UNIVERSITY OF KALYANI

UG 4 YEAR Computer **Application** (HONOURS/ HONOURS WITH RESEARCH) SYLLABUS

(Under NEP 2020)

W.E.F. the Academic Session 2023-24
(Third semester)

COURSE STRUCTURE Computer Science (NEP-2020)

SEMESTER I

Course Code	Course title	Nature of Course	Credit of Course	Class hour/week	Evaluation		Total
					Internal	Semester End	
CA-MJ-T-1	Computer Fundamentals and Programming using C	Major	4	4	15	60	75
CA-MJ-P-1	Programming using C Lab	Major	2	3	Problem: 60, Viva: 10, Lab Notebook: 5		75
CA-MI-T-1	Computer Fundamentals and Programming using C	Minor	3	3	10	25	35
CA-MI-P-1	Programming using C Lab	Minor	1	2	Problem+ Viva:15		15
CA-MU-T-1	Computer Science for Beginners	Multidisciplinary Course	3	3	10	35	45
CA-SEC-P-1	Office Automation Lab	Skill Enhancement Course	3	3	Problem: 35, Viva: 5, Lab Notebook: 5		45
		Value Added Course	4	4	10	40	50
Total			**20**	**22**			**340**

SEMESTER II

Course Code	Course title	Nature of Course	Credit of Course	Class hour/week	Evaluation		Total
					Internal	Semester End	
CA-MJ-T-2	Digital System Design	Major	4	4	15	60	75
CA-MJ-P-2	Digital System Design Lab	Major	2	3	Problem: 60, Viva: 10, Lab Notebook: 5		75
CA-MI-T-2	Database Management Systems	Minor	3	3	10	25	35
CA-MI-P-2	Database Management Systems Lab	Minor	1	2	Problem + Viva =15		15
CA-MU-P-2	Office Automation	Multidisciplinary Course	3	3	10	35	45
AECC-1		Ability Enhancement Course	4	4	10	40	50
CS-SEC-P- 2	Web Development and Applications Lab	Skill Enhancement Course	3	3	Problem: 35, Viva: 5, Lab Notebook: 5		45
		Summer Course	4	50 (Total contact hour with organization			
Total			**20**	**22**			**340**

SEMESTER III

Course Code	Course title	Nature of Course	Credit of Course	Class hour/week	Evaluation		Total
					Internal	Semester End	
CA-MJ-T-3	Computer Organization & Architecture	Major	6	4	15	60	75
CA-MI-T-3	Computer Fundamentals and Programming using C	Minor- (theory)	3	3	10	25	35
CA-MI-P-3	Programming using C Lab	Minor-(Practical)	1	2	Problem + Viva: 15		15
CA-MU-T-3	AI for Everyone	Multidisciplinary Course	3	3	10	35	45
		Ability Enhancement Course					
CA-SEC-P-3	Data Analysis through Python/R(Lab)	Skill Enhancement Course	3	3	Problem: 35, Viva: 5, Lab Notebook: 5		45
		Value Added Course	4	4	10	40	50
			20	19			265

SEMESTER IV

Course Code	Course title	Nature of Course	Credit of Course	Class hour/week	Evaluation		Total
					Internal	Semester End	
CA-MJ-T-4	Object Oriented Programming	Major- (theory)	4	4	15	60	75
CA-MJ-P-4	Object Oriented Programming using C++ Lab	Major-(practical)	2	3	Problem: 60, Viva: 10, Lab Notebook: 5		75
CA-MJ-T-4	Computer Networking	Major- (theory)	4	4	15	60	75
CA-MJ-P-4	Computer Networking Lab	Major-(practical)	2	3	Problem: 60, Viva: 10, Lab Notebook: 5		75
CA-MI-T-4	Database Management Systems	Minor- (theory)	3	3	10	25	35
CA-MI-P-4	Database Management Systems Lab	Minor-(practical)	1	2	Problem + Viva: 15		15
		Ability Enhancement Course					
		Summer Course	4	50 (Total contact hour with organization)	Problem: 20, Viva: 20, Lab Notebook: 10		50
Total			20	19			400

SEMESTER V

Course Code	Course title	Nature of Course	Credit of Course	Class hour/week	Evaluation		Total
					Internal	Semester End	
CA-MJ-T-5	Algorithm and Data Structure	Major- (theory)	4	4	15	60	75
CA-MJ-P-5	Algorithm and Data Structure using C++ Lab	Major-(practical)	2	3	Problem: 60, Viva: 10, Lab Notebook: 5		75
CA-MJ-T-6	Database Management System	Major- (theory)	4	4	15	60	75
CA-MJ-P-6	Database Management System Lab	Major-(practical)	2	3	Problem: 60, Viva: 10, Lab Notebook: 5		75
CA-MI-T-5	Computer Fundamentals and Programming using C	Minor I- (theory)	3	3	15	25	40
CA-MI-P-5	Programming using C Lab	Minor I-(practical)	1	2	Problem + Viva: 10		10
CA-MI-T-6	Database Management Systems	Minor II- (theory)	3	3	15	25	40
CA-MI-P-6	Database Management Systems Lab	Minor II-Practical)	1	2	Problem + Viva: 10		10
Total			**20**	**24**			**400**

SEMESTER VI

Course Code	Course title	Nature of Course	Credit of Course	Class hour/week	Evaluation		Total
					Internal	Semester End	
CA-MJ-T-7	Graphics and Multimedia	Major- (theory)	4	4	15	60	75
CA-MJ-P-7	Graphics and Multimedia Lab	Major-(practical)	2	3	Problem: 60, Viva: 10, Lab Notebook: 5		75
CA-MJ-T-8	Object Oriented Programming Java With Web Application	Major- (theory)	4	4	15	60	75
CA-MJ-P-8	Object Oriented Programming Lab	Major-(practical)	2	3	Problem: 60, Viva: 10, Lab Notebook: 5		75
CA-MJ-T-9	Software Engineering	Major- (theory)	4	4	15	60	75
CA-MJ-P-9	Software Engineering Lab	Major-(practical)	2	2	Problem: 60, Viva: 10, Lab Notebook: 5		75
		Outreach/Internship	2	3			25
Total			**20**	**23**			**475**

SEMESTER VII							
Course Code	Course title	Nature of Course	Credit of Course	Class hour/week	Evaluation		Total
					Internal	Semester End	
CA-MJ-T-10	Java With Web Application	Major- (theory)	4	4	15	60	75
CA-MJ-P-10	Java With Web Application Lab	Major-(practical)	2	3	Problem: 60, Viva: 10, Lab Notebook: 5		75
CA-MJ-T-11	Computer Networking	Major- (theory)	4	4	15	60	75
CA-MJ-P-11	Computer Networking Lab	Major-(practical)	2	3	Problem: 60, Viva: 10, Lab Notebook: 5		75
CA-MJ-T-12	Unix and Shell Programming	Major- (theory)	4	4	15	60	75
CA-MJ-P-12	Unix and Shell Programming Lab	Major-(practical)	2	3	Problem: 60, Viva: 10, Lab Notebook: 5		75
CA-MI-T-7	Computer Fundamentals and Programming using C	Minor I- (theory)	3	3	15	25	40
CA-MI-P-7	Computer Fundamentals and Programming using C Lab	Minor I-(practical)	1	2	Problem + Viva: 10		10
CA-MI-T-8	Python Programming	Minor II- (theory)	3	3	15	25	40
CA-MI-P-8	Python Programming Lab	Minor I-(practical)	1	2	Problem + Viva: 10		10
Total			26	31			500

SEMESTER VIII Honours without Research							
Course Code	Course title	Nature of Course	Credit of Course	Class hour/week	Evaluation		Total
					Internal	Semester End	
CA-MJ-T-13	Data Mining & Data Warehousing	Major- (theory)	3	3	15	25	40
CA-MJ-P-13	Data Mining & Data Warehousing Lab	Major-(practical)	1	2	Problem + Viva: 10		10
CA-MJ-T-14	Cloud Computing	Major- (theory)	3	3	15	25	40
CA-MJ-P-14	Cloud Computing Lab	Major-(practical)	1	2	Problem + Viva: 10		10
CA-MJ-T-15	Research Methodology	Major- (theory)	3	3	15	25	40
CA-MJ-P-15	Research Methodology Lab	Major-(practical)	1	2	Problem + Viva: 10		10
CA-HWoR-T-1	Data Science	HWoR-(theory_)	4	4	15	60	75
CA-HWoR-P-1	Data Science Lab	HWoR-(practical_)	2	3	Problem: 60, Viva: 10, Lab Notebook: 5		75
CA-HWoR-T-2	Cryptography and Network Security	HWoR-(theory_)	4	4	15	60	75
CA-HWoR-P-2	Cryptography and Network Security Lab	HWRo-(Practical_)	2	3	Problem: 60, Viva: 10, Lab Notebook: 5		75
Total			24	29			450

*HWoR-Honours without Research

Course Code	Course title	Nature of Course	Credit of Course	Class hour/week	Evaluation		Total
					Internal	Semester End	
CA-MJ-T-16	Data Mining & Data Warehousing	Major- (theory)	3	3	15	25	40
CA-MJ-P-16	Data Mining & Data Warehousing Lab	Major-(practical)	1	2	Problem + Viva: 10		10
CA-MJ-T-17	Cloud Computing	Major- (theory)	3	3	15	25	40
CA-MJ-P-17	Cloud Computing Lab	Major-(practical)	1	2	Problem + Viva: 10		10
CA-MJ-T-18	Research Methodology	Major- (theory)	3	3	15	25	40
CA-MJ-P-18	Research Methodology Lab	Major-(practical)	1	2	Problem + Viva: 10		10
CA-HWR-T-1	Technical Report writing and IPR	HWR - (theory)	3	3	15	25	40
CA-HWR-P-1	Technical Report writing and IPR Lab	HWR -(practical)	1	2	Problem + Viva: 10		10
CA-D-P-1	Dissertation	Dissertation	8	3	10	35	200
Total			**24**	**15**			**500**

The table is titled: **SEMESTER VIII Honours with Research**

*HWR-Honours with Research

Computer Fundamentals and Programming using C (CA-MJ-T-1) (60L)   **Credit 4**

Introduction to Computer and Problem Solving: Information and Data. Hardware: CPU, Primary and Secondary storage, I/O devices Software: Systems and Application.	3L
Generation of Computers: Super, Mainframe, Mini and Personal Computer. Introduction to Programming Languages: Machine Language, Assembly Language, High Level Language. Problem Solving: Flow Charts, Decision Tables and Pseudo codes.	6L
Number Systems and Codes: Number representation: Weighted Codes, Non-weighted codes, Positional, Binary, Octal, Hexadecimal, Binary Coded Decimal (BCD), Conversion of bases. Complement notions. Binary Arithmetic, Binary Codes: Gray, Alphanumeric, ASCII, EBCDIC; Parity Bits. Single Error-Detecting and Correcting Codes, Hamming Codes, Fixed and Floating Point Arithmetic: Addition, Subtraction, Multiplication and Division	12L
Boolean Algebra: Fundamentals of Boolean Algebra, Switches and Inverters, Functionally Complete Gates (AND, OR, NOT), NAND, NOR. Switching function and Boolean function. De Morgan's theorem, Minterm and Maxterm, Truth table and minimization of switching function up to four variables, Algebraic and K-map method of logic circuit synthesis: Two level and Multi level.	6L
C Language preliminaries: C character set, Identifiers and keywords, Data types, Declarations, Expressions, statements and symbolic constants.	3L
Input-Output: getchar, putchar, scanf, printf, gets, puts, functions.	1L
Pre-processor commands: #include, #define, #ifdef	1L
Operators and expressions: Arithmetic, unary, logical, bit-wise, assignment and conditional operators	2L
Storage types: Automatic, external, register and static variables.	2L
Functions: Defining and accessing, passing arguments, Function prototypes, Recursion, Library functions, Static functions	4L
Arrays: Defining and processing, Passing arrays to a function, Multi-dimensional arrays Strings: Defining and operations on strings.	4L
Pointers: Declarations, Passing pointers to a function, Operations on pointers, Pointer Arithmetic, Pointers and arrays, Arrays of pointers function pointers.	4L
Structures: Defining and processing, Passing to a function, Unions, typedef, array of structure, and pointer to structure	4L
File structures: Definitions, concept of record, file operations: Storing, creating, retrieving, updating Sequential, relative, indexed and random-access mode, Files with binary mode (Low level), performance of Sequential Files, Direct mapping techniques: Absolute, relative and indexed sequential files (ISAM) concept of index, levels of index, overflow of handling.	6L
File Handling: File operation: creation, copy, delete, update, text file, binary file	2L

Recommended Books:

1. P. K. Sinha & Priti Sinha , ―Computer Fundamentals‖, BPB Publications, 2007.
2. Dr. Anita Goel, Computer Fundamentals, Pearson Education, 2010.
3. Kernighan, Brian W., and Dennis M. Ritchie.The C programming language. 2006.
4. Schildt, Herbert, and C. Turbo. "C: the complete reference, Osborne." (2000).
5. Balagurusamy, E. programming in ANSI C. Tata McGraw-Hill Education, 2002.
6. Kanetkar, Yashavant P. Let us C. BPB publications, 2016.

Programming using C Lab (CA-MJ-P-1)   **Credit – 2**

Introduction: History, Basic Structure, Algorithms, Structured programming constructs. C Programming elements: Character sets, Keywords, Constants, Variables, Data Types, Operators- Arithmetic, Relational, Logical and Assignment; Increment and Decrement and Conditional, Operator Precedence and Associations; Expressions, type casting. Comments, Functions, Storage Classes, Bit manipulation, Input and output. C Preprocessor: File inclusion, Macro substitution. Statements: Assignment, Control statements- if, ifelse, switch, break, continue, goto, Loops-while, do-while, for. Functions: argument passing, return statement, return values and their types, recursion Arrays: String handling with arrays, String handling functions. Pointers: Definition and initialization, Pointer arithmetic, Pointers and arrays, String functions and manipulation, Dynamic storage allocation. User defined Data types: Enumerated data types, Structures. Structure arrays, Pointers to Functions and Structures, Unions. File Access: Opening, Closing, I/O operations.

Computer Fundamentals and Programming using C (CA-MI-T-1) (40L)   **Credit – 3**

Introduction to Computer and Problem Solving: Information and Data. Hardware: CPU, Primary and Secondary storage, I/O devices Software: Systems and Application	3L
Generation of Computers: Super, Mainframe, Mini and Personal Computer. Introduction to Programming Languages: Machine Language, Assembly Language, High Level Language. Problem Solving: Flow Charts, Decision Tables and Pseudo codes.	6L
Number Systems and Codes: Number representation: Weighted Codes, Non-weighted codes, Positional, Binary, Octal, Hexadecimal, Binary Coded Decimal (BCD), Conversion of bases. Complement notions. Binary Arithmetic, Binary Codes: Gray, Alphanumeric, ASCII, EBCDIC; Parity Bits. Single Error-Detecting and Correcting Codes, Hamming Codes, Fixed and Floating Point Arithmetic: Addition, Subtraction, Multiplication and Division	12L

Boolean Algebra: Fundamentals of Boolean Algebra, Switches and Inverters, Functionally Complete Gates (AND, OR, NOT), NAND, NOR. Switching function and Boolean function. De Morgan's theorem, Minterm and Maxterm, Truth table and minimization of switching function up to four variables, Algebraic and K-map method of logic circuit synthesis: Two level and Multi level.	6L
C Language preliminaries: C character set, Identifiers and keywords, Data types, Declarations, Expressions, statements and symbolic constants.	3L
Input-Output: getchar, putchar, scanf, printf, gets, puts, functions. Pre-processor commands: #include, #define, #ifdef	5L
Operators and expressions: Arithmetic, unary, logical, bit-wise, assignment and conditional operators	5L

Programming using C Lab (CA-MI-P-1)   **Credit – 1**

Introduction: History, Basic Structure, Algorithms, Structured programming constructs. C Programming elements: Character sets, Keywords, Constants, Variables, Data Types, Operators- Arithmetic, Relational, Logical and Assignment; Increment and Decrement and Conditional, Operator Precedence and Associations; Expressions, type casting. Comments, Functions, Storage Classes, Bit manipulation, Input and output.
Functions: argument passing, return statement, return values and their types, recursion Arrays: String handling with arrays, String handling functions. Pointers: Definition and initialization, Pointer arithmetic, Pointers and arrays, String functions and manipulation, Dynamic storage allocation.
C Preprocessor: File inclusion, Macro substitution. Statements: Assignment, Control statements- if, ifelse, switch, break, continue, goto, Loops-while, do-while, for.

