

Curriculum Structure and Curriculum Content for the Batch: <b>2022-25</b>
Department: Department of Computer Applications
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.

## **Title: Vision and Mission Statements of the Department of Computer Applications**

### **Vision**

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

### **Mission**

1. To provide high-quality education through outstanding teaching industry-relevant novel curricula to enable them to accomplish a successful career in the field of computer science and its applications.
2. To contribute to the advancement of 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 achieve academic and professional growth.
4. To provide valuable services to society through education, entrepreneurship, and professional activities in the field of Computer Science and its Applications.

## Program Educational Objectives/Program Outcomes and Program-Specific Objectives

<b>Program Educational Objectives -PEO's</b>
PEO: 1. Have a strong foundation and ability to apply knowledge of Computer Science, mathematics and humanities to conceive, analyze, design and implement IT solutions to problems in real life applications.
PEO: 2. Have a comprehensive background to practice Software Engineering Principles in a variety of domains that require Software architecture, design, development and testing practices.
PEO: 3. Have an understanding of professional and ethical obligations of a software engineer towards society and the need for lifelong learning.
PEO: 4. Have an ability to effectively participate in multidisciplinary teams using ICT.
<b>Program Outcomes-PO's</b>
<b>PO 1: Computational knowledge:</b> 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.
<b>PO 2: Problem analysis:</b> Identify, formulate, research literature, and solve complex computing problems reaching substantiated conclusions using fundamental principles of mathematics, computing sciences, and relevant domain disciplines
<b>PO 3: Design/Development of Solutions:</b> 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.
<b>PO 4: Conduct investigations of complex problems:</b> 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.
<b>PO 5: Modern tool usage:</b> Create, select, adapt and apply appropriate techniques, resources, and modern computing tools to complex computing activities, with an understanding of the limitations.
<b>PO 6: Professional Ethics:</b> Understand and commit to professional ethics and cyber regulations, responsibilities, and norms of professional computing practice.
<b>PO 7: Life-long learning:</b> Recognize the need, and have the ability, to engage in independent learning for continual development as a computing professional.
<b>PO 8: Project management and finance:</b> 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.
<b>PO 9: Communication Efficacy:</b> 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.
<b>PO 10: Societal and Environmental Concern:</b> 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
<b>PO 11: Individual and team work:</b> Function effectively as an individual, and as a member

or leader in diverse teams, and in multidisciplinary environments.

**PO 12:** Innovation and Entrepreneurship: Identify a timely opportunity and using 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.

## Curriculum Structure-Overall

Semester: I to VI						Total Program Credits: 132	Year : 2022-25
Course with course code	I	II	III	IV	V	VI	
	Mathematical Techniques for Computer Applications (22EBCB101)	Discrete Mathematical Structures (22EBCB102)	Applied Statistics (22EBCB201)	Programming with C# and .Net (22EBCC204)	Cloud Computing (22EBCC301)	Professional Elective-3 (22EBCE3XX)	
	Web Technology (22EBCC101)	Operating Systems (22EBCC104)	Computer Networks (22EBCC201)	Machine Learning (22EBCC205)	Advanced JAVA Programming (22EBCC302)	Professional Elective-4 (22EBCE3XX)	
	Fundamentals of Computer Organization (22EBCC102)	Object-Oriented Programming in C++ (22EBCC105)	Database Management Systems (22EBCC202)	DevOps Lab (22EBCC205)	Big Data Analytics (22EBCC303)	Capstone Project (22EBCC302)	
	Professional Communication (22EBCH101)	Software Engineering (22EBCC106)	Java Programming (22EBCC203)	Software Testing (22EBCC206)	Cyber Security (22EBCE301)	Industry Training (22EBCE301)	
	Programming using C (22EBCC103)	Data Structures with Applications (22EBCC107)	Database Management Systems Lab (22EBCC201)	Minor Project-1 (22EBCC207)	Mobile Application Development (22EBCE309)	Industry Project (22EBCE302)	
	C Programming Lab. (22EBCC101)	C++ Programming Lab. (22EBCC104)	Full Stack Web Development (22EBCC202)	Professional Aptitude and Logical Reasoning (22EBCC201)	Minor Project-2 (22EBCC301)		
	Web Programming Lab (22EBCC102)	Data Structures Lab. (22EBCC105)	Python Programming (22EBCC203)	Industry Readiness and Leadership Skills (22EBCC204)			
	IT Skills Development Practices ) (22EBCC103)	Multimedia & Graphics Design Practices (22EBCC106)	Arithmetical Thinking and Analytical Reasoning (22EBCH201)				
Credits	<b>23</b>	<b>22</b>	<b>22</b>	<b>22</b>	<b>25</b>	<b>18</b>	

## Curriculum Structure-Semester wise

### Semester- I

No	Code	Course	Category	L-T-P	Credits	Contact Hours	ISA	ESA	Total	Exam Duration
1	22EBCB101	<a href="#">Mathematical Techniques for Computer Applications</a>	BS	4-0-0	4	4	50	50	100	3 hours
2	22EBCC101	<a href="#">Web Technology</a>	PSC	4-0-0	4	4	50	50	100	3 hours
3	22EBCC102	<a href="#">Fundamentals of Computer Organization</a>	PSC	4-0-0	4	4	50	50	100	3 hours
4	22EBCC103	<a href="#">Programming using C</a>	PSC	4-0-0	4	4	50	50	100	3 hours
5	22EBCP101	<a href="#">C Programming Lab.</a>	PSC	0-0-1.5	1.5	3	50	50	100	3 hours
6	22EBCP102	<a href="#">Web Programming Lab</a>	PSC	0-0-1.5	1.5	3	50	50	100	3 hours
7	22EBCP103	<a href="#">IT Skills Development Practices</a>	PSC	0-0-1	1	4	100	--	100	--
8	22EBCH101	<a href="#">Professional Communication</a>	HSC	2-0-1	3	4	50	50	100	3 hours
<b>Total</b>				<b>18-0-5</b>	<b>23</b>	<b>30</b>	<b>450</b>	<b>350</b>	<b>800</b>	

**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	22EBCB102	<a href="#">Discrete Mathematical Structures</a>	BS	3-0-0	3	3	50	50	100	3 hours
2	22EBCC104	<a href="#">Operating Systems</a>	PSC	3-0-1	4	5	50	50	100	3 hours
3	22EBCC105	<a href="#">Object-Oriented Programming in C++</a>	PSC	3-0-0	3	3	50	50	100	3 hours
4	22EBCC106	<a href="#">Software Engineering</a>	PSC	3-0-1	4	5	50	50	100	3 hours
5	22EBCC107	<a href="#">Data Structures with Applications</a>	PSC	4-0-0	4	4	50	50	100	3 hours
6	22EBCP104	<a href="#">C++ Programming Lab.</a>	PSC	0-0-1.5	1.5	3	50	50	100	3 hours
7	22EBCP105	<a href="#">Data Structures Lab.</a>	PSC	0-0-1.5	1.5	3	50	50	100	3 hours
8	22EBCP106	<a href="#">Multimedia &amp; Graphics Design Practices</a>	PSC	0-0-1	1	4	100	--	100	--
<b>Total</b>				<b>16-0-6</b>	<b>22</b>	<b>30</b>	<b>450</b>	<b>350</b>	<b>800</b>	

