

Curriculum Structure and Curriculum Content for the Batch: 2024-27

Department of Computer Applications
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Program: Bachelor of Computer Applications

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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

1. 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.
2. To contribute to advancing knowledge in both fundamentals and applied areas of Computer Science.
3. To provide a scholarly and pleasant learning platform that enables staff and students to grow academically and professionally.
4. 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: 1. Have 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/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. : 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. : Computing Professional and Society: 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 7. : Ethics: Understand and commit to professional ethics and cyber regulations, responsibilities, and norms of professional computing practice.
PO 8. : Individual and Collaborative Team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary environments.
PO 9. : Communication: 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. : Project management and finance: Demonstrate knowledge and understanding of the computing and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO 11. : **Life-long learning:** Recognize the need, and have the ability, to engage in independent learning for continual development as a computing professional.

Program Specific Objectives -PSO's

PSO 12: **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 13: **Professional Competency:** Apply computing concepts, skills, and processes to produce a product/project in the domain demonstrating professional knowledge and attitude.

Semester	CORRECTED		BCA Regular		Total Program Credit: 132		Year: 2024 – 2027
Courses Semester wise	I	II	III	IV	V	VI	
	Foundational Mathematics 24EBCB101 (3-1-0)	Applied Statistics 24EBCB103 (3-0-1)	Linear Algebra 24EBCB202 (4-0-1)	Machine Learning 24EBCC209 (3-0-1)	Big Data Analytics 24EBCC305 (3-0-1)	Capstone Project 24EBCP303 (0-0-14)	Industry Training 24EBCI301 (0-0-6)
	Discrete Mathematical Structures 24EBCB102 (3-1-0)	Operating Systems 24EBCC103 (4-0-1)	Object Oriented Programming using C++ 24EBCC207 (3-0-0)	Computer Networks 24EBCC212 (3-0-1)	Cloud Computing 24EBCC301 (3-0-1)	Elective -2 24EBCE3XX (3-0-0)	Industry Project 24EBCI302 (0-0-14)
	Computer Organization 24EBCC101 (4-0-1)	Data Structures with C 24EBCC104 (4-0-0)	Software Engineering 24EBCC208 (3-0-1)	Java Programming 24EBCC205 (3-0-0)	Cyber Security 24EBCC306 (3-0-1)	Elective -3 24EBCE3XX (3-0-0)	
	C Programming 24EBCC102 (1-0-3)	Database Management System 24EBCC105 (4-0-1)	Data Mining 24EBCC211 (3-0-1)	Professional Aptitude and Logical Reasoning 23EHSC201 (3-0-0)	Elective -1 24EBCE3XX (3-0-0)	--	--
	Web Technology 24EBCP101 (0-0-2)	Data Structures Lab 24EBCP102 (0-0-1.5)	OOPs using C++ lab 24EBCP203 (0-0-2)	Software Testing 24EBCC210 (3-0-1)	Natural Language Processing & Gen AI 24EBCC307 (2-0-2)	--	--
	Professional Communication 24EBCH101 (2-0-1)	Python Programming 24EBCP103 (0-0-2)	Server-Side Web Development 24EBCP204 (0-0-1.5)	Java Lab 24EBCP206 (0-0-1.5)	Mobile Application Development 24EBCP301 (0-0-1.5)	--	--
		Corporate Communication 23EHSH101 (0.5-0-0)	DevOps 24EBCP205 (0-0-2)	Full Stack Web Development with MERN 24EBCP207 (0-0-2)	Mini Project 24EBCP302 (0-0-3)	--	--
			Problem Solving and Analytical Skills 23EHSH102 (0.5-0-0)	Arithmetical Thinking and Analytical Reasoning 23EHSH203 (0.5-0-0)	Industry Readiness and Leadership Skills 23EHSH204 (0.5-0-0)		
Credits	22	22	22	22	24	20	

Curriculum Structure-Semester wise

Semester - I

No	Code	Course	Category	L-T-P	Credits	Contact Hours	ISA	ESA	Total	Exam Duration
1	24EBCB101	Foundational Mathematics	BS	3-1-0	4	5	50	50	100	3 hours
2	24EBCB102	Discrete Mathematical Structures	BS	3-1-0	4	5	50	50	100	3 hours
3	24EBCC101	Computer Organization	PC	4-0-1	5	6	50	50	100	3 hours
4	24EBCC102	C Programming	PC	1-0-3	4	7	50	50	100	3 hours
5	24EBCP101	Web Technology	PC	0-0-2	2	4	80	20	100	3 hours
6	24EBCH101	Professional Communication	HSS	2-0-1	3	4	50	50	100	3 hours
TOTAL				13-2-7	22	31	330	270	600	

ISA: In Semester Assessment

ESA: End Semester Assessment

L: Lecture

T: Tutorials

P: Practical

Date:

Program Head

Semester - II

No	Code	Course	Category	L-T-P	Credits	Contact Hours	ISA	ESA	Total	Exam Duration
1	24EBCB103	Applied Statistics	BS	3-0-1	4	5	63	37	100	3 hours
2	24EBCC103	Operating Systems	PC	4-0-1	5	6	60	40	100	3 hours
3	24EBCC104	Data Structures with C	PC	4-0-0	4	4	50	50	100	3 hours
4	24EBCC105	Database Management System	PC	4-0-1	5	6	60	40	100	3 hours
5	24EBCP102	Data Structures Lab	PC	0-0-1.5	1.5	3	80	20	100	3 hours
6	24EBCP103	Python Programming	PC	0-0-2	2	4	80	20	100	3 hours
7	23EHS101	Corporate Communication	HSS	0.5-0-0	0.5	1	100	-	100	--
TOTAL				15.5-0-6.5	22	29	493	207	700	

ISA: In Semester Assessment

ESA: End Semester Assessment

L: Lecture

T: Tutorials

P: Practical

Date:

Program Head

Semester - III

No	Code	Course	Category	L-T-P	Credits	Contact Hours	ISA	ESA	Total	Exam Duration
1	24EBCB202	Linear Algebra	BS	4-0-1	5	6	60	40	100	3 hours
2	24EBCC207	Object Oriented Programming using C++	PSC	3-0-0	3	3	50	50	100	3 hours
3	24EBCC208	Software Engineering	PSC	3-0-1	4	5	63	37	100	3 hours
4	24EBCC211	Data Mining	PSC	3-0-1	4	5	63	37	100	3 hours
5	24EBCP203	OOPs using C++ Lab	PSC	0-0-2	2	4	80	20	100	3 hours
6	24EBCP204	Server-Side Web Development	PSC	0-0-1.5	1.5	3	80	20	100	3 hours
7	24EBCP205	DevOps	PSC	0-0-2	2	4	80	20	100	3 hours
8	23EHS102	Problem Solving and Analytical Skills	HSS	0.5-0-0	0.5	1	100	-	100	-
TOTAL				13.5-0-8.5	22	31	576	224	800	

ISA: In Semester Assessment

ESA: End Semester Assessment

L: Lecture

T: Tutorials

P: Practical

Date:

Program Head

Semester - IV

No	Code	Course	Category	L-T-P	Credits	Contact Hours	ISA	ESA	Total	Exam Duration
1	24EBCC209	Machine Learning	PSC	3-0-1	4	5	63	37	100	3 hours
2	24EBCC212	Computer Networks	PSC	3-0-1	4	5	63	37	100	3 hours
3	24EBCC205	Java Programming	PSC	3-0-0	3	3	50	50	100	3 hours
4	24EBCC210	Software Testing	PSC	3-0-1	4	5	63	37	100	3 hours
5	24EBCP206	Java Lab	PSC	0-0-1.5	1.5	3	80	20	100	3 hours
6	24EBCP207	Full Stack Web Development with MERN	PSC	0-0-2	2	4	80	20	100	3 hours
7	23EHSC201	Professional Aptitude and Logical Reasoning	HSS	3-0-0	3	3	50	50	100	3 hours
8	23EHS203	Arithmetical Thinking and Analytical Reasoning	HSS	0.5-0-0	0.5	1	100	-	100	-
TOTAL				15.5-0-6.5	22	29	549	251	800	

ISA: In Semester Assessment

ESA: End Semester Assessment

L: Lecture

T: Tutorials

P: Practical

Date:

Program Head

Semester - V

No	Code	Course	Category	L-T-P	Credits	Contact Hours	ISA	ESA	Total	Exam Duration
1	24EBCC305	Big Data Analytics	PSC	3-0-1	4	5	63	37	100	3 hours
2	24EBCC301	Cloud Computing	PSC	3-0-1	4	5	63	37	100	3 hours
3	24EBCC306	Cyber Security	PSC	3-0-1	4	5	63	37	100	3 hours
4	24EBCE3XX	Elective -1	PSE	3-0-0	3	3	50	50	100	3 hours
5	24EBCC307	Natural Language Processing and Gen AI	PSC	2-0-2	4	6	50	50	100	2 hours
6	24EBCP301	Mobile Application Development	PSC	0-0-1.5	1.5	3	80	20	100	3 hours
7	24EBCP302	Mini Project	PW	0-0-3	3	6	50	50	100	3 hours
8	23EHS204	Industry Readiness and Leadership Skills	HSS	0.5-0-0	0.5	1	100	-	100	-
TOTAL				14.5-0-9.5	24	34	519	281	800	

ISA: In Semester Assessment

ESA: End Semester Assessment

L: Lecture

T: Tutorials

P: Practical

Date:

Program Head

Semester – VI

No	Code	Course	Category	L-T-P	Credits	Contact Hours	ISA	ESA	Total	Exam Duration
1	24EBCP303	Capstone Project	PW	0-0-14	14	28	50	50	100	3 hours
2	24EBCE3XX	Elective -2	PE	3-0-0	3	3	50	50	100	3 hours
3	24EBCE3XX	Elective -3	PE	3-0-0	3	3	50	50	100	3 hours
		OR		6-0-14	20	34	150	150	300	
1	24EBCI302	Industry Project	IW	0-0-14	14	28	50	50	100	3 hours
2	24EBCI301	Industry Training	IW	0-0-6	6	12	50	50	100	3 hours
TOTAL				0-0-20	20	40	100	100	200	

ISA: In Semester Assessment

ESA: End Semester Assessment

L: Lecture

T: Tutorials

P: Practical

Date:

Program Head

Semester	I	II	III	IV	V	VI	Total
Credits	22	22	22	22	24	20	132

List of Program Electives

Sem	Name of the Course	Course Code
Group- Data Analytics		
5	<u>Social Network Analysis</u>	24EBCE301
6	<u>Data Visualization</u>	24EBCE302
Group- Software Development		
5	<u>Agile Project Management</u>	24EBCE303
6	<u>Programming C# using .Net</u>	24EBCE304
Group- Cyber Security		
5	<u>Web Security</u>	24EBCE305
6	<u>Network Security</u>	24EBCE306

Curriculum Content- Course wise

Semester - I

Program: Bachelor of Computer Applications		Semester - I
Course Title: Foundational Mathematics		Course Code: 24EBCB101
L-T-P: 3-1-0	Credits: 4	Contact Hours: 5 hrs/week
ISE Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 40	Tutorial/Practical: 24	Exam Duration: 3 Hours
Unit I		
1	Number System: Definitions, Number Representations: Decimal, Binary, Octal, and Hexadecimal; Conversion Methods, LCM, HCF, GCD	8 hrs
2	Sequences and Series: AM, GM, HM & their Relation; Odd and Even Series and their Properties; Fibonacci Sequence: Definition, Matrix form; Primes and Divisibility; Prime Factorization: Definition, Methods; Practice problems.	8 hrs
Unit II		
3	Coordinate Geometry: Introduction to Coordinate Geometry: Distance Formula, Section Formula, Equation of line in Cartesian Plane; Coordinate Geometry formulas and theorems: Calculation of distance between two points, Midpoint theorem, Angle Formula, Area of Triangle in Cartesian Plane; Polar Coordinate System: Polar Grid, Polar Coordinates Formula, Cartesian to Polar Coordinates; 3D polar coordinates.	10 hrs
4	Matrices & Determinants: Definitions, Types of Matrices: Inverse Matrix, Transpose of Matrix; Determinants: Properties, Laplace formula, Determinant of Matrix; Examples.	6 hrs
Unit III		
5	Straight Lines: Definitions, Types of Equations of Straight Lines, Measuring Straight Lines, Angle between two Straight Lines; Examples.	8 hrs
Text Books 1. Handouts provided by Course Teacher.		

