INDIRA

सावित्रीबाई फुले पुणे विद्यापीठ

Indira College of Engineering and Management

an Autonomous Institute of

Savitribai Phule Pune University, Pune Maharashtra, India

National Education Policy (NEP)-2020 Compliant Curriculum

Syllabus IMCA (Integrated Master of Computer Applications)

(With effect from Academic Year 2025-26)

Indira Chanakya Campus (ICC), S.No. 64,65, Gat No. 276 At Post : Parandwadi, Near Somatne phata, Tal. : Maval, Dist. Pune – 410 506

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Integrated MCA Syllabus structure
Level 4.5 Semester - I

Course Code	Name of Course	Course Category (As per NEP)	Teaching Scheme Hrs/Week			Credits	Evaluation Scheme				
							Theory		Practical		Total Marks
			L	T	P		CIA	ESE	INT	EXT	
CA-101 - T	Problem Solving and Programming in C	**MM**	02	--	--	**02**	15	35	--	--	**50**
CA-102 - P	Lab course on Programming in C and Scilab programing	**MM**	--	--	04	**02**	--	--	15	35	**50**
CA-103 - T	Computer Organization & Architecture	**MM**	02	--	--	**02**	15	35	--	--	**50**
CA-104 - P	Lab course on Computer Organization & Architecture	**VSC**	--	--	04	**02**	--	--	15	35	**50**
CA-105 - T	Open Elective-I	**OE**	02	--	--	**02**	15	35	--	--	**50**
CA-107 - OE	Open Elective-II		02	--	--	**02**	15	35	--	--	**50**
CA-108-VSEC	Web Development	**SEC**	--	--	04	**02**	--	--	15	35	**50**
CA–109-IKS	Indian Knowledge System	**IKS**	02	--	--	**02**	50	--	--	--	**50**
CA-110-AEC	Business Communication	**AEC**	02	--	--	**02**	50	--	--	--	**50**
CA-111-VEC	Understanding India	**VEC**	02	--	--	**02**	50	--	--	--	**50**
CA-112-CC	Course from College Basket (Yoga/Sports/Dance/Drama/Health wellness/NSS/Cultural activities/Fine arts)	**CC**	--	--	04	**02**	--	--	50	--	**50**
Total			**14**		**16**	**22**	**210**	**140**	**95**	**105**	**550**

Level 4.5 Semester - II

Course Code	Name of Course	Course Category (As per NEP)	Teaching Scheme Hrs/Week			Credits	Evaluation Scheme				
							Theory		Practical		Total Marks
			L	T	P		CIA	ESE	INT	EXT	
CA-151 - T	Advanced C Programming	**MM**	02	--	--	**02**	15	35	--	--	**50**
CA-152- P	Lab course on Advanced C Programming	**MM**	--	--	04	**02**	--	--	15	35	**50**
CA-153 - T	Introduction to Microcontrollers	**MM**	02	--	--	**02**	15	35	--	--	**50**
CA-154 - T	Hands on training in Digital Electronics	**SEC**	--	--	04	**02**	--	--	15	35	**50**
CA-155 - T	Statistics	**MN**	02	--	--	**02**	15	35	--	--	**50**
CA-156 - VSC	Laboratory course on R Programming	**VSC**	--	--	04	**02**	--	--	15	35	**50**
CA-157-OE	Open Elective-III	**OE**	02	--	--	**02**	15	35	--	--	**50**
CA-158-OE	Open Elective-IV		02	--	--	**02**	15	35	--	--	**50**
CA-156-AEC	Essentials of Business Etiquette	**AEC**	02	--	--	**02**	02	50	--	--	**--**
CA – 160 - VEC	Democracy, Election and Governance	**VEC**	02	--	--	**02**	02	50	--	--	**--**
CA–161 - CC	Course from College Basket (Yoga/Sports/Dance/Drama/Health wellness/NSS/Cultural activities/Fine arts)	**CC**	--	--	04	**02**	--	--	50	--	**50**
Total			**14**		**16**	**22**	**79**	**275**	**95**	**105**	**450**

Exit option: Award of UG Certification in Bachelor of Computer Application (BCA) with 44 credits and an additional 08 credits (for either courses by Microsoft/CCNA/Salesforce/Google/AWS/Oracle/ RedHat etc or Swayam/ NPTEL/MKCL equivalent to core NSQF course or an Internship) or else Continue with Major andMinor

Integrated MCA Syllabus structure

Level 5.0 Semester – III

Course Code	Name of Course	Course Category (As per NEP)	Teaching Scheme Hrs/Week			Credits	Evaluation Scheme				
			L	T	P		Theory		Practical		Total Marks
							CIA	ESE	INT	EXT	
CA-201 – T	Data Structures and Algorithms	**MM**	02	-	-	**02**	15	35	-	-	**50**
CA-202-T	Database Management Systems	**MM**	02	-	-	**02**	15	35	-	-	**50**
CA-203– P	Lab course on DBMS	**MM**	-	-	04	**02**	-	-	15	35	**50**
CA- 204 – T	Object Oriented Programming with C++	**MM**	02	-	-	**02**	15	35	-	-	**50**
CA-205 – VSC	Hands on training on Oops and DS	**VSC**	-	-	04	**02**	-	-	15	35	**50**
CA-206-FP	Field Project	**FP**	-	-	04	**02**	-	-	50	-	**50**
CA 207 MN	Programming with Python	**MN**	02	-	-	**02**	15	35	-	-	**50**
CA – 208 – MN	Lab course on Programming with Python	**MN**	-	-	04	**02**	-	-	15	35	**50**
CA-– 209 – OE	Open Elective-V	**OE**	02	-	-	**02**	15	35	-	-	**50**
CA - 210 – AEC	Modern Indian Language (Hindi/ Marathi/ Sanskrit Language)	**AEC**	02	-	-	**02**	50	-	-	-	**50**
CA - 211 – CC	Yoga/Sports/Dance/Drama/Health wellness/NSS/Cultural activities/Fine arts	**CC**	--	--	04	**02**	--	--	50	--	**50**
Total			**12**		**20**	**22**	**125**	**175**	**145**	**105**	**550**

Level 5.0 Semester – IV

Course Code	Name of Course	Course Category (As per NEP)	Teaching Scheme Hrs/Week			Credits	Evaluation Scheme				
			L	T	P		Theory		Practical		Total Marks
							CIA	ESE	INT	EXT	
CA-251- T	Relational Database Management Systems	**MM**	02	--	--	**02**	15	35	-	-	**50**
CA-252- P	Lab course on RDBMS	**MM**	--	--	04	**02**	-	-	15	35	**50**
CA- 253 -T	Data Science	**MM**	02	--	--	**02**	15	35	-	-	**50**
CA-254- P	Lab course on Data Science	**MM**	--	--	04	**02**	-	-	15	35	**50**
CA-255-SEC	Computer Graphics and Visualization	**SEC**	--	02	--	**02**	-	-	50	-	**50**
CA- 256 CEP	Community Project	**CEP**	--	--	04	**02**	-	-	50	-	**50**
CA – 257 – MN	Operating system & Shell Programming	**MN**	02	--	--	**02**	15	35	-	-	**50**
CA – 258 – MN	Lab course on Shell Programming		--	--	04	**02**	-	-	15	35	**50**
CA – 259 – OE	Open Elective-VI	**OE**	02	--	--	**02**	15	35	-	-	**50**
CA-260-AEC	Modern Indian Language (Hindi/ Marathi/ Sanskrit Language)	**AEC**	02	--	--	**02**	50	--	--	--	50
CA-261- CC	Yoga/Sports/Dance/Drama/Health wellness/NSS/Cultural activities/Fine arts	**CC**	--	--	04	**02**	--	--	50	--	**50**
Total			**10**	**2**	**20**	**22**	**110**	**140**	**195**	**105**	**550**

Exit option: Award of UG Diploma in Bachelor of Computer Application (BCA) with 88 credits and an additional 08 credits (for either courses by Microsoft/CCNA/Salesforce/Google/AWS/Oracle/ RedHat etc. orSwayam/ NPTEL/MKCL equivalent to core NSQF courses or an internship) or else Continue with Major and Minor

Detailed Drafts

F.Y. Integrated M.C.A.

Semester I

F.Y. Integrated M.C.A. (2025 Course)
CA – 101 – T : Problem Solving and Programming in C

Teaching Scheme:	**Credits**	**Examination Scheme:**
Theory: 02 Hrs/Week	**02**	**Continuous Evaluation: 15 Marks** **End-Semester: 35 Marks**

Course Objectives:

- To learn formulation of algorithm for a given problem
- To study various data types, arrays and functions in C
- To understand input-output and, control and iterative statements in C

Course Outcomes:

On completion of the course, students will be able to

CO1:Formulate an algorithm and draw flowchart for the given problem
CO2::Develop programs using appropriate data types in C
CO3:Develop programs using appropriate control structures in C
CO4:Develop programs using appropriate control structures in C
CO5:Develop programs using appropriate control structures in C

Course Contents

Unit I	**Problem solving, algorithms and flowcharts**	**06 Hrs**	**CO1**

1.1 Types of Problems
1.2 Problem solving using computer
1.3 Difficulties with problem solving, Problem solving aspects
1.4 Definition & Characteristics of algorithm
1.5 Examples of algorithms
1.6 Flow charts with example
1.7 Top-down design Problem solving using Arithmetic Statements Conditional Statement & Iterative tatements.

Unit II	**C Fundamentals**	**07 Hrs**	**CO2**

2.1 Introduction to C, Features of C, Structure of C Program, C Character Set, Identifiers and Keywords, Variables and constants
2.2 Data types- Basic data types, Enumerated types, Type casting, Declarations, Expressions, Operators and Expressions Unary and Binary arithmetic operators, Increment Decrement operators, Relational and logical operators, Bit wise operators, Assignment operators, Comma operator, size of operator, Ternary conditional operator, Precedence and associativity
2.3 Input Output Statements: printf, scanf functions, getchar, putchar, getch functions, gets,puts functions, Escape sequence characters, Format specifiers

Unit III	Control & Iterative Structures	05 Hrs	CO3
3.1 If, If- Else Statements, Nested If Statements, Conditional Branching – switch statement, 3.2 Loop (while, do…while, for), break, continue, goto statements			
Unit IV	**Functions**	**06 Hrs**	**CO4**
4.1 Introduction to Functions, Function Arguments, Library & User defined functions 4.2 Methods for parameter passing, Recursion, Storage Classes – Auto, Static, Global and Register			
Unit V	**Arrays**	**06 Hrs**	**CO5**
5.1 Introduction, Array Declarations, Bounds Checking 5.2 Single dimension Arrays, Two dimension Arrays, Arrays & Function			

Reference Books:

1. Cormen, Leiserson, Rivest, Stein, "Introduction to algorithms"
2. Brian W. Kernighan, Dennis M. Ritchie , "The C Programming Language", ISBN:9788120305960, PHI Learning
3. R.G. Dromey, "How to Solve it by Computer", ISBN: 9788131705629, PearsonEducation
4. Behrouz A. Forouzan, RichardF. Gilberg, "A Structured Programming ApproachUsing C", ISBN:9788131500941, Cengage Learning India
5. E. Balaguruswamy, "Programming in ANSI C", ISBN: 9781259004612, Tata Mc-GrawHill Publishing Co Ltd.-New Delhi
6. Maureen Spankle, "Problem Solving and Programming Concepts", ISBN: 81-317-0711-3
7. Y S Kanetkar, "Let Us C", BPB Publications

F.Y. Integrated M.C.A. (2025 Course) CA – 102 – P: Lab course on Programming in C and Scilab programing		
Teaching Scheme: **Practical: 04 Hrs / Week**	**Credits** **02**	**Examination Scheme:** **Continuous Evaluation: 15 Marks** **End-Semester :35 Marks**

Course Objectives:

- To learn formulation of algorithm for a given problem
- To study various data types, arrays and functions in C
- To understand input-output and, control and iterative statements in C
- To learn to apply theoretical concepts of discrete mathematics to solve problems.
- To study various data types, arrays and functions in R.