**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	22EBCB201	<a href="#">Applied Statistics</a>	BS	3-0-1	4	5	50	50	100	3 hours
2	22EBCC201	<a href="#">Computer Networks</a>	PSC	3-0-1	4	5	50	50	100	3 hours
3	22EBCC202	<a href="#">Database Management Systems</a>	PSC	4-0-0	4	4	50	50	100	3 hours
4	22EBCC203	<a href="#">Java Programming</a>	PSC	3-0-1	4	5	50	50	100	3 hours
5	22EBCP201	<a href="#">Database Management Systems Lab</a>	PSC	0-0-1.5	1.5	3	80	20	100	3 hours
6	22EBCP202	<a href="#">Full Stack Web Development</a>	PSC	0-1-2	3	6	80	20	100	3 hours
7	22EBCP203	<a href="#">Python Programming</a>	PSC	0-0-1	1	2	80	20	100	3 hours
8	22EBCH201	<a href="#">Arithmetical Thinking and Analytical Reasoning</a>	HSC	0.5-0-0	0.5	1	100	--	100	--
<b>Total</b>				<b>13.5-1-7.5</b>	<b>22</b>	<b>31</b>	<b>540</b>	<b>260</b>	<b>800</b>	

**ISA:** In Semester Assessment

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Date:

Program Head

### Semester- IV

No	Code	Course	Category	L-T-P	Credits	Contact Hours	ISA	ESA	Total	Exam Duration
1	22EBCC204	<a href="#">Programming with C# and .Net</a>	PSC	3-0-1	4	5	50	50	100	3 hours
2	22EBCC205	<a href="#">Machine Learning</a>	PSC	3-0-1.5	4.5	6	80	20	100	3 hours
3	22EBCP205	<a href="#">DevOps Lab</a>	PSC	0-0-2	2	4	80	20	100	3 hours
4	22EBCP206	<a href="#">Software Testing</a>	PSC	0-1-2	3	6	80	20	100	3 hours
5	22EBCP207	<a href="#">Minor Project-1</a>	PSC	0-0-5	5	10	80	20	100	3 hours
6	23EHSC201	<a href="#">Professional Aptitude and Logical Reasoning</a>	HSC	3-0-0	3	3	50	50	100	1.5 hours
7	23EHS204	<a href="#">Industry Readiness and Leadership Skills</a>	HSC	0.5-0-0	0.5	1	100	--	100	--
<b>Total</b>				<b>9.5-1-11.5</b>	<b>22</b>	<b>35</b>	<b>520</b>	<b>180</b>	<b>700</b>	

**ISA:** In Semester Assessment

**ESA:** End Semester Assessment

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Date:

Program Head

### Semester- V

No	Code	Course	Category	L-T-P	Credits	Contact Hours	ISA	ESA	Total	Exam Duration
1	22EBCC301	<a href="#">Cloud Computing</a>	PSC	3-0-1	4	5	50	50	100	3 hours
2	22EBCC302	<a href="#">Advanced JAVA Programming</a>	PSC	3-0-1	4	5	50	50	100	3 hours
3	22EBCC303	<a href="#">Big Data Analytics</a>	PSC	3-0-1	4	5	50	50	100	3 hours
4	22EBCE301	<a href="#">Cyber Security (Elective-1)</a>	PSE	3-0-1	4	5	50	50	100	3 hours
5	22EBCE309	<a href="#">Mobile Application Development(Elective-2)</a>	PSE	3-0-1	4	5	50	50	100	3 hours
6	22EBCP301	<a href="#">Minor Project-2</a>	PW	0-0-5	5	10	50	50	100	3 hours
<b>Total</b>				<b>15-0-10</b>	<b>25</b>	<b>35</b>	<b>300</b>	<b>300</b>	<b>600</b>	

**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	22EBCE3XX	<a href="#">Professional Elective-3</a>	PSE	3-0-1	4	5	50	50	100	3 hours
2	22EBCE3XX	<a href="#">Professional Elective-4</a>	PSE	3-0-1	4	5	50	50	100	3 hours
3	22EBCP302	<a href="#">Capstone Project</a>	PSC	0-0-10	10	20	50	50	100	3 hours
		<b>OR</b>		<b>6-0-12</b>	<b>18</b>	<b>30</b>	<b>150</b>	<b>150</b>	<b>300</b>	
1	22EBCI301	<a href="#">Industry Training</a>	PW	0-0-8	8	16	200	--	200	3 hours
2	22EBCI302	<a href="#">Industry Project</a>	PW	0-0-10	10	20	50	50	100	3 hours
<b>Total</b>				<b>0-0-18</b>	<b>18</b>	<b>36</b>	<b>250</b>	<b>50</b>	<b>300</b>	

**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	23	22	22	22	25	18	132

### List of Program Electives

Sr.No	Name of the Course	Course Code
	<b>Group-Cyber Security</b>	
1	<a href="#">Cyber Security (3-0-1)</a>	22EBCE301
2	<a href="#">Security Operations and Incident Response</a>	22EBCE302
3	<a href="#">Ethical Hacking &amp; Penetration Testing</a>	22EBCE303
4	<a href="#">Blockchain Technologies</a>	22EBCE304
5	<a href="#">Digital Forensics</a>	22EBCE305
6	<a href="#">Cyber Attacks and Counter Measures</a>	22EBCE306
	<b>Group- Software Engineering</b>	
1	<a href="#">User Interface Design</a>	22EBCE307
2	<a href="#">ASP.NET MVC Framework</a>	22EBCE308
3	<a href="#">Mobile Application Development</a>	22EBCE309
4	<a href="#">Agile Project Management</a>	22EBCE310
5	<a href="#">Secure Software Engineering</a>	22EBCE311
6	<a href="#">Object Oriented Modelling and Design</a>	22EBCE312
	<b>Group- Data Analytics and Machine Learning</b>	
1	<a href="#">Statistical Techniques for Data Analytics</a>	22EBCE313
2	<a href="#">Internet of Things</a>	22EBCE314
3	<a href="#">Natural Language Processing</a>	22EBCE315
4	<a href="#">Social Network Analysis</a>	22EBCE316
5	<a href="#">Generative Language Modelling</a>	22EBCE317
6	<a href="#">Neural Networks and Deep Learning</a>	22EBCE318

## Curriculum Content- Course wise

### Semester - I

<b>Program: Bachelor of Computer Applications</b>		<b>Semester - I</b>
<b>Course Title: Mathematical Techniques for Computer Applications</b>		<b>Course Code: 22EBCB101</b>
<b>L-T-P: 4-0-0</b>	<b>Credits: 4</b>	<b>Contact Hours: 4hrs/week</b>
<b>ISA Marks: 50</b>	<b>ESA Marks: 50</b>	<b>Total Marks: 100</b>
<b>Teaching Hours: 40</b>	<b>Tutorial/Practical: --</b>	<b>Exam Duration: 3hrs</b>
<b>Unit I</b>		
<b>1</b>	<b>Graph theory:</b> 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.	<b>12 hrs</b>
<b>2</b>	<b>Trees:</b> 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.	<b>12 hrs</b>
<b>Unit II</b>		
<b>3</b>	<b>Matrices</b> Introduction to the system of linear equations and their solutions, elementary row operations-echelon form, Rank of a matrix.	<b>06 hrs</b>
<b>4</b>	<b>System of linear equations:</b> 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.	<b>10 hrs</b>
<b>Unit III</b>		
<b>5</b>	<b>Vector space:</b> 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.	<b>10 hrs</b>

**Text Books**

1. David C. Lay, "Linear Algebra and its Applications", 3<sup>rd</sup> Ed., Pearson Education, 2005.
2. Discrete Mathematics and its applications., Kenneth H Rosen, Mcgrawhill, 7ed, 2011
3. Discrete and Combinatorial Mathematics by Ralph P. Grimaldi, Pearson Education, Asia, Fourth edition-2002.
4. Grewal B. S., "Higher Engineering Mathematics", 39<sup>th</sup> Ed., Tata McGraw Hill, New Delhi, 2005.