Computer Science for Beginners (CA-MU-T-1) (40L)   **Credit 3**

Introduction to Computer and Problem Solving: Information and Data Hardware: CPU, Primary and Secondary storage, Cache Memory, I/O devices, Bus structure, BIOS Software: Systems and Application. Generation of Computers: Super, Mainframe, Mini and Personal Computer, Work stations, Parallel machines (concept only). Introduction to Programming Languages: Machine Language, Assembly Language, High Level Language. Problem Solving: Flow Charts, Decision Tables and Pseudo codes. System Software: Classifications- Operating Systems (OS); Translators – Compilers and Interpreters, Preprocessors, Assemblers, Loaders, Linkers, Line and Screen Editors, other utilities. Virus: Concept, Detection and Protection	20L
Number representation: Weighted Codes, Non-weighted codes, Positional, Binary, Octal, Hexadecimal, Binary Coded Decimal (BCD), Conversion of bases. Complement notions: 1's complement, 2's complement, Binary Arithmetic, Binary Codes: Gray, Alphanumeric, ASCII, EBCDIC; Single Error-Detecting and Correcting Codes, Hamming Codes, Fixed point, Floating point representation.	10L
Fundamentals of Boolean Algebra, Switches and Inverters, Functionally Complete Gates (AND, OR, NOT), NAND, NOR, Boolean Function. De Morgan's Theorem, Min-term, Max term, Truth tables and minimization of Logic expression up to four variables, Boolean Algebraic and K-map methods of Logic circuit synthesis, two-level and multi-level.	10L

Text/ Reference Books:
1. Digital Circuits, Vol - I & II, D. Ray Chaudhuri, Platinum Publishers.
2. Digital Systems - Principle & Applications, Tocci & Widmer, EEE.
3. Digital Logic & State Machine Design, Comer, Oxford.
4. Digital Principle & Applications, Malvino & Leach, McGraw Hill.
5. Digital Design, Mano, PHI.
6. Computer Fundamentals, Anita Goel, Pearson Education.
7. Introduction to Computer Science, P.K.Sinha, P.Sinha, BPB Publication.

Office Automation Lab (CA-SEC-P-1) (40L)   **Credit 3**

Word Processing: Document creation, saving, editing; Formatting text and paragraphs; header and footers; clipart, tables; tools, Inserting images, files; mail merge; margins; Hyphenation; page setups; OLE; index and references; comments; templates; macros.	8L
Spreadsheet: Workbook, worksheets, cell; address; entering, editing, formatting, filtering, sorting worksheet data; printing; charts; functions and formula; macros; importing, exporting files.	12L
Presentation: Slides; formatting; wizard, layout; word art; animation	4L
Web Web page design can be taught in the laboratory classes by using HTML. Basic Tags and Document structure, HTML Tags, Head Tags, Title Tags, Introduction to HTML and Web design, How to create simple Web page, How to format text, Create Table, Adding Web link and Images, Forms, Adding styles and classes to web pages, Borders and Background, Simple Fine Sharing, Internet Information Services, Peer to Peer Networking.	16L

Value Added Course :

Digital System Design (CA-MJ-T-2) (60L)   **Credit 4**

Combinational Circuits: Realization of AND and OR Gates using diodes and NOT Gate using transistors, Standard Gate Assemblies, IC chips packaging nomenclature, Half and Full Adder(3 bits), Multi-bit adders – Ripple carry and Carry Look Ahead Adder, Adder/subtractor, BCD-Adder, Data selectors/multiplexers – expansions, reductions, function realization, universal function realization, multi-function realization, Decoders/Demultiplexers : function realization, De-multiplexer and function realization, Encoder, Priority Encoder, Parity bit Generator/checker, Gray Code Generator, Code Converters, I/O features of BCD to 7-segment LED decoder/driver(7447/7448), Seven segment display unit, Comparators.	25L
Sequential Circuits: Model of Sequential computing, Difference between Combinational and Sequential circuit, RS-Latch: using NAND and NOR Gates, RS Latch as a Static RAM Cell, Problems of Basic Latch circuits, Digital Clock – Duty Cycle, Rising time, Falling time, Clocked Flip Flops - SR, JK, D, T, Level Trigger and Edge Trigger, Excitation Functions of each flip-flops, Flip-flops with Preset and Clear, Application of Flip-flops: Asynchronous Counter (UP/DOWN) up to 4 bit counter, Mod – n Counter, Synchronous Counters – different mod counters, Ring counter, Registers: Registers with serial and parallel load, Shift Registers.	25L
Data Converter: D/A Conversion principle using basic circuit, R-2R Ladder circuit, Counter based A/D converter, Successive approximation method for A/D conversion. DTL and TTL NAND gate circuits and its operations, Fan in & Fan out, Noise margin, SSI, MSI, LSI, and VLSI classifications.	10L

Recommended Books:
(1) Digital Circuits, Combinational Circuit, Vol. 1 by D. Roy Choudhuri, Platinam Publication.
(2) Digital Circuits, Sequential Circuit, Vol. 2 by D. Roy Choudhuri, Platinam Publication.
(3) Digital Logic and Computer Design by M.Morris Mano, PHI
(4) Digital Principle and Applications by Malvino & Leach, TMH
(5) Digital Systems Principles and Applications by Ronal J. Tocci and Neal S. Widmer, PHI
(6) Digital Fundamentals by Floyd, Pearson Education

Digital System Design Lab (CA-MJ-P-2)   **Credit 2**

Combinational Circuits: 1) Implement Half Adder/Half Subtractor / Full Adder / Full Subtractor using Logic Gates. Realize a logic function using basic/universal gates in SOP and POS form. Study the functionalities of 7483 and design a BCD adder using 7483 or equivalent. 2) Design a 4 bit 2's complement adder – subtractor unit using 7483 or equivalent and XOR gates. 3) Design a circuit to convert BCD numbers to corresponding gray codes. 4) Design a 4:1 MUX using NAND gates. Study of 74153 and 74151. Design Full Adder / Subtractor using MUX. 5) Design a 2:4 decoder using NAND gates. Study of 74155 and 74138. Design Full Adder / Subtractor using decoders. 6) Design a parity generator/checker using basic gates. 7) Design magnitude comparator using basic/universal gates. Study of 7485. 8) Design a seven segment display unit.
Sequential Circuits: 1) Realize S-R, D, J-K and T flip-flop using basic gates. (Study the undefined state in S-R flip-flop). 2) Study the functional characteristic of IC 74194 with emphasis on timing diagram. 3) Design Asynchronous and Synchronous counters. (Mod-8, Mod-10 up counter)

4) Study the functional characteristics of RAM IC chip. Study of open collector and tri-state output. Horizontal expansion of RAM chips by cascading. (Use 74189, 7489, or any available chip).

Database Management Systems (CA-MI-T-2) (40L)   Credit 3

Introduction Concept & Overview of DBMS, Data Models, Database Languages, Database Administrator, Database Users, Three Schema architecture of DBMS. Characteristics of database approach, data models, database system architecture and data independence.	4L
Entity Relationship (ER) Modelling Basic concepts, Design Issues, Mapping Constraints, Keys, Entity-Relationship Diagram, Weak Entity Sets, Extended E-R features.	4L
Relation data model Structure of relational Databases, Relational Algebra, Relational Calculus, Extended Relational Algebra Operations, Views, Modifications Of the Database	15L
SQL and Integrity Constraints Concept of DDL, DML, DCL. Basic Structure, Set operations, Aggregate Functions, Null Values, Domain Constraints, Referential Integrity Constraints, assertions, views, Nested Subqueries, Database security application development using SQL, Stored procedures and triggers.	10L
Relational Database Design Functional Dependency, Different anomalies in designing a Database., Normalization using functional dependencies, Decomposition, Boyce-Codd Normal Form, 3NF	7L

Recommended Books:
1. Henry F. Korth and Silberschatz Abraham, ―Database System Concepts‖, Mc.Graw Hill.
2. Elmasri Ramez and Novathe Shamkant, ―Fundamentals of Database Systems‖, Benjamin Cummings Publishing. Company.
3. Ramakrishnan: Database Management System , McGraw-Hill
5. Date C. J., ―Introduction to Database Management‖, Vol. I, II, III, Addison Wesley.
6. Ullman JD., ―Principles of Database Systems‖, Galgottia Publication.

Database Management Systems Lab (CA-MI-P-2)   Credit 1

Structured Query Language (SQL) 1. Creating Database: Creating a Database Creating a Table Specifying Relational Data Types Specifying Constraints Creating Indexes 2. Table and Record Handling: INSERT statement Using SELECT and INSERT together DELETE, UPDATE, TRUNCATE statements DROP, ALTER statements 3. Retrieving Data from a Database: The SELECT statement Using the WHERE clause Using Logical Operators in the WHERE clause

Using IN, BETWEEN, LIKE , ORDER BY, GROUP BY and HAVING clasue Using Aggregate Functions Combining Tables Using JOINS Subqueries 4. Database Management Creating Views Creating Column Aliases Creating Database Users Using GRANT and REVOKE	

Office Automation (CA-MU-P-2) (40L)   **Credit 3**

Word Processing: Document creation, saving, editing; Formatting text and paragraphs; header and footers; clipart, tables; tools, Inserting images, files; mail merge; margins; Hyphenation; page setups; OLE; index and references; comments; templates; macros.	8L
Spreadsheet: Workbook, worksheets, cell; address; entering, editing, formatting, filtering, sorting worksheet data; printing; charts; functions and formula; macros; importing, exporting files.	12L
Presentation: Slides; formatting; wizard, layout; word art; animation	4L
Web Web page design can be taught in the laboratory classes by using HTML. Basic Tags and Document structure, HTML Tags, Head Tags, Title Tags, Introduction to HTML and Web design, How to create simple Web page, How to format text, Create Table, Adding Web link and Images, Forms, Adding styles and classes to web pages, Borders and Background,	16L

AECC1 (Ability Enhancement Course):

Web Development and Applications Lab (CS-SEC-P- 2) (40L)   **Credit 3**

Introduction to Web development Overview of web technologies and the role of HTML and CSS, understanding the structure of a web page, introduction to web browsers and developer tools	3L
HTML Fundamentals Introduction to HTML tags and elements, creating headings, paragraphs, lists, and links, working with images and multimedia content, creating forms for user input	3L
CSS basics Introduction to CSS and its role in web page styling, selectors, properties, and values, applying inline, internal, and external style sheets, formatting text, backgrounds, and borders.	3L
CSS Layout and box model Understanding the box model and its impact on layout, working with margins, padding, and borders, positioning elements using floats, positioning properties, and flexbox, creating responsive layouts with media queries.	2L
Typography and colors Styling text with fonts, sizes, weights, and styles, formatting text using CSS properties, understanding color models and applying colors to elements.	2L
Images and multimedia Working with images: sizing, aligning, and optimizing, incorporating videos and audio into web pages, implementing responsive images and media.	2L

CSS Selectors and specificity Understanding CSS selectors and specificity, applying styles to specific elements and classes, using pseudo-classes and pseudo-elements.	5L
Responsive Web design Introduction to responsive design principles, creating fluid layouts using CSS media queries, adapting web pages for different screen sizes and devices.	4L
CSS Frameworks and libraries Overview of popular CSS frameworks (e.g., Bootstrap, Foundation), using pre-built CSS components and grids, customizing and integrating CSS frameworks into web projects.	5L
Web development best practices Organizing and structuring code files and directories, validating HTML and CSS code, optimizing web pages for performance, introduction to version control with Git.	3L
Building and deploying a website Planning and designing a basic website structure, Implementing HTML and CSS to create the website, testing and debugging the website across different browsers, deploying the website to a local host/web server	8L

Recommended Books:
1. Mastering HTML, CSS & Java Script Web Publishing, Laura Lemay, Rafe Colburn, Jennifer Kyrnin, BPB Publication.
2. Web designing and development, Satish Jain, BPB Publications.
3. HTML & CSS: The complete reference, Thomas Powell, McGraw Hill education.
4. Web programming with HTML5, CSS and JavaScript, John Dean, Joneas and Bartlet learning.
5. Sams Teach Yourself HTML, CSS, and JavaScript All in One, Julie C Meloni, Pearson Education.
6. Learning Web App development, Semmy Purewal, O'Reilly.

Summer Course (Credit 4)

Semester – III

Computer Organization & Architecture (CA-MJ-T-3) (60L)   **Credit 6**

Logic gates, Boolean algebra, combinational circuits, circuit simplification, flip-flops and sequential circuits, decoders, multiplexers, registers, counters and memory units.	9L
Number systems, complements, fixed and floating point representation, character representation, addition, subtraction, magnitude comparison, multiplication and division algorithms for integers	12L
Computer registers, bus system, instruction set, timing and control, instruction cycle, memory reference, input-output and interrupt, Interconnection Structures, Bus Interconnection design of basic computer.	10L
Register organization, arithmetic and logical micro-operations, stack organization, micro programmed control. Instruction formats, addressing modes, instruction codes, machine language, assembly language, input output programming, RISC, CISC architectures, pipelining and parallel architecture.	9L
Cache memory, Associative memory, mapping	10L
Input / Output: External Devices, I/O Modules, Programmed I/O, Interrupt-Driven I/O, Direct Memory Access, I/O Channels.	10L

Recommended Books:
1. M. Mano, Computer System Architecture, Pearson Education 1992
2. A. J. Dos Reis, Assembly Language and Computer Architecture using C++ and JAVA, Course Technology, 2004

3. W. Stallings, Computer Organization and Architecture Designing for Performance, 8th Edition, Prentice Hall of India,2009
4. M.M. Mano , Digital Design, Pearson Education Asia,2013
5. Carl Hamacher, Computer Organization, Fifth edition, McGrawHill, 2012.

Computer Fundamentals and Programming using C (CA-MI-T-3)   **Credit 3**

Programs on the following topics: Introduction: History, Basic Structure, Algorithms, Structured programming constructs. C Programming elements: Character sets, Keywords, Constants, Variables, Data Types, Operators- Arithmetic, Relational, Logical and Assignment; Increment and Decrement and Conditional, Operator Precedence and Associations; Expressions, type casting. Comments, Functions, Storage Classes, Bit manipulation, Input and output. C Preprocessor: File inclusion, Macro substitution. Statements: Assignment, Control statements- if, ifelse, switch, break, continue, goto, Loops-while, do-while, for. Functions: argument passing, return statement, return values and their types, recursion Arrays: String handling with arrays, String handling functions. Pointers: Definition and initialization, Pointer arithmetic, Pointers and arrays, String functions and manipulation, Dynamic storage allocation. User defined Data types: Enumerated data types, Structures. Structure arrays, Pointers to Functions and Structures, Unions. File Access: Opening, Closing, I/O operations.

Programming using C Lab (CA-MI-P-3)   **Credit 1**
Assignments are to be added based on the topics mentioned in the theory

AI for Everyone (CA-MU-T-3) (40L)   **Credit 3**

Introduction to Artificial Intelligence ☐ Definition and scope of AI ☐ Historical overview and key milestones ☐ Differentiating AI from human intelligence	6L
AI Subfields and Technologies ☐ Machine learning: Supervised, unsupervised, and reinforcement learning ☐ Deep learning and neural networks ☐ Natural language processing (NLP) and computer vision	6L
Applications of AI ☐ AI in healthcare: Diagnosis, treatment, and medical imaging ☐ AI in finance: Fraud detection, algorithmic trading, and risk assessment ☐ AI in transportation: Autonomous vehicles and traffic optimization ☐ AI in customer service and chatbots ☐ AI in education: Personalized learning and intelligent tutoring systems	8L
Ethical and Social Implications of AI ☐ Bias and fairness in AI systems ☐ Privacy and data protection concerns ☐ Impact of AI on employment and the workforce ☐ AI and social inequality	5L
Other Important Issues ☐ Ethical guidelines and responsible AI practices ☐ AI and Innovation ☐ Emerging trends and future directions in AI	15L

☐ AI and creativity: Generative models and artistic applications

AECC:
Data Analysis through Python/R(Lab) (CA-SEC-P-3)   **Credit 3**

Use Python 3.6 or above. Use a text editor sensitive to whitespace like Notepad++, gedit, vim,
Sublime Text, and NOT Notepad / WordPad. The following exercises are suggestive in nature.

