KLE Technological University | Creating Value, Leveraging Knowledge

Curriculum Structure and Curriculum Content for the Batch: 2023-26
Department of Computer Applications
Program: Bachelor of Computer Applications

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Table of Contents

KLE Technological University | Creating Value, Leveraging Knowledge

Vision and Mission of KLE Technological University

Vision

KLE Technological University will be a national leader in Higher Education–recognised globally for innovative culture, outstanding student experience, research excellence and social impact.

Mission

KLE Technological University is dedicated to teaching that meets highest standards of excellence, generation and application of new knowledge through research and creative endeavors.

The three-fold mission of the University is:

- To offer undergraduate and post-graduate programs with engaged and experiential learning environment enriched by high quality instruction that prepares students to succeed in their lives and professional careers.

- To enable and grow disciplinary and inter-disciplinary areas of research that build on present strengths and future opportunities aligning with areas of national strategic importance and priority.

- To actively engage in the Socio-economic development of the region by contributing our expertise, experience and leadership, to enhance competitiveness and quality of life.

As a unified community of faculty, staff and students, we work together with the spirit of collaboration and partnership to accomplish our mission.

Vision and Mission Statements of the Department

Department Vision

To be a premier department offering UG and PG Programs in computer applications to develop competitive professionals having the right knowledge, research skills, and attitude to meet global challenges in the field of computer science and its applications

Department Mission

- To provide high-quality education through outstanding teaching industry-relevant novel curricula to enable them to accomplish a successful career in computer science and its applications.
- To contribute to advancing knowledge in both fundamentals and applied areas of Computer Science.
- To provide a scholarly and pleasant learning platform that enables staff and students to grow academically and professionally.
- To provide valuable services to society through education, entrepreneurship, and professional activities in Computer Science and its Applications.

Program Educational Objectives/Program Outcomes and Program-Specific Objectives

Program Educational Objectives -PEO's
PEO: 1Have a strong foundation and ability to apply knowledge of Computer Science, Mathematics, and Humanities to conceive, analyse, design, and implement IT solutions to problems in real-life applications.
PEO: 2. Have a comprehensive background to practice Software Engineering Principles in various domains that require software architecture, design, development, and testing practices.
PEO: 3. Understand the professional and ethical obligations of a software engineer towards society and the need for lifelong learning.
PEO: 4. Have the ability to participate in multi-disciplinary teams using ICT effectively.
Program Outcomes-PO's
PO 1: Computational knowledge: Apply knowledge of computing fundamentals, computing specialization, mathematics, and domain knowledge appropriate for the computing specialization to the abstraction and conceptualization of computing models from defined problems and requirements.
PO 2: Problem analysis: Identify, formulate research literature, and solve complex computing problems, reaching substantiated conclusions using fundamental principles of mathematics, computing sciences, and relevant domain disciplines.
PO 3: Design/Development of Solutions: Design and evaluate solutions for complex computing problems, and design and evaluate systems, components, or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.
PO 4: Conduct investigations of complex problems: Use research-based knowledge and research methods, including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5: Modern tool usage: Create, select, adapt, and apply appropriate techniques, resources, and modern computing tools to complex computing activities, with an understanding of the limitations.
PO 6: Professional Ethics: Understand and commit to professional ethics and cyber regulations, responsibilities, and norms of professional computing practice.
PO 7: Life-long learning: Recognize the need, and have the ability, to engage in independent learning for continual development as a computing professional.
PO 8: Project management and finance: Demonstrate knowledge and understanding of the computing and management principles and apply these to one's work as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 9: Communication Efficacy: Communicate effectively with the computing community, and with society at large, about complex computing activities by being able to comprehend and write effective reports, design documentation, make effective presentations and give and understand instructions clearly.
PO 10: Societal and Environmental Concern: Understand and assess societal, environmental, health, safety, legal, and cultural issues within local and global contexts and the consequential responsibilities relevant to professional computing practice.

PO 11: Individual and teamwork: Function effectively as an individual and as a member or leader in diverse teams and multi-disciplinary environments.
PO 12: Innovation and Entrepreneurship: Identify a timely opportunity and use of innovation to pursue that opportunity to create value and wealth for the betterment of the individual and society at large.
Program Specific Objectives -PSO's
PSO 1: IT skills: An ability and capacity acquired through deliberate, systematic, and sustained effort to carry out complex IT activities involving innovative ideas, technical skills, and interpersonal skills.
PSO 2: Professional Competency: Apply computing concepts, skills, and processes to produce a product/project in the domain, demonstrating professional knowledge and attitude.

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Curriculum Structure-Overall

Course with course code	Semester		Total Program Credits:132			Year: 2023-26	
	I	II	III	IV	V	VI	
	Operating Systems (22EBCC104) 3-0-1	Linear Algebra and Graph Theory (23EBCB102) 4-0-0	Applied Statistics (24EBCB201) 3-0-1	Java Programming (24EBCC205) 3-0-0	Cloud Computing (24EBCC301) 3-0-1	Industry Training (22EBCI301) 0-0-8	Elective-2 (24EBCE3XX) 3-0-1
	Discrete Mathematical Structures (23EBCB101) 4-0-0	Database Management Systems (23EBCC103) 4-0-0	Computer Networks (24EBCC201) 3-0-1	Big Data Analytics (24EBCC206) 3-0-1	Advanced JAVA Programming (24EBCC302) 3-0-1		Elective-3 (24EBCE3XX) 3-0-1
	Computer Organization and Architecture (23EBCC101) 3-1-0	Data Structures and Algorithms (23EBCC104) 4-0-0	Object-Oriented Programming using C++ (24EBCC202) 3-0-2	DevOps Lab (24EBCP201) 0-0-1.5	Machine Learning (24EBCC303) 3-0-1	Industry Project (23EBCI301) 0-0-17	Capstone Project (23EBCP302) 0-0-17
	Problem solving using C (23EBCP101) 0-0-3	Software Engineering (23EBCC105) 3-1-0	Data Mining (24EBCC203) 3-0-1	Minor Project-1 (23EBCP201) 0-0-6	Natural Language Processing & Gen AI(24EBCC304) 2-0-2		
	Python Programming (23EBCP102) 0-0-1	Data Structures and Algorithms Lab (23EBCP104) 0-0-2	Full Stack Web Development (24EBCC204) 1-0-2.5	Java Programming Lab (24EBCP202) 0-0-2	Elective-1 (24EBCE3XX) 3-0-1		
	Web Technology (23EBCP103)	Database Management Systems Lab (23EBCP105)	Arithmetical Thinking and Analytical	Professional Aptitude and	Minor Project-2 (23EBCP301)		

	0-0-1.5	0-0-1.5	Reasoning (23EHSH203) 0.5-0-0	Logical Reasoning (23EHSC201) 3-0-0	0-0-6		
	Professional Communication (23EBCH101) 2-0-0	Problem-Solving and Analytical Skills (23EHSH102) 0.5-0-0		Industry Readiness and Leadership Skills(23EHSH204) 0.5-0-0			
	Corporate Communication Skills (23EBCH102) 0.5-0-0						
Credits	**20**	**20**	**21**	**20**	**26**	**25**	

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Curriculum Structure-Semester wise

Semester - I

No	Code	Course	Category	L-T-P	Credits	Contact Hours	ISA	ESA	Total	Exam Duration (in hrs)
1	22EBCC104	Operating Systems	PSC	3-0-1	4	5	50	50	100	3 hours
2	23EBCB101	Discrete Mathematical Structures	BS	4-0-0	4	4	50	50	100	3 hours
3	23EBCC101	Computer Organization and Architecture	PSC	3-1-0	4	5	50	50	100	3 hours
4	23EBCP101	Problem solving using C	PSC	0-0-3	3	6	80	20	100	3 hours
5	23EBCP102	Python Programming	PSC	0-0-1	1	2	80	20	100	3 hours
6	23EBCP103	Web Technology	PSC	0-0-1.5	1.5	3	80	20	100	3 hours
7	23EBCH101	Professional Communication	HSC	2-0-0	2	2	50	50	100	3 hours
8	23EBCH102	Corporate Communication Skills	HSC	0.5-0-0	0.5	1	100	--	100	--
Total				**12.5-1-6.5**	**20**	**28**	**540**	**260**	**800**	

ISA: In Semester Assessment **ESA**: End Semester Assessment **L**: Lecture **T**: Tutorials **P**: Practical

Date: Program Head

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Semester - II

No	Code	Course	Category	L-T-P	Credits	Contact Hours	ISA	ESA	Total	Exam Duration (in hrs)
1	23EBCB102	Linear Algebra and Graph Theory	BS	4-0-0	4	4	50	50	100	3 hours
2	23EBCC103	Database Management Systems	PSC	4-0-0	4	4	50	50	100	3 hours
3	23EBCC104	Data Structures and Algorithms	PSC	4-0-0	4	4	50	50	100	3 hours
4	23EBCC105	Software Engineering	PSC	3-1-0	4	5	50	50	100	3 hours
5	23EBCP104	Data Structures and Algorithms Lab	PSC	0-0-2	2	4	80	20	100	3 hours
6	23EBCP105	Database Management Systems Lab	PSC	0-0-1.5	1.5	3	80	20	100	3 hours
7	23EHSH102	Problem-Solving and Analytical Skills	HSC	0.5-0-0	0.5	1	100	--	100	--
Total				**15.5-1-3.5**	**20.0**	**25**	**460**	**240**	**700**	

ISA: In

Semester Assessment **ESA**: End Semester Assessment **L**: Lecture **T**: Tutorials **P**: Practical

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Semester- III

ISA: In Semester Assessment **ESA**: End Semester Assessment **L**: Lecture **T**: Tutorials **P**: Practical

No	Code	Course	Category	L-T-P	Credits	Contact Hours	ISA	ESA	Total	Exam Duration (in hrs)
1	24EBCB201	Applied Statistics	BS	3-0-1	4	5	50	50	100	3 hours
2	24EBCC201	Computer Networks	PSC	3-0-1	4	5	50	50	100	3 hours
3	24EBCC202	Object-Oriented Programming using C++	PSC	3-0-2	5	7	50	50	100	3 hours
4	24EBCC203	Data Mining	PSC	3-0-1	4	5	50	50	100	3 hours
5	24EBCC204	Full Stack Web Development	PSC	1-0-2.5	3.5	6	50	50	100	1.5 hours
6	23EHSH203	Arithmetical Thinking and Analytical Reasoning	HSC	0.5-0-0	0.5	1	100	--	100	--
TOTAL				**13.5-0-7.5**	**21**	**29**	**350**	**250**	**600**	

Date: Program Head

KLE Technological University | Creating Value, Leveraging Knowledge

Semester- IV

No	Code	Course	Category	L-T-P	Credits	Contact Hours	ISA	ESA	Total	Exam Duration (in hrs)
1	24EBCC205	Java Programming	PSC	3-0-0	3	3	50	50	100	3 hours
2	24EBCC206	Big Data Analytics	PSC	3-0-1	4	5	50	50	100	3 hours
3	24EBCP201	DevOps Lab	PSC	0-0-1.5	1.5	3	80	20	100	1.5 hours
4	23EBCP201	Minor Project-1	PSC	0-0-6	6	12	50	50	100	3 hours
5	23EHSH204	Industry Readiness and Leadership Skills	HSC	0.5-0-0	0.5	1	100	--	100	--
6	23EHSC201	Professional Aptitude and Logical Reasoning	HSC	3-0-0	3	3	50	50	100	3 hours
7	24EBCC205	Java Programming Lab	PSC	0-0-2	2	4	80	20	100	3 hours
TOTAL				**9.5-0-10.5**	**20**	**31**	**460**	**240**	**700**	

ISA: In Semester Assessment **ESA**: End Semester Assessment **L**: Lecture **T**: Tutorials **P**: Practical

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Semester- V

No	Code	Course	Category	L-T-P	Credits	Contact Hours	ISA	ESA	Total	Exam Duration (in hrs)
1	24EBCC301	Cloud Computing	PSC	3-0-1	4	5	63	37	100	3 hours
2	24EBCC302	Advanced JAVA Programming	PSC	3-0-1	4	5	63	37	100	3 hours
3	24EBCC303	Machine Learning	PSC	3-0-1	4	5	63	37	100	3 hours
4	24EBCC304	Natural Language Processing & Gen AI	PSC	2-0-2	4	6	50	50	100	2 hours
5	24EBCE3XX	Elective-1	PSE	3-0-1	4	5	63	37	100	3 hours
6	23EBCP301	Minor Project-2	PSC	0-0-6	6	12	50	50	100	3 hours
TOTAL				14-0-12	26	38	352	248	600	

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Date: Program Head

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Semester- VI

No	Code	Course	Category	L-T-P	Credits	Contact Hours	ISA	ESA	Total	Exam Duration (in hrs)
1	24EBCE3XX	Elective-2	PSE	3-0-1	4	5	63	37	100	3 hours
2	24EBCE3XX	Elective-3	PSE	3-0-1	4	5	63	37	100	3 hours
3	23EBCP302	Capstone Project	PSC	0-0-17	17	34	50	50	100	3 hours
		OR		**6-0-19**	**25**	**44**	**176**	**124**	**300**	
1	22EBCI301	Industry Training	PW	0-0-8	8	16	50	50	100	--
2	23EBCI301	Industry Project	PW	0-0-17	17	34	50	50	100	3 hours
TOTAL				**0-0-25**	**25**	**50**	**100**	**100**	**200**	

ISA: In Semester Assessment **ESA**: End Semester Assessment **L**: Lecture **T**: Tutorials **P**: Practical

Date: Program Head

List of Program Electives

S.No	Name of the Course	Course Code
Professional Elective – 1, 2 & 3		
Group-Cyber Security (Elective1)		
1	Cyber Security	24EBCE301
2	Security Operations and Incident Response	24EBCE302
3	Ethical Hacking & Penetration Testing	24EBCE303
4	Blockchain Technologies	24EBCE304
5	Digital Forensics	24EBCE305
6	Cyber Attacks and Counter Measures	24EBCE306
Group- Software Engineering (Elective2)		
1	User Interface Design	24EBCE307
2	ASP.NET MVC Framework	24EBCE308
3	Mobile Application Development	24EBCE309
4	Agile Project Management	24EBCE310
5	Secure Software Engineering	24EBCE311
6	Object Oriented Modeling and Design	24EBCE312
Group- Data Analytics and Machine Learning (Elective3)		
1	Statistical Techniques for Data Analytics	24EBCE313
2	Internet of Things	24EBCE314
3	Social Network Analysis	24EBCE315

Curriculum Content- Course wise

Semester - I

Program: Bachelor of Computer Applications		**Semester: I**
Course Title: Operating Systems		**Course Code:22EBCC104**
L-T-P: 3-0-1	**Credits:4**	**Contact Hours:5 hrs/week**
ISA Marks:50	**ESA Marks:50**	**Total Marks:100**
Teaching Hours:40	**Practical Hours: 24**	**Exam Duration:3 Hours**

	Unit I	
1	**Chapter1: Fundamentals of Process** Operating System Functions and Characteristics, Process Concept, Process Control and Operations, System Call, Inter Process Communication.	**6 Hrs.**
2	**Chapter2: CPU Scheduling** Basic Concepts, Schedulers, Scheduling Criteria, Scheduling Algorithms, Multithreading models.	**6 Hrs.**
3	**Chapter3: Process Synchronization** Background, The critical section problem, Peterson's solution, Synchronization Hardware, Semaphores, Producer Consumer problem,	**4 Hrs.**
	Unit II	
4	**Chapter 4: Deadlocks** Deadlocks: System model; Deadlock characterization; methods for handling deadlocks; Deadlock prevention; Deadlock avoidance; Deadlock detection and recovery from deadlock.	**6 Hrs.**
5	**Chapter 5: Memory Management** Memory Management Strategies: Background; Swapping, Contiguous memory allocation; Segmentation, Paging, Structure of page table.	**6 Hrs.**
6	**Chapter 6: Virtual Memory Management** Background, Demand paging, Page replacement	**4 Hrs.**
	Unit III	
7	**Chapter 7 : File System Management** Implementing File System: File system structure File system implementation; Directory implementation; Allocation methods.	**4 Hrs.**
8	**Chapter 8: Secondary Storage Management** Mass storage structures; Disk structure; Disk scheduling.	**4 Hrs.**

Text Books:

1 Abraham Silberschatz, Peter Galvin and Greg Gagne, Operating System Principles, 10 ed edition, Wiley-India, 2018
2 W. Richard Stevens, Stephen A. Rago, "Advanced Programming in the UNIX Environment", 3 Ed. Addison Wesley Professional, 2018

References:

1. William Stallings, "Operating System Internals and Design Principles", 1 ed., Pearson Education, Asia, 2015
2. Gary Nutt," Operating System", 3 ed., Pearson Education,

BACK

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Program: Bachelor of Computer Applications		Semester: I
Course Title: Discrete Mathematical Structures		Course Code:23EBCB101
L-T-P:4-0-0	Credits:4	Contact Hours:4 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 50		Exam Duration: 3 Hrs

	Unit I	
1	**Sets, Proof Templates and Induction** Basic Definitions, Operations on Sets, Principles of Inclusion and Exclusion, Mathematical Induction, Exercises.	**8 Hrs**
2	**Formal Logic** Introduction to Propositional Logic, Truth and Logical Truth, Normal Forms, Predicates & Quantification, Exercises.	**8 Hrs**
3	**Integers** The integers and Division, Primes and GCD's, Integers and Algorithms. Applications of Number Theory.	**4 Hrs**
	Unit II	
4	**Relations and Ordered Sets** Introduction, Operations on Relations, Composition and Properties of Relations, Equivalence Relation. Partial Ordered Set, Hasse-Diagram of Poset.	**10 Hrs**
5	**Lattices and Counting Principles** Definition, Products, Properties and Special of Lattices. Permutations and Combinations. Generalized Permutations and Combinations.	**10 Hrs**
	Unit – III	
6	**Functions** Basic Definitions, Types of Functions, Composition and Invertible functions. The Pigeon- Hole Principle, Exercises.	**5 Hrs**
7	**Algebraic Structures** Binary Operations, Monoids, Semi-groups, Introduction to Groups, Sub-groups.	**5 Hrs**

Text Books:

1. Discrete Mathematics and its Applications, Kenneth H Rosen, McGraw-Hill, 8th edition, 2021
2. Gary Haggard, John Schlipf and Sue Whiteside, Discrete Mathematics and Computer Science, Thomson, 2007.Discrete and Combinatorial Mathematics by Ralph Grimaldi, Pearson Education, Asia, 5th edition-2023

References:

1. Kolman, Bernad and Busby, R.C., Discrete Mathematical Structures, 6th edition, Pearson Education India, 2015.
2. Lipschutz Seymour and Lipson Marc, Discrete Mathematics, 3rd edition, Tata McGraw-Hill, 2017.

