices	Students shall follow an appropriate software development methodology. Requirement analysis, design, implementation, testing, validation, and documentation shall be part of the project. Agile practices, version control systems (e.g., Git), and testing tools are encouraged.
6	Documentation	Students shall prepare and maintain Project Synopsis, SRS, SDD, Project Plan, Test Plan, Test Cases, Progress Reports, and Final Project Report.
7	Progress Monitoring	Students shall meet the Project Guide regularly and present project progress. Periodic reviews shall be conducted as per the approved Mini Project Timeline.
8	Interim Evaluation I	Evaluation of problem identification, literature survey, requirement analysis, SRS, SDD, and Project Plan.
9	Interim Evaluation II	Evaluation of design and development progress, demonstration of completed modules, and testing and validation strategy.
10	Final Evaluation	Evaluation of working software/product, innovation, technical quality, project report, presentation, demonstration, and viva voce.
11	Project Assessment Board	The Project Assessment Board shall be constituted by the Head of the Department and shall consist of the following members: • **Chairperson:** Any one of the Mini Project Coordinators • **Members:** o One Mini Project Coordinator o Project Guide/one senior faculty member,

		The Project Assessment Board shall be responsible for conducting the interim reviews and final evaluation of the Mini Project.
12	Ethical Practices	Students shall adhere to professional ethics and academic integrity. Plagiarism is strictly prohibited. Proper citation and acknowledgement shall be provided for all referenced materials.
13	Attendance Requirement	Attendance requirements specified in the Academic Regulations shall be applicable for project evaluation. Students shall actively participate in all review activities.
14	Final Submission	The final project report, source code, and supporting documents shall be submitted after obtaining approval from the Project Guide.
16	Publication and Innovation	Students are encouraged to publish project outcomes in conferences, journals, hackathons, innovation challenges, or other suitable academic and professional forums.

TIMELINE		
Sl.No	Project Related Activity	Week
1	Literature survey, identification of a practical real-world problem, and allocation of Project Guide.	1
2	Preparation and submission of Project Synopsis containing the problem statement, objectives, proposed solution, methodology, and technology stack. Approval by the Project Guide and Department.	2
3	Requirement analysis and preparation of the Software Requirements Specification (SRS), Software Design Document (SDD), project plan, test plan, test cases, and traceability matrix.	3
4	**Interim evaluation I** – Evaluation of problem definition, literature survey, SRS, SDD, and project plan by the Project Assessment Board.	4
5	Sprint I – Development of core modules and review by the Project Guide.	5
6	Sprint II – Development and integration of additional modules; Scrum review by the Project Guide.	6–7
7	**Interim evaluation II** – Progress evaluation and demonstration of completed modules before the Project Assessment Board.	8
8	Sprint III – Completion of implementation, integration, testing, validation, performance evaluation, and refinement based on review feedback, with approval from the Project Guide.	9–11
9	Submission of draft project report and trial demonstration, with approval from the Project Guide.	12
10	Submission of final project report, source code, and supporting documents, with approval from the Project Guide.	13
11	Final presentation, demonstration, and viva voce before the Project Assessment Board.	14

COURSE DESCRIPTION							
REGULATION	**2025**	**L-T-J-P-S**	**0-0-0-1-0**	**VERSION**	**25/0**	**CREDITS**	**-**
(L- Lecture, T-Tutorial, J-Project, P-Practical, S-Self-learning & Team Work)							

COURSE CODE	**COURSE NAME**	**COURSE CATEGORY**
A250201/CA330K	**AI TOOLS FOR SOFTWARE DEVELOPMENT AND PROFESSIONAL PRODUCTIVITY**	SE
Pre-Requisite		
Basic programming and software development knowledge, along with basic internet usage skills.		