1. The Interpreter as a calculator. Basic arithmetic operations. Introduction to the simple numeric data types – integers, floating point numbers, Boolean, complex numbers. Inter conversion of data types.
a. Use the Python prompt as a basic calculator. Explore the order of operations using parentheses.
b. Explore the various functions in the math module. Eg: find GCD of two numbers, area and perimeter of circle using math.pi, etc.
c. Exploring the complex data type and their operations, eg: finding the modulus and phase angle of a complex number.
d. The print function – Printing values. Repeat the previous experiments now using the print function
2. Basic user interactions using the print() and input() functions.
a. Write a simple python script using the print function in a text editor, save it with the extension ".py". Run it in the terminal / command prompt.
b. Take input two strings from the user, and print the first one twice, and the other one thrice.
c. Ask the user to enter two numbers, and output the sum, product, difference, and the GCD.
d. More programs that test concepts learned in week 1 which involves the usage of the print and input functions.
3. Strings, List, Tuples, the re (regular expression) module
a. Ask the user for two strings, print a new string where the first string is
reversed, and the second string is converted to upper case. Sample strings:
"Pets", "party", output: "steP PARTY". Only use string slicing and +
operators.
b. From a list of words, join all the words in the odd and even indices to form
two strings. Use list slicing and join methods.
c. Simulate a stack and a queue using lists. Note that the queue deletion operation won't run in O(1) time.
d. Explore the 're' module, especially re.split, re.join, re.search and re.match methods.
4. Conditionals, looping constructs, and generators
a. Use list comprehension to find all the odd numbers and numbers divisible by
3 from a list of numbers.
b. Using while loops to do Gaussian addition on a list having an even number of numbers. Print each partial sum. Eg: if the list is [1, 2, 3, 4, 5, 6], the program should output "1 + 6", "2 + 5", and "3+4" in separate lines, and the result of the addition "21". Extend it to handle lists of odd length.
c. Primarily testing using for and while loops.
d. Use (c) to generate a list of primes within a user-given range.
e. Explore the 'key' function of sum( ), min( ), max( ), and sort( ) functions using lambdas.
5. User defined functions
a. Implement popular sorting algorithms like quick sort and merge sort to sort lists of numbers.
b. Implement the Pascal's triangle.
c. Three positive integers a, b, and c are Pythagorean triples if $a2+ b2 =c2$. Write
a function to generate all Pythagorean triples in a certain range.
d. Write two functions that simulate the toss of a fair coin, and the roll of an unbiased 'n' sided die using the random module.
e. Like (d), but now the coin and the die are not fair, with each outcome having
a given probability.
6. File handling, sys, pickle and csv modules
a. Basic file operations. Explore the different file modes.
b. Emulate the unix 'cp', 'grep', 'cat' programs in Python. In each case, the user

should pass the arguments to the program as command line arguments.

c. Use pickle for persistent storage of variables

7. Sets and dictionaries

a. Use sets to de-duplicate a list of numbers, and a string such that they contain only the unique elements

b. Use the set union and intersection operations to implement the Jaccard and Cosine similarity of two sets.

c. Use dictionaries to count the word and letter occurrences in a long string of text.

d. Invert a dictionary such the previous keys become values and values keys. Eg: if the initial and inverted dictionaries are d1 and d2, where d1 = {1: 'a', 2: 'b', 3: 120}, then d2 = {'a': 1, 2: 'b', 120: 3}.

e. What if the values in (d) are not immutable? Use frozensets. For repeated values, use lists. Eg: if d1 = {1: 'a', 2: 'a', 4: [1, 2]}, then d2 = {'a': [1, 2], frozenset([1, 2]): 4}.

f. Write a function to generate the Fibonacci numbers in (a) exponential time using the naïve algorithm, and (b) in linear time using dynamic programming (memorization) with a dictionary.

8. Object Oriented Programming

a. Create a 'Graph' class to store and manipulate graphs. It should have the following functions:

i. Read an edge list file, where each edge (u, v) appears exactly once in the file as space separated values.

ii. Add and remove nodes and edges

iii. Print nodes, and edges in a user readable format

iv. Computes basic statistics of the graph like degree distribution, clustering coefficient, and the number of connected components.

v. Finding all the neighbors of a node

vi. Finding all the connected components and storing them as individual graph objects inside the class

vii. Finding single source shortest paths using Breadth First Search

b. Make a 'DiGraph' class to handle directed graphs which inherits from the

'Graph' class. In addition to all of the functionalities of (a), it should support the following operations

i. Finding the predecessors and successors of a node

ii. Creating a new 'DiGraph' object where all the edges are reversed.

iii. Finding the strongly connected components

c. Extend (a) and (b) to handle weighted graphs, and implement Dijkstra's and Floyd-Warshall algorithms to compute the single source and all pairs shortest paths.

d. Use the graph containers in (a), (b), and (c) to implement additional graph algorithms.

Reference Books

1. Introduction to Computation and Programming Using Python: With Application to Understanding Data, Guttag, John V. MIT Press.
2. Learn Python 3 the Hard Way: A Very Simple Introduction to the Terrifyingly Beautiful World of Computers and Code, Shaw, Zed A, Addison-Wesley Professional.
3. Think Python 2e. Green Tea Books, Downey, Allen B.
4. Practical Programming: An Introduction to Computer Science Using Python 3.6. Pragmatic Bookshelf, Gries, Paul, Jennifer Campbell, and Jason Montojo.

Value Added Course:

Object Oriented Programming (CA-MJ-T-4) (60L)   Credit 4

Concept of OOPs Difference with procedure-oriented programming, Data abstraction and information hiding: Objects, Classes, methods.	2L
Introduction to Java Java Architecture and Features, Understanding the semantic and syntax differences between C++ and Java, Compiling and Executing a Java Program, Variables, Constants, Keywords Data Types, Operators (Arithmetic, Logical and Bitwise) and Expressions, Comments, Doing Basic Program Output, Decision Making Constructs (conditional statements and loops) and Nesting, Java Methods (Defining, Scope, Passing and Returning Arguments, Type Conversion and Type and Checking, Built-in Java Class Methods).	4L
Arrays, Strings and I/O Creating & Using Arrays (One Dimension and Multi-dimensional), Referencing Arrays Dynamically, Java Strings: The Java String class, Creating & Using String Objects, Manipulating Strings, String Immutability & Equality, Passing Strings To & From Methods, String Buffer Classes. Simple I/O using System.out and the Scanner class, Byte and Character streams, Reading/Writing from console and files.	8L
Object-Oriented Programming Overview Principles of Object-Oriented Programming, Defining & Using Classes, Controlling Access to Class Members, Class Constructors, Method Overloading, Class Variables & Methods, Objects as parameters, final classes, Object class, Garbage Collection.	4L
Inheritance, Interfaces, Packages, Enumerations, Autoboxing and Metadata Single Level and Multilevel, Method Overriding, Dynamic Method Dispatch, Abstract Classes, Interfaces and Packages, extending interfaces and packages, Package and Class Visibility, Wrapper Classes, Autoboxing/Unboxing, Enumerations and Metadata.	10L
Understanding utility of structures and unions, Declaring, initializing and using simple structures and unions, manipulating individual members of structures and unions, Array of Structures, Individual data members as structures, Passing and returning structures from functions, Structure with union as members, Union with structures as members. Understanding a Pointer Variable, Simple use of Pointers (Declaring and Dereferencing Pointers to simple variables), Pointers to Pointers, Pointers to structures, Problems with Pointers, passing pointers as function arguments, returning a pointer from a function, using arrays as pointers, Passing arrays to functions. Pointers vs. References, Declaring and initializing references, Using references as function arguments and function return values	12L
Exception types, uncaught exceptions, throw, built-in exceptions, creating your own exceptions; Multi-threading: The Thread class and Runnable interface, creating single and multiple threads, Thread prioritization, synchronization and communication, suspending/resuming threads. Differentiating between static and dynamic memory allocation, use of malloc, calloc and free functions, use of new and delete operators, storage of variables in static and dynamic memory allocation.	15L
File I/O, Preprocessor Directives Opening and closing a file (use of fstream header file, ifstream, ofstream and fstream classes), Reading and writing Text Files, Using put(), get(), read() and write() functions, Random access in files, Understanding the Preprocessor Directives (#include, #define, #error, #if, #else, #elif, #endif, #ifdef, #ifndef and #undef), Macros	5L

Reference Books

Java: The Complete Reference, Herbert Schildt, McGraw-Hill Education.

HerbtzSchildt, "C++: The Complete Reference", Fourth Edition, McGraw Hill.2003

BjarneStroustrup, "The C++ Programming Language", 4th Edition, Addison-Wesley , 2013.

BjarneStroustroup, "Programming -- Principles and Practice using C++", 2nd Edition, Addison-Wesley 2014.

E Balaguruswamy, "Object Oriented Programming with C++", Tata McGraw-Hill Education, 2008.

Paul Deitel, Harvey Deitel, "C++ How to Program", 8th Edition, Prentice Hall, 2011.

John R. Hubbard, "Programming with C++", Schaum's Series, 2nd Edition, 2000.

Andrew Koeni, Barbara, E. Moo, "Accelerated C++", Published by Addison-Wesley , 2000.

Scott Meyers, "Effective C++", 3rd Edition, Published by Addison-Wesley, 2005.

Harry, H. Chaudhary, "Head First C++ Programming: The Definitive Beginner's Guide", First Create space Inc, O-D Publishing, LLC USA.2014

Walter Savitch, "Problem Solving with C++", Pearson Education, 2007.

Stanley B. Lippman, JoseeLajoie, Barbara E. Moo, "C++ Primer", Published by AddisonWesley, 5th Edition, 2012 7.

Programming with JAVA by John R. Hubbard, Schaum's Series.

Object Oriented Programming using C++ Lab (CA-MJ-P-4)   **Credit 2**

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1. Write a Programme to print the sum and product of digits of an integer.

2. Write a Programme to reverse a number.

3. Write a Programme to compute the sum of the first n terms of the following series S = 1+1/2+1/3+1/4+……

4. Write a Programme to compute the sum of the first n terms of the following series S =1-2+3-4+5…………….

5. Write a function that checks whether a given string is Palindrome or not. Use this function to find whether the string entered by user is Palindrome or not.

6. Write a function to find whether a given no. is prime or not. Use the same to generate the prime numbers less than 100.