BACK

Program: Bachelor of Computer Applications		**Semester - I**
Course Title: Computer Organization and Architecture		**Course Code: 23EBCC101**
L-T-P: 3-1-0	**Credits:4**	**Contact Hrs: 5 hrs/week**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hrs: 40	**Practical Hours: 24**	**Exam Duration: 3 hours**

	Unit I	
1	**Chapter 1: Binary Systems, Boolean Algebra and Logic Gates** Digital Computers and Digital Systems, Binary Numbers, Number Base Conversions, Signed Binary Numbers, Binary Logic, Boolean Algebra and Logic Gates.	**4 Hrs**
2	**Chapter 2: Simplification of Boolean Functions and Combinational Logic** The Map Method, Two- and Three-Variable Maps, Four Variable Map, Product of Sums Simplification, Don't-Care Conditions, Combinational Logic: Design Procedure, Combinational Logic Circuits, Code Conversions.	**6 Hrs**
3	**Chapter 3: Sequential Circuit Design** Introduction, Flip-Flops and Triggering of Flip-Flops, Latches, Clocked Sequential Circuits, Introduction to Registers and Counters, Binary storage and Registers, Design of Shift registers and Counters.	**6 Hrs**
	Unit II	
4	**Chapter 4: Basic Structure of Computers** Computer Types, Functional Units, Basic Operational Concepts, Bus Structure, Memory Locations and Addresses.	**6 Hrs**
5	**Chapter 5: Machine instruction and Programs** Memory Operations, Instructions & Instruction Sequencing, Addressing Modes, Assemble Language.	**6 hrs**
6	**Chapter 6: The Memory System** Basics Concepts, Semiconductor RAM Memories, Read-only Memories, Cache Memories, Virtual Memory.	**4 Hrs**
	Unit – III	
7	**Chapter 7: Input/Output Organization** Accessing I/O Devices, Interrupts, Direct Memory Access.	**4 Hrs**
8	**Chapter 8: Embedded Systems:** Examples of Embedded Systems, Processor Chips for Embedded Applications, A Simple Microcontroller.	**4 Hrs**

Text Book:

1. Digital Logic and Computer Design, Morris Mano, Pearson Education Asia(Kindle Edition)2017.
2. Computer Organization and an Embedded System, Carl Hamacher, Z Varnesic and S Zaky,NManjikian, 6th Edition, McGraw Hill, 2023.

References:

1. Digital Electronics Principles and Applications, Tokheim, 9th Edition, McGraw Hill, 2021.

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BACK

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Program: Bachelor of Computer Applications		**Semester - I**
Course Title: Problem Solving using C		**Course Code: 23EBCP101**
L-T-P: 0-0-3	**Credits: 3**	**Contact hrs: 6 Hrs/week**
ISA Marks: 80	**ESA Marks: 20**	**Total Marks: 100**
Teaching Hrs: --	**Tutorial/Practical: 78**	**Exam Duration: 3 Hrs**

1	**Introduction to Problem Solving** Introduction to algorithms, Flowcharts and its Notations, Top down design.	**6 Hrs**
2	**Basics of C programming language** C Tokens: Keywords, Identifiers, Variables, Constants, Operators; Expressions, Data types, Input and Output statements, Structure of C program	**15 Hrs**
3	**Decision Making and Branching Statements** Conditional and Unconditional branching statements. Introduction to Debugging Skills.	**9 Hrs**
4	**Looping** While, do while, for, Nested loops.	**12 Hrs**
5	**Functions** Introduction to Functions, Types of functions, Categories of functions.	**9 Hrs**
6	**Arrays and Strings** Introduction: Declaration, accessing elements, Storing values in arrays; Operations on one dimensional array, Operations on two dimensional arrays.	**12 Hrs**
7	**Pointers** Introduction: declaring a pointer, pointer variables, pointer expression and arithmetic, passing arguments to functions using pointers.	**9 Hrs**
8	**Structures and Unions** Introduction to Structures, passing structures to functions, Array of structures, Pointers to structures, Introduction to Unions.	**6 Hrs**

Text Books :

1. Programming in ANSI C by E Balgurusamy 8th Edition Tata McGraw Hill, 2019.
2. R.G. Dromey, How to Solve it by Computer, 1sted, PHI, 2008.
3. YashvantKanetkar, Let us C, 17thed, BPS Publication, 2018.

Reference Books:

1. Elliot B.Koffman,JeriR.Hanly Problem Solving and Program Design in C,8thed,PHI,2016
2. M.T.Somashekara, D.S.Guru, K S Manjunath Problem Solving with C 2nd Edition PHI , 2018
3. BasavarajAnami, S A Angadi, S SManavi Computer Concept and C Programming A Holistic approach to Learning C with C 2nd Edition PHI,2010

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BACK

Program: Bachelor of Computer Applications		Semester - I
Course Title: Python Programming		Course Code: 23EBCP102
L-T-P: 0-0-1	Credits: 1	Contact: 2 hrs/week
ISA Marks: 80	ESA Marks: 20	Total Marks: 100
Teaching Hrs: --	Tutorial/Practical: 24 hrs	Exam Duration: 3 Hrs

Unit-I

1	**Introduction to Python** Installing Python 3.X, Using the Python shell, Strings, print () function, Data types, Order of Evaluation, Number Formats, Rules for defining variable, Built in types, Tuples, List, Dictionary, Ranges of sequences, Control flow statements	**6 Hrs**
2	**Functions** def Statements with Parameters, Return Values and return Statements, None Value, Keyword Arguments, Local and Global Scope, Exception Handling	**6 Hrs**
3	**Classes and Objects** Object, defining a Class, Objects and Their Scope, Modules and Packages, importing a Module, making a Module from Pre-existing Code, Testing of modules and packages	**6 Hrs**
4	**Files and Directories** File objects, writing text files, Appending Text to a file, reading text files, File exceptions, Paths and directories, File operations, Globbing, Searching for files, Clipping logs, Navigating the file System with the os Module, Working with regular expressions	**6 Hrs**

Text Books:

1) Python The Complete Reference, Martin C Brown, Mc Graw Hill, 2018
2) Learning Python, Mark Lutz, Orielly, 5th Edition, 2013
3) Python Programming: A Modern Approach, VamsiKurama, Pearson, 2017

Reference Books:

1) Think Python, 2nd Edition, Allen Downey, Green Tea Press, 2017
2) Core Python Programming, W.Chun, Pearson, 2016
3) Introduction to Python, Kenneth A. Lambert, Cengages, 2015

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BACK

Program: Bachelor of Computer Applications		Semester - I
Course Title: Web Technology		Course Code: 23EBCP103
L-T-P: 0-0-1.5	Credits: 1.5	Contact: 3 hrs/week
ISA Marks: 80	ESA Marks: 20	Total Marks: 100
Teaching Hrs: --	Tutorial/Practical: 36 hrs	Exam Duration: 3 Hrs

Unit-I

1	**Chapter 1 : Fundamentals of Web** Introduction to the Internet, The World Wide Web, Web Browsers, Web Servers, Uniform Resource Locators, Hypertext Transfer Protocol, Security, Web Programmer's Toolbox	8 Hrs
2	**Chapter 2: HTML 5** HTML5 tags, Multimedia tags, Form attributes, Meter tag, Drag and drop, Image tags, Block & inline, Geo location, Location properties, Handling errors and rejections, Google map, Canvas, URL schemes, ASCII encoding	8 Hrs
3	**Chapter 3: CSS and Bootstrap 5** Levels of Style Sheets, Style Specification Formats, Box Model, Basic layouts, Animations, Accordions, Progress bar, Validation, Borders, Fonts, Alerts, Toasts, Navbars, Card utilities, Pagination, Slideshow using carousel	10 Hrs
4	**Chapter 4: Dynamic documents and JavaScript** JavaScript Execution Environment, Element Access in JavaScript, Event Handling, Button, Text Box and Password Elements, Positioning Elements, Dynamic Content, Stacking Elements, Dragging and Dropping Elements.	10 Hrs

Text Books :

1. Robert W Sebesta, Programming the World Wide Web, 8th Edition, Pearson education,2020.

Reference Books:

1. Thomas Powell, HTML & CSS: The Complete Reference, 5th Edition, McGraw-Hill, 2017
2. Eric Meyer, Estelle Weyl, CSS: The Definitive Guide : Web Layout and Presentation, 5th Edition, O' Reilly, 2023.

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BACK

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Program: Bachelor of Computer Applications		**Semester - I**	
Course Title: Professional Communication		**Course Code: 23EBCH101**	
L-T-P: 2-0-0	**Credits: 2**	**Contact Hrs.: 2 Hrs/Week**	
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**	
Teaching Hrs: 30		**Examination Duration: 3 Hrs.**	
Unit-I			
1	**Chapter 1: Parts of Speech** Noun, Pronoun, Verb, Adjective, Adverb, Preposition, Conjunction, Exclamation and Interjection.		**2 Hrs**
2	**Chapter 2: Sentence Structures** Auxiliary Verbs, PNQ Paradigm		**2 Hrs**
3	**Chapter 3: Advanced Sentence Structures** Forms of Verbs, Tenses.		**1 Hr**
4	**Chapter 4: Basic Writing Strategies** Active and Passive		**1 Hr**
5	**Chapter 5: Analytical Grammar** Error Identification		**2 Hrs**
6	**Chapter 6: Words' Usage** Vocabulary – Antonyms, Synonyms, Homonyms, Homophones		**2 Hrs**
7	**Chapter 7: Word Building** Word Formation – Prefixes, Suffixes and Affixes.		**2 Hrs**
Unit-II			
8	**Chapter 8: Group Communication** Group Discussion		**3 Hrs**
9	**Chapter 9: Presentation Skills** Individual Presentation		**3 Hrs**
10	**Chapter 10: Conversations** Situational Role Plays.		**3 Hrs**
11	**Chapter 11: Critical Analysis** Book Review, Movie Review		**3 Hrs**
Unit-III			
12	**Chapter 12: Business Writing** Report Writing, Letter Writing		**3 Hrs**
13	**Chapter 13: Creative Writing** Passage Writing		**3 Hrs**
Text Book: 1. English Grammar and Composition by Wren and Martin's 2. English Grammar in Use Book by Raymond Murphy			
References: 1. Essential English Grammar by Raymond Murphy 2. Intermediate English Grammar by Raymond Murphy 3. Advanced English Grammar by Raymond Murphy			

BACK

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Program: Bachelor of Computer Applications		**Semester - I**
Course Title: Corporate Communication Skills		**Course Code: 23EBCH102**
L-T-P: 0.5-0-0	**Credits: 0.5**	**Contact Hours: 1 hr/week**
ISA Marks: 100	**ESA Marks: --**	**Total Marks: 100**
Teaching Hours: 12		**Exam Duration: --**

1	**Modules:** **Communication Skills:** Tools of Communication, Listening, Body Language, Common Postures and Gestures, Open and Closed Body Language, Body Language to be used in Corporate Scenarios, Voice: Pitch, Pace, and Pause, **Verbal Language:** Positive & Negative Vocabulary, Corporate Conversations **Presentation Skills:** Zero Presentation, Individual Presentations and feedback, Making Presentations Interactive, Types of Questions, taking off and Signing off differently, Captivating your Audience, Corporate Presentations **Written English:** Vocabulary Enhancement Strategies, Root Words in English, Grammar Improvement Techniques, Dictionary Usage, Similar and Contradictory Words **Spoken English:** Phonetic and Non-Phonetic Languages, Introduction to IPA, sounds in English, Syllables, Word Stress, Rhythm, Pausing, and Intonation	**12 Hrs**

Text Books:

1. Communication Skills: A Practical Guide to Improving Your Social Intelligence, Presentation, Persuasion and Public Speaking: 9 (Positive Psychology Coaching) 11 July 2015.
2. Business Communication Today | Fourteenth Edition | By Pearson, 12 July 2018.

Reference Books:

1. 10 Skills for Effective Business Communication: Practical Strategies from the World's Greatest Leaders, 21 August 2018

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BACK

II Semester

Program: Bachelor of Computer Applications		**Semester - II**
Course Title: Linear Algebra and Graph Theory		**Course Code: 23EBCB102**
L-T-P: 4-0-0	**Credits: 4**	**Contact Hours: 4 hrs/week**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hours: 50		**Examination Duration: 3hrs**

	Unit-I	
1	**Chapter 1: Matrices** Introduction to the system of linear equations and their solutions, elementary row operations-echelon form, Rank of a matrix.	**06 Hrs**
2	**Chapter 2: System of linear equations** Consistency of system of linear equation, solution of system of equations by (i) Direct Methods-Gauss elimination, Gauss Jordon method (ii) Iterative Methods- Guass-Seidal method. Eigen values and Eigen vectors of a matrix. Largest Eigen value and the corresponding Eigen vector by power method, Application case study.	**14 Hrs**
	Unit-II	
3	**Chapter 3: Vector space** Vector spaces and sub spaces- examples, Linear combinations Spanning sets, subspaces, Linear spans Row space of a matrix, Linear dependence and linear independence. Basis and dimensions, application to matrices, Rank of a Matrix. Sums and direct sums, Coordinates, Application case study.	**08 Hrs**
4	**Chapter 4: Graph theory** Definitions and examples of graph, Sub graphs, Components, Graph Isomorphism, Vertex Degree, Euler Trails and Circuits, Planar Graphs, Hamilton Paths and Cycles, Graph Coloring and Chromatic Polynomials.	**12 Hrs**
	Unit III	
5	**Chapter 5: Trees** Definitions, Properties, examples, Rooted trees and Binary rooted trees, preorder and post order traversals, sorting, spanning trees, prefix codes and weighted trees, Optimization and Matching- Dijkstra's shortest path algorithm, Minimum spanning trees, Kruskal and prim's algorithms.	**10 Hrs**

Text Books:

1. David C. Lay, "Linear Algebra and its Applications", 5th Ed., Pearson Education, 2015.
2. Discrete Mathematics and its applications., Kenneth H Rosen, Mcgrawhill,8th ed,2021
3. Discrete and Combinatorial Mathematics by Ralph P.P. Grimaldi, Pearson Education, Asia, 5th edition-2023.
4. Grewal B. S., "Higher Engineering Mathematics", 43rd Ed., Khanna Publishers, 2014

Reference Books:

1. Seymour Lipschutz and Marc Lipson, "Linear Algebra", Schaums outline.
2. Theory and Problems of Combinatorics including concept of Graph Theory by V. K.Balakrishnan (Schaum's outline series), Mcgraw Hill, 2020
3. Graph Theory with Applications to Engineering and Computer Science by NarsinghDeo, PHI publications ,2016

Program: Bachelor of Computer Applications		**Semester – II**
Course Title: Database Management Systems		**Course Code: 23EBCC103**
L-T-P: 4-0-0	**Credits: 4**	**Contact Hours: 4 hrs/week**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hours: 50		**Examination Duration: 3hrs**

	Unit-I	
1	**Chapter 1: Conceptual Data Modelling Using Entities and Relationships** Introduction; Characteristics of Database approach; Advantages of using DBMS approach; Database applications, Data models, schemas and instances; Three-schema Architecture and Data Independence. Using High-Level Conceptual Data Models for Database Design; An Example Database Application; Entity Types, Entity Sets, Attributes and Keys, Relationship Types, Relationship Sets. Roles and Structural Constraints; Weak Entity Types; Refining the ER Design; ER Diagrams, Naming Conventions and Design Issues.	**10 Hrs**
2	**Chapter 2: Relational Data Model and Relational Algebra** Relational Model Concepts; Relational Model Constraints and Relational Database Schemas; Update Operations and dealing with constraint violations; Unary Relational Operations: SELECT and PROJECT; Binary Relational Operations: CARTESIAN PRODUCT, JOIN, ER- to-Relational Mapping.	**6 Hrs**
3	**Chapter 3: SQL** SQL Data Definition and Data Types; SQL constraints; DDL and DML statements; JOIN Operations; Complex SQL Queries.	**4 Hrs**
	Unit-II	
4	**Chapter 4: Database Design** Informal Design Guidelines for Relation Schemas; Functional Dependencies; Normal Forms Based on Primary Keys; Boyce-Codd Normal Form.	**10 Hrs**
5	**Chapter 5: Introduction to Transaction Processing** Introduction to Transaction Processing; Transactions and System concepts; Desirable Properties of Transactions; Characterizing Schedules Based on-Recoverability, Serializibilty.	**10 Hrs**
	Unit-III	
6	**Chapter 6: Concurrency Control Techniques** Introduction, Two-phase Locking Techniques for Concurrency Control, Dealing with Dead-lock and Starvation, Concurrency control based on Time stamp Ordering.	**5 Hrs**
7	**Chapter 7: Database Security** Introduction to DB Security Issues, Discretionary Access Control, Mandatory Access Control And Role-Based Access Control, SQL Injections, SQL Attacks.	**5 Hrs**

Text Books :

1. Elmasri R. and Navathe S., Fundamentals Database Systems, 7th Edition, Pearson Education, 2015.

References:

1. Carlos Coronel, Steven Morris, Database Systems, Design, Implementation &

Management. Cengage 2017.
2. Elmasri and Navathe, Fundamentals of Database Systems, Fifth Edition, Addison- W, 2007.
3. Raghu Ramakrishna and Johannes Gehrke, Database Management Systems, Third Edition, McGraw-Hill, 2003.