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Program: Bachelor of Computer Applications		Semester - I
Course Title: Discrete Mathematical Structures		Course Code: 24EBCB102
L-T-P:3-1-0	Credits: 4	Contact Hours: 5 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 40	Tutorial/Practical: 24	Exam Duration: 3 Hrs
Unit I		
1	Logic and Proofs Propositional Logic, Applications of Propositional Logic, Propositional Equivalences, Predicates and Quantifiers: Nested Quantifiers and Rules of Inference. Application in: Artificial Intelligence, Data mining and Software Engineering:	8 hrs
2	Counting The Basics of Counting, The Pigeonhole Principle, Permutations and Combinations, Generalized Permutations and Combinations, Generating Permutations and Combinations. Application in: Programming languages, Computer Networks, Data base management system, Computer architecture and Principles of Compiler Design	8 hrs
Unit II		
3	Recurrence Relations Applications of Recurrence Relations, Formulating Recurrence relations, Solving Linear and nonlinear Recurrence Relations, Generating Functions: recurrence relation and Inclusion–Exclusion. Application in: Data structures, Algorithm Design and Analysis	8 hrs
4	Number Theory Divisibility and Modular Arithmetic, Primes and Greatest Common Divisors: Primes, Trial Division, The Sieve of Eratosthenes, the Euclidean Algorithm and gcds as Linear Combinations; Solving Congruences : Linear Congruences ; Applications of Congruences : Hashing Functions & Pseudorandom Numbers and Polynomial Arithmetic. Application in: Computer Networks , Cryptography and Network Security	8 hrs
Unit – III		
5	Groups Binary Operations, Semi groups, Monoid, Group, Abelian group and Products & Quotients of Semi Groups.	4 hrs

	Application in: Quantum Computing, Computer Graphics, Cryptography and Network Security	
6	Finite fields: Fields, Finite fields of the form $GF(p)$ and Finite fields of the form $GF(2^n)$ Application in: Cryptography and Network Security, Error-Correcting Codes, Computer Algebra Systems, Signal Processing and control systems	4 hrs
Text Book: (List of books as mentioned in the approved syllabus) 1. Kenneth H. Rosen, Kamala Krithivasan, Discrete Mathematics and its Applications, 8th Edition, Tata Mc-GrawHill Publication, July 30, 2021 . 2. Kolman, Busby and Ross, Discrete Mathematical Structures, 6Ed., Pearson 2018		
ReferencesBooks: 1. Grimaldi R.P, Discrete and Combinatorial Mathematics- An Applied Introduction 5th Ed., Pearson Education, 8 May 2019. 2. Dr. D .S. Chandrashekar Discrete Mathematical Structures, 6th Edition. Prism Publication January 2019, 3. William Stallings, Cryptography and Network Security Principles And Practices, 8th Edition, Pearson, June 6, 2022.		

Course Title: Computer Organization		Course Code: 24EBCC101
L-T-P: 4-0-1	Credits: 5	Contact Hours: 6 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs :50	Tutorial/Practical : 24	Exam Duration: 3 Hrs
Unit I		
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	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.	8 hrs
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.	8 hrs
Unit II		
4	Basic Structure of Computers Computer Types, Functional Units, Basic Operational Concepts, Bus Structure, Memory Locations and Addresses.	8 hrs
5	Machine instruction and Programs Memory Operations, Instructions & Instruction Sequencing, Addressing Modes, Assembly Language.	6 hrs
6	The Memory System Basics Concepts, Semiconductor RAM Memories, Read-only Memories, Cache Memories, Virtual Memory.	6 hrs
Unit – III		
7	Input/output Organization Accessing I/O Devices, Interrupts, Direct Memory Access.	5 hrs
8	Embedded Systems Examples of Embedded Systems, Processor Chips for Embedded Applications, A Simple Microcontroller.	5 hrs
Text Book: - Digital Logic and Computer Design, Morris Mano, Pearson Education Asia (Kindle Edition)2017. - Computer Organization and an Embedded System, Carl Hamacher, Z Varnesic and S Zaky, N Manjikian, 6th Edition, McGraw Hill, 2023.		
References Books: Digital Electronics Principles and Applications, Tokheim, 9th Edition, McGraw Hill, 2021.		

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Program: Bachelor of Computer Applications		Semester - I
Course Title: C Programming		Course Code: 24EBCC102
L-T-P: 1-0-3	Credits: 4	Contact Hours: 7 Hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
TeachingHrs : 12	Tutorial/Practical: 72	Exam Duration: 03 Hrs
Unit I		
1	Introduction to Problem solving and Programming Problem Solving Framework, Problem Scenario, Principles of Programming, Programming paradigms – procedural, object, logical, functional, Design of C Compilers, Rules and Syntax Orders, Syntax and Semantics, Programming for problem solving.	6 hrs
2	Basics of C programming language Characteristics and uses of C, Structure of C program, C Tokens: Keywords, Identifiers, Variables, Constants, Operators, Data-types, Input and Output statements.	12 hrs
3	Decision control statements Conditional branching statements: if statement, if else statement, else if ladder, switch statement, unconditional branching statements: break, continue.	12 hrs
Unit II		
4	Functions Introduction, Function declaration, definition, call, returns statement, passing parameters to functions, introduction to macros. Introduction to Coding Standards.	5 hrs
5	Iterative statements while, do while, for, nested statements	10 hrs
6	Arrays and Strings Introduction, Declaration, Accessing elements, Storing values in arrays, Operations on one dimensional array, Operations on two dimensional arrays.	15 hrs
Unit – III		
7	Pointers Introduction, declaring pointer, pointer variables, pointer expression and arithmetic, passing arguments to functions using pointers, pointers and arrays, passing an array to a function.	6hrs
8	Structures and Unions Introduction, passing structures to functions, Array of structures, Unions	6hrs
Text Books 1. Elliot B. Koffman ,Jeri R. Hanly Problem Solving and Program Design in C,8th ed, PHI, 2016. 2. Yashvant Kanetkar, Let us C ,18th ed, BPS Publication, 2016.		
ReferencesBooks:		