Guidelines for Instructor's Manual

The instructor shall frame at least 14 assignments. Instructor's manual consisting of University syllabus, conduction & Assessment guidelines is to be developed.

Guidelines for Student Journal

The laboratory assignments are to be submitted by student in the form of journal. Journal consists of Certificate, table of contents, and handwritten write-up for each assignment. Write-up shall include Title, Problem Statement, software and Hardware requirements, Dateof Completion.
Program codes with sample output of all performed assignments are to be submitted as softcopy. Use of DVD containing students programs maintained by lab In-charge is highly encouraged. For reference one or two journals may be retained with program prints.

Guidelines for Assessment

Continuous assessment of laboratory work is to be carried out based on overall performanceof students. For each lab assignment, the instructor will assign grade/marks based on parameters such as timely completion, understanding, neatness etc. with appropriate

Sr. No.	Assignment List
	C Programming
1	Assignment on use of data types, simple operators (expressions)
2	Assignment on decision making statements (if and if-else, nested structures, switch case)
3	Assignment on use of while loops, for loops, nested loops
4	Assignment on exit, goto, continue, break
5	Assignment on menu driven programs.
6	Assignment on writing C programs in modular way (use of user defined functions)
7	Assignment on call by value
8	Assignment on call by reference
9	Assignment on recursive functions
10	Assignment on use of arrays (1-D array) and functions
11	Assignment on use of multidimensional array (2-D arrays) and functions
12	Assignment on Standard Library Function
	Scilab Programming
1	Introduction to Scilab software.
2	Problems on Systems of Linear Equations and Matrices using Scilab software
3	Problems on Eigen values and Eigen vectors using Scilab software.
4	Problems on Numerical methods using Scilab software.
5	Problems on Differentiation and Integration using Scilab software.
6	Numerical Differentiation Numerical Integration

F.Y. Integrated M.C.A. (2025 Course)
CA – 103 – T: Computer Organization and Architecture

Teaching Scheme: **Theory: 02 Hrs/Week**	**Credits** **02**	**Examination Scheme:** **Continuous Evaluation: 15 Marks** **End-Semester : 35 Marks**

Course Objectives:

- To study number system, logic gates
- To understand combinational and sequential circuits
- To provide a broad overview of architecture and functioning of computer systems
- To learn the basic concepts behind the architecture and organization of computers.

Course Outcomes: On completion of the course, student will be able to–

CO1: Understand Data representation and Computer Arithmetic
CO2: Understand Boolean Algebra & Logic Gates
CO3: Design of combinational circuits
CO4: Design of sequential circuits
CO5: Describe block diagram of CPU, Memory and types of I/O transfers

Course Contents

Unit I	**Data representation and Computer Arithmetic**	**04 Hrs**	**CO1**

1.1 Review of Decimal, Binary, Octal, Hexadecimal Number systems
1.2 inter-conversion
1.3 BCD code, Gray code, Excess-3 code, ASCII , EBCDIC, Unicode
1.4 Signed and Unsigned numbers
1.5 1's and 2's complements, Binary arithmetic.

Unit II	**Boolean Algebra & Logic Gates**	**07 Hrs**	**CO2**

2.1 Boolean theorems, Boolean Laws, De Morgan's Theorem,
2.2 Reduction of Logic expression using Boolean Algebra,
2.3 Introduction to Logic (AND, OR, NOT),
2.4 Classification of Logic gates, Universal Logic gates, Implementation of other gates using universal gates.
2.5 Basic concepts of Karnaugh map, minterm and maxterm.

Unit III	**Combinational Circuits**	**07 Hrs**	**CO3**

3.1 Definition of combinational circuits,
3.2 Detail study of Half adder, Full adder, Half subtractor, Full subtractor, Multiplexer (4:1) & Demultiplexer(1:4), Encoder (8-line-to- 3-line) and Decoder (3-line- to-8-line),
3.3 Parity generator and checker,
3.4 Block diagram of ALU.

Unit IV	**Sequential circuits**	**07 Hrs**	**CO4**

4.1 Definition of sequential circuits, Detail study of Flip Flops and truth tables: S-R FF, J- K FF, T and D type FFs, Flip flop as memory device.
4.2 Counters: Asynchronous-Mod16, Mod-10, Mod-8, up down counter, Synchronous- Ring counter, Event counter.
4.3 Shift Registers and their types, serial to parallel and parallel to serial converters using shift registers.

Unit V	CPU, Memory and I/O Organization	05 Hrs	CO5

5.1 Block diagram of CPU, functions of CPU, general register organization, flags, Concept of RISC and CISC

5.2 Memory System hierarchy, Cache Memory, Internal Memory, External Memory, Concept of Virtual Memory.

5.3 Basics of I/O organisation: types of I/O data transfers.

Reference Books:

1. R.P. Jain, "Modern Digital Electronics", McGraw-Hill Publications

2. Flod and Jain, "Digital Fundamentals", Pearson Publication.

3. Morris Mano, "Computer System Architecture" Prentice-Hall.

F.Y. Integrated M.C.A. (2025 Course) CA -104-P: Lab course on Computer Organization & Architecture		
Teaching Scheme: **Practical: 04 Hours/Week**	**Credits** **02**	**Examination Scheme:** **Continuous Evaluation: 15 Marks** **End-Semester : 35 Marks**

Course Objectives:

- To study number system, logic gates
- To understand combinational and sequential circuits
- To provide a broad overview of architecture and functioning of computer systems
- To learn the basic concepts behind the architecture and organization ofcomputers.

Guidelines for Instructor's Manual

The instructor shall frame at least 10 assignments. Instructor's manual consisting of University syllabus, conduction & Assessment guidelines is to be developed.

Guidelines for Student Journal

The laboratory assignments are to be submitted by student in the form of journal. Journal consists of Certificate, table of contents, and handwritten write-up for each assignment. Write- up shall include Title, Problem Statement, Date of Completion etc.For reference one or two journals may be retained.

Guidelines for Assessment

Continuous assessment of laboratory work is to be carried out based on overall performance of students. For each lab assignment, the instructor will assign grade/marks based on parameters such as timely completion, understanding, neatness etc. with appropriate weightage

List of Assignments

1. To Study and verify the Truth Tables of Logic Gates.
2. To Study De-morgan's theorems.
3. Code Converters using K-Map.
4. Half Adder and Full Adder.
5. Decimal to BCD Encoder
6. Multiplexer (2:1) and De-multiplexers (1:2)
7. Flip-flops (SR, D and JK-FF)
8. 4-bit binary asynchronous counter using IC 7493.
9. Shift Registers.
10. Study of 4-bit ALU (IC 74181)
11. Study of 3-bit Synchronous Up-Down counter.
12. Parity generator and checker

F.Y. Integrated M.C.A. (2025 Course) CA-108- VSEC: Web Development		
Teaching Scheme: **Practical: 04 Hours/Week**	**Credits** **02**	**Examination Scheme:** **Continuous Evaluation: 15 Marks** **End-Semester : 35 Marks**

Course Objectives:

- To understand web-based application development process.
- To study basics of HTML elements and tag.
- To know the usage of CSS in HTML.
- To design and create simple websites.
- To apply JavaScript to websites.

Course Outcomes: After successful completion of this course, learner will be able to

CO1: Enlist various HTML elements and tags
CO2: Use HTML elements and tags
CO3: Apply CSS and Java script features.
CO4: Design a website using HTML, CSS and JavaScript.

Guidelines for Instructor's Manual

The instructor shall frame at least 14 assignments. Instructor's manual consisting of college syllabus, conduction & Assessment guidelines is to be developed.

Guidelines for Student Journal

The laboratory assignments are to be submitted by students in the form of journal. Journal consists of Certificate, table of contents, and handwritten write-up for each assignment. Write-up shall include Title, Problem Statement, software and Hardware requirements, Date of Completion.
Program codes with sample output of all performed assignments are to be submitted as soft copy. Use o DVD containing students programs maintained by lab In-charge is highly encouraged. For reference one or two journals may be retained with the program prints.

Guidelines for Assessment

Continuous assessment of laboratory work is to be carried out based on overall performance of students For each lab assignment, the instructor will assign grade/marks based on parameters such as timely completion, understanding, neatness
etc. with appropriate weightage.

List of Assignments
Assignment 01: Using basic HTML elements (headings, paragraphs, line break, color, fonts, links, Images, etc.)
Assignment 02: Creating Lists using HTML Tags
Assignment 03: Creating Tables using HTML Tags
Assignment 04: Creating Frames in HTML
Assignment 05: Creating Forms using HTML
Assignment 06: Designing of HTML screens using CSS
Assignment 07: Using Functions in JavaScript
Assignment 08: Carryout Validation using JavaScript
Assignment 09: Using Event Handling.
Assignment 10: Designing website using basic elements of HTML, CSS and JavaScript.
Assignment 11: Designing website using HTML, CSS and advanced JavaScript elements and event handling

Reference Books:

1. Steven Holzner, HTML Black Book, Dremtech press.
2. Web Applications : Concepts and Real World Design, Knuckles, Wiley-India
3. Internet and World Wide Web How to program, P.J. Deitel & H.M. Deitel PearsonEducation
4. Programming the World Wide Web , Robert W Sebesta (3rd Edition)
5. Learn HTML and CSS faster by Mark Myer

E-Resources:

1. https://www.coursera.org/learn/html-css-javascript-for-web-developers
2. https://www.coursera.org/learn/introduction-to-web-development-with-html-css-javacript?action=enroll#modules
3. https://www.scribd.com/doc/41532231/CSS-HTML-JavaScript-LAB-Good-Practical-Programs
4. https://www.udemy.com/course/web-development-learn-by-doing-html5-css3-from- scratch-introductory/
5. https://www.udemy.com/course/javascriptfundamentals/

Detailed Drafts

F.Y. Integrated M.C.A.