Back

Program: Bachelor of Computer Applications		**Semester - II**
Course Title: Data Structures and Algorithms		**Course Code: 23EBCC104**
L-T-P: 4-0-0	**Credits: 4**	**Contact: 4 hrs/week**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching hrs: 50		**Exam Duration: 3 Hrs**

	Unit - I	
1	**Introduction to Data Structures and Stack** Data structure, Dynamic memory allocation in C, Introduction to Algorithms, Asymptotic notations and common functions. **Stack**: Definition, Operations, Representation, Applications: infix to postfix conversion, postfix expression evaluation, Parenthesis matching.	**10 Hrs**
2	**Recursion** Definition and properties, Principle of Recursion, Comparison between Recursion and Iteration, Factorial function, Multiplication of natural numbers, Fibonacci sequence, Binary search, Towers of Hanoi problem	**4 Hrs**
3	**Queues** Queue and its representation, Variants of Queues: Linear Queue, Circular Queue, Priority Queue.	**6 Hrs**
	Unit - II	
4	**Lists** Concept of Lists: Definition, Representation of linked list in memory, Operations: Traversing, Searching, Insertion and Deletion, Doubly Linked List, Circular Linked List, Applications of Linked List.	**10 Hrs**
5	**Trees and Graphs** Binary tree: Definition, Operations, Representation, AVL tree and 2-3 tree algorithm, Applications of Trees. Graphs: Definition, Representation of Graphs, Graph Traversal, Minimum Spanning Trees: Kruskal and Prims Algorithm.	**10 Hrs**
	Unit - III	
6	**Sorting** Introduction and Types of Sorting: Internal and External sort, Divide and Conquer: Merge, Quick and Heap Sort, Efficiency of Sorting Algorithms	**5 Hrs**
7	**Searching** Introduction to Searching, Search Algorithms: Sequential Search, Binary Search Efficiency of Search Algorithms, Hashing: Hash Function and Hash Tables, Collision Resolution Techniques	**5 Hrs**

Text Books

1. YedidyahLangsam, Augenstein, M.J. and Tenanbaum, Data Structures using C and C++, Second Edition, Pearson Education Asia, 2015
2. Anany Levitin, Introduction to design and Analysis of Algorithms, Third Edition, Pearson Education, 2012.

References:

1. Weiss, M.A., Data Structures and Algorithm Analysis in C, 2, Pearson Education Asia, 1997

2. Gilberg, R.F. and Forouzan, B.A. , Data Structures A Pseudo code Approach with C, 3, Reprint,Thomson Course Technology, 2005
3. ReemaThareja, Data Structures using C , 2 nd Edition, 2014, Oxford University Press
4. G.W Rowe, Introduction to Data Structure and Algorithms with C and C++ , prentice Hall India

Back

Program: Bachelor of Computer Applications		Semester - II
Course Title: Software Engineering		Course Code: 23EBCC105
L-T-P: 3-1-0	Credits: 4	Contact: 5 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching hrs: 40	Practical Hours: 24	Exam Duration: 3 Hrs

	Unit - I	
1	**Introduction.** Professional software development, Software engineering ethics, Case studies.	**5 Hrs**
2	**Software processes.** Software process models, Process activities, Coping with change, Process improvement.	**6 Hrs**
3	**Agile Software Development.** Agile methods, Agile development techniques, Agile project management. Scaling agile methods.	**5 Hrs**
	Unit - II	
4	**Requirements Engineering.** Functional and Non-functional requirements, Requirements Engineering processes, Requirements elicitation, Requirement specification, Requirements validation, and Requirements change.	**6 Hrs**
5	**System modelling.** Context models, Interaction Models, Structural models, and Behavioural models. Model-driven architectures.	**6 Hrs**
6	**Architectural design.** Architectural design decisions, Architectural views, Architectural patterns, and Application Architectures.	**4 Hrs**
	Unit - III	
7	**Design and implementation.** Object-oriented design using UML, design patterns, Implementation Issues, Open source development.	**4 Hrs**
8	**Software Testing.** Development Testing, Test-driven Development, Release Testing, and User testing.	**4 Hrs**

Text Books

1. Ian Summerville, Software Engineering, 10the, Pearson Ed, 2021

References:

1 Roger S. Pressman, Software Engineering: A Practitioners Approach, 7the, McGraw, 2022

2 Jalote, P, An Integrated Approach to Software Engineering, 6e, willy Publications, 2018

3 Blaha M, Rumbaugh, Object Oriented Modelling and Design with UML, Second, Pearson, 2013

Back

Program: Bachelor of Computer Applications		Semester - II
Course Title: Data Structures and Algorithms Lab		Course Code: 23EBCP104
L-T-P: 0-0-2	Credits: 2	Contact Hours: 4 Hrs/week
ISA Marks: 80	ESA Marks: 20	Total Marks: 100
Teaching Hrs: --	Tutorial/Practical: 48hrs	Examination Duration: 3 Hrs.

Unit-I

1	**Demonstration** Naming conventions and standards for commenting during implementation. Implement the various concepts like dynamic memory allocation, structures and pointer. Iterative and recursive algorithms	8 Hrs
2	**Exercises** Static implementation of linear data structure. Various operations on linked list: Traverse, Search, Insertion, and Deletion. Dynamic implementation of Stack and queue. Recognize the merits and demerits of implementing one data structure over another. Graph Traversal Techniques Comparison of sorting algorithms efficiency.	28 Hrs
3	**Structured Enquiry** Applications of Graph, Tree	8 Hrs
4	**Open Ended Experiment** Build an application using data structures and algorithms selected	4 Hrs

Text Books :

1. YedidyahLangsam, Augenstein, M.J. and Tenanbaum, Data Structures using C and C++, Second Edition, Pearson Education Asia, 2015
2. Anany Levitin, Introduction to design and Analysis of Algorithms, Third Edition, Pearson Education, 2012.

References:

1. Weiss, M.A., Data Structures and Algorithm Analysis in C, 2, Pearson Education Asia, 1997
2. Gilberg, R.F. and Forouzan, B.A. , Data Structures A Pseudo code Approach with C, 3, Reprint,Thomson Course Technology, 2005
3. ReemaThareja, Data Structures using C , 2 nd Edition, 2014, Oxford University Press
4. G.W Rowe, Introduction to Data Structure and Algorithms with C and C++ , prentice Hall India

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Back

Program: Bachelor of Computer Applications		Semester – II
Course Title: Database Management Systems Lab		Course Code: 23EBCP105
L-T-P: 0-0-1.5	Credits: 1.5	Contact Hrs.: 3hrs/week
ISA Marks: 80	ESA Marks: 20	Total Marks: 100
Teaching Hrs: --	Tutorial/Practical: 36	Exam Duration: 3 hrs

	Demonstration	
1	Introduction to RDBMS and Constructing an Entity Relationship Diagram for a given statement.	**3 Hrs**
2	Basic SQL commands – i) DDL: CREATE, DROP, ALTER, TRUNCATE, and RENAME. ii) DML: INSERT, UPDATE, and DELETE commands. iii) DQL: SELECT command.	**4 Hrs**
	Exercises	
3	i) Queries for creating tables for the given schema. ii) Specifying entity integrity constraints and foreign key constraints for the schema.	**3 Hrs**
4	i) Specifying other constraints (CHECK, DEFAULT) on relations. ii) Solving simple queries for data retrieval using operators – IN, LIKE, BETWEEN, ALIASES.	**4 Hrs**
5	i) Solving aggregate functions for the given schema using GROUP BY and HAVING clause. ii) Queries for sorting the data in the relation.	**4 Hrs**
6	i) Queries using JOIN clause on the given schema. ii) Solving complex JOIN operations – INNER JOIN, LEFT JOIN, RIGHT JOIN, and FULL JOIN. iii) Solving nested queries.	**6 Hrs**
	Structured Enquiry	
7	To implement the following for the given problem statement stating the assumptions made: i) Developing conceptual schema. ii) ER-to-relational schema mapping. iii) Populating the database with data. iv) Solving simple, complex and nested queries on the database.	**8 Hrs**
	Open Ended Experiment	
8	To implement the following for the given problem statement stating the assumptions made: i) Developing conceptual schema. ii) ER-to-relational schema mapping. iii) Normalizing the database.	**4 Hrs**

	iv) Populating the database with data. v) Solving simple, complex and nested queries on the database.	

Text Book:

1. Elmasri R. And Navathe S., Fundamentals Database Systems, 7th Edition, Pearson Education, 2015.

References:

1. Carlos Coronel, Steven Morris, Database Systems, Design, Implementation & Management. Cengage 2017.
2. Elmasri and Navathe, Fundamentals of Database Systems, Fifth Edition, Addison-W, 2007.
3. Raghu Ramakrishna and Johannes Gehrke, Database Management Systems, Third Edition, McGraw-Hill, 2003.

.

Back

Program: Bachelor of Computer Applications		Semester - II
Course Title: Problem-Solving and Analytical Skills		Course Code: 23EHSH102
L-T-P: 0.5-0-0	Credits:0.5	Contact Hrs: 1 hr/week
ISA Marks: 100	ESA Marks: --	Total Marks: 100
Teaching Hrs: 12		Exam Duration: --

Content		
1	**Modules** **Analytical Thinking:** Analysis of Problems, Puzzles for practice, Human Relations, Direction Tests; Looking for Patterns: Number and Alphabet Series, Coding Decoding; Diagrammatic Solving: Sets and Venn diagram-based puzzles; Visual Reasoning, Clocks and Calendars **Mathematical Thinking:** Number System, Factors and Multiples, Using Simple Equations for Problem Solving, Ratio, Proportion, and Variation **Verbal Ability:** Problem Solving using Analogies, Sentence Completion **Discussions & Debates:** Team efforts in Problem Solving; A Zero Group Discussion, Mock Group Discussions, and Feedback; Discussion v/s Debate; Starting a Group Discussion: Recruitment and other Corporate Scenarios; Evaluation Parameters in a Recruitment Group Discussion, Types of Initiators: Verbal and Thought, Conclusion of a Discussion	**12 Hrs**

Text Books

Vikas Modules, Innovations Unlimited Training Services, Bangalore.

Reference Books:

1. https://www.indiabix.com/general-knowledge/questions-and-answers/

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Back

III Semester

Program: Bachelor of Computer Applications		**Semester - III**
Course Title: Applied Statistics		**Course Code: 24EBCB201**
L-T-P: 3-0-1	**Credits: 4**	**Contact Hours: 5 Hrs/Week**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hours: 40	**Practical Hours: 24**	**Exam Duration: 3hrs**

	Unit I	
1	**Description of data** Introduction: Data, Type of Variables, mean, weighted mean, median, mode, Quartiles, Variance, Coefficient of variation, skewness, Histogram, Box plots, Normal Quantile-Quantile plots.	**8 Hrs**
2	**Probability** Introduction: Definition, Interpretation of probability value, addition rule, multiplication rule, Baye's rule.	**8 Hrs**
	Unit II	
3	**Random variables and Probability Distribution** Random variables, simple Examples, Discrete and continuous random variables. Theoretical distributions: Binomial, Poisson, Normal, Exponential.	**8 Hrs**
4	**Statistical Inference I** Introduction: Sampling, SRSWR, SRSWOR, Cluster Sampling, Stratified Sampling, Basic terminologies of testing hypothesis, Confidence interval, Sample size determination, Hypothesis test for proportions, means(single and differences), using P-value approach.	**8 Hrs**
	Unit III	
5	**Correlation and Regression** Meaning of correlation and regression, coefficient of correlation, Linear regression (ANOVA approach), Multiple linear regression,	**4 Hrs**
6	**Statistical Inference II** Test for independence of attributes (m x n contingency table) Inference based on choice of suitable test procedure (Goodness of fit).	**4 Hrs**

Text Books

1. J. Susan Milton, Jesse C. Arnold, Introduction to Probability and Statistics: Principles and Applications for Engineering and the Computing Sciences, 4th Ed, TATA McGraw-Hill Edition 2007.
2. Kishor S Trivedi, probability and statistics with reliability queuing and computer science applications, 1ed, PHI, 2000.

Reference Books:

1. Gupta S C and Kapoor V K, Fundamentals of Mathematical Statistics, 1ed, Sultan Chand
2. Jiawei Han, Micheline Kamber, Data Mining: Concepts and Techniques,MKP
3. Sheldon M.Ross, Introduction to Probability and Statistics for Engineers and Scientists.

Back

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Program: Bachelor of Computer Applications		Semester - III
Course Title: Computer Networks		Course Code: 24EBCC201
L-T-P:3-0-1	Credits: 4	Contact Hrs: 5hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 40	Practical Hours: 24	Exam Duration: 3 hrs

	Unit –I	
1	**Computer Networks and the Internet** Internet, The Network Edge and Core, Delay, Loss, and Throughput in Packet-Switched Networks, Protocol Layer and Service Models: OSI and TCP/IP, Network Attacks.	**8 Hrs**
2	**Application Layer** Principles of network applications, the web and HTTP, DHCP, file transfer-FTP, electronic mail in the internet, DNS, peer-to-peer applications.	**8Hrs**
	Unit –II	
3	**Transport-Layer** Introduction and transport-layer services-relationship between transport and network layers - overview of the transport layer in the internet, multiplexing and de multiplexing, connectionless transport: UDP, principles of reliable data transfer, connection-oriented transport TCP, TCP congestion control.	**8 Hrs**
4	**Network Layer** Introduction, virtual circuit and datagram networks, what 's inside router? The Internet protocol (IP): forwarding and addressing in the internet, routing algorithms, routing in the internet, broadcast and multi cast routing.	**8 Hrs**
	Unit –III	
5	**The link layer: Links, Access networks, and LANs** Introduction to the link layer, error-detection and correction techniques, multiple access links and protocols, retrospective: A day in the life of a web page request.	**8 Hrs**

Text Books:

1. Computer Networking, A Top-Down Approach, by J.F.Kurose, K.W.Ross, 8th edition Pearson Education,2020.
2. TCP/IP Protocol Suite, 6th MGH 2022 by B. A. Forouzan

Reference Books:

1."Computer Networks" by 'Andrew S. Tanenbaum', Pearson Education Asia, 6th Edition 2021.

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Back

Program: Bachelor of Computer Applications		Semester - III
Course Title: Object- Oriented Programming using C++		Course Code:24EBCC202
L-T-P:3-0-2	Credits: 5	Contact Hrs: 7 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 40	Practical Hrs: 48	Exam Duration: 3 hrs

	Unit –I	
1	**Introduction to OOPs and C++:** Need for Object-Orientation, Characteristics of Object-Oriented Languages, Structure of C++ program, Input and Output statements: cin & cout, Keywords, Data Type: Basic, Derived and User-Defined, Variable declaration & initialization, Operators in C++ and their precedence, Control Statement and Loops.	**6 Hrs**
2	**Functions:** Function Declaration, Function Definition, Calling the function, Comparison with library functions, Passing Arguments to Functions, Returning values from Functions, Reference Arguments, Function Overloading, Recursion, Inline functions, Default Arguments.	**5 Hrs**
3	**Objects and Classes:** C++ Objects as Physical Objects, C++ Objects as Data Types, Constructor and its types, Objects as Function Arguments, Constructor Overloading, Returning objects from Functions, Classes, Objects, and Memory, Static data members and member functions in C++, Pointers to objects, Destructors in C++ , Nested Classes.	**5 Hrs**
	Unit –II	
4	**Arrays and Strings:** Defining Arrays, Initializing Arrays, Multidimensional Arrays, Passing Arrays to Functions, Arrays as Class Member Data, Array of Objects. String Constants, Array of Strings, Strings as Class Members, C++ string Class: Defining and Assigning string Objects, I/O with string Objects, Modifying and Comparing string Objects.	**5 Hrs**
5	**Inheritance and Polymorphism:** Derived Class and Base class, Types of Inheritance in C++, Access Specifiers in C++, Derived Class Constructors, Overriding Member functions, Abstract Classes. Polymorphism in C++, Compile-time Polymorphism and Runtime Polymorphism, Virtual Functions and Friend functions, 'this' pointer in C++.	**6 Hrs**
6	**Operator Overloading:** Definition, Rules for overloading operators, Overloading Unary Operators, Overloading Binary Operators, Manipulation of strings using operators, Data Conversion.	**5 Hrs**
	Unit –III	
7	**Exception Handling:** Exception Handling in C++, Handling Multiple Exceptions, User-defined Exceptions, Exception in Constructors and Destructors.	**4 Hrs**
8	**Streams and Files:**	**4 Hrs**

	File Handling through C++ classes: Classes for file stream operations, I/O Redirection in C++.	