1. B W Kernighan, D M Ritchie, The Programming language C, 2ed, PHI, 2004.
2. R.G.Dromey, How to Solve it by Computer, 1ed, PHI, 2008.
3. B S Gottfried, Programming with C (Schaum's Outlines Series), 4th ed, TMH, 2018.2008.
4. C Programming: A Modern Approach, 2nd Edition, K. N. King, 2008

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Program: Bachelor of Computer Applications	Semester – I
Course Title: Web Technology	Course Code: 24EBCP101

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: 48	Exam Duration: 3 Hrs
Content		
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	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	12 hrs
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	14 hrs
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.	14 hrs
Text Book: 1. Robert W Sebesta, Programming the World Wide Web, 8th Edition, Pearson education, 2020		
References 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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Program: Bachelor of Computer Applications	Semester – I
Course Title: Professional Communication	Course Code: 24EBCH101

L-T-P: 2-0-1	Credits:3	Contact Hours: 40hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 25	Tutorial/Practical: 15	Exam Duration: 3 Hrs
Content		
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.	2 Hrs
4	Chapter 4: Basic Writing Strategies Active and Passive	2 Hrs
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
8	Chapter 8: Group Communication Group Discussion	2 Hrs
9	Chapter 9: Presentation Skills Individual Presentation	2 Hrs
10	Chapter 10: Conversations Situational Role Plays.	2 Hrs
11	Chapter 11: Critical Analysis Book Review, Movie Review	2 Hrs
12	Chapter 12: Business Writing Report Writing, Letter Writing	2 Hrs
13	Chapter 13: Creative Writing Passage Writing	1 Hrs
14	Practical	15 Hrs
Text Book: (List of books as mentioned in the approved syllabus) 1. English Grammar and Composition by Wren and Martin's 2. English Grammar in Use Book by Raymond Murphy		

References Books:

1. Essential English Grammar by Raymond Murphy
2. Intermediate English Grammar by Raymond Murphy
3. Advanced English Grammar by Raymond Murphy

[BACK](#)**II Semester**

Program: Bachelor of Computer Applications	Semester – II
Course Title: Applied Statistics	Course Code:24EBCB103



L-T-P: 3-0-1	Credits: 4	Contact Hours: 5 Hours/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 40	Tutorial/Practical: 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.	6 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,	5 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).	5 Hrs
Text Book : 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.		
ReferenceBooks: 1. Gupta S C and Kapoor V K, Fundamentals of Mathematical Statistics, 1ed, Sultan Chand & Sons, New Delhi, 2000. 2. Jiawei Han, Micheline Kamber, Data Mining: Concepts and Techniques, Morgan Kaufmann Publishers, 2005. 3. Sheldon M.Ross, Introduction to Probability and Statistics for Engineers and Scientists.		

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Program: Bachelor of Computer Applications		Semester – II
Course Title: Operating Systems		Course Code: 24EBCC103
L-T-P: 4-0-1	Credits: 5	Contact Hours: 6 Hours/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 50	Practical Hrs: 24	Exam Duration: 3hrs
Unit-I		
1	Fundamentals of Process Operating System Functions and Characteristics, Process Concept, Process Control and Operations, System Call, Inter Process Communication.	7 Hrs
2	CPU Scheduling Basic Concepts, Schedulers, Scheduling Criteria, Scheduling Algorithms, Multi- threading models and Thread API, Thread library.	7 Hrs
3	Process Synchronization Background, Synchronization, Producer Consumer problem, The critical section problem, Semaphores, Peterson’s Solution, Classical problems of synchronization.	6 Hrs
Unit-II		
4	Deadlocks Deadlock System model and Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock.	7 Hrs
5	Memory Management Memory Management Strategies, Background: Swapping, Contiguous Memory Allocation, Segmentation, Paging, Structure of page table.	7 Hrs
6	Virtual Memory Management Virtual Memory Management: Background, Demand Paging, Page Replacement.	6 Hrs
Unit-III		
7	File System Management Implementing File System, File System Structure, File System Implementation Directory Implementation, Allocation Methods.	5 Hrs
8	Secondary Storage Management Mass storage structures, Disk Structure, Disk Scheduling	5 Hrs
Text Book: 1. Abraham Silberschatz, Peter Galvin and Greg Gagne, Operating System Principles, 10 ed., Wiley-India, 2018		



2. W. Richard Stevens, Stephen A. Rago, "Advanced Programming in the UNIX Environment", 3 ed. Addison Wesley Professional, 2018

Reference Books:

1. William Stallings, "Operating System Internals and Design Principles", 1 ed., Pearson Education, Asia, 2015
2. Gary Nutt, "Operating System", 3 ed., Pearson Education, 2009

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Program: Bachelor of Computer Applications		Semester - II
Course Title: Data Structures with C		Course Code: 24EBCC104
L-T-P: 4-0-0	Credits: 4	Contact: 4 Hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
TeachingHrs :50	Tutorial/Practical: --	Exam Duration: 3 Hrs
Unit-I		
1	Introduction to Data Structures Overview of C: Structures, Pointers, Dynamic Memory Allocation, Introduction to Data Structures	8 Hrs
2	Stacks and Recursion Stack: Definitions and Examples, Representing Stacks in C, Applications: Infix to postfix conversion, evaluation of postfix expression, parenthesis matching. Linked Implementation of Stacks, Recursion	12 Hrs
Unit-II		
3	Queues Queue: Definitions, Representing Queues in C Variants of Queues: Linear queue, circular queue, Applications of queue, Linked Implementation of Queues	8 Hrs
4	Lists Concept of lists: Definition, Representation of linked lists in Memory, Variants of Lists: Singly Linked List, Doubly Linked lists, Circular linked lists. Operations: Traversing, Searching, Insertion and Deletion. Applications of Linked lists	12 Hrs
Unit-III		
5	Graphs Graphs: Definitions and examples of graph, Subgraphs, Components, Graph Isomorphism, Vertex Degree, Euler Trails and Circuits, Planar Graphs, Hamilton Paths and Cycles, Graph Colouring and Chromatic Polynomials,	5 Hrs
6	Sorting and Searching Definitions and Importance, Exchange Sorting : Bubble sort, Selection Sort, Insertion sort; Searching : Linear and Binary Search	5 Hrs
Text Book: 1. Data Structures Using C and C++ - Y. Langsam, M. Augenstein And A. M. Tenenbaum, Prentice - Hall of India Pvt. Ltd. Edition- 2, 2020 2. Data Structures with C -- Seymour Lipschutz, Tata McGraw Hill India LTD, Edition-1, 2011		
ReferenceBooks: 1. Data Structures and Algorithms Made Easy – Narshiman Karumunchi, Career Monk Publications, Edition-2, 2017. 2. Data Structure Through C - Yashavant P Kanetkar, BPB Publication, Edition-2.		