**Reference Books:**

1. Seymour Lipchitz and Marc Lipson, "Linear Algebra", Schaums outline.
2. Theory and Problems of Combinatorics including the concept of Graph Theory by V. K. Balakrishnan (Schaum's outline series), McGraw Hill, 1995.
3. Graph Theory with Applications to Engineering and Computer Science by Narsingh Deo, PHI publications (1986).

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<b>Program: Bachelor of Computer Applications</b>		<b>Semester - I</b>
<b>Course Title: Web Technology</b>		<b>Course Code: 22EBCC101</b>
<b>L-T-P: 4-0-0</b>	<b>Credits: 4</b>	<b>Contact Hours: 4hrs/week</b>
<b>ISA Marks: 50</b>	<b>ESA Marks: 50</b>	<b>Total Marks: 100</b>
<b>Teaching Hours: 50</b>	<b>Tutorial/Practical: --</b>	<b>Exam Duration: 3hrs</b>
<b>Unit I</b>		
<b>1</b>	<b>Fundamentals of Web:</b> A Brief Introduction to the Internet, The World Wide Web, Web Browsers, Web Servers, Uniform Resource Locators, The Hypertext Transfer Protocol, Security, The Web Programmer's Toolbox.	<b>08 hrs</b>
<b>2</b>	<b>HTML :</b> Origins and Evolution of HTML , Standard HTML Document Structure, Basic Text Markup, Images, Hypertext Links, Lists, Tables, Forms, Audio and Video elements, Syntactic Differences between HTML and XHTML.	<b>07 hrs</b>
<b>3</b>	<b>CSS and Bootstrap :</b> Levels of Style Sheets, Style Specification Formats, Selector Forms, Property-Value Forms, Properties of Font and List, Alignment of Text, The Box Model, Background Images, The span and div Tags, Conflict Resolution, Bootstrap buttons, panels, alerts and themes.	<b>05 hrs</b>
<b>Unit II</b>		
<b>4</b>	<b>Dynamic documents and JavaScript</b> The JavaScript Execution Environment, Element Access in JavaScript, Events and Event Handling, Handling Events from Body, Button, Text Box and Password Elements, Positioning Elements, Dynamic Content, Stacking Elements, Reacting to a Mouse Click, Dragging and Dropping Elements.	<b>10 hrs</b>
<b>5</b>	<b>PHP Programming</b> History, Unique features, Basic development concepts, Creating your first PHP script, Writing & running the script, Understanding the scripts, Handling script errors, Storing data in variables, Understanding PHP's data types, Setting & checking variable data types, Using constant and Manipulating variables with operators, Handling form input and conditional statements, Processing arrays with loops & iterators, Creating user defined function, Creating classes, Using Advanced OOP concepts.	<b>10 hrs</b>
<b>Unit III</b>		
<b>6</b>	<b>Working with databases &amp; SQL</b> Introducing databases & SQL, Using PHP MySQLi extension, Adding or modifying data, Handling errors, Building a Login form.	<b>05 hrs</b>

<b>7</b>	<b>Working with Cookies, Sessions &amp; Headers</b> Working with Cookies ,Cookie Basics , Cookie Attributes , Cookie Headers ,Setting Cookies ,Reading Cookies , Removing Cookies, Working with Sessions , Session Basics , Creating Sessions and Session Variables , Removing Sessions and Session Variables, Using HTTP headers.	<b>05 hrs</b>
<b>Text Books:</b> <ol style="list-style-type: none"> <li>1. Robert W Sebesta, Programming the World Wide Web, 8<sup>th</sup> Edition, Pearson education, 2015.</li> <li>2. Vikram Vaswani, A Beginner's Guide PHP, Mc Graw Hill, 2009.</li> </ol>		
<b>Reference Books:</b> <ol style="list-style-type: none"> <li>1. Luke welling &amp; Laura Thomson, PHP and MySQL Web Development 4th Edition, 201Steven.</li> <li>2. .Holzner, PHP Complete Reference, Mc Graw Hill, 2010.</li> </ol>		

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<b>Program: Bachelor of Computer Applications</b>		<b>Semester - I</b>
<b>Course Title: Fundamentals of Computer Organization</b>		<b>Course Code: 22EBCC102</b>
<b>L-T-P: 4-0-0</b>	<b>Credits: 4</b>	<b>Contact Hours: 4hrs/week</b>
<b>ISA Marks: 50</b>	<b>ESA Marks: 50</b>	<b>Total Marks: 100</b>
<b>Teaching Hours: 50</b>	<b>Tutorial/Practical: --</b>	<b>Exam Duration: 3hrs</b>
<b>Unit I</b>		
<b>1</b>	<b>Binary Systems, Boolean Algebra and Logic Gates</b> Digital Computers and Digital Systems, Binary Numbers, Number Base Conversions, Octal and Hexadecimal Numbers, Complements, Signed Binary Numbers, Binary Codes, Binary storage and Registers Binary Logic, Basic Definitions, Axiomatic Definition of Boolean Algebra, Basic Theorems and Properties of Boolean Algebra, Boolean Functions, Canonical and Standard forms, Other Logic Operation, Digital Logic Gates, Integrated Circuits	<b>10 hrs</b>
<b>2</b>	<b>Simplification of Boolean Functions and Combinational Logic</b> The map method, Two- and Three- Variable Maps, Four Variable Map, Product of Sums Simplification, NAND and NOR Implementation, Other Two-Level Implementation, Don't care Conditions, Introduction, Design Procedure, Adders, Subtractors, Code Conversions, Decoder and Encoders, Multiplier	<b>10 hrs</b>
<b>Unit II</b>		
<b>3</b>	<b>Basic Structure of Computer</b> Computer Types, Functional Units, Basic Operational Concepts, Bus structures, performance, Memory Location and Addresses	<b>04 hrs</b>
<b>4</b>	<b>Machine instruction and Programs</b> Memory Operations, Instructions & Instruction Sequencing, Instructions & Instruction Sequencing Addressing Modes, Assemble Language, Case Study: IA-32 Pentium.	<b>08 hrs</b>
<b>5</b>	<b>Input/Output Organization</b> Accessing I/O Devices, Interrupts, Direct Memory Accesses, Buses.	<b>08 hrs</b>
<b>Unit III</b>		
<b>6</b>	<b>Memory Systems.</b> Some Basic concepts are RAM Memories, -Only Memories, Cache Memories, and Virtual Memories.	<b>05 hrs</b>
<b>7</b>	<b>Embedded systems</b> Examples of embedded systems, Processor chips for Embedded applications, A simple microcontroller.	<b>05 hrs</b>

**Text Books:**

1. Digital Logic and Computer Design, Morris Mano, Pearson Education Asia 2016.
2. Computer Organization and an Embedded System, Carl Hamacher, Z Varnesic and S Zaky, 6th Edition, McGraw Hill, 2012.