Text Books:

1. Object – Oriented Programming in C++, Robert Lafore, 4th edition, Pearson Publications.

Reference Books:

1.E Balaguruswamy, Object Oriented Programming in C++, 4th Edition, Tata McGraw Hill

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Back

Program: Bachelor of Computer Applications		Semester - III
Course Title: Data Mining		Course Code: 24EBCC203
L-T-P: 3-0-1	Credits: 4	Contact Hrs: 5 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 40	Practical Hrs: 24	Exam Duration: 3hrs

	Unit –I	
1	**Introduction** Fundamentals of data mining, Kinds of pattern, technologies used, applications, issues, data objects and attribute types, Basic Statistical Descriptions of Data, Data Visualization.	**7 Hrs**
2	**Data Pre-processing** Need of pre-processing the Data, Data Cleaning, Data Integration and Transformation, Data Reduction, Discretization.	**4 Hrs**
3	**Data Warehousing and Online Analytical Processing** Data Warehouse: Basic Concepts, Data Warehouse Modelling: Data Cube and OLAP, Data Warehouse Design and Usage, Data Warehouse Implementation, Data Generalization by Attribute-Oriented Induction.	**5 Hrs**
	Unit –II	
4	**Mining Frequent Patterns, Associations, and Correlations** Basic Concepts, Frequent Itemset Mining Methods, Which Patterns Are Interesting? Pattern Evaluation Methods, Pattern Mining in Multilevel, Multidimensional Space, Constraint-Based Frequent Pattern Mining.	**5 Hrs**
5	**Classification** Basic Concepts, Decision Tree Induction, Bayes Classification Methods, Rule-Based Classification, Model Evaluation and Selection, Techniques to Improve Classification Accuracy, Bayesian Belief Networks, Classification by Backpropagation	**6 Hrs**
6	**Graph Mining, Social Network Analysis, and Multi-relational Data Mining** Methods for Mining Frequent Sub graphs, Mining Variant and Constrained Substructure Patterns, Characteristics of Social Networks, Mining on Social Networks, Multirelational mining, Multirelational Classification, Multirelational Clustering with User Guidance.	**5 Hrs**
	Unit –III	
7	**Cluster Analysis** Cluster Analysis, Partitioning Methods, Hierarchical Methods, Density-Based Methods, Grid-Based Methods, Evaluation of Clustering	**4 Hrs**
8	**Mining Complex Types of Data** Multidimensional Analysis and Descriptive Mining of Complex, Data Objects, Mining Spatial Databases, Mining Multimedia Databases, Mining Time Series and Sequence Data, Mining Text Databases, Mining the World Wide Web.	**4 Hrs**

Text Books: 1. J. Han, M. Kamber., Data Mining Concepts and Techniques, 3rd edition, Kaufmann publishers, 2011
Reference Books: 1. Pujari, A.K, Datamining Techniques, 1, Universities Press, 2010

.

Back

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Program: Bachelor of Computer Applications		**Semester - III**
Course Title: Full Stack Web Development		**Course Code: 24EBCC204**
L-T-P: 1-0-2.5	**Credits: 3.5**	**Contact Hrs: 6 hrs/week**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hrs: 12	**Practical Hours: 60**	**Exam Duration: 1.3 hrs**

1	**Introduction to HTML basics, JavaScript** Introduction to World Wide Web, Web Application Architecture, HTML Basics, Cascading Style Sheets, JavaScript Basics, Bootstrap	**12 Hrs**
2	**RESTful API using NodeJS and Express** Introduction to Node.js. Building servers using the http and net modules, Node modules and events, Express, REST API client, Postman, Accessing Data, Data Security using Bcrypt. API security using JWT tokens.	**24 Hrs**
3	**React Components and React State** React Classes, Composing Components, Passing Data Using Properties, Passing Data Using Children, Dynamic Composition. Initial State, Async State Initialization, Updating State, Lifting State Up, Event Handling, Stateless Components.	**24 Hrs**
4	**MongoDB** Introducing MongoDB, Key features of MongoDB, MongoDB shell, MongoDB databases, MongoDB collections, MongoDB CRUD operations	**12 Hrs**

Text Books:

1. Pro MERN Stack, 2nd Edition by Vasan Subramanian, published by Apress.

References:

1. Amos Q, Haviv, MERN Web Development, Packt Publishing 2014
2. COLIN J. IHRIG, Full Stack Javascript Development with MERN, Sitepoint.
   Greg Lim, Beginning MERN Stack Development

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Back

Program: Bachelor of Computer Applications		Semester - III
Course Title: Arithmetical Thinking and Analytical Reasoning		Course Code:23EHSH203
L-T-P: 0.5-0-0	Credits: 0.5	Contact Hrs: 1 hr /week
ISA Marks: 100	ESA Marks: --	Total Marks: 100
Teaching Hours: 12		Exam Duration: --

1	**Modules:** **Analytical Thinking:** Importance of Sense of Analysis for Engineers, Corporate Methodology of Testing Sense of Analysis, **Puzzles for practice:** Analytical, Mathematical, Classification Puzzles, Teamwork in Problem Solving **Mathematical Thinking:** Problems on Finance: Percentages, Gain and Loss, Interest; Distribution and Efficiency Problems: Averages, Time Work, Permutations Combinations **Verbal Ability:** Comprehension of Passages, Error Detection and Correction Exercises, Common Verbal Ability questions from Corporate Recruitment Tests	**12 Hrs**

Text Books:

1. Vikas Modules, Innovations Unlimited Training Services, Bangalore.

References:

1. https://www.indiabix.com/general-knowledge/questions-and-answers/

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Back

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IV Semester

Program: Bachelor of Computer Applications		**Semester - IV**	
Course Title: Java Programming		**Course Code: 24EBCC205**	
L-T-P: 3-0-0	**Credits: 3**	**Contact Hours: 3 Hrs/week**	
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**	
Teaching Hrs: 40	**Tutorial/Practical: --**	**Examination Duration: 3 Hrs.**	
Unit-I			
1	**Introduction** Java Fundamentals, The History, and Philosophy of Java, Java's Magic: The Byte code, The Java Buzzwords, The Java Development Kit, A First Simple Program, Data Types, Variables, Constants, Operators, Control Statements		**8 Hrs**
2	**Introducing Classes, Objects, and Methods** Class Fundamentals, Object Creation, Reference Variables and Assignment, Methods, Constructors and its types, the new Operator Revisited, Garbage Collection, This Keyword, Java's Access Modifiers, Pass Objects to Methods, Method Overloading, Constructors Overloading, static keyword, Static Blocks, Introducing Nested and Inner Classes.		**8 Hrs**
Unit - II			
3	**Inheritance** Inheritance basics, constructors and Inheritance understanding super keyword and superclass, creating a Multilevel Hierarchy, Superclass References and Subclass Objects, Method Overriding, Using Abstract Classes, using final: To prevent overriding and inheritance, Using final with Data Members, the Object Class.		**5 Hrs**
4	**Packages and Interfaces** Working with Package, packages and member access, Understanding Protected Members, Importing Packages, Implementing Interfaces, Using Interface References, default method example, Multiple Inheritance Issues, Use static Methods in an Interface, Private Interface Methods.		**6 Hrs**
5	**Exception Handling** The Exception Hierarchy, Exception Handling Fundamentals, Using Try and catch blocks, the consequences of an uncaught exception, using multiple catch statements, catching subclass exceptions, Throwing an Exception, Rethrowing an Exception, A Closer Look at Throwable, Java's Built-in Exceptions, Creating Exception Subclasses.		**5 Hrs**
Unit - III			
6	**Multithread Programming** Multithreading Fundamentals, The Thread Class and Runnable Interface, creating a Thread, Creating Multiple Threads, Determining When a Thread Ends, Thread Priorities, Synchronization, Using Synchronized Methods.		**4 Hrs**
7	**Collections** Collection Interfaces, Collection and Iterator Interfaces in the Java Library, Linked Lists, Array Lists, Hash Sets, Tree Sets, Object Comparison, Queues and Dequeues, Priority Queues, Maps.		**4 Hrs**

Text Books:

1. Herbert Schildt, Java: A Beginner's Guide Ninth Edition, 9th Edition, McGraw Hill; Eighth edition(2022).
2. Herbert Schildt, JAVA The Complete Reference 11th edition, Tata McGraw Hill 2019.

References:

1. Kathy Sierra: Head First Java: A Brain-Friendly Guide, Third Edition, Shroff/O'Reilly; Third edition (1 June 2022).

Back

Program: Bachelor of Computer Applications		Semester - IV
Course Title: Big Data Analytics		Course Code: 24EBCC206
L-T-P: 3-0-1	Credits: 4	Contact Hrs.: 5 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 40	Tutorial/Practical: 24 hrs	Exam Duration: 3 hrs

	Unit –I	
1	**Introduction** What is Big Data? Data Analytics, Data Analytics Life Cycle, Big Data Characteristics, Different Types of Data.	**4 Hrs**
2	**Big Data Storage** Clusters, File Systems and Distributed File Systems, NoSQL, Sharding, Replication, Combining Sharding and Replication. On Disk Storage Devices, In-memory Storage Devices.	**6 Hrs**
3	**Big Data Processing** Parallel Data Processing, Distributed Data Processing, Hadoop, Map Reduce.	**6 Hrs**
	Unit –II	
4	**Big Data Modeling** Data Model Structures, Data Model Operations, Processing Workloads, Processing in Batch Mode, Processing in Real-time Mode.	**8 Hrs**
5	**Big Data Technologies** MongoDB - What is MongoDB? Why MongoDB? Terms Used in RDBMS and MongoDB, Data Types in MongoDB, MongoDB Query Language.	**8 Hrs**
	Unit –III	
6	**Hive** What is Hive?, Hive Architecture, Hive Data Types, Hive File Format, Hive Query Language (HQL), RCFile Implementation, User-Defined Function (UDF).	**4 Hrs**
7	**Big Data Visualization** Big Data Visualization and Interpretation, Data visualization techniques, Tools for Big Data visualization, Interpretation and analysis of visualized data, Case studies and real-world applications	**4 Hrs**

Text Books:

1. "Big Data Fundamentals Concepts, Drivers & Techniques " by Thomas Erl, WajidKhattak and Paul Buhler, Prentice Hall, 2015
2. “Big Data and Analytics” by Seema Acharya, SubhashiniChellappan, Wiley India Pvt Ltd 2014.

References:

1. "Big Data and Analytics: Turning Big Data into Big Money " by Frank J Ohlhorst, Wiley and SAS Business Series, 2012
2. "Data Mining and Predictive Analysis: Intelligence Gathering and Crime Analysis " by Colleen Mccue , Elsevier, 2007.

Back

Program: Bachelor of Computer Applications		Semester - IV
Course Title: DevOps Lab		Course Code: 24EBCP201
L-T-P: 0-0-1.5	Credits: 1.5	Contact Hours: 3 hrs/week
ISA Marks: 80	ESA Marks:20	Total Marks: 100
Teaching Hours:--	Tutorial/Practical: 36 hrs	Exam Duration: 3 hrs

Unit I

1	**Introduction to DevOps and Revision Control System:** Introducing DevOps, The Agile wheel of wheels, DevOps and ITIL. The revision control system, The build server, The artifact repository, Package managers, Test environments, Staging/production, Release management, Scrum, Kanban, and the delivery pipeline, Wrapping up – a complete example, Identifying bottlenecks.	8 Hrs
2	**Everything is Code** The, Roles and code, Which source code management system? A word about source code management system migrations, Choosing a branching strategy, Branching problem areas, Artifact version naming, Choosing a client, Setting up a basic Git server, Shared authentication, Hosted Git servers, Large binary files, Trying out different Git server implementations, Docker intermission, Gerrit : a) Installing the git-review package, b)The value of history revisionism, The pull request model, GitLab.	8 Hrs
3	**Building the Code** Why do we build code? The many faces of build systems, The Jenkins build server, managing build dependencies, Continuous Integration, Continuous Delivery, Jenkins plugins, the host server, build slaves, Software on the host, Triggers, Job chaining and build pipelines, A look at the Jenkins file system layout, Build servers and infrastructure as code, Building by dependency order, Build phases.	8 Hrs
4	**Testing the Code** Manual testing, Pros and cons with test automation, Unit testing, JUnit in general and JUnit in particular, A JUnit example, Mocking, Test Coverage, Automated integration testing	6 Hrs
5	**Deploying the Code** Configuring the base OS, describing clusters, delivering packages to a system, deploying with Dockers, Containerization using kubernetes.	6 Hrs

Text Books :

1. Practical DevOps by Joakim Verona Publisher: Packt Publishing, Release Date: February 2016, ISBN: 9781785882876.

Reference Books:

1. Effective DevOps, Building a Culture of Collaboration, Affinity, and Tooling at Scale ,By Jennifer Davis, Ryn Daniels, Publisher: O'Reilly Media, Release Date: June 2016.

2. The DevOps Handbook: How to Create World-Class Speed, Reliability, and Security in Technology Organizations, Gene Kim, Patrick Debois, John Willis, Jez HumbleIT Revolution Press, 2016.

Back

Program: Bachelor of Computer Applications		Semester - IV
Course Title: Minor Project-1		Course Code: 23EBCP201
L-T-P: 0-0-6	Credits: 6	Contact Hrs: 12 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 150		Exam Duration: 3hrs

Project Theme:

Dynamic Client-Server Web Applications: Delivering Rich Interactive Experiences

The projects under this theme shall focus on integration of client-server architecture to create web applications that provide users with enhanced engagement and dynamic content presentation.

The objective of the theme is to explore the synergy between client-side interactivity and server-side data processing to deliver rich and responsive web experiences. By leveraging the concepts studied such as Web Technology, MongoDB, ExpressJS, ReactJS, and NodeJS. The projects developed shall seamlessly blend dynamic content delivery with user-driven interactions. Special emphasis will be placed on techniques for real-time data updates, user authentication, and efficient data exchange between the client and the server.

These project prototypes shall showcase real-time collaboration, dynamic content rendering, and user-driven customization, illustrating the transformative potential of client-server synergy in web development.

Objectives:

1. Able to carry out the survey of the given real-world problem and prepare the SRS as per the industry
   Standard (IEEE standard).
2. Work effectively and collectively in a team.
3. Identify various design components and suitable architecture for the system development by applying Knowledge of Object Oriented Design.
4. Use CASE tools to design various models required for the given problem also documentation tools.

Learning Outcomes:

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

1. Identify and define the problem statement and justify scope of the proposed problem
2. Gather and analyze system requirements
3. Propose an optimized solution among the existing solutions and practice software analysis and design techniques.
4. Apply coding, debugging and testing tools to enhance the quality of the software
5. Prepare the proper documentation of software projects following the standard guidelines to develop technical report writing and oral presentation.

Methodology:

Students are asked to make a team of 3-4 members and can choose the different categories of projects like desktop applications, web applications, mobile applications, and distributed applications and work once it is approved by the coordinator.

Back

Program: Bachelor of Computer Applications		Semester - IV
Course Title: Java Programming Lab		Course Code: 23EBCP202
L-T-P:0-0-2	Credits: 2	Contact Hrs: 4 hrs/week
ISA Marks: 80	ESA Marks: 20	Total Marks: 100
Teaching Hrs: --	Practical Hours: -- 48	Exam Duration: 3 hrs

Unit – 1

Demonstration

Java fundamentals

Inheritance Concepts

Interfaces and packages

Exception handling and collections

Exercises

1. **Simple Inheritance and Constructor calling**
2. **Interface, Abstract class and inheritance with method overriding and Hiding**
3. **Exception handling and Collections**

Multi-threading concept

Unit – 2

Structured Query

1. Based on Java fundamental concepts, Simulate a simple calculator app as menu driven application.

2. A program to implements below concepts
   1. Inheritance with abstraction using Abstract class and Interfaces
   2. Exception Handling

Usage of Collections ArrayList and HashMap

Text Books

1. Herbert Schildt, Java: A Beginner's Guide Ninth Edition, 9th Edition, McGraw Hill; Eighth edition (2022).
2. Herbert Schildt, JAVA The Complete Reference 11th edition, Tata McGraw Hill 2019.

References

1. Kathy Sierra: Head First Java: A Brain-Friendly Guide, Third Edition, Shroff/O'Reilly; Third edition (1 June 2022).

Program: Bachelor of Computer Applications		Semester - IV
Course Title: Industry Readiness and Leadership Skills		Course Code: 23EHSH204
L-T-P:0.5-0-0	Credits: 0.5	Contact Hrs: 1 hr/week
ISA Marks: 100	ESA Marks: --	Total Marks: 100
Teaching Hrs: 12		Exam Duration: --

Unit – I

1	**Modules:** **Written Communication**: Successful Job Applications, Résumé Writing, Emails, Letters, Business Communication, Essay and Paragraph Writing for Recruitment Tests **Interview Handling Skills**: Understanding Interviewer Psychology, Common Questions in HR Interviews, Grooming, Interview Etiquette **Lateral & Creative Thinking**: Lateral Thinking by Edward de Bono, Fractionation and Brain Storming, Mind Maps, Creativity Enhancement through Activities **Team Building & Leadership Skills**: Communication in a Team, Leadership Styles, Playing a Team member, Ethic	**12 Hrs**

Text Books:

1 Vikas Modules, Innovations Unlimited Training Services, Bangalore.

References:

1. https://www.indiabix.com/general-knowledge/questions-and-answers/

Back

Program: Bachelor of Computer Applications		Semester - IV
Course Title: Professional Aptitude and Logical Reasoning		Course Code: 23EHSC201
L-T-P:3-0-0	Credits: 3	Contact Hrs: 3 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 40		Exam Duration: 3 hrs

	Unit –I	
1	Chapter 1. – Arithmetical Reasoning	**10 Hrs**
2	Chapter 2. – Analytical Thinking	**4 Hrs**
3	Chapter 3. – Syllogistic Logic,	**2 Hrs**
	Unit –II	
4	Chapter 4. – Verbal Logic	**9 Hrs**
5	Chapter 5. – Non-Verbal Logic	**7 Hrs**
	Unit –III	
6	Chapter 6. - Lateral Thinking	**8 Hrs**

Text Books:

1. A Modern Approach to Verbal and Non – Verbal Reasoning – R. S. Aggarwal, Sultan Chand and Sons, New Delhi
2. Quantitative Aptitude – R. S. Aggarwal, Sultan Chand and Sons, New Delhi

Reference Books:

1 .Verbal and Non – Verbal Reasoning – Dr. Ravi Chopra, MacMillan India

2. Lateral Thinking – Dr. Edward De Bono, Penguin Books, New Delhi

Back

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V-Semester

Program: Bachelor of Computer Applications		**Semester: V**
Course Title: Cloud computing		**Course Code: 24EBCC301**
L-T-P:3-0-1	**Credits: 4**	**Contact Hrs.: 5 hrs./week**
ISA Marks: 63	**ESA Marks: 37**	**Total Marks: 100**
Teaching Hrs.: 40	**Practical Hours: 24**	**Exam Duration: 3 hrs**