7. Write a Programme to compute the factors of a given number.

8. Write a macro that swaps two numbers. WAP to use it. |

9. Write a Programme to print a triangle of stars as follows (take number of lines from user):

```
*
***
*****
*******
*********
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10. Write a Programme to perform following actions on an array entered by the user: i) Print the even-valued elements ii) Print the odd-valued elements iii) Calculate and print the sum and average of the elements of array iv) Print the maximum and minimum element of array v) Remove the duplicates from the array vi) Print the array in reverse order The program should present a menu to the user and ask for one of the options. The menu should also include options to re-enter array and to quit the program.

11. Write a Programme that prints a table indicating the number of occurrences of each alphabet in the text entered as command line arguments.

12. Write a program that swaps two numbers using pointers.

13. Write a program in which a function is passed address of two variables and then alter its contents.

14. Write a program which takes the radius of a circle as input from the user, passes it to another function that computes the area and the circumference of the circle and displays the value of area and circumference from the main() function.

15. Write a program to find sum of n elements entered by the user. To write this program, allocate memory dynamically using malloc() / calloc() functions or new operator.

16. Write a menu driven program to perform following operations on strings:

a) Show address of each character in string

b) Concatenate two strings without using strcat function.
c) Concatenate two strings using strcat function.
d) Compare two strings
e) Calculate length of the string (use pointers)
f) Convert all lowercase characters to uppercase
g) Convert all uppercase characters to lowercase
h) Calculate number of vowels
i) Reverse the string
17. Given two ordered arrays of integers, write a program to merge the two-arrays to get an ordered array.
18. Write a Programme to display Fibonacci series (i)using recursion, (ii) using iteration
19. Write a Programme to calculate Factorial of a number (i)using recursion, (ii) using iteration
20. Write a Programme to calculate GCD of two numbers (i) with recursion (ii) without recursion.
21. Create Matrix class using templates. Write a menu-driven program to perform following Matrix operations (2-D array implementation): a) Sum b) Difference c) Product d) Transpose
22. Create the Person class. Create some objects of this class (by taking information from the user). Inherit the class Person to create two classes Teacher and Student class. Maintain the respective information in the classes and create, display and delete objects of these two classes (Use Runtime Polymorphism).
23. Create a class Triangle. Include overloaded functions for calculating area. Overload assignment operator and equality operator.
24. Create a class Box containing length, breath and height. Include following methods in it: a) Calculate surface Area b) Calculate Volume c) Increment, Overload ++ operator (both prefix & postfix) d) Decrement, Overload -- operator (both prefix & postfix) e) Overload operator == (to check equality of two boxes), as a friend function f) Overload Assignment operator g) Check if it is |
a Cube or cuboid Write a program which takes input from the user for length, breath and height to test the above class.
25. Create a structure Student containing fields for Roll No., Name, Class, Year and Total Marks. Create 10 students and store them in a file.
26. Write a program to retrieve the student information from file created in previous question and print it in following format: Roll No. Name Marks
27. Copy the contents of one text file to another file, after removing all whitespaces.
28. Write a function that reverses the elements of an array in place. The function must accept only one pointer value and return void.

Computer Networking (CA-MJ-T-4) (60L)   **Credit 4**

Introduction; Data communications: components, data representation (ASCII, ISO etc.), direction of data flow (simplex, half duplex, full duplex); Networks: distributed processing, network criteria, physical structure (type of connection, topology), categories of network (LAN, MAN, WAN); Internet: brief history, internet today; Protocols and standards; Reference models: OSI reference model, TCP/IP reference model, their comparative study.	6L
Analog and digital signal; data-rate limits; digital to digital line encoding schemes; pulse code modulation; parallel and serial transmission; digital to analog modulation; multiplexing techniques- FDM, TDM; transmission media	5L
Message switching; Circuit switching; Packet switching- connectionless datagram switching, connection-oriented virtual circuit switching; dial-up modems; digital subscriber line; cable TV for data transfer.	4L
Error detection and error correction techniques; data-link control- framing and flow control; error recovery protocols- stop and wait ARQ, go-back-n ARQ; Point to Point Protocol on Internet; HDLC	8L
CSMA/CD protocols; Ethernet LANS; connecting LAN and back-bone networks- repeaters, hubs, switches, bridges, router and gateways	10L

FDDI, token bus, token ring; Reservation, polling, concentration; Multiple access protocols: Pure ALOHA, Slotted ALOHA	
Internetworking & devices: Repeaters, Hubs, Bridges, Switches, Router, Gateway; Addressing: Internet address, classful address, subnetting; Routing: techniques, static vs. dynamic routing, routing table for classful address; Routing algorithms: shortest path algorithm, flooding, distance vector routing, link state routing; Protocols: ARP, RARP, IP, ICMP, IPV6; Unicast and multicast routing protocols.	13L
Process to process delivery; UDP; TCP; Congestion control algorithm: Leaky bucket algorithm, Token bucket algorithm, choke packets; Quality of service: techniques to improve QoS	8L
Overview of DNS; SMTP, SNMP, FTP, HTTP & WWW	6L

Recommended Books:
1. B. A. Forouzan: Data Communications and Networking, Fourth edition, THM ,2007.
2. A. S. Tanenbaum: Computer Networks, Fourth edition, PHI , 2002
3. W. Stallings: Data and Computer Communications (5th Ed.), PHI/ Pearson Education
4. Miller: Data Communication & Network, Vikas

Computer Networking Lab (CA-MJ-P-4) (40L)   Credit 2

Familiarization with Networking cables (CAT5, CAT6, UTP), Connectors (RJ-45, T connector), Hubs, Switches, LAN installation & configuration (peer-to-peer) process.	5L
Web page design by HTML, Capturing Form Data, GET and POST form methods, dealing with multi value fields, Redirecting a form after submission.	15L
Anatomy of an Array, creating index based and Associative array, accessing array looping with Index based array, with associative array using each() and for each() Some useful Library function.	20L

Database Management Systems (CA-MI-T-4) (40L)   Credit 3

Concept & Overview of DBMS, Data Models, Database Languages, Database Administrator, Database Users, Three Schema architecture of DBMS. Characteristics of database approach, data models, database system architecture and data independence.	4L
Basic concepts, Design Issues, Mapping Constraints, Keys, Entity-Relationship Diagram, Weak Entity Sets, Extended E-R features.	6L
Structure of relational Databases, Relational Algebra, Relational Calculus, Extended Relational Algebra Operations, Views, Modifications Of the Database.	5L
Concept of DDL, DML, DCL. Basic Structure, set operations, Aggregate Functions, Null Values, Domain Constraints, Referential Integrity Constraints, assertions, views, Nested Subqueries, Database security application development using SQL, Stored procedures and triggers.	9L
Functional Dependency, Different anomalies in designing a Database., Normalization using functional dependencies, Decomposition, Boyce-Codd Normal Form, 3NF	6L
Operations on files, File of Unordered and ordered records, overview of File organizations, indexing structures for files (Primary index, secondary index, clustering index), Multilevel indexing using B and B+ trees.	10L

Recommended Books:
1. Henry F. Korth and Silberschatz Abraham, ―Database System Concepts‖, Mc.Graw Hill.
2. Elmasri Ramez and Novathe Shamkant, ―Fundamentals of Database Systems‖, Benjamin Cummings Publishing. Company.
3. Ramakrishnan: Database Management System, McGraw-Hill
5. Date C. J., ―Introduction to Database Management‖, Vol. I, II, III, Addison Wesley.
6. Ullman JD., ―Principles of Database Systems‖, Galgottia Publication.

Database Management Systems Lab (CA-MI-P-4) Credit 1

Structured Query Language (SQL) 1. Creating Database: Creating a Database Creating a Table Specifying Relational Data Types Specifying Constraints Creating Indexes 2. Table and Record Handling: INSERT statement Using SELECT and INSERT together DELETE, UPDATE, TRUNCATE statements DROP, ALTER statements 3. Retrieving Data from a Database: The SELECT statement Using the WHERE clause Using Logical Operators in the WHERE clause Using IN, BETWEEN, LIKE , ORDER BY, GROUP BY and HAVING clasue Using Aggregate Functions Combining Tables Using JOINS Subqueries 4. Database Management Creating Views Creating Column Aliases Creating Database Users Using GRANT and REVOKE

Ability Enhancement course:

Summer Course:

Semester – V

Algorithm and Data Structure (CA-MJ-T-5) (60L) Credit 4

Data Types, 1D, 2D and Multi-dimensional Arrays, Sparse Matrices. Polynomial representation, Singly, Circular and Doubly Lists	10L
Array and linked representation of stack, Prefix, Infix and Postfix expressions, utility and conversion of these expressions from one to another, evaluation of postfix and prefix expression using stack, applications of stack, limitations of Array representation of stack. Array and Linked representation of Queue, Circular Queue, De-queue, Priority Queues, Developing Recursive Definition of Simple Problems and their implementation; Advantages and Limitations of Recursion; Understanding what goes behind Recursion (Internal Stack Implementation), Tail recursion.	12L
Introduction to Tree as a data structure: Binary Trees (Recursive and Iterative Traversals), Binary Search Tree (Traversal, Insertion, Deletion and Searching), Threaded Binary Trees (Traversal and advantages). Linear Search, Binary Search, Comparison of Linear and Binary Search with respect to time complexity, Selection Sort, Bubble sort, Insertion Sort, Merge Sort, Quick sort, Heap sort, Shell Sort, Radix sort, Comparison of Sorting Techniques with respect to time complexity	15L
Introduction to Hashing, Different hashing Techniques, Collision and resolving collision by Open Addressing, Closed Hashing, Separate Chaining, Choosing a Hash Function.	3L

Basic Design and Analysis techniques of Algorithms; time and space complexity; Correctness of Algorithm. Asymptotic Notations: Big-O, omega, theta etc. Advanced Analysis Technique of algorithm: Amortized analysis, Master's Theorem	8L
Iterative techniques, Divide and Conquer (Examples: Merge sort, Quick Sort, Binary Search), Dynamic Programming (Examples: matrix-chain multiplication, All pair shortest paths, single-source shortest path, Travelling Salesman problem) , Greedy Algorithms (Examples: matrix-chain multiplication, All pair shortest paths, single-source shortest path, Travelling Salesman problem), Introductory concepts of P class, NP-hard class, NP-complete class, Circuit Satisfiability problem, Clique Decision Problem	12L

Recommended Books:

T.H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein Introduction to Algorithms, PHI, 3rd Edition 2009
Sarabasse & A.V. Gelder Computer Algorithm – Introduction to Design and Analysis, Publisher – Pearson 3rd Edition 1999
 Goodman: Introduction to Design and Analysis Of Algorithms TMH
Fundamentals of Data Structures in C, Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed,
University Press.
Data Structures: A Pseudocode Approach with C, Richard F. Gilberg and Behrouz A.
Forouzan, Cengage Learning.
Data Structure using C, E Balagurusamy, McGraw Hill.
Data Structures Using C and C++, Aaron M. Tanenbaum, Moshe J. Augenstein, Yedidyah Langsam, PHI.
Classic Data Structures, Debasis Samanta, Second Edition, EEE, PHI.
Data Structures, Seymour Lipschutz, Schaum's Outlines, Tata McGraw Hill.
Data Structures Through C (A practical approach), G.S Baluja, DhanpatRai& Co.

Algorithm and Data Structure using C++ Lab (CA-MJ-P-5)   **Credit 2**

1. Write a program to search an element from a list. Give user the option to perform Linear or Binary search. Use Template functions. 2. Write a program using templates to sort a list of elements. Give user the option to perform sorting using Insertion sort, Bubble sort or Selection sort. 3. Implement Linked List using templates. Include functions for insertion, deletion and search of a number, reverse the list and concatenate two linked lists. 4. Implement Doubly Linked List using templates. Include functions for insertion, deletion and search of a number, reverse the list. 5. Implement Circular Linked List using templates. Include functions for insertion, deletion and search of a number, reverse the list. 6. Perform Stack operations using Linked List implementation. 7. Perform Stack operations using Array implementation. Use Templates. 8. Perform Queues operations using Circular Array implementation. Use Templates. 9. Create and perform different operations on Double-ended Queues using Linked List implementation. 10. Write a program to scan a polynomial using linked list and add two polynomial. 11. Write a program to calculate factorial and to compute the factors of a given no. (i)using recursion, (ii) using iteration 12. (ii) Write a program to display fibonacci series (i)using recursion, (ii) using iteration 13. Write a program to calculate GCD of 2 number (i) with recursion (ii) without recursion 14. Write a program to create a Binary Search Tree and include following operations in tree: (a) Insertion (Recursive and Iterative Implementation) (b) Deletion by copying (c) Deletion by Merging (d) Search a no. in BST (e) Display its preorder, postorder and inorder traversals Recursively (f) Display its preorder, postorder and inorder traversals Iteratively (g) Display its level-by-level traversals (h) Count the non-leaf nodes and leaf nodes (i) Display height of tree (j) Create a mirror image of tree (k) Check whether two BSTs are equal or not

15. Write a program to convert the Sparse Matrix into non-zero form and vice-versa.
16. Write a program to reverse the order of the elements in the stack using additional stack.
17. Write a program to reverse the order of the elements in the stack using additional Queue.
18. Write a program to implement Diagonal Matrix using one-dimensional array.
19. Write a program to implement Lower Triangular Matrix using one-dimensional array.
20. Write a program to implement Upper Triangular Matrix using one-dimensional array.
21. Write a program to implement Symmetric Matrix using one-dimensional array.
22. Write a program to create a Threaded Binary Tree as per inorder traversal, and implement operations like finding the successor / predecessor of an element, insert an element, inorder traversal.
23. Write a program to implement various operations on AVL Tree.

Database Management System (CA-MJ-T-6) (60L)   **Credit 4**

Drawbacks of Legacy System; Advantages of DBMS; Layered Architecture of Database, Data Independence; Data Models; Schemas and Instances; Database Languages; Database Users, DBA; Data Dictionary.	4L
Entity, Attributes and Relationship, Structural Constraints, Keys, ER Diagram of Some Example Database, Weak and strong Entity Set, Specialization and Generalization, Constraints of Specialization and Generalization, Aggregation	4L
Basic Concepts of Relational Model; Relational Algebra; Tuple Relational Calculus; Domain Relational Calculus.	8L
Domain Constraints, Referential Integrity, View.	4L
Basic Structure, Data Definition, Constraints and Schema Changes; Basic SQL Queries (Selection, Insertion, Deletion, Update); Order by Clause; Complex Queries, Aggregate Function and Group by Clause; Nested Sub Queries; Views, Joined Relations; Set Comparisons (All, Some); Derived Relations.	12L
Problems of Un-Normalized Database; Functional Dependencies (FD), Derivation Rules, Closure of FD Set, Canonical Cover; Normalization: Decomposition to 1NF, 2NF, 3NF or BCNF Using FD; Lossless Join Decomposition Algorithm; Dependency preservation	16L
Fixed Length and Variable Length Records; Spanned and Un-Spanned Organization of Records; Primary File Organizations and Access Structures Concepts; Unordered, Sequential, Hashed; Concepts of Primary and Secondary Index; Dense and Sparse Index; Index Sequential Files; Multilevel Indices. (Concepts only)	8L
Operations on files, File of Unordered and ordered records, overview of File organizations, indexing structures for files (Primary index, secondary index, clustering index), Multilevel indexing using B and B+ trees.	4L

Recommended Books:
1. Henry F. Korth and Silberschatz Abraham, ―Database System Concepts‖, Mc.Graw Hill.
2. Elmasri Ramez and Novathe Shamkant, ―Fundamentals of Database Systems‖, Benjamin Cummings Publishing. Company.
3. Ramakrishnan: Database Management System , McGraw-Hill
5. Date C. J., ―Introduction to Database Management‖, Vol. I, II, III, Addison Wesley.
6. Ullman JD., ―Principles of Database Systems‖, Galgottia Publication

Database Management System Lab (CA-MJ-P-6)   **Credit 2**

Structured Query Language (SQL) 1. Creating Database: Creating a Database Creating a Table Specifying Relational Data Types Specifying Constraints

Creating Indexes
2. Table and Record Handling:
INSERT statement
Using SELECT and INSERT together
DELETE, UPDATE, TRUNCATE statements
DROP, ALTER statements
3. Retrieving Data from a Database:
The SELECT statement
Using the WHERE clause
Using Logical Operators in the WHERE clause
Using IN, BETWEEN, LIKE , ORDER BY, GROUP BY and HAVING clasue
Using Aggregate Functions Combining Tables Using JOINS Subqueries
4. Database Management:
Creating Views
Creating Column Aliases
Creating Database Users Using
GRANT and REVOKE
5. Cursors in Oracle PL / SQL
6. Writing Oracle PL / SQL Stored Procedures

Computer Fundamentals and Programming using C (CA-MI-T-5) (45L)   Credit 3

Introduction to Computer and Problem Solving: Information and Data. Hardware: CPU, Primary and Secondary storage, I/O devices Software: Systems and Application.	3L
Generation of Computers: Super, Mainframe, Mini and Personal Computer. Introduction to Programming Languages: Machine Language, Assembly Language, High Level Language. Problem Solving: Flow Charts, Decision Tables and Pseudo codes.	6L
Number Systems and Codes: Number representation: Weighted Codes, Non-weighted codes, Positional, Binary, Octal, Hexadecimal, Binary Coded Decimal (BCD), Conversion of bases. Complement notions. Binary Arithmetic, Binary Codes: Gray, Alphanumeric, ASCII, EBCDIC; Parity Bits. Single Error-Detecting and Correcting Codes, Hamming Codes, Fixed and Floating Point Arithmetic: Addition, Subtraction, Multiplication and Division	10L
Boolean Algebra: Fundamentals of Boolean Algebra, Switches and Inverters, Functionally Complete Gates (AND, OR, NOT), NAND, NOR. Switching function and Boolean function. De Morgan's theorem, Minterm and Maxterm, Truth table and minimization of switching function up to four variables, Algebraic and K-map method of logic circuit synthesis: Two level and Multi level.	6L
C Language preliminaries: C character set, Identifiers and keywords, Data types, Declarations, Expressions, statements and symbolic constants.	3L
Input-Output: getchar, putchar, scanf, printf, gets, puts, functions.	1L
Pre-processor commands: #include, #define, #ifdef	1L
Operators and expressions: Arithmetic, unary, logical, bit-wise, assignment and conditional operators	1L
Storage types:	2L

Automatic, external, register and static variables.	
Functions: Defining and accessing, passing arguments, Function prototypes, Recursion, Library functions, Static functions	4L
Arrays: Defining and processing, Passing arrays to a function, Multi-dimensional arrays Strings: Defining and operations on strings.	4L
Pointers: Declarations, Passing pointers to a function, Operations on pointers, Pointer Arithmetic, Pointers and arrays, Arrays of pointers function pointers.	4L

Recommended Books:

1. P. K. Sinha & Priti Sinha , ―Computer Fundamentals‖, BPB Publications, 2007.
2. Dr. Anita Goel, Computer Fundamentals, Pearson Education, 2010.
3. Kernighan, Brian W., and Dennis M. Ritchie.The C programming language. 2006.
4. Schildt, Herbert, and C. Turbo. "C: the complete reference, Osborne." (2000).
5. Balagurusamy, E. programming in ANSI C. Tata McGraw-Hill Education, 2002.
6. Kanetkar, Yashavant P. Let us C. BPB publications, 2016.

Programming using C Lab (CA-MI-P-5)   **Credit 1**

Basic Structure: Character set, keywords, identifiers, constants, variables and type declaration. Sample programs, preprocessor.

Operators: Arithmetic, Relational, Logical, Assignment, Increment and Decrement, Conditional, comma; operator precedence and associatively; arithmetic expression-evaluation and type conversion. Character I/O, Escape sequence and formatted I/O.

Branching and Looping: if, if-else, while, do-while, for**.**

Arrays: One-dimensional and Two-dimensional, Different types of uses. String handling with arrays – read and write, concatenation, comparison, string functions.

User defined functions: Need; Call by Reference and Call by value; return values and types; nesting of functions; recursion.

Structures: Initialization; arrays of a structure, arrays within structures, structure within structure.

Pointers: Declaration and initialization; operators; pointer arithmetics; accessing variables, pointer & arrays, strings, functions.

File handling: Opening & Closing, I/O.

Examples:

1. Write a Program to print the sum and product of digits of an integer.
2. Write a Program to reverse a number.
3. Write a Program to compute the sum of the first n terms of the following series, S=1+1/2+1/3+1/4+……
4. Write a Program to compute the sum of the first n terms of the following series, S =1-2+3-4+5…………….
5. Write a function that checks whether a given string is Palindrome or not. Use this function to find whether the string entered by user is Palindrome or not.
6. Write a function to find whether a given no. is prime or not. Use the same to generate the prime numbers less than 100.
7. Write a Program to compute the factors of a given number.
8. Write a macro that swaps two numbers. WAP to use it.
9. Write a Program to print a triangle of stars as follows (take number of lines from user):