**Reference Books:**

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<b>Program: Bachelor of Computer Applications</b>		<b>Semester - I</b>
<b>Course Title: Programming using C</b>		<b>Course Code: 22EBCC103</b>
<b>L-T-P: 4-0-0</b>	<b>Credits: 4</b>	<b>Contact Hours: 4hrs/week</b>
<b>ISA Marks: 50</b>	<b>ESA Marks: 50</b>	<b>Total Marks: 100</b>
<b>Teaching Hours: 50</b>	<b>Tutorial/Practical: --</b>	<b>Exam Duration: 3hrs</b>
<b>Unit I</b>		
<b>1</b>	<b>Overview of C &amp; Constants, Variables, and Data Types</b> History of C, Applications of C, Structure of C program, executing a C program. Character set, C tokens, keywords & identifiers, Constants, variables, data types, declaration of variables, declaration of storage classes, assigning values to variables defining symbolic constants, declaring a variable as constant, declaring a variable as volatile, overflow and underflow of data	<b>04 hrs</b>
<b>2</b>	<b>Operators and Expressions</b> Arithmetic operators, relational operators, logical operators, assignment operator, increment and decrement operator, conditional operator, bitwise operators, comma operator, special operators, arithmetic expressions, evaluation of expressions, precedence of arithmetic operators, type conversions in expressions, operator precedence and associativity, mathematical functions	<b>04 hrs</b>
<b>3</b>	<b>Managing Input and Output Operations</b> The scanf() & printf() functions for input and output operations, reading a character, writing a character, (the getchar() & putchar() functions) , the address operator(&), formatted input and output using format specifiers, Writing simple complete C programs	<b>04 hrs</b>
<b>4</b>	<b>Control Statements</b> Decision making with if statement, simple if statement, if..else statement, nesting of if..else statements, else..if ladder, switch statement, ? : operator, goto statement, break statement, programming examples	<b>04 hrs</b>
<b>5</b>	<b>Decision Making and Looping (Loop Control Structures)</b> While statement, do-while statement, for statement, nested loops, jumps in loops, continue statement, programming examples.	<b>04 hrs</b>
<b>Unit II</b>		
<b>6</b>	<b>Arrays</b> The meaning of an array, one dimensional and two dimensional arrays, declaration and initialization of arrays, reading, writing and manipulation of above types of arrays, multidimensional arrays, dynamic arrays, programming examples	<b>04 hrs</b>
<b>7</b>	<b>Character Arrays and Strings</b> Declaring and initialing string variables, reading string from terminal, writing string to screen, arithmetic operations on characters, putting	<b>04 hrs</b>

	strings together, comparison of two strings, string handling functions, table of strings, other features of strings, programming examples	
<b>8</b>	<b>User Defined Functions</b> Need for user defined functions, a multi-function program, elements of User defined functions, defining functions, return values and their types, function calls, function declaration, category of functions, no arguments and no return values, arguments but no return values, arguments with return values, no arguments with return value, functions that return multiple values, nesting of functions, recursion, passing arrays to functions, passing string to functions, programming examples	<b>04 hrs</b>
<b>9</b>	<b>Structures and Unions</b> Defining a structure, declaring structure variables, accessing structure members, structure initialization, copying and comparing structure variables, operations on individual members, array of structures, structures within structures, structures and functions, Unions, size of structures, bit fields, programming examples	<b>04 hrs</b>
<b>10</b>	<b>Pointers</b> Understanding pointers, accessing the address space of a variable, declaring and initialization pointer variables, accessing a variable through its pointer, chain of pointers, pointer expressions, pointers and arrays, pointer and character strings, array of pointers, pointer as function arguments, functions returning pointers, pointers to functions, pointers and structures, programming examples	<b>04 hrs</b>
<b>Unit III</b>		
<b>11</b>	<b>File Management in C,</b> Defining and opening a file, closing a file, input/output operations on files, error handling during I/O operations, random access files, command line arguments, programming examples	<b>05 hrs</b>
<b>12</b>	<b>Dynamic Memory Allocation,</b> Dynamic memory allocation, allocating a block of memory: malloc, allocating multiple blocks of memory: calloc, releasing the used space: free, altering the size of a block: realloc, programming examples.	<b>05 hrs</b>

**Text Books:**

1. Balagurusamy Programming in ANSI C 8<sup>th</sup> Edition Tata McGraw Hill, 2019.

**Reference Books:**

1. Techniques of Problem Solving by Steven George Krant, Universities Press
2. M.T.Somashekara, D.S.Guru, K S Manjunath Problem Solving with C 2<sup>nd</sup> Edition PHI , 2018
3. Basavaraj Anami, S A Angadi, S S Manavi Computer Concept and C Programming A Holistic approach to Learning C with C 2<sup>nd</sup> Edition PHI,2010.

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<b>Program: Bachelor of Computer Applications</b>		<b>Semester - I</b>
<b>Course Title: C Programming Lab</b>		<b>Course Code: 22EBCP101</b>
<b>L-T-P: 0-0-1.5</b>	<b>Credits: 1.5</b>	<b>Contact Hours: 3hrs/week</b>
<b>ISA Marks: 50</b>	<b>ESA Marks: 50</b>	<b>Total Marks: 100</b>
<b>Teaching Hours: --</b>	<b>Tutorial/Practical: 36</b>	<b>Exam Duration: 3hrs</b>
Expt No.	Lab assignments/experiment	
<b>1</b>	Programs to demonstrate 'C' Basic Constructs like program structure, variables, operators, Expressions and data types.	
<b>2</b>	Programs to demonstrate Conditional Control statements of 'C'	
<b>3</b>	Programs to demonstrate Arrays and string handling in C	
<b>4</b>	Programs to demonstrate functions and pointers and dynamic memory management	
<b>5</b>	Programs to demonstrate file handling	
	<b>Exercises</b>	
<b>6</b>	Practice programs on 'C' basic constructs.	
<b>7</b>	Practice programs on Conditional Control statements of 'C'	
<b>8</b>	Practice programs on Arrays and string handling in C	
<b>9</b>	Practice programs on functions and pointers and dynamic memory management	
<b>10</b>	Practice programs on file handling	
	<b>Structured inquiry</b>	
<b>11</b>	Implementation of Simple applications using 'C' language	

<b>Program: Bachelor of Computer Applications</b>		<b>Semester - I</b>
<b>Course Title: Web Programming Lab</b>		<b>Course Code: 22EBCP102</b>
<b>L-T-P: 0-0-1.5</b>	<b>Credits: 1.5</b>	<b>Contact Hours: 3hrs/week</b>
<b>ISA Marks: 50</b>	<b>ESA Marks: 50</b>	<b>Total Marks: 100</b>
<b>Teaching Hours: --</b>	<b>Tutorial/Practical: 36</b>	<b>Exam Duration: 3hrs</b>
Expt No.	Lab assignments/experiment	
<b>1-2</b>	Web designing using all elements of HTML and HTML5.	
<b>3</b>	Applying CSS and CSS3 to HTML pages	

4-5	Client side scripting using JavaScript	
6-7	Exercise programs on Web designing using all elements of HTML and HTML5.	
8	Exercise programs on Applying CSS and CSS3 to HTML pages	
9-10	Exercise programs on Client side scripting using JavaScript	
11	Develop a customized web-based application.	