Content		
Unit –I		
1	**Introduction** Motivation for cloud computing, elastic computing and its advantages: Business models for cloud providers, Types of clouds: multi-cloud, cloud platforms. Data center infrastructure: Network equipment and multi-port server interfaces, Leaf spine network topology	**5 Hrs**
2	**Virtualization and containerization** Virtual Machines: approaches to virtualization, levels of trust, live migration of virtual machines. Advantages and disadvantages of virtual machines, isolation facilities in an operating system, Linux namespaces used for isolation, container approach for isolated apps, Docker containers, Docker software components, items in a Docker file. Monolithic applications in a data center	**10 Hrs**
Unit –II		
3	**Automation** Automation in data centers, Advantages and disadvantages of Automation levels of automation, zero touch provisioning and infrastructure as code, automation tools	**4 Hrs**
4	**Orchestration** Orchestration: Automation with a larger scope, Kubernetes: container orchestration system, Kubernetes cluster model, Kubernetes pods: creation, templates, and binding time, Kubernetes nodes and control plane, worker node software components	**10 Hrs**
Unit –III		
5	**Microservices** The Microservices approach, advantages and disadvantages of Microservices, Microservices Granularity, Communication protocols used for Microservices, communication among Microservices, creating a Microservices, server mesh proxy	**6 Hrs**
6	**Serverless computing and event processing** Traditional client-server architecture, scaling a server in a cloud environment, Serverless computing approach, stateless servers and containers, Architecture of a Serverless infrastructure, An example of Serverless processing, advantages and disadvantages of Serverless computing.	**5 Hrs**

Text Books:

1. Douglas Comer, "The Cloud Computing: The Future of Computing", 1st ed, Chapman and Hall/CRC 1 July 2021.

2. Dan C. Marinescu, Cloud Computing Theory and Practice, 3rd Edition, Elsevier - February 15, 2022.

Reference Books:

1. Rajkumar Buyya, Christian Vecchiola, S.ThamaraiSelvi, Mastering Cloud Computing, McGraw Hill, 2013.
2. Anthony T. Velte, Toby J. Velte, Robert Elsenpeter, Cloud Computing, A Practical Approach, McGraw Hil, 2017

Integrated Practices

Expt./Job No.	Brief description about the experiments	Slots
1	Hypervisors (Type-I and Type-II). Virtual machines with Para/Full Virtualization	03
2	Implementation of cloud service models (IaaS, PaaS, SaaS)	03
3	Demonstration of Docker and containers	03
4	Implementation Docker and containers	03

Back

Program: Bachelor of Computer Applications		Semester - V
Course Title: Advanced Java Programming		Course Code: 24EBCC302
L-T-P: 3-0-1	Credits: 4	Contact Hours: 5 hrs/week
ISA Marks: 63	ESA Marks: 37	Total Marks: 100
Teaching Hrs: 40	Practical: 24	Exam Duration: 03 Hrs

	Unit I	
1	**Database Programming** The Design of JDBC: JDBC Driver Types and Typical Uses of JDBC; the Structured Query Language; JDBC Configuration; Working with JDBC Statements; Query Execution; Scrollable and Updatable Result Sets; Row Sets.	**6 hrs**
2	**Servlets** Understanding the Client-Server Model, Understanding Web server software, Background; The Life Cycle of a Servlet; A Simple Servlet; The Servlet API; The javax. servlet Package; Reading Servlet Parameters; The javax.servlet.http Package; Handling HTTP Requests and Responses.	**7 hrs**
3	**Session Management** HTTP as a stateless protocol, Hidden form fields, Cookies, session tracking Http Session, Exception handling and error pages, Directives	**4 hrs**
	Unit II	
4	**Java Server Pages** JSP Technologies, Configuring the JSP Server, Handling JSP Errors, JSP Translation Time Errors, JSP Request Time Errors, Creating a JSP Error Page	**7 hrs**
5	**Java Beans** Concepts of Java Beans, Developing Java Beans, Controls and Properties of a Bean, Types of Properties.	**3 hrs**
6	**Introduction to Spring Framework** Introduction to spring 3.0, spring configuration, IOC, DI, Basic MVC flow	**5 hrs**
	Unit – III	
7	**Introduction to Spring Boot** Introduction to Spring Boot, Bootstrapping, tomcat Deployment, Building RESTFUL Web Services, Exception Handling	**4 hrs**
8	**Hibernate Introduction** Introduction to Hibernate 3.0, Hibernate Architecture, First Hibernate Application	**4 hrs**

Text Books

1. Herbert Schildt, Java the Complete Reference, 12th Edition Paperback, Tata McGraw-Hill, 2022
2. Java for Web Development, Sarika Agarwal and Vivek Gupta BPB Publications, 2022

References Books:

1. Core Java Volume II – Advanced Features (13th Edition), Authors: Cay S. Horstmann, 2024

2. Advanced Java Programming, Prof. Pushpender Sarao, Lambert Academic Publishing, 2023

Expt. No.	**Integrated Practices**	**Lab Slots**
1.	Program to demonstrate JDBC connection using Statement and Prepared Statement. **Note** Use Scanner class, Perform CRUD operations	1
2.	Program to demonstrate JDBC connection using Prepared Statement with Scrollable result sets and row sets. **Note** Use Scanner class, Perform CRUD operations	1
3.	Program to demonstrate dynamic page rending using JSP, Servlet and JDBC connection **Note:** Use maven as build tool	2
4.	Program to demonstrate usage of scripting elements, page and taglib directives in JSP	2
5.	Program to demonstrate Cookies and HttpSession Session tracking techniques using JSP and Servlets **Note:** Use maven as build tool	2
6.	Program to demonstrate Exception handling in JSP using page attributes and deployment descriptor file	1
7.	Write a java bean program to validate username and password using JSP use bean action tag	1
8.	Program to demonstrate Spring DI and MVC framework with Hibernate Integration. Note**:** Use maven as build tool	2

Back

Program: Bachelor of Computer Applications		Semester: V
Course Title: Machine Learning		Course Code: 24EBCC303
L-T-P: 3-0-1	Credits: 4	Contact Hrs: 5 hrs/week
ISA Marks: 63	ESA Marks: 37	Total Marks: 100
Teaching Hrs: 40	Practical: 24	ESA Exam Duration: 3 hrs

	Unit –I	
1	**Introduction to Machine Learning** Introduction to Machine Learning, Applications of Machine Learning, Types of Machine Learning: Supervised, Unsupervised and Reinforcement learning, Dataset Formats, Features and Observations.	**6 hrs**
2	**Supervised Learning, Linear Regression, Logistic Regression** Linear Regression, Logistic Regression: Single and Multiple variables, Sum of Squares Error Function, The Gradient Descent Algorithm: Application, The Cost Function, Classification Using Logistic Regression, Regularization.	**10 hrs**
	Unit –II	
3	**Supervised Learning Classification** Introduction to Neural Network, Model representation, Gradient Checking, Back Propagation Algorithm, Multi-class Classification, Support Vector Machines, Applications & Use-cases.	**8 hrs**
4	**Unsupervised Learning: Clustering and Dimensionality Reduction** Introduction to Clustering, K Means Clustering Algorithm, Cost Function, Application, Dimensionality Reduction, PCA- Principal Component Analysis Applications, Clustering Data, and PCA.	**8 hrs**
	Unit –III	
5	**Introduction to Deep Learning and CNN** Deep Learning, Difference between Machine Learning and Deep Learning, Usage of Deep Learning, Deep Feed forward Networks, Convolution Neural Networks (CNN) – Convolutional Layer: Filters, Stacking Multiple Feature Maps, Tensor Flow Implementation, Pooling Layer, and CNN Architectures.	**5 hrs**
6	**Recurrent Neural Networks** Unfolding Computational Graphs, Recurrent Neural Networks, Bidirectional RNNs, Sequence Modelling.	**3 hrs**

Text Book:

1. Aurelien Geron, Hands on Machine Learning with Scikit-Learn, Keras and TensorFlow, 2nd Edition, O' Reilly Media, Inc. 2019

Reference Books:

1. Tom Mitchell., Machine Learning, Mc Graw Hill, McGraw-Hill Science, 3rd edition.
2. Aurelian Gerona, Hands-On Machine Learning with Scikit-Learn and Tensor Flow, Concepts, Tools, and Techniques to Build Intelligent Systems, Publisher: O'Reilly Media, July, 2016.
3. Luca Pietro Giovanni Antiga, Thomas Viehmann, Eli Stevens, Deep Learning with PyTorch Manning Publications, 2020.

Expr. No.	Integrated Practices	Sessions
1	Explore the features of Scikit-learn, NumPy, SciPy, and TensorFlow Libraries for Machine Learning.	**1**
2	Implement a Single and Multi-variable Linear Regression Model to analyse and predict continuous outcomes.	**2**
3	Illustrate the use of Logistic Regression for solving Binary Classification Problems.	**1**
4	Demonstrate classification using Support Vector Machines (SVM) for high-dimensional data.	**1**
5	Apply Neural Networks for classification and evaluate their performance on benchmark datasets.	**2**
6	Analyse the role of Principal Component Analysis (PCA) in reducing the dimensionality of data.	**2**
7	Implement the K-Means Clustering algorithm for discovering inherent groupings in data.	**1**
8	Develop a Convolutional Neural Network (CNN) to solve real-world problems involving image data.	**2**

Back

Program: Bachelor of Computer Applications		Semester: V
Course Title: Natural Language Processing and Gen AI		Course Code:24EBCC304
L-T-P: 2-0-2	Credits: 4	Contact Hrs: 6 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 30	Practical Hours: 48	Exam Duration:2 Hrs

	Unit I	
1	**Introduction to NLP & Preprocessing** NLP overview & applications, Challenges in language understanding, Basic components of NLP systems, Text preprocessing: Tokenization, Stop word removal, Stemming, Lemmatization, POS tagging, Bag of Words, Introduction to word embeddings.	5 hrs
2	**Parsing and Syntax Analysis** Grammar rules in NLP, Dependency and Constituency Parsing, Parsing techniques and algorithms, Introduction to neural dependency parsing	4 hrs
3	**Language Models & Transformers** N-grams and statistical models, Neural language models: Word2Vec, GloVe, Transformers for text understanding and generation, Sequence-to-sequence models, Attention mechanisms	6 hrs
	Unit II	
4	**Machine Translation & Generation** Overview of Machine Translation, Statistical vs Neural Machine Translation, Seq2Seq with attention, Text generation techniques: LSTM, Transformers, Role of Auto encoders & Decoders	5 hrs
5	**Generative AI and Advanced Architectures** Discriminative vs Generative models, Generative Adversarial Networks (GANs) in NLP, Types of GANs, Diffusion models: concepts & types, Introduction to Chabot's and Dialogue Systems	5 hrs
6	**Large Language Models (LLMs)** Introduction to LLMs: GPT, BERT, Prompting techniques for GenAI, Adapters and LoRA (Low-Rank Adaptation), Applications and limitations of LLMs	5 hrs

Text Books:

1. "Practical Natural Language Processing: A comprehensive Guide to Building Real World NLP systems" by Sowmya Vajjala,Bodhisattwa Majumder,Anuj Gupta and Harshit Surana.2020
2. "Hands-On Generative AI with Transformers and Diffusion Models by Omar Sanseviero,Pedro Cuenca,Apolinario Passos,Jonathan Whitakar,2024

Reference Books:

1. "Generative Deep Learning: Teaching Machines to Paint, Write, Compose, and Play" by David Foster,2019

Back

Program: Bachelor of Computer Applications		Semester: V
Course Title: Minor Project-2		Course Code: 23EBCP301
L-T-P: 0-0-6	Credits: 6	Contact Hours: 12 Hrs/Week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hours: 150		Exam Duration: 3 Hours

Content

Project Theme 1:

1. **Big Data and Data Analytics using Machine Learning**

   This theme emphasizes the utilization of tools such as Hadoop, Spark, and TensorFlow to support the application of Big Data technologies in solving data-driven problems. Students will explore methods for collecting, processing, and analyzing large datasets, and will employ Machine Learning techniques to derive meaningful insights. Through this theme, students will enhance their understanding of distributed data systems, data processing pipelines, and algorithmic learning models.

OR

Project Theme2:

Modern Web Application Development with Full-Stack Technologies

1. **Java-Based Applications**

   This theme provides students the opportunity to develop software solutions using Java-based technologies, encouraging strong foundations in object-oriented programming, application logic, and modular design. Students will gain hands-on experience in developing scalable, efficient, and secure applications, reinforcing core concepts essential to enterprise and standalone software development.

OR

2. **MERN Stack (MongoDB, Express.js, React.js, Node.js)**

   This theme is designed to immerse students in full-stack web development using the MERN stack. It enables learners to design and build modern, responsive, and data-driven web applications. Emphasis is placed on front-end and back-end integration, RESTful API development, and NoSQL database interactions, aligning with current industry practices and trends in web application development.

Objectives:

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

1. Conduct a comprehensive survey of a real-world Big Data problem and prepare the Software Requirements Specification (SRS) following IEEE industry standards.
2. Work effectively and collaboratively in a team to analyze and solve data-intensive problems.
3. Design and implement data architectures using Big Data technologies like Hadoop and Spark.
4. Apply Machine Learning algorithms using tools such as TensorFlow or Scikit-Learn to analyze large datasets.
5. Utilize data visualization tools to present insights derived from Big Data analytics.
6. Build and deploy full-stack applications using Java or MERN stack, demonstrating practical implementation of real-world problems.
7. Integrate Machine Learning models into web or desktop applications to offer intelligent data-driven features.

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Scheme of Evaluation

In-Semester Assessment	**Assessment**	**Marks**
	Problem Definition, Literature Review	05
	Synopsis and Software Requirement Specification (SRS)	05
	Design (Block Diagram, Data Flow Diagram [DFD], Entity-Relationship [ER] Diagram, and Use-case Diagrams)	10
	Coding and Implementation	10
	Integration and testing	05
	Project Report	10
	Presentation skills and Viva-voce	05
	Total	**50**
End-Semester Assessment	Presentation, Demonstration	30
	Modification	10
	Viva-voce	10
	Total	**50**

Back

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List of Electives

Program: Bachelor of Computer Applications		Semester: V
Course Title: Cyber Security		Course Code: 24EBCE301
L-T-P: 3-0-1	Credits: 4	Contact Hrs: 5 Hrs/week
ISA Marks: 63	ESA Marks: 37	Total Marks: 100
Teaching Hrs: 40	Practical: 24	ESA Exam Duration: 3 Hrs

	Unit –I	
1	**Introduction to Cybercrime, Cyber offences** Cybercrime definition and origins of the word, Cybercrime and information Security, Classifications of Cybercrimes, A global Perspective on cybercrimes. Criminal plans and Attacks, Social Engineering, Cyber stalking, Cyber Cafe and Cybercrimes, Botnets, Proliferation of Mobile and Wireless Devices, Credit Card Frauds in Mobile and Wireless Computing Era. Security challenges posed by mobile devices.	**8 hrs**
2	**Tools and Methods used in Cybercrime, Phishing and identity Theft** Phishing, Password Cracking, Key loggers and Spywares, Virus and Worms, Trojan and backdoors, Steganography, DOS and DDOS attack, SQL injection, Buffer Overflow, Attacks on wireless networks, Phishing, identity Thefts.	**8 hrs**
	Unit –II	
3	**Cybercrimes and Cyber security: The Legal Perspectives Organizational Implications** Cybercrime and the legal landscape around world, why do we need Cyber laws: The Indian Context, The Indian IT Act, Digital Signature and the Indian IT Act, Amendments to the Indian IT Act, Cybercrime and Punishment, Cost of cybercrime and IPR issues, Web threats for organization, cloud computing threats; security and privacy implications, social computing issues; Guidelines for internet usage and safe computing; incident handling.	**8 hrs**
4	**Understanding computer Forensics, Forensics of Hand-held devices** Historical background of forensics; Digital forensics science; need for computer forensics; cyber forensics and digital evidence; Analysis E-mail; Digital forensics life cycle; chain of custody concepts; network forensics; Forensics and social networking; challenges in computer forensics; Hand-held devices and digital forensics; Toolkits for Hand-held device forensics; Techno-legal challenges form hand-held devices Guidelines.	**8 hrs**
	Unit –III	
5	**Social, Political, Ethical and Psychological Dimensions** Intellectual property at the Cyberspace; Ethical dimension of Cybercrimes; Psychology, Mindset and Skills of hackers and other	**4 hrs**

	cybercriminals; Sociology of cybercriminals.	
6	**Cybercrime: Illustrations, Examples and Mini Cases** Introduction, Real-Life Examples, Case Studies: Illustrations of Financial Frauds in Cyber Domain, Digital Signature-Related Crime Scenarios, Digital forensics case illustrations Online Scams.	**4 hrs**

Text Book:

1. Nina Godbole & Sunit Belapur, "Cyber Security", Wiley India, 2011 and Reprint 2018.

Reference Book:

1. Dhiren R Patel, "Information security theory & practice", PHI learning PVT. Ltd, 2010.
2. Bill Nelson, "Guide to Computer Forensics and Investigations", 4th Edition, CENGAGE Publication. 2009

Integrated Practices

Sl. No	Name of the Experiment	Session
1	Kali Linux -commands.	1
2	Symmetric and asymmetric algorithms.	1
3	Network Mapper utility for network discovery and security auditing.	1
4	Wireshark open-source packet analyzer.	1
5	Implementation of a steganography using stegosuite tool.	1
6	Aircrack-ng to assess Wi-Fi network security.	1
7	THC Hydra brute force cracks a remote authentication service.	1
8	Open Web Application Security Project Zed Attack Proxy.	1
9	BitLocker Drive Encryption.	1
10	Domain Information Gathering with WHOIS Lookup.	1
11	Scan Files for Vulnerabilities with Virus Total.	1
12	Real world case studies on various scenarios and detailed report on the cybercrimes i. Email account hacking ii. Credit card Fraud iii. Phishing iv. Source code Theft v. Software piracy	1