Semester II

F.Y. Integrated M.C.A. (2025 Course)
CA– 151 - T: Advanced C Programming

Teaching Scheme:	Credits	Examination Scheme:
Theory: 02 Hrs/Week	02	Continuous Evaluation: 15 Marks End-Semester : 35 Marks

Course Objectives:

- To learn advanced features in C Programming
- To study advanced data types
- To understand built-in library functions

Course Outcomes: On completion of the course, student will be able to–

CO1: Apply Pre-processor directives
CO2: Develop programs using pointers
CO3: Develop programs using Structures
CO4: Manipulate strings using library functions
CO5: Write programs to perform operations on Files

Course Contents

Unit I	Preprocessor	06 Hrs	CO1

1.1 Concept, Format of preprocessor directives, File inclusion directives (#include), Macrosubstitution directives (#define), nested macros, parameterized macros,
1.2 Macros versus functions, #error / #pragma directives, Conditional compilation (#if/#ifdef/#else/#elif/#endif), Predefined macros (_DATE_ / _TIME_ /_FILE_ /_LINE_ /_STDC_)

Unit II	Pointers	07 Hrs	CO2

2.1 Concept – reference & dereference, Declaration, definition, initialization & use, Types of pointers, Pointer Arithmetic, Multiple indirection,
2.2 parameter passing – call by value and call by referenceArrays &
Pointers - Pointer to array, Array of pointers,
2.3 Functions & pointers - Passing pointer to function, Returning pointer from function,Function pointer, Pointers &const
2.4 Dynamic memory management, Allocation, Resizing, Releasing, Memory leak / danglingpointers

Unit III	Strings	05 Hrs	CO4

3.1 Concept, Declaration, definition, initialization, format specifiers, String literals/ constants & variables – reading & writing from & to console, Importance of terminating NULL character,Strings & pointers
3.2 Array of strings & array of character pointers, User defined functions, predefined functionsin string.h - strlen , strcpy , strcat , strcmp , strcmpi , strrev , strlwr , strupr , strset , strchr ,strrchr , strstr , strncpy , strncat , strncmp , strncmpi , strnset , strtok, Command line arguments – argc and argv

Unit IV	Structures	06 Hrs	CO3
4.1 Concept, Declaration, definition, initialization, accessing structure members (. operator),Array of structures, Pointers to structures, Declaring pointer to structure **4.2** Accessing structure members via pointer to structure, Structures & functions, Passing each member of structure as a separate argument, Passing structure by value /address Nested structures, typedef & structures, Concept of Union			
Unit V	**File Handling**	**06 Hrs**	**CO5**
5.1 Concept of streams, need, Types of files, Operations on text & binary files, Random access file, library functions for file handling – fopen, fclose, fgetc, fseek, fgets, fputc etc			

Reference Books & E-Books:

1. The C Programming Language (Second Edition) – By B. W. Kerninghan& D. M. Ritchie
2. Programming in C – A Practical Approach – By Ajay Mittal (Pearson Publications)
3. Programming with C – By Byron S Gottfried (Schaum's Outlines)
4. A structural Programming Approach using C – By BehrouzForouzan& Richard Gilberg
5. Y S Kanetkar, "Let Us C", BPB Publications

F.Y. Integrated M.C.A. (2025 Course) CA– 152 – P : Lab course on Advanced C Programming		
Teaching Scheme: **Practical: 04 Hrs/Week**	**Credits** **02**	**Examination Scheme:** **Continuous Evaluation: 15 Marks** **End-Semester :35**

Course Objectives:

- To learn advanced features in C Programming
- To study advanced data types
- To understand built-in library functions

Guidelines for Instructor's Manual

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Guidelines for Student Journal

The laboratory assignments are to be submitted by student in the form of journal. Journalconsists of Certificate, table of contents, and handwritten write-up for each assignment.Write-up shall include Title, Problem Statement, software and Hardware requirements, Date of Completion.
Program codes with sample output of all performed assignments are to be submitted assoftcopy. Use of DVD containing students programs maintained by lab In-charge is highlyencouraged. For reference one or two journals may be maintained with program prints.

Guidelines for Assessment

Continuous assessment of laboratory work is to be carried out based on overall performance of students. For each lab assignment, the instructor will assign grade/marks based on parameters such as timely completion, understanding, neatness etc. with appropriate weightage.

Sr. No.	Assignment
1	To demonstrate use of preprocessor directives
2	To demonstrate use of pointers
3	To demonstrate advanced use of pointers
4	To demonstrate concept of strings, array of strings
5	To demonstrate string operations using pointers
6	To demonstrate command line arguments
7	To demonstrate structures (using array and functions)
8	To demonstrate nested structures
9	To demonstrate use of bitwise operators.
10	To demonstrate file handling

F.Y. Integrated M.C.A. (2025 Course)
CA – 153 – T : Introduction to Microcontrollers

Teaching Scheme:	Credits	Examination Scheme:
Theory: 02 Hrs/Week	02	Continuous Evaluation: 15 Marks End-Semester : 30 Marks

Course Objectives:

- To study the basics of microcontroller.
- To learn 8051 Programming.
- To understand interfacing techniques of 8051microcontroller.
- To learn to design simple applications using 8051microcontroller.

Course Outcomes: On completion of the course, student will be able to–

CO1: Write programs using instruction set of 8051 microcontroller.
CO2: Interface I/O peripherals to 8051 microcontroller.
CO3: Design simple microcontroller-based applications.
CO4: Understanding Interrupts and Interfacing

Course Contents

Unit I	**Introduction**	**04 Hrs**	**CO1**

1.1 Introduction of microcontroller and microprocessor,
1.2 difference between microcontroller and microprocessor,
1.3 classification of microcontrollers,
1.4 Applications of microcontrollers.

Unit II	**8051 microcontroller**	**04 Hrs**	**CO2**

2.1 Features of 8051 microcontrollers,
2.2 block diagram & Architecture of 8051,
2.3 Internal Memory organization, SFRS, PSW register, pin functions of 8051, Structure of I/O ports and its Operation, External Memory Interface.

Unit III	**8051: Programmer's Model**	**09 Hrs**	**CO3**

3.1 Introduction to Assembly programming, Compilers. Assemblers, Instruction classification, Instruction set,
3.2Addressing Modes: Immediate, register, direct, indirect and relative, assembler directives (ORG, END) features with examples.
3.3 Introduction to 8051 programming in C.

Unit IV	**Timers and Counters**	**07 Hrs**	**CO3**

4.1 Timer / counter: TMOD, TCON, SCON, SBUF, PCON Registers, Timer modes
4.2 programming for time delay using mode 1 and mode 2.

Unit V	**Interrupts and Interfacing**	**06 Hrs**	**CO4**

5.1 Interrupts: Introduction to interrupt, Interrupt types and their vector addresses,
5.2 Interrupt enable register and interrupt priority register (IE, IP).
5.3 Basics of Interfacing: ADC, DAC, LCD, stepper motor.

Reference Books:

1. 8051 microcontroller and Embedded system using assembly and C : Mazidi and McKinley, Pearson publications.
2. The 8051 microcontroller – Architecture, programming and applications: K.Uma Rao and Andhe Pallavi, Pearson publications.

F.Y. Integrated M.C.A. (2025 Course) CA -154-P: Hands on training in Digital Electronics		
Teaching Scheme: **Practical: 04 Hrs/Week**	**Credits** **02**	**Examination Scheme:** **Continuous Evaluation: 15 Marks** **End-Semester : 35 Marks**

Course Objectives:

- To study the basics of microcontroller.
- To learn 8051 Programming.
- To understand interfacing techniques of 8051microcontroller.
- To learn to design simple applications using 8051microcontroller.

Guidelines for Instructor's Manual

The instructor shall frame at least 12 assignments. Instructor's manual consisting of College syllabus, conduction & Assessment guidelines is to be developed.

Guidelines for Student Journal

The laboratory assignments are to be submitted by student in the form of journal. Journal consists of Certificate, table of contents, and handwritten write-up for each assignment. Write-up shall include Title, Problem Statement, software and Hardware requirements, Date of Completion etc.
Program codes with sample output of all performed assignments are to be submitted as softcopy. Use o DVD containing students programs maintained by lab In-charge is highly encouraged. For reference one or two journals may be retained with program prints.

Guidelines for Assessment

Continuous assessment of laboratory work is to be carried out based on overall performance of students For each lab assignment, the instructor will assign grade/marks based on parameters such as timely completion, understanding, neatness
etc. with appropriate weightage

List of Assignments

1. Study of 8051 microcontroller chip, keil µvision-5.
2. Study of proteus simulator for 8051 simulation.
3. Program to find Largest/smallest from a series.
4. Program to perform Addition / subtraction / multiplication/division of 8/16 bit data.
5. Program to perform Arithmetic, logical & code conversion problems
6. Program to perform data transfer/exchange between specified memorieslocations.
7. Interfacing of LED/LEDs to 8051 microcontroller.
8. Interfacing of switch & LED to 8051 microcontroller.
9. Waveform generation using DAC Interface to 8051 Microcontroller.
10. Traffic light controller using 8051 microcontroller.
11. Interfacing LCD to 8051Microcontroller.
12. Interfacing with IR sensor to 8051 microcontroller and LCD.
13. ADC interfacing to 8051 Microcontroller.
14. Stepper motor interfacing to 8051 microcontroller.

15. DC motor interfacing to 8051 microcontroller.

F.Y. Integrated M.C.A. (2025 Course) CA– 155 – T: Statistics		
Teaching Scheme: Theory: 02 Hrs/Week	**Credits 02**	**Examination Scheme: Continuous Evaluation: 15 Marks End-Semester : 35**

Course Objectives:

- To introduce the fundamental principles of permutations, combinations, and probability including conditional and Bayes' theorem.
- To develop the ability to compute and interpret measures of central tendency for various types of data.
- To enable students to understand and apply measures of dispersion in statistical analysis.
- To equip students with skills for graphical data presentation and understanding of probability distributions.
- To familiarize students with concepts of correlation, regression, and basic sampling techniques.

Course Outcomes: On completion of the course, students will be able to–

CO1: Solve problems using permutations, combinations, and basic probability theorems.

CO2: Calculate and interpret measures of central tendency like mean, median, and mode.

CO3: Analyze variability in data using measures of dispersion.

CO4: Represent data graphically and apply probability distributions.

CO5: Apply correlation, regression, and basic sampling methods in data analysis.

Course Contents

Unit I	Permutations and Combinations and Probability	06 Hrs	CO1

1.1. Permutations of 'n' dissimilar objects taken 'r' at a time (with or without repetitions). P = n!/(n-r) !(without proof).
1.2. Combinations of 'r' objects taken from 'n' objects. C = n!/(r!(n-r)!) (Without proof). Simple examples,
1.3. Probability: Basic Concepts, Definition, Addition and Multiplication Theorems,
1.4. Conditional
1.5. probability and Bayes' Theorem

Unit II	Measures of Central Tendency	06 Hrs	CO2

2.1 Measures of Central Tendency
2.2 Arithmetic Mean (AM),
2.3 Weighted Arithmetic Mean,
2.4 Arithmetic Mean Computed from Grouped Data,
2.5 Concept of Median, Mode,
2.6 Geometric Mean (GM),
2.7 Harmonic Mean (HM), Quartiles, Deciles, and Percentiles

Unit III	Measures of Dispersion	06 Hrs	CO3

3.1 Standard Deviation,
3.2 Root Mean Square,
3.3 Variance,
3.4 Coefficient of variation,
3.5 Absolute and relative measure of dispersion

Unit IV	Data Presentation & Probability Distribution	06 Hrs	CO4

4.1 **Data Types:** attribute, variable, discrete and continuous variable,
4.2 **Data presentation:** frequency distribution, histogram, ogive, boxplot, bar plots
4.3 **Probability distributions,** types of probability
4.4 **Distributions**- binomial distribution, Poisson distribution, normal distribution

Unit V	Correlation Theory and Sampling	06 Hrs	CO5

5.1 **Correlation:** Bivariate data, scatter plots, Linear Correlation, Correlation of Attributes,Coefficient of correlation
5.2 **Regression:** Concept, Linear Regression, Prediction
5.3 **Elementary Sampling Theory** : Sampling Theory, Random Samples, Sampling With and Without Replacement, Stratified Sampling

Reference Books:

1. Trivedi, K.S., "Probability, Statistics, Design of Experiments and Queuing Theory,With Applications of Computer Science", Prentice Hall of India, New Delhi
2. Kulkarni, M.B., Ghatpande, S.B. And Gore, S.D., "Common Statistical Tests" Satyajeet Prakashan, Pune
3. J.N. Kapur and H.C. Saxena, "Mathematical Statistics", S. Chand Publications, 20th Ed.
4. John P. D'Angelo & Douglas B. West, "Mathematical Thinking–Problem Solving And Proofs" Prentice Hall, 2nd Ed.
5. S.C. Gupta and V.K. Kapoor, *Fundamentals of Mathematical Statistics*, Sultan Chand & Sons

F.Y. Integrated M.C.A. (2025 Course) CA -156 - VSC: Laboratory course on R Programming		
Teaching Scheme: Theory: 04 Hours/Week	**Credits 02**	**Examination Scheme: Continuous Evaluation:15 Marks End-Semester :35 Marks**

Course Objectives:

- To learn to apply theoretical concepts of statistics to solve problems.
- To provide hands-on experience on R software.