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<b>Program: Bachelor of Computer Applications</b>		<b>Semester – I</b>
<b>Course Title: IT Skills Development Practices</b>		<b>Course Code: 22EBCP103</b>
<b>L-T-P: 0-0-1</b>	<b>Credits: 1</b>	<b>Contact Hours: 2hrs/week</b>
<b>ISA Marks: 100</b>	<b>ESA Marks: --</b>	<b>Total Marks: 100</b>
<b>Teaching Hours: 50</b>	<b>Tutorial/Practical: --</b>	<b>Exam Duration: --</b>
<b>Expt No.</b>	<b>Lab assignments/experiment</b>	
1-2	Workshops – Office Automation software Topics covered – 1. MS Office 2. PC Diagnostics and maintenance Yoga and Physical Education / NCC / NSS	
3	MOOC – Self-paced learning 1. HTML 5 2. Bootstrap 5.0 3. Javascript 4. XML 5. JQuery & Ajax 6. Business E-mail writing	
4-5	Seminar The students shall present a seminar (15 minutes duration) on topics such as: 1. Time Management and Organization Skills 2. Adaptability Skills 3. Critical Thinking and Problem Solving 4. Leadership Skills 5. Interpersonal Skills 6. Communication Skills Current industry trends and IT scenarios	

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<b>Program: Bachelor of Computer Applications</b>		<b>Semester – I</b>
<b>Course Title: Professional Communication</b>		<b>Course Code: 22EBCH101</b>
<b>L-T-P: 2-0-1</b>	<b>Credits: 3</b>	<b>Contact Hours: 4hrs/week</b>
<b>ISA Marks: 50</b>	<b>ESA Marks: 50</b>	<b>Total Marks: 100</b>
<b>Teaching Hours: 32</b>	<b>Tutorial/Practical: 18</b>	<b>Exam Duration: 3hrs</b>
<b>Unit I</b>		
<b>1</b>	<b>Chapter 1: Basics of Technical Communication</b> Introduction, Process of Communication, Language as a Tool, Levels of Communication Levels of Communication, Communication Networks, Importance of Technical Communications.	<b>02 hrs</b>
<b>2</b>	<b>Chapter 2: Barriers to Communication</b> Definition of Noise, Classification of Barriers.	<b>02 hrs</b>
<b>3</b>	<b>Chapter 3: Technology in Communication</b> Impact of Technology, Software for Creating Messages, Software for Writing Documents, Software for Presenting Documents, Transmitting Documents, Effective use of Available Technology.	<b>03 hrs</b>
<b>4</b>	<b>Chapter 4 : Active Listening</b> Introduction, Types of Listening, Traits of good Listener, Active versus passive listening, implications of effective listening.	<b>03 hrs</b>
<b>5</b>	<b>Chapter 5 : Effective Presentation Strategies</b> Introduction, Defining purpose, Analyzing Audience and Locale, Organizing Contents, preparing outline, Visual Aids, Understanding Nuances of Delivery, Kinesics, Proxemics, Paralinguistic's, Chronemics, Sample speech.	<b>03 hrs</b>
<b>Unit II</b>		
<b>6</b>	<b>Chapter 6 : Group Communication</b> Introduction, Group Discussion, Organizational Group discussion, Group discussion as part of selection process Meetings, conferences.	<b>02 hrs</b>
<b>7</b>	<b>Chapter 7 : Words and Phrases</b> Brief History of words, Dictionary, Thesaurus, Elements of Style, Guidelines for effectiveness.	<b>02 hrs</b>
<b>8</b>	<b>Chapter 8 : Sentence Construction</b> Introduction, Guidelines for effectiveness.	<b>03 hrs</b>
<b>9</b>	<b>Chapter 9 : Paragraph Development</b> Introduction, Central Components of a paragraph, Length, Techniques for Paragraph Development.	<b>03 hrs</b>
<b>10</b>	<b>Chapter 10 :The Art of Condensation</b> Introduction, Steps to effective precise writing.	
<b>Unit III</b>		

<b>11</b>	<b>Chapter 11: Letters and Emails</b> Business letters Emails.	<b>03 hrs</b>
<b>12</b>	<b>Chapter 12: Research paper, Dissertation and Thesis</b> Introduction, Research paper, Dissertation, Thesis.	<b>03 hrs</b>
<b>Text Books:</b> <ol style="list-style-type: none"> <li>1. Kenneth and Rosen, Discrete Mathematics and its Applications 6th edition, Tata McGraw-Hill Publications 2007.</li> <li>2. Gary Haggard, John Schlipf and Sue Whiteside, Discrete Mathematics and Computer Science, Thomson, 2007.</li> <li>3. Grimaldi, R.P., Discrete and Combinatorial Mathematics an Applied Introduction, 4ed, Pearson Education, 2003.</li> </ol>		
<b>Reference Books:</b> <ol style="list-style-type: none"> <li>1. Goodaire, E.G. and Paramenter, M.M., Discrete Mathematics with Graph Theory, 3ed, Pearson Education 2002.</li> <li>2. KolmanBernad and Busby, R.C. Discrete Mathematical Structures 5ed, PHI 2004.</li> <li>3. Lipschutz Seymour and Lipson Marc, Discrete Mathematics, 2<sup>ed</sup>.Tata McGraw-Hill, 2006</li> </ol>		

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### Semester II

<b>Program: Bachelor of Computer Applications</b>		<b>Semester – II</b>
<b>Course Title: Discrete Mathematical Structures</b>		<b>Course Code: 22EBCB102</b>
<b>L-T-P: 3-0-0</b>	<b>Credits: 3</b>	<b>Contact Hours: 3hrs/week</b>
<b>ISA Marks: 50</b>	<b>ESA Marks: 50</b>	<b>Total Marks: 100</b>
<b>Teaching Hours: 40</b>	<b>Tutorial/Practical: --</b>	<b>Exam Duration: 3hrs</b>
<b>Unit I</b>		
<b>1</b>	<b>Sets, Proof Templates and Induction</b> Basic Definitions, Operations on Sets, Principles of Inclusion and Exclusion, Mathematical Induction, Exercises.	<b>05 hrs</b>
<b>2</b>	<b>Formal Logic</b> Introduction to propositional Logic, Truth and Logical Truth, Normal Forms, Predicates & Quantification, Exercises.	<b>05 hrs</b>
<b>3</b>	<b>Integers</b> The integers and Division, Primes and GCDs, Integers and Algorithms. Applications of Number theory.	<b>07 hrs</b>
<b>Unit II</b>		
<b>4</b>	<b>Relations and Ordered Sets</b> Introduction, Operations on relations, Composition and properties of relations, Equivalence relations. Partial Ordered sets, Hasse-diagram of partially ordered sets, extremal elements of posets.	<b>08 hrs</b>
<b>5</b>	<b>Lattices and Counting Principles</b> Definition, Products, Properties and Special types of lattices. Permutations and Combinations. Generalized Permutations and Combinations.	<b>07 hrs</b>
<b>Unit III</b>		
<b>6</b>	<b>Functions</b> Basic Definitions, Types of functions, Composition and invertible functions. The Pigeon-Hole principle, Exercises.	<b>04 hrs</b>
<b>7</b>	<b>Algebraic Structures</b> Binary Operations, Monoids, Semi-groups, Introduction to groups, Sub groups.	<b>04 hrs</b>

**Text Books:**

4. Kenneth and Rosen, Discrete Mathematics and its Applications 6th edition, Tata McGraw-Hill Publications 2007.
5. Gary Haggard, John Schlipf and Sue Whiteside, Discrete Mathematics and Computer Science, Thomson, 2007.
6. Grimaldi, R.P., Discrete and Combinatorial Mathematics an Applied Introduction, 4ed, Pearson Education, 2003.