```
        *
       ***
      *****
     *******
    *********
```

10. Write a Program to perform following actions on an array entered by the user : i) Print the even-valued elements
ii) Print the odd-valued elements
iii) Calculate and print the sum and average of the elements of array
iv) Print the maximum and minimum element of array
v) Remove the duplicates from the array
vi) Print the array in reverse order

The program should present a menu to the user and ask for one of the options. The menu should also include options to re-enter array and to quit the program.

11. Write a Program that prints a table indicating the number of occurrences of each alphabet in the text entered as command line arguments.

12. Write a program that swaps two numbers using pointers.

13. Write a program in which a function is passed address of two variables and then alter its contents.

14. Write a program which takes the radius of a circle as input from the user, passes it to another function that computes the area and the circumference of the circle and displays the value of area and circumference from the main() function.

15. Write a program to find sum of n elements entered by the user. To write this program, allocate memory dynamically using malloc() / calloc() functions or new operator.

16. Write a menu driven program to perform following operations on strings:

a) Show address of each character in string
b) Concatenate two strings without using strcat function.
c) Concatenate two strings using strcat function.
d) Compare two strings
e) Calculate length of the string (use pointers)
f) Convert all lowercase characters to uppercase
g) Convert all uppercase characters to lowercase
h) Calculate number of vowels
i) Reverse the string

17. Given two ordered arrays of integers, write a program to merge the two-arrays to get an ordered array.

18. Write a Program to display Fibonacci series (i) using recursion, (ii) using iteration.

19. Write a Program to calculate Factorial of a number (i) using recursion, (ii) using iteration.

20. Write a Program to calculate GCD of two numbers (i) with recursion (ii) without recursion.

21. Write a menu-driven program to perform following Matrix operations (2-D array implementation): a) Sum b) Difference c) Product d) Transpose

22. Copy the contents of one text file to another file, after removing all whitespaces.

23. Write a function that reverses the elements of an array in place. The function must accept only one pointer value and return void.

24. Write a program that will read 10 integers from user and store them in an array. Implement array using pointers. The program will print the array elements in ascending and descending order.

25. Write a Program to Add two distances in meter kilometre system using structure.

26. Write a Program to Add two complex numbers using structures.

| 27. Calculate the difference between two time periods using structures. | |

Database Management Systems (CA-MI-T-6) (40L)   Credit 3

Drawbacks of Legacy System; Advantages of DBMS; Layered Architecture of Database, Data Independence; Data Models; Schemas and Instances; Database Languages; Database Users, DBA; Data Dictionary.	4L
Entity, Attributes and Relationship, Structural Constraints, Keys, ER Diagram of Some Example Database, Weak and strong Entity Set, Specialization and Generalization, Constraints of Specialization and Generalization, Aggregation	4L
Basic Concepts of Relational Model; Relational Algebra; Tuple Relational Calculus; Domain Relational Calculus.	8L
Domain Constraints, Referential Integrity, View.	2L
Basic Structure, Data Definition, Constraints and Schema Changes; Basic SQL Queries (Selection, Insertion, Deletion, Update); Order by Clause; Complex Queries, Aggregate Function and Group by Clause; Nested Sub Queries; Views, Joined Relations; Set Comparisons (All, Some); Derived Relations.	10L
Problems of Un-Normalized Database; Functional Dependencies (FD), Derivation Rules, Closure of FD Set, Canonical Cover; Normalization: Decomposition to 1NF, 2NF, 3NF or BCNF Using FD;	12L

Recommended Books:

1. Henry F. Korth and Silberschatz Abraham, ―Database System Concepts‖, Mc.Graw Hill.
2. Elmasri Ramez and Novathe Shamkant, ―Fundamentals of Database Systems‖, Benjamin Cummings Publishing. Company.
3. Ramakrishnan: Database Management System , McGraw-Hill
5. Date C. J., ―Introduction to Database Management‖, Vol. I, II, III, Addison Wesley.
6. Ullman JD., ―Principles of Database Systems‖, Galgottia Publication

Database Management Systems Lab (CA-MI-P-6)   Credit 1

Structured Query Language (SQL) 1. Creating Database: Creating a Database Creating a Table Specifying Relational Data Types Specifying Constraints Creating Indexes 2. Table and Record Handling: INSERT statement Using SELECT and INSERT together DELETE, UPDATE, TRUNCATE statements DROP, ALTER statements 3. Retrieving Data from a Database: The SELECT statement Using the WHERE clause Using Logical Operators in the WHERE clause Using IN, BETWEEN, LIKE , ORDER BY, GROUP BY and HAVING clasue Using Aggregate Functions Combining Tables Using JOINS Subqueries 4. Database Management: Creating Views Creating Column Aliases Creating Database Users Using

GRANT and REVOKE 5. Cursors in Oracle PL / SQL 6. Writing Oracle PL / SQL Stored Procedures

Semester – VI

Graphics and Multimedia (CA-MJ-T-7) (60L)   Credit 4

Introduction to computer graphics & graphics systems: Overview of computer graphics, representing pictures, preparing, presenting & interacting with pictures for presentations; Visualization & image processing; RGB color model, direct coding, lookup table; storage tube graphics display, Raster scan display, 3D viewing devices, Plotters, printers, digitizers, Light pens etc.; Active & Passive graphics devices; Computer graphics software.	10L
Scan conversion: Points & lines, Line drawing algorithms; DDA algorithm, Bresenham's line algorithm, Circle generation algorithm; Ellipse generating algorithm; scan line polygon, fill algorithm, boundary fill algorithm, flood fill algorithm.	10L
Basic transformations: translation, rotation, scaling; Matrix representations & homogeneous coordinates, transformations between coordinate systems; reflection shear; Transformation of points, lines, parallel lines, intersecting lines. Viewing pipeline, Window to viewport co-ordinate transformation, clipping operations, point clipping, line clipping, clipping circles , polygons & ellipse.	12L
3D transformation & viewing 3D transformations: translation, rotation, scaling & other transformations. Rotation about an arbitrary axis in space, reflection through an arbitrary plane; general parallel projection transformation; clipping, viewport clipping, 3D viewing.	12L
Curve representation, surfaces, designs, Bezier curves , B-spline curves, end conditions for periodic B-spline curves, rational B-spline curves.	5L
Components, uses of multimedia, Fonts & Faces, Using Text in Multimedia, Font Editing & Design Tools, Hypermedia & Hypertext, Still Images – Bitmaps, Vector Drawing, 3D Drawing & rendering, Natural Light & Colors, Computerized Colors, Color Palettes, Image File Formats, How Video Works, Analog Video, Digital Video, Video File Formats, Principle of Animations. Animation Techniques, Animation File Formats, multimedia system and media streams, Source representation and compression techniques text, speech and audio, still image and video, Graphics and animation, Video conferencing. (Concepts only)	11L

Recommended Books:
 J.D.Foley, A.Van Dan, Feiner, Hughes Computer Graphics Principles & Practice 2nd edition Publication Addison Wesley 1990.
D.Hearn, Baker: Computer Graphics, Prentice Hall of India 2008.
D.F.Rogers Procedural Elements for Computer Graphics, McGraw Hill 1997.
D.F.Rogers, Adams Mathematical Elements for Computer Graphics, McGraw Hill 2nd edition 1989.
Hearn, Baker: Computer Graphics (C version 2nd Ed.), Pearson education
Mukherjee: Fundamentals of Computer graphics & Multimedia, PHI
Mukherjee Arup: Introduction to Computer Graphics, Vikas
Multimedia: Making it work by Tay Vaughan, TMH.
 Multimedia: Computing, Communications Applications by R Steinmetz and K Naharstedt, Pearson.
Multimedia Handbook by Keyes, TMH.
Multimedia System Design by K. Andleigh and K. Thakkar, PHI

Graphics and Multimedia Lab (CA-MJ-P-7) **Credit 2**

Model Lab programs: 1. Write a program to implement Bresenham_s line drawing algorithm. 2. Write a program to implement mid-point circle drawing algorithm. 3. Write a program to clip a line using Cohen and Sutherland line clipping algorithm. 4. Write a program to clip a polygon using Sutherland Hodgeman algorithm. 5. Write a program to apply various 2D transformations on a 2D object (use homogenous coordinates). 6. Write a program to apply various 3D transformations on a 3D object and then apply parallel and perspective projection on it. 7. Write a program to draw Hermite/Bezier curve. Sample practical problems can be included related to theory.

Object Oriented Programming Java with Web Application (CA-MJ-T-8) (60L) **Credit 4**

Difference between procedure and oriented programming, Data abstraction and information hiding: Objects, Classes, methods.	2L
Java Architecture and Features, Understanding the semantic and syntax differences between C++ and Java, Compiling and Executing a Java Program, Variables, Constants, Keywords Data Types, Operators (Arithmetic, Logical and Bitwise) and Expressions, Comments, Doing Basic Program Output, Decision Making Constructs (conditional statements and loops) and Nesting, Java Methods (Defining, Scope, Passing and Returning Arguments, Type Conversion and Type and Checking, Built-in Java Class Methods).	4L
Creating & Using Arrays (One Dimension and Multi-dimensional), Referencing Arrays Dynamically, Java Strings: The Java String class, Creating & Using String Objects, Manipulating Strings, String Immutability & Equality, Passing Strings To & From Methods, String Buffer Classes. Simple I/O using System.out and the Scanner class, Byte and Character streams, Reading/Writing from console and files.	8L
Principles of Object-Oriented Programming, Defining & Using Classes, Controlling Access to Class Members, Class Constructors, Method Overloading, Class Variables & Methods, Objects as parameters, final classes, Object class, Garbage Collection.	4L
Single Level and Multilevel, Method Overriding, Dynamic Method Dispatch, Abstract Classes, Interfaces and Packages, Extending interfaces and packages, Package and Class Visibility, Using Standard Java Packages (util, lang, io, net), Wrapper Classes, Autoboxing/Unboxing, Enumerations and Metadata.	10L
Exception types, uncaught exceptions, throw, built-in exceptions, creating your own exceptions; Multi-threading: The Thread class and Runnable interface, creating single and multiple threads, Thread prioritization, synchronization and communication, suspending/resuming threads. Using java.net package, Overview of TCP/IP and Datagram programming. Accessing and manipulating databases using JDBC.	12L
Java Applets: Introduction to Applets, Writing Java Applets, Working with Graphics, Incorporating Images & Sounds. Event Handling Mechanisms, Listener Interfaces, Adapter and Inner Classes. The design and Implementation of GUIs using the AWT controls, Swing components of Java Foundation Classes such as labels, buttons, textfields, layout managers, menus, events and listeners; Graphic objects for drawing figures such as lines, rectangles, ovals, using different fonts. Overview of servlets.	12L
Servlet: What and Why? Servlet API, Servlet interface, Generic Servlet, Http Servlet, Servlet life cycle, Servlet request methods, Servlet collaboration, Servlet config. What is a session? Why is it required? Creating a session? Session information passing mechanisms between client and server - Cookies, Rewriting; Destroying a session. Introduction to Javascript; Ways to use Javascript; Working with events; Client-side validation. Introduction to JQuery; Validation using JQuery; JQuery forms; JQuery examples; Key services of the application server.	8L

Reference Books:

Java: The Complete Reference, Herbert Schildt, McGraw-Hill Education.
The Java Language Specification, Java SE by James Gosling, Bill Joy, Guy L Steele Jr, GiladBracha, Alex Buckley, Published by Addison Wesley.
Effective Java by Joshua Bloch, Publisher: Addison-Wesley.
Core Java 2 by Cay S. Horstmann, GaryCornell, Volume 1 , Prentice Hall.
Programming with Java by E. Balaguruswamy, McGraw Hill.
Java: How to Program by Paul Deitel, Harvey Deitel, Prentice Hall.
Programming with JAVA by John R. Hubbard, Schaum's Series.
Core Servlets and Javaserver Pages: Core Technologies, Marty Hall and Larry Brown, Prentice Hall.
JavaScript: The Definitive Guide, David Flanagan, O'Reilly.
Enterprise JavaBeans 3.0, Richard Monson-Haefel and Bill Burke, O'Reilly.
JavaScript and JQuery: Interactive Front-End Web Development, Jon Duckett, Wiley.
Professional JavaScript for Web Developers, Nicholas C. Zakas, Wrox.

Object Oriented Programming Lab (CA-MJ-P-8)   Credit 2

1. Write a Programme to print the sum and product of digits of an integer.
2. Write a Programme to reverse a number.
3. Write a Programme to compute the sum of the first n terms of the following series $S = 1+1/2+1/3+1/4+\ldots\ldots$
4. Write a Programme to compute the sum of the first n terms of the following series $S = 1-2+3-4+5\ldots\ldots\ldots\ldots$
5. Write a function that checks whether a given string is Palindrome or not. Use this function to find whether the string entered by user is Palindrome or not.
6. Write a function to find whether a given no. is prime or not. Use the same to generate the prime numbers less than 100.
7. Write a Programme to compute the factors of a given number.
8. Write a macro that swaps two numbers. WAP to use it. |
9. Write a Programme to print a triangle of stars as follows (take number of lines from user):
*
***
*****
****
****

10. Write a Programme to perform following actions on an array entered by the user: i) Print the even-valued elements ii) Print the odd-valued elements iii) Calculate and print the sum and average of the elements of array iv) Print the maximum and minimum element of array v) Remove the duplicates from the array vi) Print the array in reverse order
The program should present a menu to the user and ask for one of the options. The menu should also include options to re-enter array and to quit the program.
11. Write a Programme that prints a table indicating the number of occurrences of each alphabet in the text entered as command line arguments.
12. Write a program that swaps two numbers using pointers.
13. Write a program in which a function is passed address of two variables and then alter its contents.
14. Write a program which takes the radius of a circle as input from the user, passes it to another function that computes the area and the circumference of the circle and displays the value of area and circumference from the main() function.
15. Write a program to find sum of n elements entered by the user. To write this program, allocate memory dynamically using malloc() / calloc() functions or new operator.
16. Write a menu driven program to perform following operations on strings:
a) Show address of each character in string

b) Concatenate two strings without using strcat function.
c) Concatenate two strings using strcat function.
d) Compare two strings
e) Calculate length of the string (use pointers)
f) Convert all lowercase characters to uppercase
g) Convert all uppercase characters to lowercase
h) Calculate number of vowels
i) Reverse the string
17. Given two ordered arrays of integers, write a program to merge the two-arrays to get an ordered array.
18. Write a Programme to display Fibonacci series (i)using recursion, (ii) using iteration
19. Write a Programme to calculate Factorial of a number (i)using recursion, (ii) using iteration
20. Write a Programme to calculate GCD of two numbers (i) with recursion (ii) without recursion.
21. Create Matrix class using templates. Write a menu-driven program to perform following Matrix operations (2-D array implementation): a) Sum b) Difference c) Product d) Transpose
22. Create the Person class. Create some objects of this class (by taking information from the user). Inherit the class Person to create two classes Teacher and Student class. Maintain the respective information in the classes and create, display and delete objects of these two classes (Use Runtime Polymorphism).
23. Create a class Triangle. Include overloaded functions for calculating area. Overload assignment operator and equality operator.
24. Create a class Box containing length, breath and height. Include following methods in it: a) Calculate surface Area b) Calculate Volume c) Increment, Overload ++ operator (both prefix & postfix) d) Decrement, Overload -- operator (both prefix & postfix) e) Overload operator == (to check equality of two boxes), as a friend function f) Overload Assignment operator g) Check if it is a Cube or cuboid Write a program which takes input from the user for length, breath and height to test the above class.
25. Design a calculator using applet
Assignments are to be added based on the topics of the theory

Software Engineering (CA-MJ-T-9) (60L)   Credit 4