Guidelines for Instructor's Manual

The instructor shall frame assignments. Instructor's manual consisting of College syllabus, conduction & Assessment guidelines is to be developed.

Guidelines for Student Journal

The laboratory assignments are to be submitted by student in the form of journal. Journal consists of Certificate, table of contents, and handwritten write-up for each assignment. Write-up shall include Title, Problem Statement, Date of Completion, etc. For reference one or two journals may be maintained with program prints.

Guidelines for Assessment

Continuous assessment of laboratory work is to be carried out based on overall performance of students. For each lab assignment, the instructor will assign grade/marks based on parameters such as timely completion, understanding, neatness etc. with
appropriate weightage.

Suggested List of Laboratory Assignments

Statistics (To be performed using R software)

1. Download and Install R, understand IDE
2. Using R execute the basic commands, array, list and frames.
3. Using R Execute the statistical functions: mean, median, mode, quartiles, range.
4. Using R import the data from Excel / .CSV file and calculate the standard deviation.
5. Import the data from Excel / .CSV and perform the Statistical distribution: Normal Distribution.

Reference:

Richard Cotton, "Learning R", SPD O'Reilly Publications

F.Y. Integrated M.C.A. (2025 Course) CA- 156-AEC: Essentials of Business etiquette		
Teaching Scheme: **Theory:02 Hrs/Week**	**Credits** **02**	**Examination Scheme:** **Continuous Evaluation: 50 Marks** **End-Semester: NA**

Course Objectives:

- To develop professional communication and etiquette skills.
- To understand workplace behaviour and corporate culture.
- To learn verbal, non-verbal, and written business communication.
- To gain confidence in networking and business interactions.

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

CO1: Understanding Business Etiquette
CO2: Demonstrate professional communication skills in business settings.
CO3: Apply workplace etiquette, time management, and teamwork.
CO4: Write effective business emails, reports, and digital communications.
CO5: Conduct themselves professionally in meetings, networking, and dining settings.

Unit I	Introduction to Business Etiquette	06 Hrs	CO1

- Meaning and Importance of Business Etiquette
- First Impressions & Personal Branding
- Grooming, Dress Code, and Body Language

Unit II	Workplace & Digital Communication Etiquette	06 Hrs	CO2 & CO3

- Workplace Behaviour and Professional Conduct
- Email & Chat Etiquette, Video Conferencing (Zoom, Teams)
- Time Management, Punctuality & Work Ethics
- Teamwork & Corporate Communication

Unit III	Business Communication Skills	06 Hrs	CO4

- Business Introductions & Small Talk
- Professional Conversations & Active Listening
- Business Writing: Emails, Memos, and Reports
- Public Speaking & Presentation Etiquette

Unit IV	Networking & Business Social Etiquette	06 Hrs	CO5

- Professional Networking for IT Students
- LinkedIn & Online Professionalism
- Business Card Etiquette & Elevator Pitch

Unit V	Meeting, Dining, & Cross-Cultural Etiquette	06 Hrs	CO5

- Business Meeting Etiquette
- Table Manners & Business Dining
- Corporate Lunch & Dinner Protocols
- Cross-Cultural Communication in Global Business

Reference Books:

1. *Business Etiquette for Dummies* – Sue Fox
2. *The Essentials of Business Etiquette* – Barbara Pachter
3. *The Etiquette Advantage in Business* – Peter Post
4. *Harvard Business Review's Guide to Office Politics*

F.Y. Integrated M.C.A. (2025 Course)
CA –160 - VEC : Democracy, Election and Governance

Teaching Scheme: Theory:02 Hrs/Week	Credits 02	Examination Scheme: Continuous Evaluation: 50 Marks End-Semester: NA

Course Objectives:

- To understand the Constitution of India, its philosophy, and its significance.
- To explore the evolution and different models of democracy.
- To study decentralization, including Panchayats, Local Governments, and Constitutional Amendments.
- To analyse governance concepts, including inclusion and exclusion.
- To examine the Constitution as a living and dynamic document.

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

CO1: Ability to explain the significance and structure of the Indian Constitution.
CO2: Ability to compare different democratic models and their evolution in India.
CO3: Understanding of decentralization and its impact on governance.
CO4: Ability to critically analyse challenges in Indian democracy related to caste, gender, & class.
CO5: Clear understanding of government vs. governance and the role of inclusion and exclusion.
CO6: Understanding Political Participation and Representation.

Unit I	Democracy - Foundation and Dimensions	06 Hrs	CO1 & CO2

- Constitution of India: Why and How?
- The Philosophy of the Constitution
- Evolution of Democracy - Different Models
- Dimensions of Democracy - Social, Economic, and Political
- Constitution as a Living Document
- Debates on Democracy and Governance Models

Unit II	Decentralization	06 Hrs	CO3 & CO4

- Indian Tradition of Decentralization
- History of Panchayat Raj Institution in the Post-Independence Period
- Local Governments
- 73rd Amendment
- 74th Amendment
- Challenges of Caste, Gender, Class, Democracy, and Ethnicity

Unit III	Governance	06 Hrs	CO5

- Meaning and Concepts
- Government and Governance
- Inclusion and Exclusion

Unit IV	Political Participation and Representation	06 Hrs.	CO6

- Types of Political Participation
- Political Parties and Party Systems in India
- Representation in Democracy
- Voter Behavior and Electoral Systems
- Youth and Women's Representation
- Electoral Reform

Unit V	Fundamental Rights, Duties, and Directive Principles	06 Hrs	CO 4

- Fundamental Rights in the Constitution
- Fundamental Duties and Their Importance
- Directive Principles of State Policy
- Rights-Based Approach to Governance
- Judicial Activism and the Protection of Rights

Reference Books:

- Banerjee-Dube, I. (2014). A history of modern India. Cambridge University Press.
- Basu, D. D. (1982). Introduction to the Constitution of India. Delhi: Prentice Hall of India.

List of Open Elective (OE) Courses offered to other Disciplines / Faculty

Department of Integrated MCA							
OE-1		**OE-2**		**OE-3**		**OE-4**	
Course code	**Subject Name**	**Course code**	**Subject Name**	**Course code**	**Subject Name**	**Course code**	**Subject Name**
CA -107-OE	Web Designing	CA-157T-OE / CA-157-OE	Data Science	CA-208T-OE / CA-208P- OE	E-Commerce & Digital Marketing	CA-208-OE	Prompt Engineering & Generative AI
CA -108T-OE / CA -108P-OE	Database Management System	CA-158P-OE	Web Programming using PHP	CA-209T-OE	Green Computing	CA-209-OE	Green Computing

Shree Chanakya Education Society's

Indira College of Engineering & Management, (ICEM)

(An Autonomous Institute affiliated to SPPU)

Second Year - Semester III & IV

As Per National Education Policy (NEP) Guidelines

Integrated
Master of Computer Applications (IMCA)

Curriculum for A.Y: 2025 - 26

(2025 Pattern)

Detailed Drafts

S.Y. Integrated M.C.A.

Semester III

S.Y. Integrated M.C.A. (2025 Course) Semester-III
CA 201 – T: Data Structures and Algorithms

Teaching Scheme: Theory: 02 Hrs./Week	Credits 02	Examination Scheme: Continuous Evaluation: 15 Marks End-Semester: 35 Marks

- **Course Objectives:**
  1. To learn the systematic way of solving problems
  2. To understand the different methods of organizing large amounts of data
  3. To efficiently implement the different data structures
  4. To efficiently implement solutions for specific problems

- **Course Outcomes:** On completion of the course, students will be able to:
  CO1: Understanding well-organized data structures in solving various problems.
  CO2: To differentiate the usage of various structures in problem solutions.
  CO3: Implementing algorithms to solve problems using appropriate data structures.
  CO4: Design and analyze data structure like stack
  CO5: Design and analyze data structure like Queue

Course Contents

Unit I	Introduction to Data Structures and Algorithms	5 Hrs	CO1

1.1 Introduction
1.1.1 Need of Data Structure
1.1.2 Definitions - Data and information, Data type, Data object, ADT, Data Structure
1.1.3 Types of Data Structures
1.2 Algorithm analysis
1.2.1 Space and time complexity, Graphical understanding of the relation between different functions of n, examples of linear loop, logarithmic, quadratic loop etc.
1.2.2 Best, Worst, Average case analysis, Asymptotic notations (Big O, Omega Ω, Theta □), Problems on time complexity calculation.

Unit II	Array as a Data Structure	7 Hrs	CO2

2.1 ADT of array, Operations
2.2Array applications - Searching
2.2.1 Sequential search, variations - Sentinel search, Probability search, ordered list search
2.2.2 Binary Search
2.2.3 Comparison of searching methods
2.3 Sorting Terminology- Internal, External, Stable, In-place Sorting
2.3.1 Comparison Based Sorting - Lower bound on comparison based sorting, Methods- Bubble Sort, Insertion Sort, Selection Sort. Algorithm design strategies - Divide and Conquer strategy, Merge Sort, Quick Sort.

Unit III	Linked List	6 Hrs	CO3

3.1 List as a Data Structure, differences with array. 3.2 Dynamic implementation of Linked List, internal and external pointers 3.3 Types of Linked List – Singly, Doubly, Circular 3.4 Operations on Linked List - create, traverse, insert, delete, search, sort, reverse, concatenate, merge, time complexity of operations. 3.5 Applications of Linked List – polynomial representation, Addition of two polynomials 3.6 Generalized linked list – concept, representation, multiple-variable polynomial representation using generalized list.