**Reference Books:**

4. Goodaire, E.G. and Paramenter, M.M., Discrete Mathematics with Graph Theory, 3ed, Pearson Education 2002.
5. KolmanBernad and Busby, R.C. Discrete Mathematical Structures 5ed, PHI 2004.
6. Lipschutz Seymour and Lipson Marc, Discrete Mathematics, 2<sup>ed</sup>.Tata McGraw-Hill, 2006

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<b>Program: Bachelor of Computer Applications</b>		<b>Semester – II</b>
<b>Course Title: Operating Systems</b>		<b>Course Code: 22EBCC104</b>
<b>L-T-P: 3-0-1</b>	<b>Credits: 4</b>	<b>Contact Hours: 5hrs/week</b>
<b>ISA Marks: 50</b>	<b>ESA Marks: 50</b>	<b>Total Marks: 100</b>
<b>Teaching Hours: 40</b>	<b>Tutorial/Practical: -- 24</b>	<b>Exam Duration: 3hrs</b>
<b>Unit I</b>		
<b>1</b>	<b>Introduction to Operating Systems, System structures</b> What operating systems do; Operating System structure; Operating System operations; Process management; Memory management; Storage management; Protection and security; Distributed systems; Special-purpose systems;. Operating System Services; User - Operating System interface.	<b>06 hrs</b>
<b>2</b>	<b>Process Management</b> Process Concept, Process scheduling, Multi-Threaded Programming: Overview; Multithreading models; Process Scheduling: Basic concepts; Scheduling criteria Scheduling algorithms.	<b>04 hrs</b>
<b>3</b>	<b>Process Synchronization</b> Synchronization: The Critical section problem; Peterson's solution, Semaphores;	<b>06 hrs</b>
<b>Unit II</b>		
<b>4</b>	<b>Deadlocks</b> Deadlocks: System model; Deadlock characterization; methods for handling deadlocks; Deadlock prevention; Deadlock avoidance; Deadlock detection and recovery from deadlock	<b>06 hrs</b>
<b>5</b>	<b>Memory Management</b> Memory Management Strategies: Background; Swapping Contiguous memory allocation; Paging Structure of page table; Segmentation, Page replacement.	<b>06 hrs</b>
<b>6</b>	<b>Implementation of File System</b> Implementing File System: File system structure File system implementation; Directory implementation; Allocation methods.	<b>04 hrs</b>
<b>Unit III</b>		
<b>7</b>	<b>Secondary Storage Structures</b> Mass storage structures; Disk structure; Disk attachment; Disk scheduling.	<b>04 hrs</b>
<b>8</b>	<b>Protection</b> Protection: Goals of protection, Principles of protection Domain of protection, Access matrix Implementation of access matrix, Access	<b>04 hrs</b>

**Text Books:**

1. Abraham Silberschatz, Peter Galvin and Greg Gagne, Operating System Principles, 10<sup>th</sup> edition, Wiley-India, 2018

**Reference Books:**

1. D.M.Dhamdhere, Operating systems-A concept based Approach, 2, Tata McGraw-Hill, 2002
2. .P.C.P. Bhatt, Operating systems, 2, PHI, 2006

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<b>Program: Bachelor of Computer Applications</b>		<b>Semester – II</b>
<b>Course Title: Object-Oriented Programming in C++</b>		<b>Course Code: 22EBCC105</b>
<b>L-T-P: 3-0-0</b>	<b>Credits: 3</b>	<b>Contact Hours: 3hrs/week</b>
<b>ISA Marks: 50</b>	<b>ESA Marks: 50</b>	<b>Total Marks: 100</b>
<b>Teaching Hours: 42</b>	<b>Tutorial/Practical: --</b>	<b>Exam Duration: 3hrs</b>
<b>Unit I</b>		
<b>1</b>	<b>Introduction to OOPS</b> Why Do We Need Object-Oriented Programming? Characteristics of Object-Oriented Languages, C++ and C, Getting Started, Basic Program Construction, Output Using cout, Directives, Comments, Integer Variables, Character Variables, Input with cin , Floating Point Types, Type bool, The setw Manipulator, Variable Type Summary, Type Conversion, Arithmetic Operators, Library Functions, Relational Operators, Logical Operators, Precedence Summary.	<b>05 hrs</b>
<b>2</b>	<b>Statements and Functions</b> Control and looping statements, Simple Functions, Overloaded Functions, Inline Functions and Recursion.	<b>05 hrs</b>
<b>3</b>	<b>Objects and Classes</b> A Simple Class, C++ Objects as Physical Objects, C++ Objects as Data Types, Constructors, Objects as Function Arguments, The Default Copy Constructor, Returning Objects from Functions, A Card-Game Example, Structures and Classes, Classes, Objects, and Memory, Static Class Data, const and Classes, What Does It All Mean?	<b>06 hrs</b>
<b>Unit II</b>		
<b>4</b>	<b>Arrays and Strings</b> Array Fundamentals, Arrays as Class Member Data, Arrays of Objects, Standard C++ string Class.	<b>05 hrs</b>
<b>5</b>	<b>Operator Overloading</b> Overloading Unary Operators, Overloading Binary Operators, Data Conversion	<b>05 hrs</b>
<b>6</b>	<b>Inheritance</b> Derived Class and Base Class, Derived Class Constructors, Overriding Member Functions, Which Function Is Used? Inheritance in the English Distance Class, Class Hierarchies, Inheritance and Graphics Shapes, Public and Private Inheritance, Levels of Inheritance, Multiple Inheritance, Ambiguity in Multiple Inheritance, Aggregation: Classes Within Classes, Inheritance and Program Development	<b>06 hrs</b>
<b>Unit III</b>		

<b>7</b>	<b>Pointers</b> Addresses and Pointers, The Address-of Operator &, Pointers and Arrays, Pointers and Functions, Pointers and C-Type Strings, Memory Management: new and delete, Pointers to Objects.	<b>05 hrs</b>
<b>8</b>	<b>Virtual Functions</b> Virtual Functions, Friend Functions, Static Functions, Assignment and Copy Initialization, 'this' Pointer, Dynamic Type Information.	<b>05 hrs</b>
<b>Text Books:</b> <ol style="list-style-type: none"> <li>Object-Oriented Programming in C++, Fourth Edition, Robert Lafore, SAMS publications</li> </ol>		
<b>Reference Books:</b> <ol style="list-style-type: none"> <li>D H. Schildt C++ The Complete Reference, 5<sup>th</sup> edition, Tata McGraw Hill, March 7 2012</li> <li>E Balaguruswamy, Object Oriented Programming with C++, 6<sup>th</sup> Edition, Tata McGraw Hill.2013</li> <li>C++ Primer Plus, Sixth Edition, Stephen Prata, Addison-Wesley Professional; 6 edition (October 28, 2011)</li> </ol>		