3. Problem Solving in Data structures and Algorithms Using C – Hemath Jain, TaranTechnologies Private Limited, Edition-1, 2016
4. Data Structures through C in Depth, S.K. Srivastava, DeepaliSrivastava, BPB Publications, 2004
5. Online platform: www.Hackerrank.com
6. <https://www.geeksforgeeks.org/>

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Program: Bachelor of Computer Applications		Semester - II
Course Title: Database Management System		Course Code: 24EBCC105
L-T-P: 4-0-1	Credits: 5	Contact Hrs.: 6hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 50	Tutorial/Practical: 24	ESA Exam Duration: 3 Hrs
Unit –I		
1	Introduction and ER Model: Introduction to DBMS; Data Models, Schemas and Instances; Three-Schema Architecture; Database Languages; 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.	6 Hrs
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; Additional Relational Operations; Relational Database Design Using ER- to-Relational Mapping.	8 Hrs
3	SQL: SQL Data Definition and Data Types; SQL constraints; DDL and DML statements; JOIN operations; Complex SQL Queries, PL/SQL.	6 Hrs
Unit –II		
4	Database Design: Informal Design Guidelines for Relation Schemas; Functional Dependencies; Normal Forms Based on Primary Keys; Boyce-Codd Normal Form.	10 Hrs
5	Introduction to Transaction Processing: Introduction to Transaction Processing; Transactions and System concepts; Desirable Properties of Transactions; Characterizing Schedules Based on- Recoverability, Serializability.	10 Hrs
Unit –III		
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	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 Book:

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

ReferenceBooks:

1. Ramakrishnan S. and Gehrke J., Database Management Systems, 3rd Ed, McGraw Hill, 2007.
2. Silberschatz A., Korth H.F. and Sudharshan S., Database System Concepts, 5th Ed, Mc- GrawHill, 2006.

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Program: Bachelor of Computer Applications		Semester - II
Course Title: Data Structures Lab		Course Code: 24EBCP102
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 Hrs: --	Tutorial/Practical: 36	Exam Duration: 3 Hrs
Experiment		
1	Introduction : Basic operations : Insertion, Delete, Traversal, Reversal	1
2	Stack Applications: Stack Operations using array, Conversion of infix to postfix and prefix, Evaluation of Postfix, Parentheses Checker.	2
3	Queue and Circular Queue Operations using array	2
4	Singly Doubly Linked List: Insertion, deletion, traversal, and reversal. Stack and Queue using Singly Linked List	2
5	Doubly Linked List: Insertion, Deletion, Traversal.	1
6	Sorting and Searching Algorithms.	1
7	Project Work : Larger project integrating multiple data structures	3
Text Book: 1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein, Introduction to Algorithms, Fourth Edition, The MIT Press, 2022.		
ReferencesBooks: 1. Mark Allen Weiss, Data Structures and Algorithm Analysis in C++, Pearson Education India; 3rd edition, 2007. 2. Antti Laaksonen, Competitive Programmers Handbook, 2018 3. Bjarne Stroustrup, C++ Programming Language, Addison-Wesley Educational Publishers Inc; 4th edition.		

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Program: Bachelor of Computer Applications		Semester - II
Course Title: Python Programming		Course Code: 24EBCP103
L-T-P: 0-0-2	Credits: 2	Contact Hrs: 4 Hrs/week
ISA Marks: 80	ESA Marks: 20	Total Marks: 100
Teaching Hrs: --	Tutorial/Practical: 48	Exam Duration: 3 hrs
Content		
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	8 Hrs
2	Functions def Statements with Parameters, Return Values and return Statements, None Value, Keyword Arguments, Local and Global Scope, Exception Handling	10 Hrs
3	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, Navigating the file System with the OS Module	8 Hrs
4	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	10 Hrs
5	NumPy and Pandas Introduction to NumPy, NumPy arrays, Array manipulation, Universal functions, Series and Dataframes, Data Manipulation using Pandas, Data cleaning and preparation, Data Visualization	12 Hrs
Text Book: 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, Vamsi Kurama, Pearson, 2017		
References 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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Program: Bachelor of Computer Applications		Semester – II
Course Title: Corporate Communication		Course Code: 23EHS101
L-T-P: 0.5-0-0	Credits: 0.5	Contact Hrs: 1 Hrs/week
ISA Marks: 100	ESA Marks: --	Total Marks: 100
Teaching Hrs: 22	Tutorial/Practical:--	Exam Duration: --
Unit –I		
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	22 Hrs
Text Book: 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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III Semester

Program: Bachelor of Computer Applications		Semester - III
Course Title: Linear Algebra		Course Code: 24EBCB202
L-T-P: 4-0-1	Credits: 5	Contact Hours: 6 Hrs/week
ISA Marks: 60	ESA Marks: 40	Total Marks: 100
Teaching Hours: 50	Practical Hours: 24	Examination Duration: 3hrs
Unit-I		
1	Matrices Introduction to the system of linear equations and their solutions, elementary row operations-echelon form, Rank of a matrix.	06 Hrs
2	System of linear equations Consistency of system of linear equation, solution of system of equations by (i) Direct methods-Gauss elimination, Gauss Jordan method (ii) Iterative methods- Gauss-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	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	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	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.