Unit IV	Stack	6 Hrs	CO4

4.1 Introduction
4.2 Operations – init(), push(), pop(), isEmpty(), isFull(), peek(), time complexity of operations.
4.3 Implementation- Static and Dynamic with comparison
4.4 Applications of stack
4.4.1 Function call and recursion, String reversal, palindrome checking
4.4.2 Expression types - infix, prefix and postfix, expression conversion and evaluation (implementation of infix to postfix, evaluation of postfix)
4.4.3Backtracking strategy - 4 queens problem (implementation using stack)

Unit V	Queue	6 Hrs	CO5

5.1 Introduction
5.2 Operations - init(), enqueue(), dequeue(), isEmpty(), isFull(), peek(),time complexity of operations, differences with stack.
5.3 Implementation - Static and Dynamic with comparison
5.4 Types of Queue - Linear Queue, Circular Queue, Priority Queue, Double Ended Queue (with implementation)
5.5 Applications – CPU Scheduling in multiprogramming environment, Round robin algorithm

Reference Books & E-Books:

- Classic Data Structures-D. Samanta, Prentice Hall India Pvt. Ltd.
- Fundamentals of Data Structures in C- Ellis Horowitz, SartajSahni,Susan AndersonFreed, 2nd Edition, Universities Press.
- Data Structures using C and C++-YedidyahLangsam, Moshe J. Augenstein, Aaron M. Tenenbaum, Pearson Education
- Data Structures: A Pseudo code approach with C, Richard Gilberg ,Behrouz A. Forouzan, Cengage Learning.
- Introduction to Data Structures in C-Ashok Kamthane, Pearson Education
- Algorithms and Data Structures, Niklaus Wirth, Pearson Education
- "Algorithms, 4th Edition" by Robert Sedgewick and Kevin Wayne
  Website: https://algs4.cs.princeton.edu/home/
  Companion site includes slides, code, and exercises.
- "Introduction to Algorithms" by Cormen, Leiserson, Rivest, and Stein (CLRS)

  Website: https://mitpress.mit.edu/9780262046305/introduction-to-algorithms/
- Free eBook: *Problem Solving with Algorithms and Data Structures using Python*
  Website: https://runestone.academy/runestone/books/published/pythonds/index.html

Online Tutorials and Resources:
- GeeksforGeeks – Data Structures
  Website: https://www.geeksforgeeks.org/data-structures/
- JavaTPoint – Data Structures Tutorial
  Website: https://www.javatpoint.com/data-structure-tutorial
- Khan Academy – Algorithms
  Website: https://www.khanacademy.org/computing/computer-science/algorithms
- Visualgo – Visualize Data Structures and Algorithms
  Website: https://visualgo.net/en

S.Y. Integrated M.C.A. (2025 Course) Semester-III CA- 202 – T: Database Management System		
Teaching Scheme: **Theory: 02 Hrs./Week**	**Credits 02**	**Examination Scheme:** **Continuous Evaluation: 15 Marks** **End-Semester: 35 Marks**

Course Objectives: -

Upon successful completion of this course, students should be able to:

- Describe the fundamental elements of database management systems
- Explain the basic concepts of data model, entity-relationship model, relational database design, relational algebra and SQL.
- Design ER-models to represent simple database application scenarios
- Convert the ER-model to relational tables, populate relational database and formulate SQL queries on data.
- Improve the database design by normalization.

Course Outcomes: -

On completion of this course, students will be able to:

CO1: Define the fundamental concepts of DBMS, including data independence, abstraction levels, and the roles of users.

CO2: Describe various data models (E-R, relational, network, hierarchical) and their applications in database design.

CO3: Apply SQL commands (DDL, DML) and techniques for querying, joining, and manipulating relational databases

CO4: Analyse relational database designs by identifying undesirable properties, functional dependencies, and normalization issues.

CO5: Evaluate database schemas using decomposition techniques, ensuring lossless joins and dependency preservation.

CO6: Design relational databases using conceptual models, normalization forms (1NF, 2NF, 3NF), and key identification algorithms.

Chapter 1	**An Introduction to DBMS**	**3 Lectures**	**CO1**

1.1. Introduction
1.2. File system Vs DBMS
1.3. Levels of abstraction & data independence
1.4.Structure of DBMS (Roles of DBMS Users)
1.5. Users of DBMS
1.6Advantages of DBMS

Chapter 2	**Conceptual Design**	**11 Lectures**	**CO2**

2.1. Overview of DB design process
2.2. Introduction to data models (E-R model, Relational model, Network model, Hierarchical model)
2.3. Conceptual design using ER data model (entities, attributes, entity sets, relations, relationship sets)
2.4. Constraints (Key constraints, Integrity constraints, referential integrity, unique constraint, Null/Not Null constraint, Domain, Check constraint, Mapping constraints)
2.5. Extended features – Specialization, Aggregation, Generalization
2.6. Pictorial representation of ER(symbols)
2.7. Structure of Relational Databases (concepts of a table)
2.8. DBMS Versus RDBMS
2.9. Case Studies on ER model

Chapter 3	**SQL**	**8 Lectures**	**CO3**

3.1 Introduction to query languages 3.2. Basic structure 3.3. DDL Commands 3.4. DML Commands 3.5. Forms of a basic SQL query (Expression and strings in SQL) 3.6. Set operations 3.7. Aggregate Operators and functions 3.8. Date and String functions 3.9. Null values 3.10. Nested Subqueries 3.11 SQL mechanisms for joining relations (inner joins, outer joins and their types) 3.12 Views 3.13. Examples on SQL (case studies)			
Chapter 4	**Relational Database Design**	**8 Lectures**	**CO4**
4.1Introduction to Relational-Database Design (undesirable properties of a RDB design) 4.2. Functional Dependency (Basic concepts, F+, Closure of an Attribute set, Armstrong's axioms) 4.3. Concept of Decomposition 4.4. Desirable Properties of Decomposition (Lossless join, Lossy join, Dependency Preservation) 4.5. Concept of normalization, Normal Forms (1NF,2NF and 3NF), Examples 4.6 Keys Concept with Examples : Candidate Keys and Super Keys, Algorithm to find the super keys / primary key for a relation			
Total: 30 Lectures			
Reference Books:			
• Database System Concepts, Henry F. Korth, Abraham Silberschatz, S.Sudarshan,ISBN:9780071289597,Tata McGraw-Hill Education • Database Management Systems RaghuRamakrishnan,ISBN:9780071254342,Mcgraw-hill higher Education • Database Management Systems, Raghu Ramakrishnan and Johannes Gehrke,McGraw-Hill Science/Engineering/Math; 3 edition, ISBN: 9780072465631 • Database Systems, Shamkant B. Navathe, RamezElmasri,ISBN:9780132144988,PEARSON HIGHER EDUCATION • Beginning Databases with PostgreSQL: From Novice to Professional, Richard Stones, Neil Matthew, ISBN:9781590594780, Apress • PostgreSQL, Korry Douglas, ISBN:9780672327568, Sams • Practical PostgreSQL (B/CD),JohnWorsley, Joshua			
Reference Links:			
1. https://www.postgresql.org/docs/manuals/ 2. https://www.postgresql.org/docs/ 3. https://w3resource.com/PostgreSQL/tutorial.php 4. https://www.tutorialspoint.com/postgresql/index.htm			

S.Y. Integrated M.C.A. (2025 Course) Semester III

CA- 203– P: Lab course on DBMS

Teaching Scheme: Practical: 04Hrs/Week	Credits02	Examination Scheme: Continuous Evaluation: 15 Marks End-Semester :35 Marks

Course Objectives:

1. To implement DDL commands in SQL.
2. To study and implements simple DML commands in SQL.
3. Understand various aggregate functions in SQL.
4. Understand and apply nested queries in SQL.
5. Understand concept of Views in SQL.

Course Outcomes:

On completion of this course the students will be able to:

1. Able to generate table in PostgreSQL
2. Insert values in table
3. Write and execute simple queries, use of aggregate functions and views in SQL.

Practical Assignment List

Suggested List of Assignments:

Assignment 1.

1. To create simple tables with only the primary key constraint (as a table level constraint & as a field level constraint) (include all data types)

Assignment 2.

1. To create more than one table, with referential integrity constraint, PK constraint.

Assignment 3.

1. To create one or more tables with following constraints, in addition to the first two constraints (PK & FK)

a. Check constraint
b. Unique constraint
c. Not null constraint

Assignment 4.

1. To drop a table, alter schema of a table, insert / update / delete records using tables created in previous Assignments. (use simple forms of insert / update / delete statements)

Assignment 5.

2. To query the tables using simple form of select statement Select <field-list> from table [where <condition> order by <field list>] Select <field-list, aggregate functions>from table [where <condition> group by <> having <> order by <>]

Assignment 6.

1. To query table, using set operations (union, intersect)

Assignment 7.

1. To query tables using nested queries (use of 'Except', exists, not exists, all clauses)
1. https://www.geeksforgeeks.org/dbms/

Reference Links:

https://www.geeksforgeeks.org/dbms/

S.Y. Integrated M.C.A. (2025 Course)
CA- 204 – T : Object Oriented Programming with C++

Teaching Scheme: Theory:02 Hrs/Week	Credits 02	Examination Scheme: Continuous Evaluation: 15 Marks End-Semester: 35 Marks

Course Objectives:

- To understand the fundamental concepts of Object-Oriented Programming (OOP) and its advantages over procedural programming.
- To learn the basics of C++ programming language, including syntax, data types, and basic programming constructs.
- To explore expressions, operators, and memory management in C++.
- To develop an understanding of functions in C++, including function overloading and inline functions.

Course Outcomes:

CO1: Differentiate between procedural and object-oriented programming paradigms.

CO2: Write basic C++ programs and apply fundamental concepts like classes, objects, and data abstraction.

CO3: Implement and use expressions, operators, and memory management techniques in C++.

CO4: Demonstrate the use of functions, including different parameter passing techniques, function overloading, and inline functions.

CO5: Develop applications using classes, objects, and other OOP concepts like inheritance and polymorphism.

Chapter I	Principle of OOP's	6 Hrs	CO1

1.1 Introduction
1.2 Procedural Vs Object Oriented Programming
1.3 Classes, Object, Data Abstraction,
1.4 Encapsulation, Inheritance, Polymorphism
1.5 Dynamic Binding, Message Passing
1.6 Object Oriented Languages
1.7 Object Based languages

Chapter II	Basics of C++	6 Hrs	CO2

2.1 A Brief History of C & C++
2.2 C Vs C++
2.3 A Simple C++ Program
2.4 Application of C++
2.5 Structure & Class
2.6 Compiling & Linking

Chapter III	Expressions	6 Hrs.	CO3
3.1 Tokens, Keywords, Identifiers & Constants, 3.2 Basic Data Types, User-Defined Data Types, 3.3 Symbolic Constant, Type Compatibility, 3.4 Reference Variables, Operator in C++, 3.5 Scope Resolution Operator, 3.6 Member De-referencing Operators, 3.7 Memory Management Operators,			
Chapter IV	**Functions In C++**	**05 Hrs.**	
4.1 The Main Function, Function Prototyping 4.2 Call by Reference, Call by Address, 4.3 Call by Value, Return by Reference 4.4 Inline Function, Default Arguments 4.5 Const Arguments, Function Overloading,			
Chapter V	**Classes & Objects**	**07 Hrs.**	
5.1 A Sample C++ Program with class 5.2 Access specifiers 5.3 Defining Member Functions 5.4 Making an Outside Function Inline 5.5 Nesting of Member Functions 5.6 Private Member Functions 5.7 Arrays within a Class 5.8 Memory Allocation for Objects 5.9 Static Data Members, Static Member 5.10 Functions, Arrays of Objects2 5.11 Object as Function Argument4s 5.12 Friend Functions, Returning Objects			

Reference Books & E-Books:

- C++: The Complete Reference Herbert Schildt,TMH,5th Ed.
- Let us C++ Kanetkar,BPB,2nd Ed
- Object Oriented Programming with C++ E. Balagurusamy,TMH,4th Ed.
- C++ Primer Stanley Lippman & Lajoi,Pearson,3rd Ed.
- C++ Programming Language Bjarne Stroustrup, Pearson, 3rd Ed.
- C++ Programming Bible Al Stevens & Clayton Walnum, Wiley Pub.