Back

Program: Bachelor of Computer Applications		Semester: V
Course Title: Security Operations & Incident Response		Course Code: 24EBCE302
L-T-P: 3-0-1	Credits: 4	Contact Hours: 5 Hrs/Week
ISA Marks: 63	ESA Marks: 37	Total Marks: 100
Teaching Hours: 40	Practical Hours: 24	Exam Duration: 3 Hours

	Unit I	
1	**Security Operations Fundamentals** CIA triad, Defence-in-Depth, SOC roles (Tier 1/2/3 analysts). SOC tools and Technologies (SIEM, EDR, IDS/IPS).	**5 Hrs**
2	**Incident Response Lifecycle** NIST Incident Response Framework (Preparation, Detection, Analysis, Containment, Eradication, Recovery, Post-Incident Review), Legal and Compliance considerations (GDPR, HIPAA, PCI-DSS).	**6 Hrs**
3	**Threat Intelligence** Types of threat intelligence (Strategic, Tactical, Operational). Threat feeds (MISP, STIX/TAXII), MITRE ATT&CK Framework.	**5Hrs**
	Unit II	
4	**Monitoring & Detection** Log management (Syslog, Windows Event Logs), Rule creation for SIEM (Splunk, ELK Stack), anomaly detection.	**6 Hrs**
5	**Incident Triage & Analysis** False positive/negative analysis, IoC (Indicators of Compromise) identification.	**5 Hrs**
6	**Incident Response Tools & Techniques** Digital Forensics, Disk imaging (FTK Imager), memory forensics, (Volatility), Timeline analysis, chain of custody.	**5 Hrs**
	Unit III	
7	**Malware Analysis** Static vs. dynamic analysis (Cuckoo Sandbox, Ghidra).	**4 Hrs**
8	**Network Forensics** Packet capture analysis (Wireshark, TCPdump), detecting lateral movement.	**4 Hrs**

Text Books:

1. The Web Application Hacker's Handbook (2nd Ed.) – Dafydd Stuttard, Marcus Pinto – 2021
2. The Art of Software Security Assessment – Mark Dowd, John McDonald, Justin Schuh – 2021
3. Practical Web Application Security (3rd Ed.) – Andrew Hoffman – 2022

Sl.l No.	Integrated Practices	Lab Slot
1	**SIEM Setup and Log Collection:** Set up a SIEM (Security Information and Event Management) system and Configure it to collect logs from various sources like servers, firewalls, and network devices.	1
2	**Log Analysis and Event Correlation:** Analyze the collected logs to identify patterns and correlate events to detect security incidents or potential threats.	1
3	**IDS/IPS Alert Analysis:** Monitor and analyze alerts generated by an Intrusion Detection or Prevention System to identify and investigate suspicious or malicious activity.	1
4	**Network Traffic Analysis:** Capture and examine network traffic using tools like Wireshark to detect Anomalies or signs of cyberattacks.	1
5	**Malware Analysis and Threat Detection:** Analyze malware samples in a safe environment to understand their Behavior and identify indicators of compromise.	1
6	**Memory Dump and Analysis:** Capture and analyze system memory to uncover running processes, hidden malware, or traces of advanced persistent threats (APTs).	1
7	**Forensic Disk Imaging and Analysis:** Create a forensic image of a disk and analyze it to extract evidence related to security breaches or data leaks.	1
8	**Incident Response Simulation: Phishing Email Attack:** Simulate a phishing attack and carry out the appropriate response steps including email header analysis, user notification, and containment.	1
9	**Incident Response Simulation: Ransomware Attack:** Perform a controlled ransomware simulation and respond with Containment, system isolation, and investigation of the ransomware's behavior.	1
10	**Threat Hunting with MITRE ATT&CK Framework:** Use the MITRE ATT&CK framework to proactively search for threats in your network based on known adversary techniques.	1
11	**Log Correlation for Insider Threat Detection:** Correlate user and system activity logs to detect signs of insider threats, such as unauthorized access or data exfiltration.	1

12	**Incident Documentation and Reporting:** Document all actions taken during a cybersecurity incident and create a detailed report covering analysis, response, and remediation steps.	1

Back

Program: Bachelor of Computer Applications		**Semester: V**
Course Title: Ethical Hacking and Penetration Testing		**Course Code:24EBCE303**
L-T-P: 3-0-1	**Credits: 4**	**Contact Hours: 5 Hrs/Week**
ISA Marks: 63	**ESA Marks: 37**	**Total Marks: 100**
Teaching Hours: 40	**Practical Hours: 24**	**Exam Duration: 3 Hours**

	Unit I	
1	**Introduction to Ethical Hacking:** Fundamentals of Ethical Hacking, Hacking phases and lifecycle, Legal, regulatory, and ethical considerations, Types of hackers (Black, White, Grey, Script Kiddies) CEH scope and career path	**4 Hrs**
2	**Foot printing and Reconnaissance:** Types of foot printing (Active, Passive), Open-source intelligence (OSINT) techniques, WHOIS,DNS, Email, Social Media reconnaissance, Countermeasures against foot printing	**3 Hrs**
3	**Scanning Networks:** Network scanning methodologies, Port scanning with Nmap, Vulnerability scanning concepts, Banner grabbing, network mapping, Countermeasures	**3 Hrs**
4	**Enumeration:** Enumeration techniques (NetBIOS, SNMP, LDAP), User account enumeration ,SMB, RPC, and SMTP enumeration, Tools: Nmap scripts, SNMPWalk, enum4linux, Enumeration countermeasures	**3 Hrs**
5	**Vulnerability Analysis:** Understanding vulnerabilities and exploits, Vulnerability management lifecycle Vulnerability assessment vs penetration testing, Tools: Nessus, OpenVAS, Nikto	**3 Hrs**
	Unit II	
6	**System Hacking:** Password cracking techniques (Offline & Online), Privilege escalation (Windows & Linux), Malware introduction: Trojans, Viruses, Ransomware, Steganography, Rootkits, Keyloggers, clearing logs and covering track	**6 Hrs**
7	**Malware Threats:** Malware propagation methods, Types: Ransomware, Backdoors, RATs, Virus & Worms vs Advanced Persistent Threats (APTs), Anti-malware strategies	**6Hrs**
8	**Sniffing and Social Engineering:** Sniffing techniques and tools (Wireshark, Ettercap), ARP poisoning, MITM attacks, Social Engineering tactics: Phishing, Vishing, Baiting Defense strategies and Awareness	**4 Hrs**
	UNIT 3	
9	**Denial of Service (DoS/DDoS) Attacks :**	**3 Hrs**

	Types of DoS and DDoS attacks, Botnets and DDoS tools, Mitigation techniques and protection mechanisms	
10	**Web Application Hacking:** OWASP Top 10,SQL Injection, XSS, CSRF, File Inclusion, Web server and application attack methodologies, Tools: Burp Suite, OWASP ZAP,Countermeasures and secure coding practices	**5Hrs**

Textbooks:

1. EC-Council Official CEH v12/v13 Courseware – EC-Council – 2023
2. Certified Ethical Hacker (CEH) All-in-One Exam Guide (v12/v13) – Matt Walker – 2022

Reference Books:

1. Basics of Hacking and Penetration Testing, 2nd Edition – Patrick Engebretson – 2021
2. Computer Forensics: Cybercriminals, Laws, and Evidence, 2nd Edition – Marie-Helen Maras – 2022

Sl. No	Integrated Practices	Lab Slot
1	Perform passive reconnaissance using various OSINT (Open Source Intelligence) tools	1
2	Carrie out active reconnaissance using Nmap to probe and identify live hosts, open ports, and services.	1
3	Conduct network scanning using Nmap and Netdiscover to discover devices and network topology.	1
4	Execute web application enumeration with tools like Dirb and Nikto	1
5	Exploit a vulnerable web application using SQL Injection techniques	1
6	Gain access to a vulnerable machine using Metasploit	1
7	Maintain unauthorized access by implementing persistence techniques using Metasploit and Netcat.	1
8	Perform privilege escalation on both Windows and Linux systems using tools like WinPEAS and LinPEAS.	1
9	Crack Wi-Fi networks using Aircrack-ng and captured WPA handshakes to test the strength of wireless security.	1
10	Simulate a rogue access point and conduct a Man-in-the-Middle (MitM) attack using Evil Twin Attack	1
11	Execute a Cross-Site Scripting (XSS) attack on a vulnerable web application using DVWA, Burp Suite,	1
12	Carriy out a Cross-Site Request Forgery (CSRF) attack using DVWA and Burp Suite.	1

Back

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Program: Bachelor of Computer Applications		Semester: V
Course Title: Blockchain Technologies		Course Code: 24EBCE304
L-T-P: 3-0-1	Credits: 4	Contact Hours: 5 Hrs/Week
ISA Marks: 63	ESA Marks: 37	Total Marks: 100
Teaching Hours: 40	Practical Hours: 24	Exam Duration: 3 Hours

	Unit I	
1	**Introduction to Blockchain**: History and evolution of Blockchain, Basic concepts: Block, Chain, Node, Consensus, Characteristics: Decentralization, Transparency, Immutability, Public vs Private vs Consortium Blockchains	6 Hrs
2	**Blockchain Architecture and Components**: Blockchain data structure and block anatomy, Cryptography basics: Hash functions, Digital Signatures, Distributed ledger technology (DLT), Peer-to-Peer (P2P) network models	5 Hrs
3	**Consensus Mechanisms**: Proof of Work (PoW), Proof of Stake (PoS) , Delegated Proof of Stake (DPoS), Practical Byzantine Fault Tolerance (PBFT),Comparison of different consensus models	5 Hrs
	Unit II	
4	**Smart Contracts:** Introduction to Smart Contracts, How smart contracts work, Smart contract lifecycle, Use cases and limitations	5 Hrs
5	**Blockchain Platforms Overview**: Ethereum: architecture and smart contract support, Hyperledger Fabric: permissioned Blockchain, Corda and Quorum overview, Comparative analysis	6 Hrs
6	**Cryptocurrency and Tokens** : Overview of cryptocurrencies (Bitcoin, Ethereum, Ripple),ICOs, NFTs, and Tokenization,Wallets, Exchanges, and Transaction Flow, Cryptocurrency regulations and risks,51% Attack, Sybil Attack, Replay Attack	5 Hrs
	Unit III	
7	**Blockchain Security and PrivBlockchain attack vectors**: Privacy techniques: Zero-Knowledge Proofs, Mixers, Secure coding practices for smart contracts	4 Hrs
8	**Use Cases and Industry Applications:** Supply Chain Management, Healthcare, Voting, Identity Management, Financial services and banking, Blockchain in IoT and Cloud Computing	4 Hrs

Textbooks:

1. Mastering Blockchain: Unlocking the Power of Cryptocurrencies, Smart Contracts, and Decentralized Applications(3rd Edition) Imran Bashir Year: 2020
2. Blockchain Applications: A Hands-On Approach Arshdeep Bahga, Vijay Madisetti : 2021

Practical No.	Integrated Practices	Lab Slot
1	set up the block chain lab environment to understand the tools	01
2	Explore Bitcoin blockchain transactions using blockchain explorers	01
3	Deploy a private Ethereum blockchain using tools Ganache	01
4	Write and deploy smart contracts using the Solidity programming language on the Ethereum blockchain.	01
5	Interacting with smart contracts via Web3.js,	01
6	Set up a Hyperledger Fabric network and deploy chaincode	01
7	Create and manage crypto currency wallets, including Generating wallet addresses and managing private keys.	02
8	Demonstrate a 51% attack to understand the vulnerabilities in blockchain consensus mechanisms.	01
9	Deploy and monitor a smart contract for minting NFTs	01
10	demonstrate blockchain transaction privacy using Zero-Knowledge Proofs to enhance understanding of privacy-preserving technologies.	02

Back

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Program: Bachelor of Computer Applications		Semester: V
Course Title: Digital Forensics		Course Code: 24EBCE305
L-T-P: 3-0-1	Credits: 4	Contact Hours: 5 Hrs/Week
ISA Marks: 63	ESA Marks: 37	Total Marks: 100
Teaching Hours: 40	Practical Hours: 24	Exam Duration: 3 Hours

	Unit I	
1	**Introduction to Digital Forensics**: History and scope of digital forensics, Types of digital crimes and incidents, Categories of digital forensics (Computer, Network, Mobile, Cloud) Role of a forensic investigator	**6 Hrs**
2	**Digital Evidence and Crime Scene Management**: Types of digital evidence, Evidence collection, preservation, and documentation, Chain of custody management, Crime scene isolation and procedures	**5 Hrs**
3	**Forensic Methodology and Investigation Process**: NIST forensic process model: Identification, Collection, Examination, Analysis, Reporting, Live vs Dead forensics, Volatile vs Non-volatile data acquisition, Incident triage procedures	**5 Hrs**
	Unit II	
4	**Disk and File System Forensics**: Hard disk architecture and partitions, File system analysis: FAT, NTFS, ext4, Deleted file recovery techniques, Data carving and slack space analysis	**5 Hrs**
5	**Memory and Live System Forensics**: Importance of volatile data acquisition, Memory dump acquisition tools and techniques, Analysing system processes, open files, and network connections Registry and system logs examination	**6 Hrs**
6	**Network Forensics**: Network traffic capturing and analysis, Packet analysis and intrusion detection, Log file correlation (firewalls, routers, SIEM),Email forensics and header analysis	**5 Hrs**
	Unit III	
7	**Mobile Device Forensics**: Mobile OS architectures (Android, iOS),Data acquisition: logical and physical extraction, SIM card and cloud backup analysis, Mobile app artefact recovery	**4 Hrs**
8	**Anti-Forensics and Countermeasures**: Common anti-forensic techniques (encryption, steganography, data wiping), Detection and countermeasures, Steganalysis and recovery methods	**4 Hrs**

Textbooks:

1. Guide to Computer Forensics and Investigations" by Bill Nelson, Amelia Phillips, and Christopher Steuart — 6th Edition, 2019
2. Digital Forensics and Incident Response by Gerard Johansen — 2nd Edition, 2020

Sl. No.	Integrated Practices	Lab Slot
1	**Setting up Digital Forensics Lab Environment:** Configure a secure and controlled digital forensics lab environment using forensic workstations	1
2	**Evidence Acquisition and Chain of Custody Handling:** Acquire digital evidence from a suspect device and document the chain of custody to maintain integrity and admissibility	1
3	**Disk Imaging and Verification:** Create a bit-by-bit forensic image of a storage device and verify Its integrity using cryptographic hash values.	1
4	**Deleted File Recovery and Data Carving:** Recover deleted files using forensic tools and perform data carving to extract hidden or fragmented data from unallocated Disk space.	1
5	**Windows Log and Registry Analysis:** Analyze Windows event logs and registry entries to identify user activities, software installations, and possible signs of Compromise.	1
6	**Memory Dump Acquisition and Analysis:** Capture a live memory dump from a running system and Analyze it for active processes, network connections, and signs of malware.	1
7	**Packet Capture and Network Forensics:** Use packet capture tools to record network traffic and perform forensic analysis to detect data exfiltration or intrusion Attempts.	1
8	**Email Header Analysis:** Examine the headers of email messages to trace their origin, identify spoofing attempts, and analyze email routing.	1
9	**Mobile Device Data Extraction and Analysis:** Extract data from mobile devices using forensic tools and Analyze call logs, messages, app data, and GPS locations.	1
10	**Anti-Forensics Detection and Steganography Analysis:** Detect the use of anti-forensics techniques such as data wiping or timestamp alteration and analyze files for hidden data using steganography tools.	1
11	**Cloud Forensics Exercise (Evidence Identification):** Identify and collect digital evidence from cloud environments,	2

	including logs, file access records, and user activities across Cloud storage services.	

Back

Program: Bachelor of Computer Applications		**Semester: V**
Course Title: Cyber Attacks & Counter Measures		**Course Code: 24EBCE306**
L-T-P: 3-0-1	**Credits: 4**	**Contact Hours: 5 Hrs/Week**
ISA Marks: 63	**ESA Marks: 37**	**Total Marks: 100**
Teaching Hours: 40	**Practical Hours: 24**	**Exam Duration: 3 Hours**

	Unit I	
1	**Introduction to Cyber Security:** Fundamentals of cybersecurity, Threats, vulnerabilities, and risks, Evolution of cyber-attacks, Cyber kill chain and attack lifecycle	**4 Hrs**
2	**Types of Cyber Attacks**: Malware: Viruses, Worms, Trojans, Ransomware, Spyware, Rootkits Phishing and Social Engineering attacks, DoS/DDoS Attacks, Insider Threats and Advanced Persistent Threats (APTs), SQL Injection, XSS, CSRF, Password attacks: Brute force, Dictionary, Key loggers	**6 Hrs**
3	**Network and Web Application Attacks**: Network reconnaissance and scanning, Man-in-the-Middle (MitM) and session hijacking, DNS Spoofing, ARP Spoofing, OWASP Top 10 Web vulnerabilities, API security threats	**6 Hrs**
	Unit II	
4	**Wireless and Mobile Security Attacks**: Wi-Fi encryption vulnerabilities (WEP, WPA, WPA2 cracking), Rogue access points, Evil Twin, Packet sniffing, Mobile device threats and app-based attacks	**4 Hrs**
5	**Cloud and IoT Cyber Threats**: Cloud service model vulnerabilities, API misconfigurations and cloud data breaches, IoT device risks, botnets, and Mirai attacks	**6 Hrs**
6	**Malware Analysis and Reverse Engineering Basics**: Malware behaviour and indicators, Static and dynamic malware analysis techniques, Malware sandboxing	**6 Hrs**
	Unit III	
7	**Attack Detection and Prevention** : Technologies Intrusion Detection/Prevention Systems (IDS/IPS), SIEM tools and log analysis, Honeypots and decoys, Network segmentation and endpoint protection	**4 Hrs**
8	**Countermeasures and Security Best Practices** :Secure network architecture and segmentation, Secure coding principles, Patch management and backup strategies, Incident response fundamentals	**4 Hrs**

Textbooks:

1. Digital Forensics and Incident Response (2nd Edition) – *Gerard Johansen* – 2020
2. Certified Ethical Hacker (CEH) All-in-One Exam Guide (v12/v13) – *Matt Walker* – 2022

Reference books:

1. EC-Council Official CEH v12/v13 Courseware – *EC-Council* – 2023
2. Incident Response & Computer Forensics (3rd Edition) – *Jason Luttgens* – 2023

Sl.No.	Integrated Practices	Lab Slot
1	Conduct malware detection and performed basic static analysis to Identify malicious code and understand its behavior.	1
2	Capture and analyse network traffic to monitor communication Patterns and detect anomalies.	1
3	Execute ARP spoofing and DNS spoofing to simulate man-in-the-Middle attacks and study their impact on network security.	1
4	Create and detect phishing emails to explore social engineering Techniques and develop countermeasures.	1
5	Simulated DoS and DDoS attacks in a controlled environment to assess system resilience under stress.	1
6	Demonstrate SQL Injection and XSS attacks on vulnerable web Applications to understand common attack vectors.	1
7	Capture wireless network handshakes and simulate WPA key Cracking to evaluate Wi-Fi network security.	1
8	Analyzed system logs and correlated events using a SIEM tool to Detect and investigate security incidents.	1
9	Perform web application security scanning to uncover Vulnerabilities and misconfigurations.	1
10	Engage in basic malware reverse engineering to understand Malicious software functions.	1
11	Configure a secure firewall and implemente an Intrusion Detection System (IDS) to enhance perimeter security.	2

Back

Program: Bachelor of Computer Applications		Semester: VI
Course Title: Industry Training		Course Code: 22EBCI301
L-T-P: 0-0-8	Credits: 8	Contact Hours: 16 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hours:-		Exam Duration: 3 hrs

Content

Overview of the Course:

Industry Training is a supervised, practical training periods for which Undergraduate, final year students earn academic credits. Industry Training provide excellent opportunities for students to put into practice much of the knowledge and skills acquired during their studies and to gain first-hand knowledge of the software industry. It is also an opportunity for employers to observe the student in the work environment and evaluate their potential for possible future employment.