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Program : Bachelor of Computer Applications		Semester: III
Course Title: Object - Oriented Programming using C++		Course code: 24EBCC207
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	Practical Hrs:--	Exam Duration:3 Hours
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.	5 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.	6 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.	8 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++.	8 Hrs
Unit – III		
6	Operator Overloading: Definition, Rules for overloading operators, Overloading Unary Operators, Overloading Binary Operators, Manipulation of strings using operators, Data Conversion.	4 Hrs
7	Exception Handling: Exception Handling in C++, Handling Multiple Exceptions, User-defined Exceptions, Exception in Constructors and Destructors.	4 Hrs

Text Book:

1. Object – Oriented Programming in C++, Robert Lafore, 4th edition, Pearson Publications, 2001.

Reference Book:

1. E Balaguruswamy, Object Oriented Programming in C++, 4th Edition, Tata McGraw Hill, 2008.

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Program: Bachelor of Computer Applications		Semester III
Course Title: Software Engineering		Course Code: 24EBCC208
L-T-P: 3-0-1	Credits: 4	Contact Hours: 5Hrs/week
ISA Marks: 63	ESA Marks: 37	Total Marks: 100
Teaching Hrs: 40	Practical Hrs:24	Exam Duration: 03 Hrs
Unit-I		
1	Introduction to Software Engineering Professional software development, Software engineering ethics, Case studies.	4 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.	6 Hrs
Unit-II		
4	Requirements Engineering Functional and Non-functional requirements, Requirements Engineering Processes, Requirements Elicitation, Requirements Specification, Requirements Validation.	5 Hrs
5	System Modeling Context Models, Interaction Models, Structural Models, and Behavioral Models. Model-driven Architecture.	6 Hrs
6	Architectural Design Architectural design decisions, Architectural views, Architectural patterns, and Application Architectures.	5 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 Sommerville, Software Engineering, 10 th edition, Pearson Ed, 2021.		
References Books 1. Roger S. Pressman, Software Engineering: A Practitioners Approach, 7 th Edition, McGraw, 2022.		

2. Jalote, P, An Integrated Approach to Software Engineering, 6th Edition, Wiley Publications, 2018.
3. Blaha .M. Rumbaugh, Object Oriented Modelling and Design with UML, 2nd Edition, Pearson, 2013.

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Program: Bachelor of Computer Applications		Semester: III
Course Title: Data Mining		Course Code: 24EBCC211
L-T-P:3-0-1	Credits:4	Contact Hrs:5 Hrs/week
ISAMarks:63	ESAMarks:37	Total Marks: 100
Teaching Hrs: 40	Tutorial/Practical: 24	ESA Exam Duration:3 Hrs
Unit– I		
1	Introduction Fundamentals of Data Mining, Kinds of Pattern, Technologies and Applications used, Issues, Data Objects and Attribute Types, Basic Statistical Descriptions of Data, Data Visualization.	6 Hrs
2	Data Preprocessing Need of Preprocessing the Data, Data Cleaning, Data Integration and Transformation, Data Reduction, Discretization and Concept Hierarchy Generation.	5 Hrs
3	Data Warehousing and Online Analytical Processing Data Warehouse Basic Concepts, Data Warehouse Modelling, Data Warehouse Design and Queries, Data Generalization by Attribute-Oriented Induction.	5 Hrs
Unit– II		
4	Mining Frequent Patterns Basic Concepts, Frequent Item set Mining Methods, Interesting Patterns, Pattern Evaluation Methods, Pattern Mining in Multilevel.	8 Hrs
5	Classification Basic Concepts, Decision Tree, Bayes Classification Methods, Model Evaluation and Selection.	8 Hrs
Unit– III		
6	Cluster Analysis Cluster Analysis, Different Kinds of Cluster Analysis, Partitioning Methods, Evaluation of Clustering, Social Networking in World Wide Web.	4 Hrs
7	Mining Complex Types of Data Multidimensional Analysis and Descriptive Mining of Complex Data Objects, Mining Spatial Databases, Mining Multimedia Databases.	4 Hrs
Text Book		
1. J. Han, M. Kamber., Data Mining Concepts and Techniques, 3rd edition, Kaufmann publishers, 2011.		



Reference Book

1. Pujari, A.K, Datamining Techniques, 1, Universities Press, 2010.

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Program: Bachelor of Computer Applications		Semester: III
Course Title: OOPs using C++ Lab		Course Code: 24EBCP203
L-T-P: 0-0-2	Credits: 2	Contact Hours: 4 Hrs/week
ISA Marks: 80	ESA Marks: 20	Total Marks: 100
Teaching Hours: --	Practical Hrs: 48 Hrs	Exam Duration: 3 Hrs
Experiment		
1	Programs on C++ data types, operators and control statements.	
2	Programs on structures, enumerations, functions, function overloading.	
3	Programs on object, class, constructors, constructor overloading.	
4	Programs on arrays and strings, various string handling function.	
5	Programs on Inheritance, Types of Inheritance, Polymorphism, Runtime Polymorphism.	
6	Programs on Operator Overloading and Exception Handling.	
Exercises		
7	Implementation of method overloading & overriding, operator overloading.	
8	Implementation of different string handling methods.	
9	Implementation of different types of inheritance.	
10	Implementation of built in exceptions and custom defined exceptions.	
11	Implementation of file handling operations.	
Structured inquiry		
12	Develop an application including Inheritance, Polymorphism and Exception Handling.	

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Program: Bachelor of Computer Applications		Semester: III
Course Title: Server-Side Web Development		Course Code: 24EBCP204
L-T-P: 0-0-1.5	Credits:1.5	Contact Hours: 3 Hours/week
ISA Marks: 80	ESA Marks: 20	Total Marks: 100
Teaching Hours: ---	Practical Hrs: 36 Hrs	Exam Duration: 03 Hrs.
Unit I		
1	Introduction to Server-Side Programming with PHP Introduction to server-side scripting and web servers, fundamentals of PHP, Setting up a PHP Development Environment (XAMPP/LAMP), PHP Syntax: Variables, Constants, Data Types, Operators and Expressions, Control Structures, Arrays, Functions.	6 Hrs
2	Advanced JavaScript JavaScript Essentials (ES6+ Features), scope of variables, Functions, Template Literals, Destructuring of variables, Spread & Rest Operators, Promises & Async/Await, Closures, Hoisting, Scope, Event Loop, Modules & Import/Export in ES6, Understanding JSON.	10 Hrs
3	Working with MySQL Introduction to MySQL and relational database design, Connecting PHP with MySQL, Performing CRUD operations, Session handling, cookies, authentication basics, Error handling and debugging.	10 Hrs
4	Responsive Frontend with Bootstrap Overview of frontend frameworks, grid system, containers, cards, navbars, forms, Styling and customizing components, Responsive design and mobile-first development, Pagination, alerts, modals with PHP output, Full-stack integration, Hosting and deployment.	10 Hrs
Text Book 1. Jon Duckett, PHP & MySQL: Server-side Web Development, Wiley, 2022		
References 1. Robin Nixon, <i>Learning PHP, MySQL & JavaScript: With jQuery, CSS & HTML5</i> , 6th Edition, O'Reilly Media, 2021. 2. Eric A. Mann, <i>PHP Cookbook: Modern Code Solutions for Professional Developers</i> , O'Reilly Media, 2021.		