Website:

- https://www.learncpp.com/
- https://www.geeksforgeeks.org/c-plus-plus/
- w3schools – C++ Tutorial

Online Courses:

- https://www.udacity.com/course/c-plus-plus-nanodegree--nd213
- https://learn.microsoft.com/en-us/training/modules/cpp-first-steps/
- https://www.edx.org/course/introduction-to-c-plus-plus

S.Y. Integrated M.C.A. (2025 Course) CA- 205 –VSC: Lab course on Oops and DS		
Teaching Scheme: **Practical: 04** **Hrs./Week**	**Credits** **02**	**Examination Scheme:** **Continuous Evaluation:15 Marks** **End-Semester: 35 Marks**

Course Objectives:

- To learn fundamental concepts of Python programming.
- To understand and implement different data types and control structures.
- To explore Python's built-in data structures such as lists, tuples, sets, and dictionaries.
- To introduce object-oriented programming (OOP) concepts in Python.
- To develop skills in file handling and exception handling for efficient programming.

Guidelines for Instructor's Manual

The instructor shall frame at least 8 assignments. Instructor's manual consisting of College syllabus, conduction & Assessment guidelines is to be developed.

Guidelines for Student Journal

The laboratory assignments are to be submitted by student in the form of journal. Journalconsists of Certificate, table of contents, and handwritten write-up for each assignment. Write-up shall include Title, Problem Statement, software and Hardware requirements, Date of Completion.

Program codes with sample output of all performed assignments are to be submitted assoftcopy. Use of DVD containing students programs maintained by lab In-charge is highlyencouraged. For reference one or two journals may be maintained with program prints

Guidelines for Assessment

Continuous assessment of laboratory work is to be carried out based on overall performance of students. For each lab assignment, the instructor will assign grade/marksbased on parameters such as timely completion, understanding, neatness etc. with appropriate weightage.

Sr.No.	Assignment

S.Y. Integrated M.C.A. (2025 Course)
CA – 207 – MN: Programming with Python

Teaching Scheme:	Credits	Examination Scheme:
Theory: 02 Hrs/Week	02	Continuous Evaluation: 15 Marks End-Semester : 35 Marks

Course Objectives:

- To study the advanced concepts of Python programming.
- To learn functional programming techniques such as lambdas, generators, and comprehensions.
- To understand object-oriented programming (OOP) concepts and their implementation in Python.
- To explore database connectivity and management using Python.
- To learn multithreading and regular expressions for efficient programming.

Course Outcomes: On completion of the course, student will be able to–

CO1: Write programs using functional programming concepts such as lambdas, generators, and coroutines.
CO2: Utilize the collections module for efficient data manipulation.
CO3: Implement object-oriented programming concepts, including classes, inheritance, and method overriding.
CO4: Develop Python programs for database management using MySQL.

Contents

Chapter I	Introduction to Python Programming	5 Hrs.	CO1

1.1. History and Features of Python
1.2. Python IDEs and installation
1.3. Writing and executing Python programs
1.4. Python syntax, keywords, identifiers
1.5. Variables, data types, type conversion
1.6. Input and output functions
1.7. Basic operators and expressions

Chapter II	Control Structures and Functions	5 Hrs.	CO2

2.1. Conditional statements: if, if-else, elif
2.2. Looping structures: for, while, break, continue, pass
2.3. range() and loop else clause
2.4. Functions: definition, calling, return values
2.5. Parameters and arguments (positional, keyword, default)
2.6. lambda functions, recursion
2.7. Variable scope and lifetime

Chapter III	Data Structures in Python	4 Hrs.	CO3

3.1. Lists: creation, indexing, slicing, methods
3.2. Tuples: definition, operations, immutability
3.3. Dictionaries: key-value pairs, methods, loops
3.4. Sets: properties, operations, use cases
3.5. String handling: slicing, built-in methods, formatting
3.6. List comprehension and dictionary comprehension

Chapter IV	Object-Oriented Programming in Python	4 Hrs.	CO4

4.1. Introduction to OOP
4.2. Classes and objects
4.3. Constructors (__init__), instance and class variables
4.4. Inheritance: single, multiple
4.5. Method overriding, use of super()
4.6. Encapsulation and data hiding

Chapter V	File Handling and Exception Handling	12 Hrs	CO5

5.1. File operations: open, read, write, append, close
5.2. Working with text and binary files
5.3. with statement
5.4. Exception handling: try, except, finally, raise
5.5. Built-in exceptions and user-defined exceptions

○

Reference Books & E-Books:

- Reema Thareja – *Python Programming: Using Problem Solving Approach*, Oxford University Press
- Yashavant Kanetkar – *Let Us Python*, BPB Publications
- Dr. R.Nageswara Rao – *Core Python Programming*, Dreamtech Press
- Mark Lutz – *Learning Python*, O'Reilly Media

Website:

- https://www.coursera.org/specializations/python
- Website: https://www.oreilly.com/library/view/head-first-java/9780596009205/

Online tutorials and resources:

- Oracle Java Tutorials: https://docs.oracle.com/javase/tutorial/
- JavaTPoint: https://www.javatpoint.com/
- Baeldung: https://www.baeldung.com/

S.Y. Integrated M.C.A. (2025 Course) CA – 208 – MN: Lab course on Programming with Python		
Teaching Scheme: **Practical: 04** **Hrs./Week**	**Credits** **02**	**Examination Scheme:** **Continuous Evaluation:15 Marks** **End-Semester: 35 Marks**

Course Objectives:

- To learn fundamental concepts of Python programming.
- To understand and implement different data types and control structures.
- To explore Python's built-in data structures such as lists, tuples, sets, and dictionaries.
- To introduce object-oriented programming (OOP) concepts in Python.
- To develop skills in file handling and exception handling for efficient programming.

Course Outcomes: On completion of the course, student will be able to–

CO1: Write Python programs using variables, data types, and operators.

CO2: Implement conditional statements, loops, and functions for problem-solving.

CO3: Manipulate and perform operations on lists, tuples, dictionaries, and sets.

CO4: Develop object-oriented programs using classes and objects.

CO5: Perform file handling operations such as reading, writing, and appending files.

Guidelines for Instructor's Manual

The instructor shall frame at least 12 assignments. Instructor's manual consisting of College syllabus, conduction & Assessment guidelines is to be developed.

Guidelines for Student Journal

The laboratory assignments are to be submitted by student in the form of journal. Journalconsists of Certificate, table of contents, and handwritten write-up for each assignment. Write-up shall include Title, Problem Statement, software and Hardware requirements, Date of Completion.

Program codes with sample output of all performed assignments are to be submitted assoftcopy. Use of DVD containing students programs maintained by lab In-charge is highlyencouraged. For reference one or two journals may be maintained with program prints

Guidelines for Assessment

Continuous assessment of laboratory work is to be carried out based on overall performance of students. For each lab assignment, the instructor will assign grade/marksbased on parameters such as timely completion, understanding, neatness etc. with appropriate weightage.

Sr.No.	Assignment
1	To demonstrate the use of different data types and type casting in Python.
2	To demonstrate the use of operators (arithmetic, comparison, assignment, bitwise, membership, and identity).
3	To demonstrate the use of conditional statements (if, if-else, elif).
4	To demonstrate the use of loops (for, while) and loop control statements (break, continue, pass).
5	To demonstrate the concept of functions, including function arguments and lambda functions.
6	To demonstrate the concept of lists, tuples, sets, and dictionaries with operations.
7	To demonstrate the concept of object-oriented programming by creating a class and object.
8	To demonstrate the use of constructors (__init__ method) and instance variables in a Python class.
9	To demonstrate file handling operations: reading, writing, and appending to a file.
10	To demonstrate exception handling using try-except-finally with multiple exceptions.

Detailed Drafts

S.Y. Integrated M.C.A.

Semester IV

S.Y. Integrated M.C.A. (2025 Course)
CA- 251- T : Relational Database Management Systems

Teaching Scheme:	Credits	Examination Scheme:
Practical: 02Hrs/Week	02	Continuous Evaluation: 15 Marks End-Semester :35 Marks

Course Objectives:

- To teach fundamental concepts of RDBMS (PL/PgSQL)
- To teach database management operations
- Be familiar with the basic issues of transaction processing and concurrency control
- To teach data security and its importance

Course Outcomes: On completion of the course, student will be able to–

CO1: Use database techniques such as SQL & PL/SQL.
CO2: Explain transaction Management in relational database System.
CO3: Explain recovery techniques in relational database Systems.

Contents

Chapter I	**Relational Database Design Using PLSQL**	**8 Hrs**	**CO1**

1.1 Introduction to PLSQL
1.2 PL/PgSqL: Datatypes, Language structure
1.3 Controlling the program flow, conditional statements, loops
1.4 Stored Functions
1.5 Cursors
1.6 Triggers

Chapter II	**Transactions Concepts and Concurrency Control**	**4 Hrs**	**CO2**

2.1 Describe a transaction, properties of transaction, state of the transaction.
2.2 Executing transactions concurrently associated problem in concurrent execution.
2.3 Schedules, types of schedules, concept of Serializability, Precedence graph for Serializability.

Chapter III	**Database Integrity and Security Concepts**	**6 Hrs.**	**CO3**

3.1 Domain constraints
3.2 Referential Integrity
3.3 Introduction to database security concepts
3.4 Methods for database security
3.4.1Discretionary access control method
3.4.2Mandatory access control
3.4.3. Role base access control for multilevel security.
3.5 Use of views in security enforcement.
3.6 Overview of encryption technique for security.
3.7 Statistical database security.

Chapter IV	**Crash Recovery**	**6 Hrs**	**CO4**

4.1 Failure classification
4.2 Recovery concepts
4.3 Log base recovery techniques (Deferred and Immediate update)
4.4 Checkpoints, Relationship between database manager and buffer cache. Aries recovery algorithm.

4.5 Recovery with concurrent transactions (Rollback, checkpoints, commit) 4.6 Database backup and recovery from catastrophic failure			
Chapter V	**Other Databases**	**6 Hrs**	**CO5**
5.1 Introduction to Parallel and distributed Databases 5.2 Introduction to Object Based Databases 5.3 NoSQL Database 5.4 Multimedia Databases 5.5 Big Data Databases			

Reference Books & E-Books:

1. Database System Concepts, Henry F. Korth, Abraham Silberschatz, S.Sudarshan,ISBN:9780071289597,Tata McGraw-Hill Education
2. Database Management Systems RaghuRamakrishnan, ISBN:9780071254342,Mcgraw- hill higher Education
3. Database Management Systems, Raghu Ramakrishnan and Johannes Gehrke,McGraw- Hill Science/Engineering/Math; 3 edition, ISBN: 9780072465631
4. Database Systems, Shamkant B. Navathe, RamezElmasri, ISBN:9780132144988,PEARSON HIGHER EDUCATION Beginning Databases with PostgreSQL: From Novice to Professional, Richard Stones, Neil Matthew, ISBN:9781590594780, Apress
5. ebsite: https://www.oracle.com/java/technologies/javase/jdk13-archive-downloads.html "Head First Java" by Kathy Sierra and Bert Bates
6. Website: https://www.oreilly.com/library/view/head-first-java/9780596009205/
7. Online tutorials and resources: Oracle Java Tutorials: https://docs.oracle.com/javase/tutorial/
8. JavaTPoint: https://www.javatpoint.com/
9. Baeldung: https://www.baeldung.com/

Reference Links:

1.https://www.postgresql.org/docs/manuals/
2.https://www.postgresql.org/docs/
3.https://www.postgresqltutorial.com/
4.https://w3resource.com/PostgreSQL/tutorial.php
5.https://www.tutorialspoint.com/postgresql/index.htm
6.https://www.javatpoint.com/postgresql-tutorial
7.https://www.guru99.com/postgresql-tutorial.html

S.Y. Integrated M.C.A. (2025 Course) CA- 252- P: Lab course on RDBMS		
Teaching Scheme: **Practical: 04 Hrs/Week**	**Credits** **02**	**Examination Scheme:** **Continuous Evaluation: 15 Marks** **End-Semester :35**

Course Objectives:

- To introduce the basics of PL/SQL programming including variables, data types, loops, and conditional logic.
- To develop proficiency in creating stored procedures, functions, and handling exceptions in PL/SQL.
- To provide practical experience in using database triggers, cursors, and managing transactions.