The companies selected for the Industry Training can range from start-ups to large scale industries. The students who got placed in campus interviews may be offered Industry Training depending upon the need of the company. Other students who wish to do internship are responsible to find a company on their own for the Training.

Back

Program: Bachelor of Computer Applications		Semester: VI
Course Title: Industry Project		Course Code: 23EBCI301
L-T-P: 0-0-17	Credits: 17	Contact Hours: 34 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hours: --		Exam Duration: 3 Hrs

Content

Overview of the Course:

The purpose of providing the Industry Project is to give you the opportunity for students, to apply the knowledge, skills and competencies they have acquired, in real life practice. An Industry Project involves a stay in a relevant company or organization.

The students who got placed in campus interviews may be offered Industry Project depending upon the need of the company. Other students who wish to do Industry Project are responsible to find a company on their own.

Back

Program: Bachelor of Computer Applications		Semester: VI
Course Title: User Interface Design		Course Code: 24EBCE307
L-T-P: 3-0-1	Credits: 4	Contact Hrs: 5 hrs/week
ISA Marks: 63	ESA Marks: 37	Total Marks: 100
Teaching Hrs: 40	Practical Hours: 24	Exam Duration:3 Hrs

	Unit I	
1	**Understanding User Behaviour** The Basics of User Research, Users' Motivation to Learn, The Patterns.	**5 Hrs**
2	**Structuring Information: Information Architecture and Application Flow** The Big Picture, The Patterns:- Feature, Search, and Browse, News Stream, Picture Manager, Dashboard, Canvas Plus Palette, Wizard.	**5 Hrs**
3	**Designing Effective Navigation and Way finding** Staying Found, The Cost of Navigation, Navigational Models, Design Conventions for Websites, The Patterns:- Clear Entry Points, Menu Page, Pyramid, Modal Panel, Deep-linked State, Escape Hatch, Fat Menus, Sitemap Footer, Sign-in Tools, Sequence Map, Breadcrumbs, Annotated Scrollbar, Animated Transition.	**6 Hrs**
	Unit II	
4	**Page Layout and Element Organization** The Basics of Page Layout, The Patterns:- Visual Framework, Centre Stage, Grid of Equals, Titled Sections, Module Tabs, Collapsible Panels, Movable Panels, Right/Left Alignment, Diagonal Balance.	**5 Hrs**
5	**Designing Lists and Structured Content** Use Cases for Lists, Back to Information Architecture, The Patterns:- Two-Panel Selector, One-Window Drilldown, List Inlay, Thumbnail Grid, Row Striping, Jump to Item, Cascading Lists, Tree Table.	**5 Hrs**
6	**Enabling User Actions and Command Execution** Pushing the Boundaries, The Patterns:- Button Groups, Hover Tools, Action Panel, Smart Menu Items, Preview, Progress Indicator, Macros.	**6 Hrs**
	Unit – III	
7	**Visualizing Complex Information and Data** The Basics of Information Graphics, The Patterns:- Overview Plus Detail, Datatips, Data Spotlight, Dynamic Queries, Data Brushing, Local Zooming, Sortable Table, Radial Table, Multi-Y Graph, Small Multiples, Tree map.	**4 Hrs**
8	**Designing User Input: Forms and Interactive Controls** The Basics of Form Design, Control Choice, The Patterns:- Forgiving Format, Structured Format, Fill-in-the-Blanks, Input Hints, Input Prompt, Password Strength Meter, Auto completion, Dropdown Chooser, Same-Page Error Messages.	**4 Hrs**

Text Book:

1. Jenifer Tidwell, Charles Brewer, Aynne Valencia, Designing Interfaces, 3rd Edition,O'Reilly Publisher ,2020

2. Dr. Michaela Kauer-Franz & Dr. Benjamin Franz, Usability and User Experience Design, Shroff/Rheinwerk Computing, 2024

References:

1. Laws of UX, Jon Yablonski, O'Reilly, April 2020.
2. 100 Things Every Designer Needs to Know About People, Susan Weinschenk, Publisher: Team W, Inc ,2024
3. Adrian Kuleszo, How to Design Better UI Components 3.0, 2023

Sl No.	**Integrated Practices** (using Canva/Panpot)	Lab Slots
1	Design a homepage with a title, message, and two navigation buttons.	1
2	Create a simple navigation bar with 3–4 links.	1
3	Build a basic form with name, email, and submit button.	1
4	Add placeholder text and labels to input fields.	1
5	Show card-style content with image, title, and text.	2
6	Make a 2x2 image grid layout for an image gallery.	1
7	Style a button with a hover color change effect.	1
8	Add a footer with contact details and social icons.	1
9	Build a one-page profile with personal info and skills.	1
10	Display a static table with 3–4 rows of data.	2

Back

Program: Bachelor of Computer Applications		Semester: VI
Course Title: ASP.NET MVC Framework		Course Code:24EBCE308
L-T-P: 3-0-1	Credits: 4	Contact Hrs: 5 hrs/week
ISA Marks: 63	ESA Marks: 37	Total Marks: 100
Teaching Hrs: 40	Practical Hours: 24	Exam Duration:3Hrs

	Unit I	
1	**Introduction to ASP.NET MVC** Introduction, The C# Language, Types, Objects, and Namespaces. Understanding the History of ASP.NET, What Is Wrong with ASP.NET Web Forms? Web Standards and REST, Agile and Test-Driven Development, Ruby on Rails, overview on Node.js. Key Benefits of ASP.NET MVC, MVC Architecture, built on the Best Parts of the ASP.NET Platform, Introducing ASP.NET MVC in Detail	**8 Hrs**
2	**MVC Application** Preparing Visual Studio, creating a New ASP.NET MVC Project, Rendering Web Pages, Creating and Rendering a View, Adding Dynamic Output, creating a Simple Data-Entry Application Setting the Scene, designing a Data Model, Linking Action Methods, Building the Form, Setting the Start URL Handling Forms, Adding Validation, Styling the Content, and Completing the Example.	**8 Hrs**
	Unit II	
3	**The MVC Pattern** The History of MVC, Understanding the MVC Pattern, Understanding the Domain Model, The ASP.NET Implementation of MVC, Comparing MVC to Other Patterns, Building Loosely Coupled Components, Using Dependency Injection, using a Dependency Injection Container, Getting Started with Automated Testing, Understanding Unit Testing, Understanding Integration Testing.	**8 Hrs**
4	**Essential Language Features** Preparing the Example Project, Adding the System. Net.Http Assembly, Using Automatically Implemented Properties, Using Object and Collection Initializers, Using Extension Methods, Applying Extension Methods to an Interface, Creating Filtering Extension Methods, Using Lambda Expressions, Using Automatic Type Inference, Using Anonymous Types, Performing Language Integrated Queries, Understanding Deferred LINQ Queries, Using Async Methods, Applying the async and await Keywords	**8 Hrs**
	Unit – III	
5	**Essential Tools for MVC** **P**reparing the Example Project, Creating the Model Classes, Adding the Controller, Adding the View, Using Ninject, Understanding the Problem, Adding Ninject to th**e Visual Studio** Project, Getting Started with Ninject, Setting up MVC Dependency Injection, Creating Chains of Dependency, Specifying Property and Constructor Parameter Values, Using Conditional Binding, Setting the Object Scope.	**4 Hrs**
6	**Unit Testing with Visual Studio** Introduction, Creating the Unit Test Project, Creating the Unit Tests, Running the Unit Tests (and Failing)Implementing the Feature, Testing and Fixing the Code, Using Moq, Understanding the Problem, Adding Moq to the Visual Studio Project, Adding a Mock Object to a Unit Test, Creating a More Complex Mock Object	**4 Hrs**

Text Book:

1. Pro ASP.NET MVC 5, Publisher Apress, 6th ed. 2022
2. Pro C# 9 with .NET 6, Foundational Principles and Practices in Programming, Apress Publisher, 2022

References:

1. Adam Freeman - Pro ASP.NET Core 7, Tenth Edition - McGraw Hill Education- 2023
2. Andrew Lock - ASP.NET Core in Action, Third Edition - Manning Publications- 2023
3. Adam Freeman - Pro ASP.NET Core 6 – Apress 2022

Sl.No	**Integrated Practices**	Lab Slots
1	Create a basic ASP.NET MVC project and render a homepage view.	2
2	Design a simple form using MVC and display user input dynamically.	1
3	Implement form validation with error messages and styling.	2
4	Build a basic data model and connect it to a view using a controller.	1
5	Use extension methods and lambda expressions in a small C# program.	2
6	Apply LINQ queries to filter and display a list of sample data.	1
7	Set up Dependency Injection using Ninject in an MVC project.	2
8	Create and run basic unit tests using Visual Studio’s testing tools.	1

Back

Program: Bachelor of Computer Applications		**Semester: VI**
Course Title: Mobile Application Development		**Course Code:24EBCE309**
L-T-P: 3-0-1	**Credits: 4**	**Contact Hrs: 5 hrs/week**
ISA Marks: 63	**ESA Marks: 37**	**Total Marks: 100**
Teaching Hrs: 40	**Practical Hours: 24**	**Exam Duration: 3 Hrs**

	Unit I	
1	**Flutter Basics & Setup** Introducing Flutter ,Defining Widgets and Elements ,Understanding Widget Lifecycle Events ,The StatelessWidget Lifecycle The StatefulWidget Lifecycle Understanding the Widget Tree and the Element Tree ,Installing the Flutter SDK ,Installing on macOS ,System Requirements ,Get the Flutter SDK, Check for Dependencies iOS Setup: Install Xcode Android Setup: Install Android Studio Set Up the Android Emulator Installing on Windows System Requirements Get the Flutter SDK Check for Dependencies Install Android Studio Set Up the Android Emulator Installing on Linux System Requirements Get the Flutter SDK Check for Dependencies Install Android Studio Set Up the Android Emulator Configuring the Android Studio Editor.	**10 Hrs**
2	**Basic Application** Setting Up the Project Using Hot Reload, Using Themes to Style Your App Using a Global App Theme Using a Theme for Part of an App, Understanding Stateless and Stateful Widgets Using External Packages Searching for Packages, Using Packages.	**6 Hrs**
	Unit II	
3	**Dart Essentials** Why Use Dart? Commenting Code Running the main() Entry Point Referencing Variables, Declaring Variables Numbers Strings Booleans Lists Maps Runes Using Operators, Using Flow Statements ,if and else ternary operator for Loops while and do-while, while and break continue switch and case Using Functions Import Packages Using Classes ,Class Inheritance Class Mixins Implementing Asynchronous Programming.	**8 Hrs**
4	**Project Structure** Creating and Organizing Folders and Files Structuring Widgets: UNDERSTANDING THE WIDGET TREE Introduction to Widgets Building the Full Widget Tree Building a Shallow Widget Tree, Refactoring with a Constant Refactoring with a Method Refactoring with a Widget Class	**8 Hrs**
	Unit – III	
5	**Widgets & Animations** Using Basic Widgets SafeArea Container Text RichText Column Row, Column and Row Nesting Buttons FloatingActionButtonFlatButtonRaisedButton ,IconButtonPopupMenuButtonButtonBar Using Images and Icons AssetBundle .Image Icon Using Decorators Using the Form Widget to Validate Text Fields Checking Orientation ADDING ANIMATION TO AN APP: Using AnimatedContainer Using AnimatedCrossFade Using Animated opacity Using Animation Controller Using Staggered Animations	**4 Hrs**

6	**App Navigation** Using the Navigator Using the Named Navigator Route Using Hero Animation, Using the BottomNavigationBar Using the BottomAppBar Using the TabBar and TabBarView, Using the Drawer and ListView.	**4 Hrs**

Text Books:

1. Macro L. Napoli Flutter® A HANDS ON GUIDE TO APP DEVELOPMENT. 1st edition 2019
2. Rap Payne Flutter App Development: How to Write for iOS and Android at Once, published on October 18, 2024, by Apress

References:

1. Alessandro Biessek, Flutter for Beginners – Third Edition, Packt Publishing, 2023.
2. Simone Alessandria, Flutter Cookbook – Second Edition, Packt Publishing, 2023.

Sl.No.	Integrated Practices	Lab Slots
1	Install Flutter SDK and run a basic "Hello World" app.	1
2	Create and compare StatelessWidget and StatefulWidget examples.	1
3	Apply a global theme and use different widgets with styled components.	1
4	Use Hot Reload to update a UI element in real-time.	1
5	Build a simple app using Dart basics like variables, lists, and functions.	1
6	Create a form with text fields and validate inputs using Form widget.	1
7	Design a UI using Row, Column, Container, Text, and Image widgets.	1
8	Add navigation between two screens using Navigator and Hero animation.	2
9	Implement a basic animation using Animated Opacity or Animated Container.	2
10	Create a simple app with a Bottom Navigation Bar and multiple tabs.	1

Back

Program: Bachelor of Computer Applications		**Semester: VI**
Course Title: Agile Project Management		**Course Code:24EBCE310**
L-T-P: 3-0-1	**Credits: 4**	**Contact Hrs: 5 hrs/week**
ISA Marks: 63	**ESA Marks: 37**	**Total Marks: 100**
Teaching Hrs: 40	**Practical Hours: 24**	**Exam Duration:3Hrs**

	Unit I	
1	**Introduction** Need of Agile software development, agile context– Manifesto, Principles, Methods, Values, Roles, Artifacts, Stakeholders, and challenges. Business benefits of software Agility.	**8 Hrs**
2	**Project Planning** Recognizing the structure of an agile team– Programmers, Managers, Customers. User stories– Definition, Characteristics and content. Estimation– Planning poker, Prioritizing, and selecting user stories with the customer, projecting team velocity for releases and iterations.	**8 Hrs**
	Unit II	
3	**Project Design** Fundamentals, Design principles–Single responsibility, Open-closed, Liskov substitution, Dependency-inversion, Interface-segregation.	**8 Hrs**
4	**Design Methodologies** Need of scrum, Scrum practices –Working of scrum, Project velocity, Burn down chart, Sprint backlog, Sprint planning and retrospective, Daily scrum, Scrum roles– Product Owner, Scrum Master, Scrum Team.	**8 Hrs**
	Unit – III	
5	**Extreme Programming and Testing** Core principles, values and practices. Kanban, Feature-driven development, Lean software development. The Agile lifecycle and its impact on testing, Test driven development– Acceptance tests	**4 Hrs**
6	**Impact on Testing:** verifying stories, writing a user acceptance test, Developing effective test suites, Continuous integration, Code refactoring. Risk based testing, Regression tests, Test automation.	**4 Hrs**

Text Books:

1. Paul D. McKendrick, Agile Software Development: A Comprehensive Guide to Agile Software Development, CRC Press, 2022.
2. Ken Schwaber, Agile Project Management with Scrum (Revised Edition), Microsoft Press, 2022.

Reference Books:

1. Lisa Crispin, Janet Gregory, Agile Testing: A Practical Guide for Testers and Agile Teams, Addison-Wesley, 2019.
2. Alistair Cockburn, Agile Software Development: The Cooperative Game (2nd Edition), Addison-Wesley, 2021.