TEACHING AND ASSESSMENT SCHEME

Teaching Scheme / Week					**Credit**	**Hours / Semester**	**Examination Scheme**		
							Theory		
L	**T**	**J**	**P**	**S**	**C**		**CIA**	**ESE**	**Total**
0	0	0	1	0	-	15	50	-	50

***L**: Lecture (One unit is of one-hour duration), **T**: Tutorial (One unit is of one-hour duration), **P**: Practical (One unit is of one-hour duration), **J**: Project (One unit is of one-hour duration), **S**: Self-Learning & Team Work (One unit is of one-hour duration), **CIA**: Continuous Internal Assessment, **ESE**: End Semester Examination*

SYLLABUS (Major Topics)

Module	Title	Major Topics	Hrs
1	Introduction to AI Tools and Prompt Engineering	Introduction to AI Tools, AI Based Productivity Tools, Prompt Engineering Basics	5
2	AI Tools and Practices for Software Development	AI Assisted Coding, Debugging and Testing, Automated Documentation, Collaborative Development Platforms	5
3	Professional Productivity, Collaboration and Responsible AI	Digital Collaboration tools, Project and Task Management, Responsible AI and Digital Ethics	5

SUGGESTED LEARNING RESOURCES

Text Book

Sl. No.	Title of Book	Author	Publication
1	Generative AI for Software Developers	Saurabh Shrivastava, Kamal Arora, Ashutosh Dubey, Dhiraj Thakur, Sanjeet Sahay	Packt Publishing, 2025, First Edition
2	Prompt Engineering	Eric C. Richardson	BPB Publications, 2025, First Edition
3	The Pragmatic Programmer: Your Journey to Mastery	Andrew Hunt, David Thomas	Addison-Wesley (Pearson), 2019, 20th Anniversary Edition (2nd Edition)

Reference

Sl. No.	Title of Book	Author	Publication
1	AI-Assisted Programming: Better Planning, Coding, Testing, and Deployment	Tom Taulli	O'Reilly Media, 2024, First Edition
2	Artificial Intelligence Ethics: An Introduction	Mark Coeckelbergh	MIT Press, 2020, First Edition

LIST OF APPROVED MOOC COURSES FOR SECOND YEAR

Sl. No	Course Name	MITS Course Code	NPTEL Course ID	Course Institute	Subject Matter Expert Name	Duration	Offering Platform	Start Date
1	Problem Solving Through Programming in C	A250201/ CA331L	noc26-cs155	IIT, Kharagpur	Prof. Anupam Basu	12 Weeks	NPTEL	July 20, 2026
2	Programming in Java	A250201/ CA332L	noc26-cs153	IIT, Kharagpur	Prof. Debasis Samanta	12 Weeks	NPTEL	July 20, 2026
3	Programming In Modern C++	A250201/ CA333L	noc26-cs159	IIT, Kharagpur	Prof. Partha Pratim Das	12 Weeks	NPTEL	July 20, 2026
4	The Joy of Computing Using Python	A250201/ CA334L	noc26-cs136	IIT, Ropar	Prof. Sudarshan Iyengar	12 Weeks	NPTEL	July 20, 2026
5	Introduction to programming in C	A250201/ CA335L	noc26-cs113	IIT Kanpur	Prof. Satyadev Nandakumar	12 Weeks	NPTEL	July 20, 2026
6	Software Engineering	A250201/ CA336L	noc26-cs151	IIT Kharagpur	Prof. Rajib Mall	12 Weeks	NPTEL	July 20, 2026
7	Introduction to Machine Learning	A250201/ CA337L	noc26-cs133	IIT, Madras	Prof. Balaraman Ravindran	12 Weeks	NPTEL	July 20, 2026
8	Data Structures and Algorithms Design	A250201/ CA338L	noc26-cs146	IIT Kanpur	Prof. Nitin Saxena	12 Weeks	NPTEL	July 20, 2026
9	Cyber Security and Privacy	A250201/ CA339L	noc26-cs144	IIT Madras	Prof. Saji K Mathew	12 Weeks	NPTEL	July 20, 2026
10	Artificial Intelligence: Concepts and Techniques	A250201/ CA3310L	noc26-cs129	IISc Bangalore	Prof. V. Susheela Devi	12 Weeks	NPTEL	July 20, 2026