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<b>Program: Bachelor of Computer Applications</b>		<b>Semester – II</b>
<b>Course Title: Software Engineering</b>		<b>Course Code: 22EBCC106</b>
<b>L-T-P: 3-0-1</b>	<b>Credits: 4</b>	<b>Contact Hours: 5hrs/week</b>
<b>ISA Marks: 50</b>	<b>ESA Marks: 50</b>	<b>Total Marks: 100</b>
<b>Teaching Hours: 40</b>	<b>Tutorial/Practical: 24</b>	<b>Exam Duration: 3hrs</b>
<b>Unit I</b>		
<b>1</b>	<b>Introduction to Software Engineering process</b> Professional software development, Software engineering ethics, Case studies, Software processes: Software process models, Process activities, Coping with change, Process improvement	<b>06 hrs</b>
<b>2</b>	<b>Agile Software Development</b> Agile methods, Agile development techniques, Agile project management. Scaling agile methods	<b>04 hrs</b>
<b>3</b>	<b>Requirement Engineering</b> Functional and Non-functional requirements, Requirements Engineering processes, Requirements elicitation, Requirement specification, Requirements validation.	<b>06 hrs</b>
<b>Unit II</b>		
<b>4</b>	<b>System Modeling &amp; Architectural Design</b> Context models, Interaction Models, Structural models, Behavioral models. model driven architectures; Architectural Design Decisions, Architectural views, Architectural patterns, Application Architectures	<b>08 hrs</b>
<b>5</b>	<b>Design and implementation</b> Object oriented design using UML, design patterns, Implementation Issues, Open source development.	<b>08 hrs</b>
<b>Unit III</b>		
<b>6</b>	<b>Component based Software Engineering</b> Components and Component models, CBSE process, Component composition.	<b>04 hrs</b>
<b>7</b>	<b>Software Testing</b> Development Testing, Test Driven Development, Release Testing, User Testing.	<b>04 hrs</b>

**Text Books:**

1. Ian Sommerville, Software Engineering, 10<sup>th</sup>e, Pearson Ed, 2018

**Reference Books:**

1. Roger S. Pressman, Software Engineering: A Practitioners Approach, 8<sup>th</sup>e, McGraw, 2015
2. Jalote, P, An Integrated Approach to Software Engineering, 6e, willy Publications, 2015.

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<b>Program: Bachelor of Computer Applications</b>		<b>Semester – II</b>
<b>Course Title: Data Structures with Applications</b>		<b>Course Code: 22EBCC107</b>
<b>L-T-P: 4-0-0</b>	<b>Credits: 4</b>	<b>Contact Hours: 4hrs/week</b>
<b>ISA Marks: 50</b>	<b>ESA Marks: 50</b>	<b>Total Marks: 100</b>
<b>Teaching Hours: 40</b>	<b>Tutorial/Practical: 24</b>	<b>Exam Duration: 3hrs</b>
<b>Unit I</b>		
<b>1</b>	<b>Introduction to Data Structures</b> Information and its meaning;, Data Types in C, Pointers in C, Data Structures and C. Arrays in C: Using One -dimensional Arrays, Implementing One-dimensional Arrays, Arrays as Parameters, Character Strings in C, Character String Operations Structures in C: Implementing Structures, Unions, Implementation of Unions, Structure Parameters, Allocation of Storage and Scope of Variables, Dynamic Memory Allocation and Cancellation in C.	<b>10 hrs</b>
<b>2</b>	<b>Stacks</b> Definition and examples, Primitive operations, Example , The stack as an ADT, Representing stacks in C, Implementing the pop operation, Testing for exceptional conditions, Implementing the push operation, Examples for infix, postfix, and prefix expressions, Basic definition and examples, Program to evaluate a postfix expression, Converting an expression from infix to postfix, Program to convert an expression from infix to postfix.	<b>10 hrs</b>
<b>Unit II</b>		
<b>3</b>	<b>Recursion</b> Recursive definition and processes, Properties of a recursive definition, Example, Factorial function, Multiplication of natural numbers. Fibonacci numbers in C, Towers of Hanoi problem.	<b>05 hrs</b>
<b>4</b>	<b>Queues</b> The queue and its sequential representation, C implementation of queues, Insert & Delete operation, Circular queue, Operations on Circular queue and its implementation, Priority queue.	<b>07 hrs</b>
<b>5</b>	<b>Lists</b> Linked list as a data structure, get node and free node operations, Header nodes, Inserting and Removing nodes from a list, Linked implementation of stacks, Array implementation of lists, Limitations of array implementation, allocating and freeing dynamic variables, Linked lists using dynamic variables.	<b>08 hrs</b>
<b>Unit III</b>		
<b>6</b>	<b>Sorting</b> Bubble Sort, Selection Sort, Insertion Sort, Shell Sort, Address Calculation Sort, Merge Sort.	<b>05 hrs</b>

<b>7</b>	<b>Searching</b> Basic Search Techniques: Linear and Binary search, Searching an ordered table, Indexed sequential search.	<b>05 hrs</b>
<b>Text Books:</b> <ol style="list-style-type: none"> <li>1. YedidyahLangsam, Augenstein, M.J. and Tenenbaum, A.M., Data Structures using C and C++ by 2ed., Pearson Education Asia, 2002.</li> </ol>		
<b>Reference Books:</b> <ol style="list-style-type: none"> <li>1. Weiss, M.A., Data Structures and Algorithm Analysis in C, 2ed Pearson Education Asia, 1997.</li> <li>2. Gilberg, R.F. and Forouzan, B.A. Data Structures A Pseudo code Approach with C, 3rd Reprint, Thomson Course Technology, 2005.</li> </ol>		

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<b>Program: Bachelor of Computer Applications</b>		<b>Semester – II</b>
<b>Course Title: C++ Programming Lab</b>		<b>Course Code: 22BCP104</b>
<b>L-T-P: 0-0-1.5</b>	<b>Credits: 1.5</b>	<b>Contact Hours: 3hrs/week</b>
<b>ISA Marks: 50</b>	<b>ESA Marks: 50</b>	<b>Total Marks: 100</b>
<b>Teaching Hours: --</b>	<b>Tutorial/Practical: 36</b>	<b>Exam Duration: 3hrs</b>
Expt No.	Lab assignments/experiment	
<b>1</b>	Introduction to C++ data types, operators and control statements.	
<b>2</b>	Introduction to structures, enumerations.	
<b>3</b>	Introduction to object, class, copy constructor, operator overloading.	
<b>4</b>	Introduction to Inheritance, pointers, File streams.	
	<b>Exercises</b>	
<b>6</b>	Implementation of method overloading & overriding.	
<b>7</b>	Implementation of unary & binary operator overloading.	
<b>8</b>	Implementation of different string handling methods.	
<b>9</b>	Implementation of different types of inheritance and class aggregation.	
	<b>Structured inquiry</b>	
<b>10</b>	Develop an application for the data encryption & decryption using file streams.	

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<b>Program: Bachelor of Computer Applications</b>		<b>Semester – II</b>
<b>Course Title: Data Structures Lab</b>		<b>Course Code: 22BCP105</b>
<b>L-T-P: 0-0-1.5</b>	<b>Credits: 1.5</b>	<b>Contact Hours: 3hrs/week</b>
<b>ISA Marks: 50</b>	<b>ESA Marks: 50</b>	<b>Total Marks: 100</b>
<b>Teaching Hours: --</b>	<b>Tutorial/Practical: 36</b>	<b>Exam Duration: 3hrs</b>
Expt No.	Lab assignments/experiment	
<b>1</b>	Program to demonstrate the concepts of pointers, dynamic memory allocation and file handling	
<b>2</b>	Program to demonstrate the working of Stack data structure	
<b>3</b>	Program to demonstrate the working of Queue data structure	
<b>4</b>	Program to demonstrate the working of Linked List data structure	
<b>5</b>	Program to demonstrate the working of Tree data structure	
<b>6</b>	Program to demonstrate the working of Graph data structure	
	<b>Exercises</b>	
<b>7</b>	Applications of Stack.	
<b>8</b>	Applications of Queue.	
<b>9</b>	Applications of Linked List.	
<b>10</b>	Applications of Tree.	
<b>11</b>	Applications of Graph.	
	<b>Structured inquiry</b>	
<b>12</b>	Develop applications like Library Management, Hotel Management, and Airline Reservations System.	