Guidelines for Instructor's Manual

The instructor shall frame at least 10 assignments. Instructor's manual consisting of College syllabus, conduction & Assessment guidelines is to be developed.

Guidelines for Student Journal

The laboratory assignments are to be submitted by student in the form of journal. Journalconsists of Certificate, table of contents, and handwritten write-up for each assignment.Write-up shall include Title, Problem Statement, software and Hardware requirements, Date of Completion.
Program codes with sample output of all performed assignments are to be submitted assoftcopy. Use of DVD containing students programs maintained by lab In-charge is highlyencouraged. For reference one or two journals may be maintained with program prints.

Guidelines for Assessment

Continuous assessment of laboratory work is to be carried out based on overall performance of students. For each lab assignment, the instructor will assign grade/marks based on parameters such as timely completion, understanding, neatness etc. with appropriate weightage.

Assignments

1. Create PL/SQL programs demonstrating the use of variables, datatypes, loops
2. Create PL/SQL programs demonstrating the use of conditional statements.
3. Create PL/SQL programs demonstrating the use of variables, datatypes, loops, and conditional statements.
4. Write and execute stored procedures for basic CRUD operations on a student database.
5. Write and execute stored functions for basic CRUD operations on a Employee database.
6. Implement implicit and explicit cursors and handle exceptions (NO_DATA_FOUND, TOO_MANY_ROWS) in PLSQL.
7. Create row-level and statement-level triggers for operations like INSERT, UPDATE, DELETE on an Employee table.
8. Create row-level and statement-level triggers for operations like INSERT, UPDATE, DELETE on an Student table.
9. Create row-level and statement-level triggers for operations like INSERT, UPDATE, DELETE on an hospital table.
10. Create row-level and statement-level triggers for operations like INSERT, UPDATE, DELETE on an hostel table.
11. Write and execute stored procedures and functions for demonstrating use of Cursors.
12. Write and execute stored procedures and functions for Handling errors and Exceptions.

S.Y. Integrated M.C.A. (2025 Course) CA- 253- T: Data Science		
Teaching Scheme: **Theory:02 Hrs/Week**	**Credits02**	**Examination Scheme:** **Continuous Evaluation: 15 MarksEnd-Semester : 35 Marks**

Course Objectives:

- To introduce the fundamentals of Data Science, including its importance, applications, data types, and lifecycle.
- To build a strong foundation in statistical methods used for summarizing and analyzing various data types.
- To develop skills for applying data science models and tasks such as classification, prediction, clustering, and association.
- To enable students to clean, preprocess, and transform data for improving data quality and model performance.
- To explore and visualize data effectively using EDA techniques and standard visualization tools.

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

CO1: Explain the role of Data Science, types of data, and its lifecycle in solving real-world problems.
CO2: Apply statistical techniques to understand and describe data properties and distributions.
CO3: Implement basic data science tasks using Python for predictive and descriptive modelling.
CO4: Perform data preprocessing operations including cleaning, normalization, reduction, and discretization.
CO5: Create meaningful visualizations to discover patterns and insights from datasets.

Course Contents

Unit I	Introduction	06 Hrs	CO1

1. What and why Why learn Data Science?, Types of Data -structured, semi-structured, unstructured Data
2. Applications of Data Science, The Data Science Lifecycle, Role of Data Scientists
3. Data sources-Open Data, Social Media Data, Multimodal Data, standard datasets

Unit II	Statistics for Data Science	06 Hrs	CO2

1. Data Objects and Attributes, Attribute Types: Nominal, Binary, Ordinal Attributes, Numeric Attributes, Discrete versus Continuous Attributes, Role of statistics in Data Science
2. Descriptive statistics - Measuring the Frequency, Measuring the Central Tendency:Mean, Median, and Mode, Measuring the Dispersion: Range, Standard deviation,
3. Variance, Inter quartile Range

Unit III	Data science Models and Tasks	06 Hrs	CO3
1. Predictive and Descriptive Models, Introduction to Machine learning and types of ML: Supervised and Unsupervised. 2. Classification, Prediction, Association, Clustering, Performing simple Data ScienceTasks using WEKA / R			
Unit IV	**Data Quality and Pre-processing**	**06 Hrs**	**CO4**
1. Data Quality: Why Preprocess the Data?, Data munging/wrangling operationsData Cleaning - Missing Values, Noisy Data 2. Data Transformation – Rescaling, Normalizing, 3. Data reduction and Data discretization			
Unit V	**Data Visualization**	**06 Hrs**	**CO5**
1. Introduction to Exploratory Data Analysis (EDA), Data visualization, 2. Basic data visualization tools –Box Plots, Histograms, Bar charts/graphs, Scatterplots, Line charts, Area plots, Pie charts			
Reference Books			
Jure Leskovek, Anand Rajaraman and Jeffrey Ullman. Mining of Massive Datasets. v2.1, Cambridge University Press.			

S.Y. Integrated M.C.A. (2025 Course) CA- 254- P: Lab course on Data Science		
Teaching Scheme: **Practical: 04 Hrs/Week**	**Credits** **02**	**Examination Scheme:** **Continuous Evaluation: 15 Marks** **End-Semester :35**

Course Objectives:

- To introduce the basics of Data Science, its lifecycle, types of data, and real-world applications.
- To understand and apply statistical concepts for data description and analysis.
- To build and evaluate data science models for classification, prediction, clustering, and association.
- To perform data preprocessing and create visualizations for effective data interpretation.

Guidelines for Instructor's Manual

The instructor shall frame at least 10 assignments. Instructor's manual consisting of College syllabus, conduction & Assessment guidelines is to be developed.

Guidelines for Student Journal

The laboratory assignments are to be submitted by student in the form of journal. Journalconsists of Certificate, table of contents, and handwritten write-up for each assignment.Write-up shall include Title, Problem Statement, software and Hardware requirements, Date of Completion.
Program codes with sample output of all performed assignments are to be submitted assoftcopy. Use of DVD containing students programs maintained by lab In-charge is highlyencouraged. For reference one or two journals may be maintained with program prints.

Guidelines for Assessment

Continuous assessment of laboratory work is to be carried out based on overall performance of students. For each lab assignment, the instructor will assign grade/marks based on parameters such as timely completion, understanding, neatness etc. with appropriate weightage.

Assignments

Lab 1: Environment Setup & Basic Data Handling Objective: Install tools and load datasets. Tasks: Install Anaconda/Jupyter. Load a CSV (e.g., Iris Dataset) using Pandas. Display summary statistics (df.describe()). Deliverable: Screenshots of code/output.

Lab 2: Data Cleaning & Missing Value Handling Objective: Preprocess messy data. Tasks: Use a dataset with missing values (e.g., Titanic Dataset). Apply strategies (drop, mean/median imputation).
Visualize missing values (missingno library). Deliverable: Cleaned dataset + brief report.

Lab 3: Exploratory Data Analysis (EDA) Objective: Analyze and visualize data patterns. Tasks: Use Wine Quality Dataset. Plot correlations (heatmap), distributions (histograms). Identify outliers using box plots. Deliverable: Jupyter notebook with visualizations.

Lab 4: Statistical Hypothesis Testing Objective: Apply inferential statistics. Tasks: Use a dataset with groups (e.g., Student Performance). Perform t-test/ANOVA to compare means. Interpret p-values. Deliverable: Hypothesis testing report.

Lab 5: Supervised Learning - Regression Objective: Predict continuous values. Tasks: Use Boston Housing Dataset. Train Linear Regression/Ridge models. Evaluate using RMSE/R^2. Deliverable: Model comparison table.

Lab 6: Supervised Learning - Classification Objective: Build a classifier. Tasks:Use Spam Email Dataset). Train Logistic Regression/SVM. Evaluate using confusion matrix. Deliverable: Accuracy metrics + ROC curve.

Lab 7: Unsupervised Learning - Clustering Objective: Group unlabeled data. Tasks: Use Mall Customer Dataset). Apply k-Means clustering. Visualize clusters (PCA/t-SNE). Deliverable: Cluster analysis report.

Lab 8: Feature Engineering & Dimensionality Reduction Objective: Optimize features. Tasks: Use a high-dimension dataset (e.g., MNIST). Apply PCA for dimensionality reduction. Re-train a model and compare accuracy. Deliverable: Feature importance plot.

Lab 9: Data Visualization & Dashboarding Objective: Create interactive dashboards. Tasks: Use COVID-19 Dataset). Build visualizations (Plotly/Seaborn). Design a Tableau/Power BI dashboard. Deliverable: Dashboard link/screenshots.

Lab 10: Capstone Mini-Project Objective: End-to-end pipeline. Tasks: Choose a domain (e.g., healthcare, finance). Perform EDA → Model → Deployment (Flask). Present insights via storytelling. Deliverable: GitHub repo + presentations

S.Y. Integrated M.C.A. (2025 Course) CA- 255-SEC: Computer Graphics and Visualization		
Teaching Scheme: **Practical: 04 Hrs/Week**	**Credits** **02**	**Examination Scheme:** **Continuous Evaluation: 15 Marks** **End-Semester :35**

Course Objectives:

- To introduce the fundamental concepts of computer graphics, including basic graphics primitives and drawing algorithms.
- To develop an understanding of 2D and 3D geometric transformations and their applications in graphics systems.
- To provide knowledge of clipping algorithms, projections, and viewing techniques used in rendering pipelines.
- To explore various visualization techniques for real-time rendering and interactive graphics.
- To equip students with hands-on skills to implement and animate graphical objects using appropriate programming tools and libraries.

Guidelines for Instructor's Manual

The instructor shall frame at least 10 assignments. Instructor's manual consisting of College syllabus, conduction & Assessment guidelines is to be developed.

Guidelines for Student Journal

The laboratory assignments are to be submitted by student in the form of journal. Journalconsists of Certificate, table of contents, and handwritten write-up for each assignment.Write-up shall include Title, Problem Statement, software and Hardware requirements, Date of Completion.
Program codes with sample output of all performed assignments are to be submitted assoftcopy. Use of DVD containing students programs maintained by lab In-charge is highlyencouraged. For reference one or two journals may be maintained with program prints.

Guidelines for Assessment

Continuous assessment of laboratory work is to be carried out based on overall performance of students. For each lab assignment, the instructor will assign grade/marks based on parameters such as timely completion, understanding, neatness etc. with appropriate weightage.
Tools: Python Turtle / Pygame/tkinter / HTML5 Canvas/ JavaScript Canvas/ C graphics.h

Assignments

1. Write a program to draw a line, rectangle, circle, and triangle.
2. Combine circles and lines to draw a smiley face.
3. Animate a ball bouncing horizontally across the screen.
4. Create a shape and fill it with different colors; change background color with a keypress.
5. Use mouse clicks to draw lines or circles on the screen.
6. Create a simple house using rectangles, triangles, and lines.
7. Draw an analog clock and animate the second hand.
8. Simulate a traffic light system that changes colors with a timer.
9. Create a simple recursive fractal like a tree or snowflake.
10. To demonstrate Drawing Basic 2D Shapes
11. Implement Bresenham's Line and Circle Drawing Algorithm
12. Apply transformations such as translation, rotation, scaling, reflection, and shearing to 2D objects.
13. Implement line clipping (Cohen-Sutherland) and polygon clipping (Sutherland-Hodgman).
14. Model basic 3D objects like a cube, pyramid, or sphere and apply transformations (rotation, translation).