The Evolving Role of Software, Software Characteristics, Changing Nature of Software, Software Engineering as a Layered Technology, Software Process Framework, Framework and Umbrella Activities, Process Models, Capability Maturity Model Integration (CMMI).	9L
Software Requirement Analysis, Initiating Requirement Engineering Process, Requirement Analysis and Modeling Techniques, Flow Oriented Modeling, Need for SRS, Characteristics and Components of SRS.	8L
Estimation in Project Planning Process, Project Scheduling	8L
Software Risks, Risk Identification, Risk Projection and Risk Refinement, RMMM Plan.	8L
Quality Concepts, Software Quality Assurance, Software Reviews, Metrics for Process and Projects.	8L
Design Concepts, Architectural Design Elements, Software Architecture, Data Design at the Architectural Level and Component Level, Mapping of Data Flow into Software Architecture, Modeling Component Level Design.	9L
Software Testing Fundamentals, Strategic Approach to Software Testing, Test Strategies for Conventional Software, Validation Testing, System testing, Black-Box Testing, White-Box Testing and their type, Basis Path Testing.	10L

Recommended Books:
1. R.S. Pressman, Software Engineering: A Practitioner_s Approach (7th Edition), McGrawHill, 2009.
2. P. Jalote, An Integrated Approach to Software Engineering (2nd Edition), Narosa Publishing House, 2003.
3. K.K. Aggarwal and Y. Singh, Software Engineering (2nd Edition), New Age International Publishers, 2008.
4. I. Sommerville, Software Engineering (8th edition), Addison Wesley, 2006.
5. D. Bell, Software Engineering for Students (4th Edition), Addison-Wesley, 2005.

6. R. Mall, Fundamentals of Software Engineering (2nd Edition), Prentice-Hall of India, 2004.

Software Engineering Lab (CA-MJ-P-9)   **Credit 2**

Assignments will be given based on the topics in **CA-MJ-T-9.**

Outreach/Internship

Semester – VII

Java With Web Application (CA-MJ-T-10) (60L)   **Credit 4**

Difference between procedure and oriented programming, Data abstraction and information hiding: Objects, Classes, methods.	2L
Java Architecture and Features, Understanding the semantic and syntax differences between C++ and Java, Compiling and Executing a Java Program, Variables, Constants, Keywords Data Types, Operators (Arithmetic, Logical and Bitwise) and Expressions, Comments, Doing Basic Program Output, Decision Making Constructs (conditional statements and loops) and Nesting, Java Methods (Defining, Scope, Passing and Returning Arguments, Type Conversion and Type and Checking, Built-in Java Class Methods).	4L
Creating & Using Arrays (One Dimension and Multi-dimensional), Referencing Arrays Dynamically, Java Strings: The Java String class, Creating & Using String Objects, Manipulating Strings, String Immutability & Equality, Passing Strings To & From Methods, String Buffer Classes. Simple I/O using System.out and the Scanner class, Byte and Character streams, Reading/Writing from console and files.	8L
Principles of Object-Oriented Programming, Defining & Using Classes, Controlling Access to Class Members, Class Constructors, Method Overloading, Class Variables & Methods, Objects as parameters, final classes, Object class, Garbage Collection.	4L
Single Level and Multilevel, Method Overriding, Dynamic Method Dispatch, Abstract Classes, Interfaces and Packages, Extending interfaces and packages, Package and Class Visibility, Using Standard Java Packages (util, lang, io, net), Wrapper Classes, Autoboxing/Unboxing, Enumerations and Metadata.	10L
Exception types, uncaught exceptions, throw, built-in exceptions, creating your own exceptions; Multi-threading: The Thread class and Runnable interface, creating single and multiple threads, Thread prioritization, synchronization and communication, suspending/resuming threads. Using java.net package, Overview of TCP/IP and Datagram programming. Accessing and manipulating databases using JDBC.	12L
Java Applets: Introduction to Applets, Writing Java Applets, Working with Graphics, Incorporating Images & Sounds. Event Handling Mechanisms, Listener Interfaces, Adapter and Inner Classes. The design and Implementation of GUIs using the AWT controls, Swing components of Java Foundation Classes such as labels, buttons, textfields, layout managers, menus, events and listeners; Graphic objects for drawing figures such as lines, rectangles, ovals, using different fonts. Overview of servlets.	12L
Servlet: What and Why? Servlet API, Servlet interface, Generic Servlet, Http Servlet, Servlet life cycle, Servlet request methods, Servlet collaboration, Servlet config. What is a session? Why is it required? Creating a session? Session information passing mechanisms between client and server - Cookies, Rewriting; Destroying a session. Introduction to Javascript; Ways to use Javascript; Working with events; Client-side validation. Introduction to JQuery; Validation using JQuery; JQuery forms; JQuery examples; Key services of the application server.	8L

Reference Books:
Java: The Complete Reference, Herbert Schildt, McGraw-Hill Education.
 The Java Language Specification, Java SE by James Gosling, Bill Joy, Guy L Steele
Jr, GiladBracha, Alex Buckley, Published by Addison Wesley.

Effective Java by Joshua Bloch, Publisher: Addison-Wesley.
Core Java 2 by Cay S. Horstmann, GaryCornell, Volume 1 , Prentice Hall.
Programming with Java by E. Balaguruswamy, McGraw Hill.
Java: How to Program by Paul Deitel, Harvey Deitel, Prentice Hall.
Programming with JAVA by John R. Hubbard, Schaum's Series.
Core Servlets and Javaserver Pages: Core Technologies, Marty Hall and Larry Brown, Prentice Hall.
JavaScript: The Definitive Guide, David Flanagan, O'Reilly.
Enterprise JavaBeans 3.0, Richard Monson-Haefel and Bill Burke, O'Reilly.
JavaScript and JQuery: Interactive Front-End Web Development, Jon Duckett, Wiley.
Professional JavaScript for Web Developers, Nicholas C. Zakas, Wrox.

Java With Web Application Lab (CA-MJ-P-10)   Credit 2

1. Write a Programme to print the sum and product of digits of an integer.
2. Write a Programme to reverse a number.
3. Write a Programme to compute the sum of the first n terms of the following series S = 1+1/2+1/3+1/4+……
4. Write a Programme to compute the sum of the first n terms of the following series S =1-2+3-4+5…………….
5. Write a function that checks whether a given string is Palindrome or not. Use this function to find whether the string entered by user is Palindrome or not.
6. Write a function to find whether a given no. is prime or not. Use the same to generate the prime numbers less than 100.
7. Write a Programme to compute the factors of a given number.
8. Write a macro that swaps two numbers. WAP to use it. |
9. Write a Programme to print a triangle of stars as follows (take number of lines from user):
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10. Write a Programme to perform following actions on an array entered by the user: i) Print the even-valued elements ii) Print the odd-valued elements iii) Calculate and print the sum and average of the elements of array iv) Print the maximum and minimum element of array v) Remove the duplicates from the array vi) Print the array in reverse order The program should present a menu to the user and ask for one of the options. The menu should also include options to re-enter array and to quit the program.
11. Write a Programme that prints a table indicating the number of occurrences of each alphabet in the text entered as command line arguments.
12. Write a program that swaps two numbers using pointers.
13. Write a program in which a function is passed address of two variables and then alter its contents.
14. Write a program which takes the radius of a circle as input from the user, passes it to another function that computes the area and the circumference of the circle and displays the value of area and circumference from the main() function.
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a) Show address of each character in string
b) Concatenate two strings without using strcat function.
c) Concatenate two strings using strcat function.
d) Compare two strings
e) Calculate length of the string (use pointers)
f) Convert all lowercase characters to uppercase

g) Convert all uppercase characters to lowercase

h) Calculate number of vowels

i) Reverse the string

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24. Create a class Box containing length, breath and height. Include following methods in it: a) Calculate surface Area b) Calculate Volume c) Increment, Overload ++ operator (both prefix & postfix) d) Decrement, Overload -- operator (both prefix & postfix) e) Overload operator == (to check equality of two boxes), as a friend function f) Overload Assignment operator g) Check if it is a Cube or cuboid Write a program which takes input from the user for length, breath and height to test the above class.

25. Design a calculator using applet

Assignments are to be added based on the topics mentioned in the theory

Computer Networking (CA-MJ-T-11) (60L)   Credit 4

Introduction; Data communications: components, data representation (ASCII, ISO etc.), direction of data flow (simplex, half duplex, full duplex); Networks: distributed processing, network criteria, physical structure (type of connection, topology), categories of network (LAN, MAN, WAN); Internet: brief history, internet today; Protocols and standards; Reference models: OSI reference model, TCP/IP reference model, their comparative study.	6L
Analog and digital signal; data-rate limits; digital to digital line encoding schemes; pulse code modulation; parallel and serial transmission; digital to analog modulation; multiplexing techniques- FDM, TDM; transmission media	5L
Message switching; Circuit switching; Packet switching- connectionless datagram switching, connection-oriented virtual circuit switching; dial-up modems; digital subscriber line; cable TV for data transfer.	4L
Error detection and error correction techniques; data-link control- framing and flow control; error recovery protocols- stop and wait ARQ, go-back-n ARQ; Point to Point Protocol on Internet; HDLC	8L
CSMA/CD protocols; Ethernet LANS; connecting LAN and back-bone networks- repeaters, hubs, switches, bridges, router and gateways FDDI, token bus, token ring; Reservation, polling, concentration; Multiple access protocols: Pure ALOHA, Slotted ALOHA	10L
Internetworking & devices: Repeaters, Hubs, Bridges, Switches, Router, Gateway; Addressing: Internet address, classful address, subnetting; Routing: techniques, static vs. dynamic routing, routing table for classful address; Routing algorithms: shortest path algorithm, flooding, distance vector routing, link state routing; Protocols: ARP, RARP, IP, ICMP, IPV6; Unicast and multicast routing protocols.	13L
Process to process delivery; UDP; TCP; Congestion control algorithm: Leaky bucket algorithm, Token bucket algorithm, choke packets; Quality of service: techniques to improve QoS	8L
Overview of DNS; SMTP, SNMP, FTP, HTTP & WWW	6L

Recommended Books:

1. B. A. Forouzan: Data Communications and Networking, Fourth edition, THM ,2007.
2. A. S. Tanenbaum: Computer Networks, Fourth edition, PHI , 2002
3. W. Stallings: Data and Computer Communications (5th Ed.), PHI/ Pearson Education
4. Miller: Data Communication & Network, Vikas

Computer Networking Lab (CA-MJ-P-11)   Credit 2

Familiarization with Networking cables (CAT5, CAT6, UTP), Connectors (RJ-45, T connector), Hubs, Switches, LAN installation & configuration (peer-to-peer) process.	5L
Web page design by HTML, Capturing Form Data, GET and POST form methods, dealing with multi value fields, Redirecting a form after submission.	15L
Anatomy of an Array, creating index based and Associative array, accessing array looping with Index based array, with associative array using each() and for each() Some useful Library function.	20L

Unix and Shell Programming (CA-MJ-T-12) (45L)   Credit 4

System structure, user perspective ☐ O/S services assumption about Hardware: The Kernel and buffer cache architecture of Unix O/S ☐ System concepts, Kernel data Structure, ☐ System administration ☐ Buffer headers, Structure of the buffer pool ☐ Scenarios for retrieval of the buffer, Reading and writing disk block, Advantage and disadvantage of buffer cache.	6L
INODES, Structure of regular, Directories conversions of a path name to an inode, Super block, Inode assignment to a new file, Allocation of disk blocks. ☐ System Calls for the System: Open read write file and record close, File creation, Operation of special files change directory and change root, change owner and change mode, STAT and FSTAT, PIPES Mounting and unmounting files system, Link Unlink.	10L
Process states and transitions layout of system memory, the context of a process, manipulation of process address space, Sleep process creation/termination. The user Id of a process, changing the size of a process. The SHELL ☐ Interprocess Communication and multiprocessor system: Process tracing system V IPO network communication sockets problem of multiprocessors systems, solution with master and hare process, and solution with semaphores.	10L
Shell Bourne shell, C shell, Unix commands, permissions, editors, filters,sed, grep family, shell variables, scripts, metacharacters and environment, if and case statements, for while and until loops. Shell programming	6L
Awk pattern scanning and processing language, BEGIN and END patterns, Awk arithmetic and variables, Awk built in variable names and operators, arrays, strings, functions, perl; the chop() function, variable and operators, $ and $. , Lists, arrays, regular expression and	8L

| substitution, file handling, subroutines, formatted printing | |
| History & Features of Linux, Linux structure, various flavours of linux. | 5L |

Reference Books:

1. M.J. Bach "Design of UNIX O.S. ", Prentice Hall of India.
2. Y.Kanetkar "Unix shell programming", BPB Pub.
3. B.W. Kernighan & R. Pike, "The UNIX Programming Environment", Prentice Hall of India, 1995.
4. S. Prata "Advanced UNIX: A Programming's Guide", BPB Publications, New Delhi.

Unix and Shell Programming Lab (CA-MJ-P-12)   **Credit 2**

| |
| Study of UNIX basic commands: <br> cal, date, echo, printf, bc, script, mailx, passwd, who, uname, tty, stty, pwd, cd, mkdir, rmdir, ls, cat, cp, rm, mv, more, file, wc, od, cmp,comm, diff, chmod, vi
 Study of vi editor
 Write a Script to print "hello world"
 Write a script to create function.
 Write a script to study local variables
 Write a script to study if...else
 Write a script to study for, while and until
 Write a script yhat finds the prime factors of a given number.
 Write a script to check if the two strings are same or not.
 Write a script that will print a message "Good Morning" or "Good Afternoon" according to the user login time.
 Linux Commands: <br> cmp, find, grep, od, tar, ps, df, du, finge, kill, nice, <br> nonhup, sleep, test, umask, who, cal, tee, expr, uname, fsck, xargs.
 Filters for stream handling features of the shell for input and output.
 E.g. pr, head, tail, cut, paste, sort, nl, uniq, tr. |

Computer Fundamentals and Programming using C (CA-MI-T-7) (40L)   **Credit 3**

Introduction to Computer and Problem Solving: Information and Data. Hardware: CPU, Primary and Secondary storage, I/O devices Software: Systems and Application	3L
Generation of Computers: Super, Mainframe, Mini and Personal Computer. Introduction to Programming Languages: Machine Language, Assembly Language, High Level Language. Problem Solving: Flow Charts, Decision Tables and Pseudo codes.	6L
Number Systems and Codes: Number representation: Weighted Codes, Non-weighted codes, Positional, Binary, Octal, Hexadecimal, Binary Coded Decimal (BCD), Conversion of bases. Complement notions. Binary Arithmetic, Binary Codes: Gray, Alphanumeric, ASCII, EBCDIC; Parity Bits. Single Error-Detecting and Correcting Codes, Hamming Codes, Fixed and Floating Point Arithmetic: Addition, Subtraction, Multiplication and Division	12L

Boolean Algebra: Fundamentals of Boolean Algebra, Switches and Inverters, Functionally Complete Gates (AND, OR, NOT), NAND, NOR. Switching function and Boolean function. De Morgan's theorem, Minterm and Maxterm, Truth table and minimization of switching function up to four variables, Algebraic and K-map method of logic circuit synthesis: Two level and Multi level.	6L
C Language preliminaries: C character set, Identifiers and keywords, Data types, Declarations, Expressions, statements and symbolic constants.	3L
Input-Output: getchar, putchar, scanf, printf, gets, puts, functions. Pre-processor commands: #include, #define, #ifdef	5L
Operators and expressions: Arithmetic, unary, logical, bit-wise, assignment and conditional operators	5L

Recommended Books:

1. P. K. Sinha & Priti Sinha , ―Computer Fundamentals‖, BPB Publications, 2007.
2. Dr. Anita Goel, Computer Fundamentals, Pearson Education, 2010.
3. Kernighan, Brian W., and Dennis M. Ritchie.The C programming language. 2006.
4. Schildt, Herbert, and C. Turbo. "C: the complete reference, Osborne." (2000).
5. Balagurusamy, E. programming in ANSI C. Tata McGraw-Hill Education, 2002.
6. Kanetkar, Yashavant P. Let us C. BPB publications, 2016.

Computer Fundamentals and Programming using C Lab (CA-MI-P-7)   **Credit – 1**