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Program: Bachelor of Computer Applications		Semester: III
Course Title: DevOps		Course Code: 24EBCP205
L-T-P: 0-0-2	Credits:2	ContactHrs:4 Hours/Week
ISAMarks:80	ESAMarks:20	TotalMarks:100
Teaching Hours: --	PracticalHours:48 Hrs	ExamDuration:3Hrs
Content		
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 need of source code control, The history of source code management system, Roles and code, 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: Installing the git-review package, The value of history revisionism, The pull request model, GitLab.	10 Hrs
3	Building the Code Importance of building code, The Jenkins build server, Managing build dependencies, Continuous Integration, Continuous Delivery, Jenkins plugins, Triggers, Job chaining and build pipelines, A look at the Jenkins filesystem layout, Build servers and infrastructure as code, Building by dependency order, Build phases.	10 Hrs
4	Testing the Code Manual Testing: Concept and limitations, Test Automation: Benefits and challenges, Unit Testing: Fundamentals and use in Python, Introduction to Pytest: Features and syntax, Writing Test Cases with Pytest (with example), Mocking with unittest.mock /pytest-mock, Test Coverage using pytest-cov, Automated Integration Testing with Pytest.	10 Hrs
5	Deploying the Code Configuring the base OS, Describing clusters, Delivering packages to a system, Deploying with Docker, Containerization using Kubernetes.	10Hrs
Textbook: 1. Moshe Zadka, DevOps in Python: Infrastructure as Python 2 nd Edition, 2022. 2. Joakim Verona, Practical DevOps, 2018.		
Reference Books: 1. Noah Gift, Kennedy Behrman, Alfredo Deza, Grig Gheorghiu, Python for DevOps: Learn Ruthlessly Effective Automation, 2020. 2. Sricharan Vadapalli, DevOps:Continuous Delivery, Integration, and Deployment with DevOps, 2018.		

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Program: Bachelor of Computer Applications		Semester - III
Course Title: Problem Solving and Analytical Skills		Course Code:23EHS102
L-T-P: 0.5-0-0	Credits: 0.5	Contact Hours:1 Hrs/week
ISA Marks: 100	ESA Marks: --	Total Marks: 100
Teaching Hrs: 12	Practical Hrs:	Exam Duration: -
Content		
1	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 Book: Vikas Modules, Innovations Unlimited Training Services, Bangalore.		
Reference Books: https://www.indiabix.com/general-knowledge/questions-and-answers/		

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Semester IV

Program: Bachelor of Computer Applications		Semester: IV
Course Title: Machine Learning		Course Code: 24EBCC209
L-T-P:3-0-1	Credits:4	ContactHrs:5 Hrs/week
ISAMarks:63	ESAMarks:37	Total Marks: 100
Teaching Hrs: 40	Practical Hrs: 24 Hrs	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.		

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Program: Bachelor of Computer Applications		Semester: IV
Course Title: Computer Networks		Course Code: 24EBCC212
L-T-P:3-0-1	Credits:4	ContactHrs:5 Hrs/week
ISAMarks:63	ESAMarks:37	Total Marks: 100
Teaching Hrs: 40	Practical Hrs: 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 Model, TCP/IP model, Network Attacks.	8 Hrs
2	Application Layer Principles of network applications, The Web and HTTP, Electronic Mail in the Internet, DNS, and Peer-to-Peer Applications.	8 Hrs
Unit– II		
3	Transport-Layer Introduction and Transport-Layer Services, Multiplexing and Demultiplexing, Connectionless Transport: UDP, Principles of Reliable Data Transfer, Connection-Oriented Transport: TCP, TCP Congestion Control.	8 Hrs
4	Network Layer Data Plane: Overview of Network Layer, What is inside a Router: Input Port Processing and Destination Based Forwarding, Switching, Output Port Processing, The Internet Protocol: IPv4, Addressing, IPv6 and More: IPv4 Datagram format, IPv4 Addressing, Network Address Translation (NAT), IPv6. Control Plane: Introduction, Routing Algorithms, Intra-AS Routing in the Internet-OSPF, Routing Among the ISP's BGP: the role of BGP, ICMP: The Internet Control Message Protocol.	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.	4 Hrs
6	The Link Layer- Links, Access networks, and LANs Continuation Switched Local Area Networks: Link Layer Addressing and ARP, Retrospective: A Day in the Life of a Web Page Request.	4 Hrs
Text Book 1. Computer Networking, A Top-Down Approach, J.F. Kurose, K.W.Ross, 8th edition Pearson Education,2020.		
References 1. TCP/IP Protocol Suite, 6 th Edition MGH 2022 by B. A. Forouzan.		

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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: 0	Exam Duration: 03 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.	4 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 4, Introducing Nested and Inner Classes.	7 Hrs
3	Strings Introduction to Strings, string Constant pool, string buffer, string builder, equals method etc.	5 Hrs
Unit II		
4	Inheritance Inheritance basics, constructors and Inheritance, understanding super keyword and super class, 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.	6 Hrs
5	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.	5 Hrs
6	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		
7	Collections Collection Interfaces, Collection and Iterator Interfaces in the Java Library, Linked Lists, Array Lists, Hash Sets, Tree Sets Object Comparison, Maps (hash map).	4 Hrs
8	Multithreading and RMI	4 Hrs

	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. RMI Architecture, Designing RMI application, Executing RMI application	
Text Books 1. Herbert Schildt, JAVA the Complete Reference 13th edition, Tata McGraw Hill 2023 2. Herbert Schildt, Java: A Beginner's Guide Ninth Edition, 9th Edition, McGraw Hill ,2022		
References 1. Head First Java, 3rd Edition: Authors: Kathy Sierra & Bert Bates - 2022 Online References 1. https://www.tutorialspoint.com 2. https://www.tpointtech.com		