S.Y. Integrated M.C.A. (2025 Course) CA – 257 – MN: Operating system & Shell Programming		
Teaching Scheme: **Practical: 02Hrs/Week**	**Credits** **02**	**Examination Scheme:** **Continuous Evaluation: 15 Marks** **End-Semester :35 Marks**

Course Objectives:

- To learn the fundamentals of Operating Systems and handle processes and threads and their communication
- To learn the mechanisms involved in memory management in contemporary OS
- To know the functionality of Multiprocessor OS and Mobile OS.
- To gain knowledge of distributed operating system concepts.
- To learn about the Basics of Linux.
- 6. To learn programmatically to implement Linux OS mechanisms

Course Outcomes: On completion of the course, student will be able to–

CO1: Understand structure of OS, process management and synchronization.
CO2: Understand multicore and multiprocessing OS.
CO3: Analyze Real-time and embedded OS
CO4: Apply Windows and Linux OS fundamentals and administration
CO5: Apply to solve shell scripting problems

Contents

Chapter I	**Overview of OS**	**7 Hrs**	**CO1**

1.1 Overview of operating systems,
1.2 Functionalities and Characteristics of OS ,
1.3 Hardware concepts related to OS ,
1.4 CPU states, I/O channels,
1.5 Memory Management, Memory Management Techniques,
1.6 Contiguous & Non-Contiguous allocation, Logical & Physical Memory - Conversion of Logical to Physical address,
1.7 Paging,
1.8 Demand Paging Page Replacement Concept,
1.9 Segmentation - Segment with paging
1.10 Virtual Memory Concept, Thrashing

Chapter II	**Process Management**	**4 Hrs**	**CO2**

2.1 Process Management and Synchronization,
2.2 PCB,
2.3 Job and processor scheduling. Scheduling Concept,
2.4 Process hierarchies,
2.5 Problems of concurrent processes,
2.6 Critical sections, Mutual exclusion Synchronization,
2.7 Deadlock,
2.8 Device and File Management,
2.9 Overview Techniques, File Systems

Chapter III	Processor Management	6 Hrs.	CO3
3. Multiprocessor and Multicore Operating Systems, 3.1 Introduction, Advantages and Disadvantages, Multicore System Vs. Multiprocessor System, 3.2 Types of Multiprocessors , Symmetric Multiprocessors, Asymmetric Multiprocessors 3.3 Basic Multicore Concepts: Memory Sharing Styles, Uniform Memory Access (UMA), Non-Uniform Memory Access (NUMA), No Remote Memory Access, (NORMA), 3.4 Cache Coherence, Inter-Process and intercore Communication: Shared Memory, Message Passing, 3.5 Mobile Operating Systems, Concept Need and Features, Types of Mobile OS Overview of Android OS, Applications of Mobile OS 3.6 Distributed Operating Systems, Concept Need and Features, Examples of Distributed OS with brief introduction, Applications of Distributed OS			
Chapter IV	**Real Time OS**	**6 Hrs**	**CO4**
4. Real Time OS, 4.1 Introduction and use of RTOS, 4.2 Components of RTOS, Types of RTOS, Features of RTOS, Factors for selecting in RTOS, 4.3 Applications of RTOS, Disadvantages of RTOS, 4.4 Embedded OS, 4.5 Concept Need and Features of embedded OS, 4.6 Examples of embedded OS with brief introduction, 4.7Applications of embedded OS			
Chapter V	**Types of OS**	**6 Hrs**	**CO5**
5.Windows OS and Windows Server, Architecture, 5.1 Windows OS , Introduction, Windows OS Installation, Process Management, Control Panel Overview, Users, Security and Privacy Settings, Identify Accessibility Settings 5.2 Service Management, Syncing Devices and File Sharing 5.3 Windows Utilities (Accessories, Disk, Management, Resource Monitor, Backup, and Recovery), Basic Troubleshooting (Networking, Security, Device Driver). Introduction to Ubuntu, Introduction, Overview of Kernel, 5.4 Installation of Ubuntu File system, Basic Commands of Linux, Managing Processes in Linux, 5.5 Installing and deleting software packages, User Management, File and Device Management, Backup and recovery, 5.6 Introduction to Graphical Environment (GNOME), Ubuntu Utilities, (Virtual Box, Evolution, Gimp, Bleach Bit, Unity Tweak Tool etc.), SAMBA Overview			

Reference Books:

- Silberschatz, A., Galvin, P.B. and Gagne, G., Operating System Concepts (10 ed.), John Wiley, 2018. ISBN 978-1-119-32091-3
- Stallings William, Operating Systems Internals and Design Principles (9 ed.), Prentice Hall, 2021. ISBN 978-0134670959
- Abraham Silberschatz, Peter Baer Galvin, Greg Gagne (2006), Operating System Principles, 7th edition, Wiley India Private Limited, New Delhi.

S.Y. Integrated M.C.A. (2025 Course) CA –258 –MN: Lab course on Shell Programming		
Teaching Scheme: **Practical: 04 Hrs/Week**	**Credits** **02**	**Examination Scheme:** **Continuous Evaluation: 15 Marks** **End-Semester :35**

Course Objectives:

- To introduce the fundamentals of Linux shell scripting and command-line usage.
- To develop the ability to use variables, flow control, loops, and functions in scripts.
- To teach string manipulation, file operations, and handling of input parameters in scripts.
- To implement decision-making using case statements and automate routine system tasks.
- To prepare students for writing real-time shell scripts for system administration and automation.

Guidelines for Instructor's Manual

The instructor shall frame at least 8 assignments. Instructor's manual consisting of College syllabus, conduction & Assessment guidelines is to be developed.

Guidelines for Student Journal

The laboratory assignments are to be submitted by student in the form of journal. Journalconsists of Certificate, table of contents, and handwritten write-up for each assignment.Write-up shall include Title, Problem Statement, software and Hardware requirements, Date of Completion.
Program codes with sample output of all performed assignments are to be submitted assoftcopy. Use of DVD containing students programs maintained by lab In-charge is highlyencouraged. For reference one or two journals may be maintained with program prints.

Guidelines for Assessment

Continuous assessment of laboratory work is to be carried out based on overall performance of students. For each lab assignment, the instructor will assign grade/marks based on parameters such as timely completion, understanding, neatness etc. with appropriate weightage.

Assignments
• Write a shell script to display system information (date, time, username, hostname) using variables. • Create a script to check whether a number is positive, negative, or zero, and whether it is even or odd. • Write a script using loops to print the multiplication table of a given number and calculate the factorial. • Create a script with functions to find the largest of three numbers and to reverse a given string. • Write a script to create a list of names, sort them, and display the first and last names in the sorted list. • Create a script that performs operations like substring extraction, length calculation, and string replacement. • Develop a script to read from a file (e.g., a list of users) and write the output to another file after processing. • Write a script that accepts command-line arguments and performs different operations based on input (e.g., addition, subtraction, etc.). • Create a menu-driven shell script using the case statement to manage basic file operations: create, delete, copy, and move. • Write a real-time admin script that monitors disk usage and sends a warning if usage exceeds a threshold, saving results to a log file.

List of Open Elective (OE) Courses offered to other Disciplines / Faculty

Department of Integrated MCA							
OE-1		OE-2		OE-3		OE-4	
Course code	Subject Name	Course code	Subject Name	Course code	Subject Name	Course code	Subject Name
CA -107-OE	Web Designing	CA-157T-OE / CA-157-OE	Data Science	CA-208T-OE / CA-208P- OE	E-Commerce & Digital Marketing	CA-208-OE	Prompt Engineering & Generative AI
CA -108T-OE / CA -108P-OE	Database Management System	CA-158P-OE	Web Programming using PHP	CA-209T-OE	Green Computing	CA-209-OE	Green Computing

Basket: Open Elective (OE)

Department of AI & DS		
OE-1	**OE-2**	**OE-3**
24UAIL304 /24UAIP304 A: DMS administration	24UAIL405 A: Data Security & Privacy	24UAIL506 A: AI & ML
24UAIL304/24UAIP304 B: Analytics using Data Science	24UAIL405 B: Design Thinking	24UAIL506 B: AR & VR applications in Industry
24UAIL304 /24UAIP304 C: Gen AI	24UAIL405 C: Social Network analysis	24UAIL506 C: Deep Neural Network
24UAIL301/ 24UAIP301: Data Engineering		

Department of Information Technology		
OE-1	**OE-2**	**OE-3**
24UIT304A Software engineering and development	24UIT405A Design and Analysis of Algorithms	24UIT505A Big data analytics and R Programming
24UIT304B Data Structures	24UIT405B Deep Learning	24UIT505B Internet of Things
24UIT304C Statistics for Engineers	24UIT405C Android and IOS app development	24UIT505CCryptocurrency and block chain

Department of Mechanical Engineering		
OE-1	**OE-2**	**OE-3**
24UAI304 A Non-conventional Energy System	24UME405A Mathematical Modelling	24UME505A Technology and Financial Management
24UAI304 B Solar Energy	24UME405B Advance Excel	24UME505B Product Design and Development
24UAI304 C Product Development	24UME405C Power BI	24UME505C Process Planning & Management

Department of E&TC		
OE-1	**OE-2**	**OE-3**
24UET304-A Electromagnetics wave propagation and Antenna theory	24UET403-A Network Analysis	24UET502- A Wireless Sensor Networks
24UET304-B Digital Image Processing	24UET403-B ES and RTOS	24UET502- B Speech and video signal processing
24UET304-C Electronics and Electrical Engineering	24UET403-C Mechatronics	24UET502-C Renewable energy sources and Applications

Department of IMBA					
Sr. No.	**Course Code**	**Course Name**	**Credits**		
			TH	**PR**	**Total**
Sem I	MM01	Principles of Management	02	00	02
	AEC01	Business Communication I	02	00	02
	MMM02	Principles of Marketing	02	00	02
Sem II	MMH05	Organizational Behavior	02	00	02
	AEC02	Business Communication II	02	00	02
	MMF05	Business Accounting	02	00	02

Sr. No.	**Course Code**	**Course Name**	**Credits**		
			TH	**PR**	**Total**
Sem III	MMM07	Sales & Distribution Management	02	00	02
	MM08	Entrepreneurship and Startup Ecosystem	02	00	02
	MMH07	Human Resource Management Functions & Practices	02	00	02
Sem IV	MNM03	Employee Recruitment and Record Management	02	00	02
	MMM10	Retail Management	02	00	02
	MMF10	Banking and Finance	02	00	02

Type of Course	Abbreviations
Major (Core) Subject comprising Mandatory	MM
Minor Subject	MN
Department Specific Core	DSC
School Specific Core	SSC
Indian Knowledge System	IKS
Board of Studies	BoS
Ability Enhancement Courses	AEC
Value Education Courses	VEC
Co-curricular Courses	CC
Vocational and Skill Enhancement Courses	VSEC
Vocational Skill Courses	VSC
Skill Enhancement Courses	SEC
Open Elective	OE
Generic Elective	GE
Program Core	PCC
Basic Science	BSC
Field Project	FP
Program Elective	PEC
On-job Training	OJT
Entrepreneurship, Economics and Management	EEM