Sl.No.	Integrated Experiments	Lab Slots
1	Write the Agile Manifesto and list its core principles in your own words.	1
2	Identify roles in an Agile team and create a sample team structure.	1
3	Write 3 sample user stories with clear acceptance criteria.	1
4	Simulate Planning Poker to estimate story points for user stories.	1
5	Create a basic sprint backlog and plan a 1-week sprint.	1
6	Draw a burn-down chart using sample sprint data.	1
7	Explain and apply the SOLID design principles with simple examples.	1
8	Demonstrate Scrum roles through a role-play or team assignment.	1
9	Write unit tests using TDD approach for a simple calculator function.	1
10	Use Git to push code and show how automatic testing can run after each push.	1

Back

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Program: Bachelor of Computer Applications		Semester: VI
Course Title: Secure Software Engineering		Course Code:24EBCE311
L-T-P: 3-0-1	Credits: 4	Contact Hrs: 5 hrs/week
ISA Marks: 63	ESA Marks: 37	Total Marks: 100
Teaching Hrs: 40	Practical Hours: 24	Exam Duration:3 Hrs

	Unit I	
1	**System Complexity & Context** The Problem, System Complexity The Context within Which Software Lives. Software Assurance and Software Security. The Role of Processes and Practices in Software Security. Threats to Software Security Sources of Software Insecurity. The Benefits of Detecting Software Security Defects Early: Making the Business Case for Software Security Current State.	**10 Hrs**
2	**Introduction to Properties of Secure Software** Core Properties of Secure Software. Influential Properties of Secure Software. How to Influence the Security Properties of Software: The Defensive Perspective. The Attacker's Perspective. How to Assert and Specify Desired Security Properties: Building a Security Assurance Case.	**6 Hrs**
	Unit II	
3	**Importance of Requirements Engineering** Quality Requirements, Security Requirements Engineering. Misuse and Abuse Cases: Security Is Not a Set of Features, Thinking About What You Can't Do, Creating Useful Misuse Cases, An Abuse Case Example. The SQUARE Process Model: A Brief Description of SQUARE, Tools, Expected results. SQUARE Sample Outputs: Output from SQUARE Steps, SQUARE Final Results.	**8 Hrs**
4	**Requirements Elicitation:** Overview of Several Elicitation Methods, Elicitation Evaluation Criteria. Requirements Prioritization: Identify Candidate Prioritization Methods, Prioritization Technique Comparison, and Recommendations for Requirements Prioritization. Software Security Practices for Architecture and Design Architectural Risk Analysis: Characterization, Threat. Assessment, Determination, Risk. Risk Mitigation Planning. Recapping Architectural Risk Analysis.	**8 Hrs**
	Unit – III	
5	**Software Security** Software Security Knowledge for Architecture and Design Security Principles, Security Guidelines, and Attack Patterns: Security Principles, Security Guidelines, Attack Patterns.	**4 Hrs**
6	**Software Security Testing:** Contrasting Software Testing and Software Security Testing, Functional Testing, Risk-Based Testing.	**4 Hrs**

Text Book:

1. Dafydd Stuttard, Marcus Pinto, The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws (Second Edition), Wiley, 2021.
2. John Viega, Matt Messier, Secure Programming Cookbook for C and C++ (2nd Edition), O'Reilly Media, 2020.

Reference Book:

1. Software Reliability Engineering: More Reliable Software Faster and Cheaper," was published in 2004 by AuthorHouse.

e-Learning Resources:

1. http://study.com/articles/List_of_Free_Online_Software_Engineering_Courses.html
2. https://www.coursera.org/course/softwaresec

Sl.no	Integrated Practices	Lab Slots
1	List common threats and sources of software insecurity with examples.	2
2	Explain system complexity and how it affects software security in your own words.	1
3	Create a chart showing defensive vs. attacker perspectives in software design.	2
4	Identify and write the core properties of secure software.	1
5	Write a simple misuse and abuse case for an online banking system.	1
6	Summarize the 9 steps of the SQUARE process using a diagram or table.	2
7	Compare 2 requirements elicitation methods in a table format.	1
8	Create a risk assessment sheet for a small mobile app.	1
9	List 5 security principles and match them with relevant attack patterns.	1

Back

Program: Bachelor of Computer Applications		**Semester: VI**
Course Title: Object Oriented Modelling and Design		**Course Code:24EBCE312**
L-T-P: 3-0-1	**Credits: 4**	**Contact Hrs: 5 hrs/week**
ISA Marks: 63	**ESA Marks: 37**	**Total Marks: 100**
Teaching Hrs: 40	**Practical Hours: 24**	**Exam Duration:3 Hrs**

	Unit I	
1.	**Introduction, modeling concepts, class modeling, Advanced class modeling.** What is Object orientation? What is OO development? OO themes, Evidence for usefulness of OO development, OO modeling history. Modeling as Design Technique: Modeling, abstraction, The three models. Class Modeling: Object and class concepts, Link and associations concepts, Generalization and inheritance, A sample class model, Navigation of class models. Advanced class modeling: Advanced class and object concepts, Association ends, N-ary associations, Aggregation, Abstract classes, Multiple inheritances, Metadata, Reification, Constraints, Derived data, Packages, exercises of class models.	**8 Hrs**
2.	**State modeling, Advanced state modeling.** State modeling; Events, States, Transitions and conditions, State diagrams, State diagram behavior, exercises, Advanced State Modeling; Nested state diagrams, Nested states, Signal generalization, Concurrency, A sample state Model, Relation of class and state models.	**8 Hrs**
	Unit II	
3.	**Interaction modeling, Advanced interaction modeling's** Interaction Modeling; Use case models, Sequence models, Activity models, Advanced interaction modeling: Use case relationships, Procedural sequence models; Special constructs for activity models.	**4 Hrs**
4.	**Process overview, system conception, domain analysis** Process overview: Development stages, Development life cycle. System Conception: Devising a system concept, Elaborating a concept; Preparing a problem statement. Domain Analysis: Overview of analysis, Domain class model, Domain state model, Domain interaction model;, Iterating the analysis.	**6 Hrs**
5.	**Application analysis, system design** Application analysis: Application interaction model, Application class model, Application state model, Adding operations. System design: Overview of system design, Estimating performance, Making a reuse plan, Breaking a system into sub-systems, Identifying concurrency, Allocation of sub-system, Management of data storage, Handling global resources, Choosing a software control strategy, Handling boundary conditions, Setting the trade-off priorities, Common architectural styles, Architecture of the ATM system as the example.	**6 Hrs**
	Unit – III	
6.	**Class design** Class Design: Overview of class design, Bridging the gap, Realizing use cases, Designing algorithms, Recur sing Downwards, Refactoring, Design optimization, Reification of behavior, Adjustment of inheritance, Organizing a class Design, ATM example.	**4 Hrs**
7.	**Design Pattern:**	**4 Hrs**

	What is a pattern and what makes a pattern? Relationships between patterns, Pattern description. Pattern categories; Communication patterns: Forwarder-Receiver. Management Patterns: Command processor. Idioms: What can idioms provide? Idioms and style; Where to find idioms; Counted pointer example.	

Text Books:

1. Object-Oriented Modeling and Design with UML: Ajit Singh, Object Oriented Modeling and Design using UML, Publisher details unavailable, 2024
2. Pattern–Oriented Software Architecture Volume 1 : A System of Patterns-Volume 1-Frank Busch Mann, RegineMeunier, Hans Rohnert, Peter sommerland, Michael Stal, John Wiley and Sons, 2013

ISBN: 978-1-118-72526-9

Reference Books:

1. The Unified Modeling Language User Guide: Grady Booch, James Rumbaugh, and Ivar Jacobson, The Unified Modeling Language User Guide, Addison-Wesley Professional, 2015.
2. Design Patterns: Elements of Reusable Object-Oriented Software: Erich Gamma et al., Design Patterns: Elements of Reusable Object-Oriented Software, Addison-Wesley Professional, 2024, ISBN: 978-0138141789.

Sl.No.	Integrated Practices	Lab slots
1	Create a basic class "Car" with attributes and methods.	2
2	Model inheritance using "Vehicle" as a base class and "Car" as a derived class.	1
3	Design a state diagram for a "Turnstile" system with states and transitions.	2
4	Implement a vending machine system with nested states and concurrency.	1
5	Create a use case diagram for an ATM system with actors and actions.	2
6	Design a sequence diagram for a "Login" process.	1
7	Build a domain model with "User" and "Account" classes.	2
8	Implement the Singleton pattern in a "Logger" class.	1

Back

BCA-2023-26- Elective3 Groups- Data Analytics and Machine Learning

Program: Bachelor of Computer Applications		**Semester: VI**
Course Title: Statistical Techniques for Data Analytics		**Course Code:24EBCE313**
L-T-P: 3-0-1	**Credits: 4**	**Contact Hrs: 5 hrs/week**
ISA Marks: 63	**ESA Marks: 37**	**Total Marks: 100**
Teaching Hrs: 40	**Practical Hours: 24**	**Exam Duration:3 Hrs**

	Unit I	
1	**Introduction to Statistics**: Descriptive statistics: -Measures of central tendency, dispersion, skewness, and kurtosis. Probability theory: Basic concepts, random variables, probability distributions (discrete and continuous), and joint distributions. Sampling distributions and the Central Limit Theorem.	**8 Hrs**
2	**Statistical Inference**: Estimation: Point estimation, interval estimation, confidence intervals. Hypothesis testing: Null and alternative hypotheses, type II errors and significance levels, p-values, I. Parametric and non-parametric tests: t-tests, ANOVA, chi-square tests, Mann-Whitney U test, Wilcoxon signed-rank test.	**8 Hrs**
	Unit II	
3	**Regression Analysis**: Simple linear regression: Assumptions, estimation, interpretation of coefficients, inference, diagnostics. Multiple linear regression: Model building, variable selection, multicollinearity, interaction effects. Logistic regression: Binary and multinomial logistic regression, model interpretation.	**8 Hrs**
4	**Time Series Analysis**: Time series data: Components, trends, seasonality, autocorrelation. Forecasting methods: Moving averages, exponential smoothing, ARIMA models.	**8 Hrs**
	Unit – III	
5	**Machine Learning Fundamentals**: Supervised learning: Regression and classification algorithms (e.g., linear regression, decision trees, random forests, support vector machines, k-nearest neighbors). Unsupervised learning: Clustering algorithms (e.g., K-means clustering, hierarchical clustering). Model evaluation and validation techniques	**4 Hrs**
6	**Data Visualization**: Principles of effective data visualization. Tools and techniques for creating visualizations (e.g., matplotlib, seaborn, ggplot2). Interpretation of visualizations.	**4 Hrs**

Text Books:

1. Robert S. Witte, John S. Witte, “Statistics”, 11th Edition, Wiley, 2017.
2. Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, “An Introduction to Statistical Learning”, 2nd Edition, Springer, 2021.

Reference Books:

1. Bing Liu, “Sentiment Analysis: Mining Opinions, Sentiments, and Emotions”, 2nd Edition, Cambridge University Press, 2020.
2. Robert S. Witte, John S. Witte, Statistics, 11th Edition, Wiley, 2017.

Integrated Practices

Expr. No.	Experiments	Lab Slot
1	Descriptive Statistics using Python	2
2	Probability Distributions and Random Sampling	1
3	Point and Interval Estimation	2
4	Hypothesis Testing (t-test, Chi-square, ANOVA)	1
5	Correlation and Simple Linear Regression	2
6	Multiple Linear Regression Analysis	1
7	Logistic Regression for Classification	1
8	Time Series Analysis and Forecasting	1
9	Visualization Techniques for Statistical Data	1

Back

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Program: Bachelor of Computer Applications		Semester: VI
Course Title: Internet of Things		Course Code:24EBCE314
L-T-P: 3-0-1	Credits: 4	Contact Hrs: 5 hrs/week
ISA Marks: 63	ESA Marks: 37	Total Marks: 100
Teaching Hrs: 40	Practical Hours: 24	Exam Duration:3 Hrs

	Unit I	
1	**Introduction to IoT** Definition and concepts of IoT, Evolution and history of IoT, Applications and use cases, Challenges and opportunities	**6 Hrs**
2	**IoT Architecture** Device layer: Sensors and actuators, Network layer: Connectivity protocols (e.g., MQTT, CoAP), Middleware layer: Data processing and storage, Application layer: IoT platforms and applications.	**10Hrs**
	Unit II	
3	**IoT Communication Protocols** Wireless protocols (e.g., Wi-Fi, Bluetooth, Zigbee), IoT-specific protocols (e.g., MQTT, CoAP, HTTP), Security considerations in IoT communication.	**8Hrs**
4	**IoT Hardware Platforms** Introduction to microcontrollers and microprocessors, Evaluation of popular IoT development boards (e.g., Arduino, Raspberry Pi), Sensors and actuators integration	**8 Hrs**
	Unit – III	
5	**IoT Data Processing and Analytics** Data collection, storage, and retrieval. Real-time data processing techniques, Data visualization and interpretation **IoT Applications and Case Studies:** Smart cities, Industrial IoT (IIoT), Healthcare IoT, Agriculture IoT.	**4Hrs**
6	**IoT Security and Privacy** Threats and vulnerabilities in IoT systems, Security mechanisms (e.g., encryption, authentication),Privacy concerns and regulations. **IoT Project Development:** Project planning and management, Hands-on IoT project development, Presentation and documentation	**4Hrs**

Text Books:

1. Arshdeep Bahga, Vijay Madisetti, “Internet of Things: A Hands-On Approach”, Universities Press, 2nd Edition, 2021.
2. Raj Kamal, “Internet of Things: Architecture and Design”, McGraw Hill Education, 2nd Edition, 2021.

Reference Books:

1. Olivier Hersent, David Boswarthick, Omar Elloumi, “The Internet of Things: Key Applications and Protocols”, Wiley, 2nd Edition, 2021.
2. Adrian McEwen, Hakim Cassimally, Designing the Internet of Things, 2nd Edition, Wiley, 2022.
3. Perry Lea, Internet of Things for Architects, 2nd Edition, Packt Publishing, 2021.

Integrated Practices

Expr. No.	Experiments	Lab Slot
1	Getting Started with Arduino and Raspberry Pi	2
2	Sensor Data Acquisition	1
3	Actuator Control	2
4	Wireless Communication using Bluetooth and Wi-Fi	1
5	MQTT Protocol Implementation	2
6	Cloud Data Logging	1
7	IoT-based Smart Application Simulation	1
8	Real-time Data Visualization	1
9	IoT Security Demonstration	1

Back

KLE Technological University | Creating Value, Leveraging Knowledge

Program: Bachelor of Computer Applications		Semester: VI
Course Title: Social Network Analysis		Course Code:24EBCE315
L-T-P: 3-0-1	Credits: 4	Contact Hrs: 5 hrs/week
ISA Marks: 63	ESA Marks: 37	Total Marks: 100
Teaching Hrs: 40	Practical Hours: 24	Exam Duration:3 Hrs

	Unit I	
1	**Introduction to Online Social Networks** Types of social networks, Measurement and Collection of Social Network Data. Techniques to study different aspects of OSNs — Follower-followee dynamics	**6 Hrs**
2	**Digital Influence and Content Strategies** Link farming, spam detection, hashtag popularity and prediction, linguistic styles of tweets. Case Study: An Analysis of Demographic and Behaviour Trends using Social Media: Facebook, Twitter and Instagram	**10 Hrs**
	Unit II	
3	**Social Data Analytics** Working with Social Media Data, Topic Models, Modelling social interactions on the Web – Agent Based Simulations, Random Walks and variants	**10 Hrs**
4	**Impact of Social Network Influence** Case Study: Social Network Influence on Mode Choice and Carpooling during Special Events: The Case of Purdue Game Day	**6 Hrs**
	Unit – III	
5	**Advanced Text Analytics** Application of Topic models, Information Diffusion, Opinions and Sentiments – Mining, Analysis and Summarization, Case Study: Sentiment Analysis on a set of Movie Reviews using Deep Learning techniques	**4 Hrs**
6	**Community Dynamics and Influence in Social Networks** Recommendation Systems, Language dynamics and influence in online communities, Community identification, link prediction and topical search in social networks, Case Study: The Interplay of Identity and Social Network: A Methodological and Empirical Study.	**4 Hrs**

Text Books:

1. Golbeck, Jennifer. Online Social Networks: Human Cognitive Constraints and the Structure of the Web, 2nd Edition, Springer, 2020.
2. Draief, Moez, and Massoulié, Laurent. Epidemics and Rumours in Complex Networks, 1st Edition, Springer, 2021
3. Sharma, Sanjiv. Social Media Mining for Data Analytics, 1st Edition, CRC Press, 2022.

Reference Books:

1. Aggarwal, Charu C. Machine Learning for Text, 1st Edition, Springer, 2021.
2. Liu, Bing. Sentiment Analysis and Opinion Mining, Updated Edition, Cambridge University Press, 2022.
3. Easley, David, and Kleinberg, Jon. Networks, Crowds, and Markets: Reasoning About a Highly Connected World, Revised Edition, Cambridge University Press, 2020.

Integrated Practices

Expr. No.	Name of Experiment	Lab Slot
1	Data Collection from Social Media Platforms	1
2	Graph Creation and Visualization	1
3	Basic Network Metrics Calculation	1
4	Community Detection Algorithms	2
5	Topic Modeling from Social Media Texts	1
6	Sentiment Analysis on Social Content	1
7	Spam Detection and Fake Account Analysis	2
8	Influence Analysis and Hashtag Trends	1
9	Information Diffusion Modeling	2

Back

Program: Bachelor of Computer Applications		Semester: VI
Course Title: Capstone Project		Course Code: 23EBCP302
L-T-P:0-0-17	Credits:17	Contact Hours:34 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hours: --		Exam Duration:3 Hours

Content

Theme

The capstone project aims to develop software applications that address real-world business problems by incorporating features such as user authentication, email, SMS, barcode and QR code usage, advanced search and filter facilities, reporting in various formats (DOC, XLSX, and PDF), data backup and recovery, and payment gateway integration. Students will engage in project documentation, formal design review presentations, oral defense of the project, and writing a final report. The course covers technical methods for analyzing, designing, prototyping, synthesizing, troubleshooting, and testing the system.

Objectives

1. Review and analyze relevant literature related to the project.
2. Demonstrate the skills and knowledge gained during the BCA program.
3. Implement the software engineering phases to design and develop a software application for a mini-world problem.
4. Prepare detailed documentation, including project proposal, requirements, design documents, user manuals, and technical reports for the software application developed.

Internal Semester Assessment (50%)	Assessment	Weightage in marks
	Periodic reviews by Project Guide	25
	Periodic reviews by committee	25
End Semester Assessment (50%)	Final Review	50
	Total	**100**

Back