Introduction: History, Basic Structure, Algorithms, Structured programming constructs. C Programming elements: Character sets, Keywords, Constants, Variables, Data Types, Operators- Arithmetic, Relational, Logical and Assignment; Increment and Decrement and Conditional, Operator Precedence and Associations; Expressions, type casting. Comments, Functions, Storage Classes, Bit manipulation, Input and output.
Functions: argument passing, return statement, return values and their types, recursion Arrays: String handling with arrays, String handling functions. Pointers: Definition and initialization, Pointer arithmetic, Pointers and arrays, String functions and manipulation, Dynamic storage allocation.
C Preprocessor: File inclusion, Macro substitution. Statements: Assignment, Control statements- if, ifelse, switch, break, continue, goto, Loops-while, do-while, for.

Python Programming (CA-MI-T-8) (40L)   **Credit 3**

Introduction to the Python Interpreted vs. compiled languages. Bytecodes. The importance of whitespace. Variables and the lack of explicit data types and how Python uses the concepts of duck, strong, and static typing, to figure out data types in runtime. The assignment operator, the binding of names to objects, and aliasing. Keywords and their significance.	4L

Strings: definition, declaration, and immutability, string constants, declaration, and the equivalence of single and double quotes. Multi-line strings. Raw strings. String formatting using the format function and the % operator. f-strings in Python 3.6+. Built-in functions: count, find, replace, upper, lower, strip, etc. Time and space complexities of the functions and operations. Lists: definition, declaration, and mutability. Nested lists. Indexing and slicing: same as strings. List comprehensions. The split and join methods. Built-in list functions – append, extend, count, find, index, etc. Time and space complexities of the functions and operations. Tuples: definition, declaration, and immutability. Packing and unpacking lists and tuples. The + and * operators on strings, lists, and tuples. Indexing and slicing strings, lists, and tuples.	6L
Conditionals, Iterators, and Generators **Conditionals:** If, elif, and else statements. Nested conditionals. Containment checking in containers using the in keyword. **Looping constructs:** while and for loops. Flow control using break, continue, and pass. Nested loops. **Generators:** range, zip, sorted, reversed, and enumerate	15L
User-defined Functions and Recursion Functions: definition, function signature, positional, default, and keyword arguments. Documentation strings. Unnamed functions – lambda, filter, and map. Recursion: basic idea, implementing recursion, sharing variables across the recursion stack, modifying the size of the recursion stack.	10L
File Handling and Exception Handling File handling: open and close methods, the different read and write modes. Using the with open approach to files. read, readline, readlines functions. The csv module for efficient read/write of structured data. The pickle module for persistent storage of variables in a program. Exception handling: the popular errors- Name Error, Value Error, Syntax Error, Key Error, Attribute Error, etc, and their cause and effects. Using try-except blocks for graceful handling of exceptions.	5L

Reference Books
1. Introduction to Computation and Programming Using Python: With Application to Understanding Data, Guttag, John V. MIT Press.
2. Learn Python 3 the Hard Way: A Very Simple Introduction to the Terrifyingly Beautiful World of Computers and Code, Shaw, Zed A, Addison-Wesley Professional.
3. Think Python 2e. Green Tea Books, Downey, Allen B.
4. Practical Programming: An Introduction to Computer Science Using Python 3.6. Pragmatic Bookshelf, Gries, Paul, Jennifer Campbell, and Jason Montojo.

Python Programming Lab (CA-MI-P-8)   **Credit 1**

Use Python 3.6 or above. Use a text editor sensitive to whitespace like Notepad++, gedit, vim, Sublime Text, and NOT Notepad / WordPad. The following exercises are suggestive in nature. 1. The Interpreter as a calculator. Basic arithmetic operations. Introduction to the simple numeric data types – integers, floating point numbers, Boolean, complex numbers. Inter conversion of data types. a. Use the Python prompt as a basic calculator. Explore the order of operations using parentheses. b. Explore the various functions in the math module. Eg: find GCD of two numbers, area and perimeter of circle using math.pi, etc. c. Exploring the complex data type and their operations, eg: finding the modulus and phase angle of a complex number. d. The print function – Printing values. Repeat the previous experiments now using the print function 2. Basic user interactions using the print() and input() functions. a. Write a simple python script using the print function in a text editor, save it with the extension ".py". Run it in the terminal / command prompt. b. Take input two strings from the user, and print the first one twice, and the other one thrice.

c. Ask the user to enter two numbers, and output the sum, product, difference, and the GCD.

d. More programs that test concepts learned in week 1 which involves the usage of the print and input functions.

3. Strings, List, Tuples, the re (regular expression) module

a. Ask the user for two strings, print a new string where the first string is reversed, and the second string is converted to upper case. Sample strings: "Pets", "party", output: "steP PARTY". Only use string slicing and + operators.

b. From a list of words, join all the words in the odd and even indices to form two strings. Use list slicing and join methods.

c. Simulate a stack and a queue using lists. Note that the queue deletion operation won't run in O(1) time.

d. Explore the 're' module, especially re.split, re.join, re.search and re.match methods.

4. Conditionals, looping constructs, and generators

a. Use list comprehension to find all the odd numbers and numbers divisible by 3 from a list of numbers.

b. Using while loops to do Gaussian addition on a list having an even number of numbers. Print each partial sum. Eg: if the list is [1, 2, 3, 4, 5, 6], the program should output "1 + 6", "2 + 5", and "3+4" in separate lines, and the result of the addition "21". Extend it to handle lists of odd length.

c. Primarily testing using for and while loops.

d. Use (c) to generate a list of primes within a user-given range.

e. Explore the 'key' function of sum( ), min( ), max( ), and sort( ) functions using lambdas.

5. User defined functions

a. Implement popular sorting algorithms like quick sort and merge sort to sort lists of numbers.

b. Implement the Pascal's triangle.

c. Three positive integers a, b, and c are Pythagorean triples if $a^2 + b^2 = c^2$. Write a function to generate all Pythagorean triples in a certain range.

d. Write two functions that simulate the toss of a fair coin, and the roll of an unbiased 'n' sided die using the random module.

e. Like (d), but now the coin and the die are not fair, with each outcome having a given probability.

6. File handling, sys, pickle and csv modules

a. Basic file operations. Explore the different file modes.

b. Emulate the unix 'cp', 'grep', 'cat' programs in Python. In each case, the user should pass the arguments to the program as command line arguments.

c. Use pickle for persistent storage of variables

Semester – VIII (Without Research)

Data Mining & Data Warehousing (CA-MJ-T-13) (45L)   **Credit 3**

Definition of Data Mining, Data pre-processing, Data cleaning, Data transformation, Data Reduction, Data Visualization, Data extraction from large dataset, Data integration, sub-sampling, Feature selection, Scalability issues of data mining algorithms, text mining, web mining.	15L
Classification and Prediction Structural patterns of data, Tools for pattern recognition (preliminary concept), Linear models for classification, Evaluating the accuracy of the classifier or predictor, Bayesian Classification, Training and Test sets, Parametric and Non-parametric Learning, Minimum Distance Classifiers, k-NN rule, Discriminant Analysis, Decision trees. Similarity Measure, Basic hierarchical and non-hierarchical Clustering algorithms, Some Applications, Neural Learning	20L
Data Warehousing (DWH) Introduction: Definition and description, need for data ware housing, need for strategic information, failures of past decision support systems, Application of DWH.	15L

Reference Books:
1. Data Mining: Practical Machine Learning Tools and Techniques, Ian H. Witten, Eibe Frank, Mark A. Hall, Morgan Kaufman.
2. Pattern Classification and Scene Analysis, R.O. Duba, P.E. Hart and D.G. Stork, Wiley.
3. Pattern Recognition Principles, J.T. Tou and R.C. Gonzalez, Addison-Wesley.
4. Data Mining Concepts and Techniques by Jiawei Han and Micheline Kamber, Morgan Kaufmann Publishers.
5. Data Warehousing, Data Mining and OLAP by Berson, Tata McGraw Hill.
6. Introduction to Data Mining by Pang-Ning Tan, Michael Steinbach, Vipin Kumar, Pearson Education.
7. Data mining: Introductory and Advanced Topics by Dunham M H," Pearson Education.
8. Data Mining Concepts, Methods and Algorithms by Mehmed Kantardzic, John Wiley and Sons.

Data Mining & Data Warehousing Lab (CA-MJ-P-13)   **Credit 1**

Data mining using PYTHON/C
Assignments are to be added based on the topics mentioned in the theory

Cloud Computing (CA-MJ-T-14) (40L)   **Credit 3**

Defining a Cloud, Cloud Types – NIST model, Cloud Cube model, Deployment models (Public, Private, Hybrid and Community Clouds), Service model: - Infrastructure as a Service, Platform as a Service, Software as a Service with examples of services/ service providers. Cloud Reference model, Characteristics of Cloud Computing, Benefits and advantages of Cloud Computing, A brief introduction on Composability, Infrastructure, Platforms, Virtual Appliances, Communication Protocols, Applications, Connecting to the Cloud by Clients, IaaS –concept, Workload, partitioning of virtual private server instances, Pods, aggregations. SaaS - Basic concept and characteristics, Open SaaS and SOA, examples of SaaS platform Identity as a Service (IDaaS) Compliance as a Service (CaaS)	10L
Use of Platforms in Cloud Computing: Concepts of Abstraction and Virtualization technologies: Types of virtualization (access, application, CPU, storage), Load Balancing and Virtualization: Basic Concepts, Network resources for load balancing, Advanced load balancing (including Application Delivery Controller and Application Delivery Network), Mention of The Google Cloud as an example of use of load balancing. Hypervisors: Virtual machine technology and types, VMware vSphere Machine Imaging. Porting of applications in the Cloud: The simple Cloud API and AppZero Virtual Application appliance, Concepts of Platform as a Service, Definition of services, Distinction between SaaS and PaaS, Application development Use of PaaS Application frameworks. Discussion of Google Applications Portfolio – Indexed search, Dark Web, Aggregation and disintermediation, Productivity applications and service, Adwords, Google Analytics, Google Translate, a brief discussion on Google Toolkit (including introduction of Google APIs in brief), major features of Google App Engine service.	10L
Cloud Infrastructure: Cloud Management: An overview of the features of network management systems and a brief introduction of related products from large cloud vendors, Monitoring of an entire cloud computing deployment stack – an overview with mention of some products, Lifecycle management of cloud services (six stages of lifecycle). Concepts of Cloud Security: Cloud security concerns, Security boundary, Security service boundary Overview of security mapping Security of data: Brokered cloud storage access, Storage location and tenancy, encryption, and auditing and compliance Identity management (awareness of Identity protocol standards).	8L
Concepts of Services and Applications : Service Oriented Architecture: Basic concepts of message-based transactions, Protocol stack for an SOA architecture, Event-driven SOA, Enterprise Service Bus, Service catalogs, Applications in the	12L

| Cloud: Concepts of cloud transactions, functionality mapping, Application attributes, Cloud service attributes, System abstraction and Cloud Bursting, Applications and Cloud APIs Cloud-based Storage: Cloud storage definition – Manned and Unmanned Webmail Services: Cloud mail services including Google Gmail, Mail2Web, Windows Live Hotmail, Yahoo mail, concepts of Syndication services. | |

Reference Books:
1 Cloud Computing Bible by Barrie Sosinsky, Wiley India Pvt. Ltd, 2013
2 Mastering Cloud Computing by Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, McGraw Hill Education (India) Private Limited, 2013
3 Cloud computing: A practical approach, Anthony T. Velte, Tata Mcgraw-Hill
4 Cloud Computing, Miller, Pearson
5 Building applications in cloud: Concept, Patterns and Projects, Moyer, Pearson
6 Cloud Computing – Second Edition by Dr. Kumar Saurabh, Wiley India
7 Cloud Computing – Second Edition by Dr. Kumar Saurabh, Wiley India

Cloud Computing Lab (CA-MJ-P-14)   Credit 1

Assignments are to be added based on the topics mentioned in the theory

Research Methodology (CA-MJ-T-15) (40L)   Credit 3

Concepts of Research Design: Research- Overview, types and basic steps. objectives and variables of a research problem, Literature review Importance and objective of Literature review, locating relevant literature, Writing a survey and identifying the research problem. Research Proposal- Planning and writing a research proposal, Structure and components of research proposal, Methodology for quality research , Report writing and quality publications	10L
Scientific Research and Statistical Analysis Scientific Research: Introduction, objective and methods. Modelling-Introduction, types and stages of Model building, Data consideration and testing heuristics. Statistical Analysis: Reasoning, Error Analysis and Accuracy, Descriptive Statistics, Probability, Hypothesis Testing, Regression Analysis, SPSS/R/EViews/MATLAB/Octave. Numerical computation, plotting of functions, implementation of algorithms etc**.**	10L
Research Tools Advanced Searching Methods in online repositories/consortium, like in flibnet, Indest, Scopus, etc., Meta search engines and techniques. Tools for Editing, Presentation, Data visualization- Writing Research Paper-Hands-on with LaTeX. Syntax of Research Paper-Hands-on with Grammarly. Referencing Tools-Introduction, Importance and citation, Hands-on with Mendeley or Zotero and Scholarc.	10L
Research Writing and Academic Ethics Report writing and Publishing Research Findings. Structure of a thesis/research article/ review article, including title, introduction, literature review, methods and materials, referencing. Academic Ethics - Introduction, Intellectual Property Rights, Fraud and unscientific practices in science. Plagiarism, Citation counting and Impact factor, Types of Indexing SCI/SCIE/ESCI/SCOPUS/DBLP/Google Scholar etc. Significance of conferences and their ranking.	10L

Reference Books:
1. C. R. Kothari, Research Methodology: Methods and Techniques, New Age International, New Delhi, 2004.
2. Justin Zobel, Writing for computer Science, Third Edition, Springer, 2014.
3. Kumar R. Research Methodology: A Step by Step Guide for Beginners, 3rd ed., Pearson Education, 2010.

4. Ranjit Kumar, ―Research Methodology: A Step by Step Guide for Beginners ‖ , 2/e, Pearson India, 2005.

5. Michael P. Marder, Research Methods for Science, Cambridge University Press, 2011.

6. P. Oliver, Writing Your Thesis, New Delhi: Vistaar Publications, 2004.

7. Gregory, Ethics in Research, Continuum, 2005.

8. C. Radhakrishna Rao, Statistics and Truth, CSIR, 1989.

9. Sheldon M Ross, Introduction to Probability and Statistics for Engineers and Scientists, Elsevier, 2010.

10. RA Day, How To Write and Publish a Scientific Paper, Cambridge University Press,London, 1992.

11. B. Latour, Woolgar, Laboratory Life: The Construction of Scientific Facts, 2nd Edition,Princeton: Princeton University Press, 1986.

12. S.K. Yadav, ―Elements of Research Writing ‖ , UDH Publishers & Distributors, Pvt. Ltd. New Delhi, 2015.

13. Douglas C. Montgomery and George C. Runger, ―Applied Statistics & Probability for Engineers ‖ , 3rd ed, Wiley India, 2007.

Research Methodology Lab (CA-MJ-P-15)   Credit 1

Assignments are to be added based on the topics mentioned in the theory

Data Science (CA-HWoR-T-1) (40L)   Credit 4

Introduction to big data: Variety of Big Data. Big Data and its Importance of 3 Vs, 4 Vs, 6 Vs of Big Data, Characteristics of Big Data. Introduction of Hadoop: Benefit of Hadoop, Core Components of Hadoop, Other Components of Hadoop, Hadoop Cluster, Hadoop Start-up Mode. Introduction to HDFS, Architecture of HDFS, Role and types of Name Node, HDFS Commands.	10L
Definition of Data, Data Science, Data Mining, Data pre-processing, Data cleaning, Data transformation, Data Reduction, Data Visualization, Data extraction from large dataset, Data integration, sub-sampling, Feature selection, Scalability issues of data mining algorithms, text mining, web mining.	10L
Introduction to MapReduce: Flow of Map Reduce, Word Count Problem by Using Map Reduce etc. Introduction to NoSQL: Types of NoSQL Databases. Features of various types of No-SQL databases, Brief Concept on Key-value database, Document Store, Column Family Stores and Graph databases.	10L