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Program : Bachelor of Computer Applications		Semester - IV
Course Title: Software Testing		Course Code: 24EBCC210
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 Hrs: 24	Exam Duration: 3 Hrs
Unit I		
1	Software Testing Fundamentals Testing and need of testing, Objectives of software Testing, Software Testing Types, STLC (Software Testing Life Cycle), Quality assurance.	8 Hrs
2	Levels of testing Unit Testing, Integration Testing, Functional Testing, System Testing Types, Test environment.	8 Hrs
Unit II		
3	Test Case Development Test Documentation, Test Scenario, Write Test Cases, Test Analysis, Requirements Traceability Matrix, Test Data Generation.	8 Hrs
4	Selenium Introduction to Selenium, selenium Components & Brief Introduction to each component, Selenium Web Driver, Synchronization in Web Driver, Handling Alerts & Windows, configuring other Browsers, Data Driven Testing.	8 Hrs
Unit III		
5	TestNG Overview of TestNG, Annotation of TestNG, Creating Test Suite, Execution of Test Suite, creating groups, Execution of test case with groups, Creating TestNG.xml file, Parallel of Test Cases, understanding of test results, Running only failed test cases.	8 Hrs
Text Books: 1. Test Automation using Selenium with Java–Navneesh Garg,Techcavass, 2022. 2. Software Testing: Principles and Practices-Srinivasan Desikan, Gopalaswamy Ramesh,Pearson Education,2020.		
Reference Books: 1. Learning Selenium Testing Tools with Python-Unmesh Gundec2nd Edition, 2021,Packt Publishing,2nd Edition, 2021.		

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Program: Bachelor of Computer Applications		Semester: IV
Course Title: Java Lab		Course Code: 24EBCP206
L-T-P: 0-0-1.5	Credits:1.5	Contact Hours: 3 Hours/week
ISA Marks: 80	ESA Marks: 20	Total Marks: 100
Teaching Hours: --	Practical Hrs: 36 Hrs	Exam Duration: 03 Hrs

Exp No	List of Experiments	Lab Slots
1	Program to demonstrate Java fundamentals like Class and object Creation, constructor overloading and chaining	1
2	Program to demonstrate Strings objects, string comparison etc	1
3	Program to demonstrate garbage collection in java	1
4	Program to demonstrate single inheritance Concepts with super keywords	1
5	Program to demonstrate multi-level, hierarchical Inheritance , hybrid inheritance with superclass reference and subclass objects also method overriding, method hiding	3
6	Program to demonstrate Interfaces and abstract class with inheritance concept	2
7	Program to demonstrate various types of Exception handling with try catch, throw and throws keyword	1
8	Program to demonstrate a program on usage of various collection types like arrayList, LinkedList, Maps, Sets etc. and iterators with Multi-threading concept	2

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Program: Bachelor of Computer Applications		Semester - IV
Course Title: Full Stack Web Development with MERN		Course Code: 24EBCP207
L-T-P: 0-0-2	Credits: 2	Contact Hrs: 4hrs/week
ISA: 80	ESA: 20	Total Marks: 100
Teaching Hrs:--	Practical Hrs: 48 Hrs	Exam Duration: 3 Hrs.
Content		
1	Getting Started with MERN Stack Development and building ReactJS Framework: Components and State. Overview of MERN (MongoDB, Express.js, React.js, Node.js), Client-Server Architecture. Getting Started with ReactJS: A Quick Overview, The Role of JSX in React Development, Setting Up the Environment, JSX Creating your first React component, Components (Functional vs Class), Props, and State management using React Hooks.	14 Hrs
2	Backend Development NodeJS and Express.js Framework. Introduction to NodeJS, Setting up Node.js environment, HTTP Module, File System (fs) Module, URL Module, Events Module, NPM, Asynchronous Programming. Setting up the Express.js environment, Creating a basic Express application, Routing in Express.js, Request and Response Objects, Middleware in Express.js: Understanding and implementing middleware functions. Building RESTful APIs, Form Data.	14 Hrs
3	Database Management Using MongoDB An Overview of NoSQL Databases: MongoDB vs. SQL, Key features of MongoDB, MongoDB shell: Leveraging MongoDB Compass for Visual Database Management, Setting Up Databases and Collections in MongoDB, MongoDB CRUD operations. Database Integration.	12 Hrs
4	Case study Blogging Platform, Task Management System (To-Do List Application), E-commerce Website (Basic), Real-Time Chat Application, Job Board Application, Online Learning Platform, Social Media Platform (Basic), Online Booking System (Event or Hotel Booking)	8 Hrs.
Text Book		
1. Vasan Subramanian, Pro MERN Stack, 2nd Edition, Apress, 2019.		
Reference Books		
1. Amos Q, Haviv, MERN Web Development, Packt Publishing, 2014.		
2. Colin J. Ihrig, Full Stack JavaScript Development with MERN, 2nd Edition, SitePoint, 2019.		

List of Experiments		Lab slots
1.	Set up a React development environment and create your first app.	1
2.	Build a simple React app with JSX using functional and class components for dynamic content management through props and state.	2
3.	Build a simple web server using Node.js' native HTTP module.	1
4.	To parse and manipulate URLs in Node.js using the URL module.	1
5.	Design asynchronous task handling in Node.js to prevent blocking the event loop.	1
6.	Set up an Express.js environment to create a basic server that responds with a message in the browser.	1
7.	Design a system to access and log client request data using req() method and send responses using res() method.	1
8.	Build and test a basic REST API with enhanced request handling using middleware and Postman.	2
9.	Create a MongoDB database and collection and visually perform CRUD operations and analyse documents using the MongoDB shell.	2

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

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Program : Bachelor of Computer Applications		Semester - IV
Course Title: Arithmetical Thinking and Analytical Reasoning		Course Code: 23EHS203
L-T-P: 0.5-0-0	Credits: 0.5	Contact Hours: 1 hrs/week
ISA Marks: 100	ESA Marks: --	Total Marks: 100
Teaching Hrs: 12	Tutorial/Practical:--	Exam Duration: --
Unit – I		
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 Book: Vikas Modules, Innovations Unlimited Training Services, Bangalore.		
Reference Books: https://www.indiabix.com/general-knowledge/questions-and-answers/		

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