Data Warehousing (DWH) Introduction: Definition and description, need for data ware housing, need for strategic information, failures of past decision support systems, Application of DWH.	10L

Reference Books:

Data Mining: Practical Machine Learning Tools and Techniques, Ian H. Witten, Eibe Frank, Mark A. Hall, Morgan Kaufman.

Pattern Classification and Scene Analysis, R.O. Duba, P.E. Hart and D.G. Stork, Wiley.

Pattern Recognition Principles, J.T. Tou and R.C. Gonzalez, Addison-Wesley.

Data Mining Concepts and Techniques by Jiawei Han and Micheline Kamber, Morgan Kaufmann Publishers.

Data Warehousing, Data Mining and OLAP by Berson, Tata McGraw Hill.

Introduction to Data Mining by Pang-Ning Tan, Michael Steinbach, Vipin Kumar, Pearson Education.

Data mining: Introductory and Advanced Topics by Dunham M H," Pearson Education.

Data Mining Concepts, Methods and Algorithms by Mehmed Kantardzic, John Wiley and Sons.

Michael Minelli, Michehe Chambers, "Big Data, Big Analytics: Emerging Business

Intelligence and Analytic Trends for Today's Business", 1st Edition, Ambiga Dhiraj, Wiely CIO Series, 2013.

DT Editorial Services, "Big Data, Black Book: Covers Hadoop 2, MapReduce, Hive, YARN, Pig, R and Data Visualization", Dreamtech Press India Pvt. Ltd., 2020

Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007.

Rajkumar Buyya, "Big Data Principles and Paradigms", MK

Tom White, "Hadoop: The Definitive Guide", 3rd Edition, O'reilly, 2012.

Lars George, "HBase: The Definitive Guide", O'Reilley, 2011
Alan Gates, "Programming Pig", O'Reilley, 2011.
 Bart Baesens "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications (WILEY Big Data Series)", John Wiley & Sons,2014

Data Science Lab (CA-HWoR-P1)   Credit 2

Data mining using PYTHON/C
Assignments are to be added based on the topics mentioned in the theory

Cryptography and Network Security (CA-HWoR-T2) (60L)   Credit 4

Introduction to Cryptography Introduction to security attacks - services and mechanism - introduction to cryptography -Conventional Encryption: Conventional encryption model - classical encryption techniques - substitution ciphers and transposition ciphers – cryptanalysis – steganography - stream and block ciphers introduction only.	8L
Confidentiality and Modular Arithmetic Confidentiality using conventional encryption – traffic confidentiality - key distribution – random number generation - Introduction to graph - ring and field - prime and relative prime numbers - modular arithmetic - Fermat's and Euler's theorem - primality testing - Euclid's Algorithm - Chinese Remainder theorem - discrete algorithms.	10L
Public key cryptography and Authentication requirements Principles of public key crypto systems - RSA algorithm – security of RSA - key management – Diffle-Hellman key exchange algorithm - introductory idea of Elliptic curve cryptography – Elgamel encryption - Message Authentication and Hash Function: Authentication requirements-authentication functions – message authentication code - hash functions - birthday attacks –security of hash functions and MACS.	18L
Integrity checks and Authentication algorithms: MD5 message digest algorithm - Secure hash algorithm (SHA) Digital Signatures: Digital Signatures - authentication protocols - digital signature standards (DSS)	8L
Web and System Security Web Security: Secure socket layer and transport layer security - secure electronic transaction (SET) - System Security: Intruders - Viruses and related threads - firewall design principals – trusted systems.	11L
Introduction to Blockchain and Cryptocurrency, Concept of Consensus, Ethereum and application of Blockchain and Cryptocurrency in different domains considering the security aspects	5L

Reference Books:
William Stallings, "Crpyptography and Network security Principles and Practices", Pearson/PHI.
Wade Trappe, Lawrence C Washington, "Introduction to Cryptography with coding theory", Pearson.
Ferouzen "Cryptography & Network Security", TMH Publication.

Cryptography and Network Security Lab (CA-HWoR-P2)   Credit 2

Assignments are to be added based on the topics mentioned in the theory

Data Mining & Data Warehousing (CA-MJ-T-16) (60L)   **Credit 3**

Introduction Definition of Data Mining, Data pre-processing, Data cleaning, Data transformation, Data Reduction, Data Visualization, Data extraction from large dataset, Data integration, sub-sampling, Feature selection, Scalability issues of data mining algorithms, text mining, web mining.	15L
Classification and Prediction Structural patterns of data, Tools for pattern recognition (preliminary concept), Linear models for classification, Evaluating the accuracy of the classifier or predictor, Bayesian Classification, Training and Test sets, Parametric and Non-parametric Learning, Minimum Distance Classifiers, k-NN rule, Discriminant Analysis, Decision trees. Similarity Measure, Basic hierarchical and non-hierarchical Clustering algorithms, Some Applications, Neural Learning.	30L
Data Warehousing (DWH) Introduction: Definition and description, need for data ware housing, need for strategic information, failures of past decision support systems, Application of DWH.	15L

Reference Books :
1. Data Mining: Practical Machine Learning Tools and Techniques, Ian H. Witten, Eibe Frank, Mark
A. Hall, Morgan Kaufman.
2. Pattern Classification and Scene Analysis, R.O. Duba, P.E. Hart and D.G. Stork, Wiley.
3. Pattern Recognition Principles, J.T. Tou and R.C. Gonzalez, Addison-Wesley.
4. Data Mining Concepts and Techniques by Jiawei Han and Micheline Kamber, Morgan
Kaufmann Publishers.
5. Data Warehousing, Data Mining and OLAP by Berson, Tata McGraw Hill.
6. Introduction to Data Mining by Pang-Ning Tan, Michael Steinbach, Vipin Kumar, Pearson
Education.
7. Data mining: Introductory and Advanced Topics by Dunham M H," Pearson Education.
8**.** Data Mining Concepts, Methods and Algorithms by Mehmed Kantardzic, John Wiley and
Sons.

Data Mining & Data Warehousing Lab (CA-MJ-P-16)   **Credit 1**

Assignments are to be added based on the topics mentioned in the theory

Cloud Computing (CA-MJ-T-17) (40L)   **Credit 3**

Defining a Cloud, Cloud Types – NIST model, Cloud Cube model, Deployment models (Public, Private, Hybrid and Community Clouds), Service model: - Infrastructure as a Service, Platform as a Service, Software as a Service with examples of services/ service providers. Cloud Reference model, Characteristics of Cloud Computing, Benefits and advantages of Cloud Computing, A brief introduction on Composability, Infrastructure, Platforms, Virtual Appliances, Communication Protocols, Applications, Connecting to the Cloud by Clients, IaaS –concept, Workload, partitioning of virtual private server instances, Pods, aggregations. SaaS - Basic concept and characteristics, Open SaaS and SOA, examples of SaaS platform Identity as a Service (IDaaS) Compliance as a Service (CaaS)	10L
Use of Platforms in Cloud Computing: Concepts of Abstraction and Virtualization technologies: Types of virtualization (access, application, CPU, storage), Load Balancing and Virtualization: Basic Concepts, Network resources for load balancing, Advanced load balancing (including Application Delivery Controller and Application	10L

Delivery Network), Mention of The Google Cloud as an example of use of load balancing. Hypervisors: Virtual machine technology and types, VMware vSphere Machine Imaging. Porting of applications in the Cloud: The simple Cloud API and AppZero Virtual Application appliance, Concepts of Platform as a Service, Definition of services, Distinction between SaaS and PaaS, Application development Use of PaaS Application frameworks. Discussion of Google Applications Portfolio – Indexed search, Dark Web, Aggregation and disintermediation, Productivity applications and service, Adwords, Google Analytics, Google Translate, a brief discussion on Google Toolkit (including introduction of Google APIs in brief), major features of Google App Engine service.	
Cloud Infrastructure: Cloud Management: An overview of the features of network management systems and a brief introduction of related products from large cloud vendors, Monitoring of an entire cloud computing deployment stack – an overview with mention of some products, Lifecycle management of cloud services (six stages of lifecycle). Concepts of Cloud Security: Cloud security concerns, Security boundary, Security service boundary Overview of security mapping Security of data: Brokered cloud storage access, Storage location and tenancy, encryption, and auditing and compliance Identity management (awareness of Identity protocol standards).	8L
Concepts of Services and Applications: Service Oriented Architecture: Basic concepts of message-based transactions, Protocol stack for an SOA architecture, Event-driven SOA, Enterprise Service Bus, Service catalogs, Applications in the Cloud: Concepts of cloud transactions, functionality mapping, Application attributes, Cloud service attributes, System abstraction and Cloud Bursting, Applications and Cloud APIs Cloud-based Storage: Cloud storage definition – Manned and Unmanned Webmail Services: Cloud mail services including Google Gmail, Mail2Web, Windows Live Hotmail, Yahoo mail, concepts of Syndication services.	12L

Reference Books:

1 Cloud Computing Bible by Barrie Sosinsky, Wiley India Pvt. Ltd, 2013
2 Mastering Cloud Computing by Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, McGraw Hill Education (India) Private Limited, 2013
3 Cloud computing: A practical approach, Anthony T. Velte, Tata Mcgraw-Hill
4 Cloud Computing, Miller, Pearson
5 Building applications in cloud: Concept, Patterns and Projects, Moyer, Pearson
6 Cloud Computing – Second Edition by Dr. Kumar Saurabh, Wiley India
7 Cloud Computing – Second Edition by Dr. Kumar Saurabh, Wiley India

Cloud Computing Lab (CA-MJ-P-17)   **Credit 1**

Assignments are to be added based on the topics mentioned in the theory

Research Methodology (CA-MJ-T-18) (40L)   **Credit 3**

Concepts of Research Design: Research- Overview, types and basic steps. objectives and variables of a research problem, Literature review Importance and objective of Literature review, locating relevant literature, Writing a survey and identifying the research problem. Research Proposal- Planning and writing a research proposal, Structure and components of research proposal, Methodology for quality research , Report writing and quality publications	10L
Scientific Research and Statistical Analysis Scientific Research: Introduction, objective and methods. Modelling-Introduction, types and stages of Model building, Data consideration and testing heuristics. Statistical Analysis: Reasoning, Error Analysis	10L

and Accuracy, Descriptive Statistics, Probability, Hypothesis Testing, Regression Analysis, SPSS/R/EViews/MATLAB/Octave. Numerical computation, plotting of functions, implementation of algorithms etc**.**	
Research Tools Advanced Searching Methods in online repositories/consortium, like in flibnet, Indest, Scopus, etc., Meta search engines and techniques. Tools for Editing, Presentation, Data visualization- Writing Research Paper-Hands-on with LaTeX. Syntax of Research Paper-Hands-on with Grammarly. Referencing Tools-Introduction, Importance and citation, Hands-on with Mendeley or Zotero and Scholarc.	10L
Research Writing and Academic Ethics Report writing and Publishing Research Findings. Structure of a thesis/research article/ review article, including title, introduction, literature review, methods and materials, referencing. Academic Ethics - Introduction, Intellectual Property Rights, Fraud and unscientific practices in science. Plagiarism, Citation counting and Impact factor, Types of Indexing SCI/SCIE/ESCI/SCOPUS/DBLP/Google Scholar/UGCCARE etc. Significance of conferences and their ranking.	10L

Reference Books:
1. C. R. Kothari, Research Methodology: Methods and Techniques, New Age International, New Delhi, 2004.
2. Justin Zobel, Writing for computer Science, Third Edition, Springer, 2014.
3. Kumar R. Research Methodology: A Step by Step Guide for Beginners, 3rd ed., Pearson Education, 2010.
4. Ranjit Kumar, ―Research Methodology: A Step by Step Guide for Beginners‖ , 2/e, Pearson India, 2005.
5. Michael P. Marder, Research Methods for Science, Cambridge University Press, 2011.
6. P. Oliver, Writing Your Thesis, New Delhi: Vistaar Publications, 2004.
7. Gregory, Ethics in Research, Continuum, 2005.
8. C. Radhakrishna Rao, Statistics and Truth, CSIR, 1989.
9. Sheldon M Ross, Introduction to Probability and Statistics for Engineers and Scientists, Elsevier, 2010.
10. RA Day, How To Write and Publish a Scientific Paper, Cambridge University Press,London, 1992.
11. B. Latour, Woolgar, Laboratory Life: The Construction of Scientific Facts, 2nd Edition,Princeton: Princeton University Press, 1986.
12. S.K. Yadav, ―Elements of Research Writing‖ , UDH Publishers & Distributors, Pvt. Ltd. New Delhi, 2015.
13. Douglas C. Montgomery and George C. Runger, ―Applied Statistics & Probability for Engineers‖ , 3rd ed, Wiley India, 2007.

Research Methodology Lab (CA-MJ-P-18)   **Credit 1**

Assignments are to be added based on the topics mentioned in the theory

Technical Report writing and IPR (CA-HWR-T-1) (40L)   **Credit 3**

Module 1 Interpretation and Report Writing: Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports.	10L
Module 2 Testing of Hypotheses: Hypothesis, Basic Concepts Concerning Testing of Hypotheses, Testing of Hypothesis, Test Statistics and Critical Region, Critical Value and Decision Rule, Procedure for Hypothesis Testing, Hypothesis Testing for Mean, Proportion, Variance, for Difference of Two Mean, for Difference of Two Proportions, for Difference of Two Variances, P-Value approach, Power of Test, Limitations of the Tests of Hypothesis. Chi-square Test: Test of Difference of more than Two Proportions, Test of	10L

Independence of Attributes, Test of Goodness of Fit, Cautions in Using Chi Square Tests.	
Module 3 Advanced Searching Methods in online repositories/consortium, like in-flibnet, Indest, Scopus, etc., Meta search engines and techniques. Tools for Editing, Presentation, Data visualization- Writing Research Paper-Hands-on with LaTeX. Syntax of Research Paper-Hands-on with Grammarly. Referencing Tools-Introduction, Importance and citation, Hands-on with Mendeley or Zotero and Scholarc.	10L
Module 4 Intellectual Property: The Concept, Intellectual Property System in India, Development of TRIPS Complied Regime in India, Patents Act, 1970, Trade Mark Act, 1999,The Designs Act, 2000, The Geographical Indications of Goods (Registration and Protection) Act1999, Copyright Act,1957,The Protection of Plant Varieties and Farmers' Rights Act, 2001,The Semi-Conductor Integrated Circuits Layout Design Act, 2000, Trade Secrets, Utility Models, IPR and Biodiversity, The Convention on Biological Diversity (CBD) 1992, Competing Rationales for Protection of IPRs, Leading International Instruments Concerning IPR, World Intellectual Property Organisation (WIPO),WIPO and WTO, Paris Convention for the Protection of Industrial Property, National Treatment, Right of Priority, Common Rules, Patents, Marks, Industrial Designs, Trade Names, Indications of Source, Unfair Competition, Patent Cooperation Treaty (PCT), Advantages of PCT Filing, Berne Convention for the Protection of Literary and Artistic Works, Basic Principles, Duration of Protection, Trade Related Aspects of Intellectual Property Rights(TRIPS) Agreement, Covered under TRIPS Agreement, Features of the Agreement, Protection of Intellectual Property under TRIPS, Copyright and Related Rights, Trademarks, Geographical indications, Industrial Designs, Patents, Patentable Subject Matter, Rights Conferred, Exceptions, Term of protection, Conditions on Patent Applicants, Process Patents, Other Use without Authorization of the Right Holder, Layout-Designs of Integrated Circuits, Protection of Undisclosed Information, Enforcement of Intellectual Property Rights, UNSECO.	10L

Reference Books:
1. C. R. Kothari, Research Methodology: Methods and Techniques, New Age International, New Delhi, 2004.
2. Justin Zobel, Writing for computer Science, Third Edition, Springer, 2014.
3. Kumar R. Research Methodology: A Step by Step Guide for Beginners, 3rd ed., Pearson Education, 2010.
4. Ranjit Kumar, ―Research Methodology: A Step by Step Guide for Beginners ‖ , 2/e, Pearson India, 2005.
5. Michael P. Marder, Research Methods for Science, Cambridge University Press, 2011.
6. P. Oliver, Writing Your Thesis, New Delhi: Vistaar Publications, 2004.
7. Gregory, Ethics in Research, Continuum, 2005.
8. C. Radhakrishna Rao, Statistics and Truth, CSIR, 1989.
9. Sheldon M Ross, Introduction to Probability and Statistics for Engineers and Scientists, Elsevier, 2010.
10. RA Day, How To Write and Publish a Scientific Paper, Cambridge University Press,London, 1992.
11. B. Latour, Woolgar, Laboratory Life: The Construction of Scientific Facts, 2nd Edition,Princeton: Princeton University Press, 1986.
12. S.K. Yadav, ―Elements of Research Writing ‖ , UDH Publishers & Distributors, Pvt. Ltd. New Delhi, 2015.
13. Douglas C. Montgomery and George C. Runger, ―Applied Statistics & Probability for Engineers ‖ , 3rd ed, Wiley India, 2007.

Technical Report writing and IPR Lab (CA-HWR-P1)   **Credit 1**

Assignments are to be added based on the topics mentioned in the theory

Dissertation (Credit 8)