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<b>Program: Bachelor of Computer Applications</b>		<b>Semester – II</b>
<b>Course Title: Multimedia &amp; Graphics Design Practices</b>		<b>Course Code: 22EBCP106</b>
<b>L-T-P: 0-0-1</b>	<b>Credits: 1</b>	<b>Contact Hours: 4hrs/week</b>
<b>ISA Marks: 100</b>	<b>ESA Marks: --</b>	<b>Total Marks: 100</b>
<b>Teaching Hours: 50</b>	<b>Tutorial/Practical: --</b>	<b>Exam Duration: --</b>
Expt No.	Lab assignments/experiment	
<b>1</b>	<b>Introduction:</b> Elements of Multimedia System, Categories of Multimedia., Features of Multimedia, Applications of Multimedia System., Convergence of Multimedia System, Stages of Multimedia Application Development	
<b>2</b>	<b>Introduction to GIMP-</b> What is GIMP?, Installing GIMP, GIMP vs Photoshop, GIMP vs Inkscape, GIMP vs Krita, GIMP vs Lightroom, Photoshop Alternatives	
<b>3</b>	<b>GIMP Menus:</b> GIMP File Menu, GIMP Edit Menu, GIMP Select Menu, GIMP View Menu, GIMP Image Menu, GIMP Layers, GIMP Colors, GIMP Tools, GIMP Filters	
<b>4</b>	<b>Basic Tasks:</b> GIMP Fonts, GIMP Brushes GIMP Layer Masks, GIMP Deselect, GIMP Draw Line, GIMP Draw Circle ,GIMP Draw Rectangle, GIMP Draw Arrow, GIMP GIF Creation, GIMP Move Layer, GIMP Rotate Image, GIMP Clone Tool, GIMP Heal Tool, Save Image as JPEG, Save Image as PNG, GIMP Animations, GIMP Change Colors Resize Image in GIMP, Text in GIMP, GIMP Text Outline, GIMP Crop, GIMP Patterns	
<b>5</b>	<b>GIMP Plugins:</b> Introduction to GIMP Plugins, GIMP DDS Plug-in, GIMP Resynthesizer	
<b>6</b>	<b>Photo Editing:</b> GIMP Photo Editing, GIMP Remove Background, GIMP HDR, GIMP Smoke Effect, GIMP Cartoon Effect, GIMP Remove Watermark	
<b>7</b>	<b>Logo Making: GIMP Logo Making:</b> Miscellaneous: GIMP Online Resources. How to Use GIMP, JavaTpoint GIMP Resources.	

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### Semester- III

<b>Program: Bachelor of Computer Applications</b>		<b>Semester – III</b>
<b>Course Title: Applied Statistics</b>		<b>Course Code: 22EBCB201</b>
<b>L-T-P: 3-0-1</b>	<b>Credits: 4</b>	<b>Contact Hours: 5hrs/week</b>
<b>ISA Marks: 50</b>	<b>ESA Marks: 50</b>	<b>Total Marks: 100</b>
<b>Teaching Hours: 40</b>	<b>Tutorial/Practical: 24</b>	<b>Exam Duration: 3hrs</b>
<b>Unit I</b>		
<b>1</b>	<b>Description of data</b> Introduction: Data, Type of Variables, mean, weighted mean, median, mode, Quartiles, Variance, Coefficient of variation, skewness, Histogram, Box plots, Normal Quantile-Quantile plots.	<b>08 hrs</b>
<b>2</b>	<b>Probability</b> Introduction: Definition, Interpretation of probability value, addition rule, multiplication rule, Baye's rule.	<b>06 hrs</b>
	<b>Tutorial:</b> Introduction to Data handling, Description of data graphically, Histogram, Skewness, Boxplot, QQ-norm.	<b>08 hrs</b>
<b>Unit II</b>		
<b>3</b>	<b>Random variables and Probability Distribution</b> Random variables, simple Examples, Discrete and continuous random variables. Theoretical distributions: Binomial, Poisson, Normal, Exponential.	<b>08 hrs</b>
<b>4</b>	<b>Statistical Inference I</b> 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.	<b>08 hrs</b>
	<b>Tutorial:</b> Probability distribution, Testing of Hypothesis for proportions, means(single and differences)	<b>08 hrs</b>
<b>Unit III</b>		
<b>5</b>	<b>Correlation and Regression</b> Meaning of correlation and regression, coefficient of correlation, Linear regression (ANOVA approach), Multiple linear regression,	<b>05 hrs</b>
<b>6</b>	<b>Statistical Inference II</b> Test for independence of attributes (m x n contingency table) Inference based on choice of suitable test procedure (Goodness of fit).	<b>05 hrs</b>
	<b>Tutorial:</b> Linear Regression with ANOVA approach, Multiple Regression with ANOVA approach	<b>04 hrs</b>

**Text Books**

1. J. Susan Milton, Jesse C. Arnold, Introduction to Probability and Statistics: Principles and Applications for Engineering and the Computing Sciences, 4<sup>th</sup> 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 & 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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<b>Program: Bachelor of Computer Applications</b>		<b>Semester – III</b>
<b>Course Title: Computer Networks</b>		<b>Course Code: 22EBCC201</b>
<b>L-T-P: 3-0-1</b>	<b>Credits: 4</b>	<b>Contact Hours: 5hrs/week</b>
<b>ISA Marks: 50</b>	<b>ESA Marks: 50</b>	<b>Total Marks: 100</b>
<b>Teaching Hours: 40</b>	<b>Tutorial/Practical: 24</b>	<b>Exam Duration: 3hrs</b>
<b>Unit I</b>		
<b>1</b>	<b>Computer Networks and the Internet</b> 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.	<b>08 hrs</b>
<b>2</b>	<b>Application Layer</b> Principles of network applications, the web and HTTP, DHCP, file transfer-FTP, electronic mail in the internet, DNS, peer-to-peer applications.	<b>08 hrs</b>
<b>Unit II</b>		
<b>3</b>	<b>Transport-Layer</b> 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.	<b>08 hrs</b>
<b>4</b>	<b>Network Layer</b> 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.	<b>08 hrs</b>
<b>Unit III</b>		
<b>5</b>	<b>The link layer: Links, Access networks, and LANs</b> 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.	<b>08 hrs</b>
	<b>List of assignments to be done using Packet tracer and Wireshark tool.</b>	
SI No.	Demonstration	Sessions
1	Study of Network Devices in Detail: Hubs, Switches, Routers, Gateways.	1
	<b>Exercises</b>	
2	Study of basic network administration commands.	1
3	Demonstration of Wireshark tool and its Functionalities.	1
4	Explore and analyse HTTP, DNS, and SMTP protocols using the Wireshark tool.	1
5	Analyse TCP and UDP protocol configurations using Wireshark tool.	1

6	Investigating Ethernet protocol and ARP with Wireshark tool.	1
7	Implement a program to explore the connectivity and transmission of data using Socket Programming concepts for reliable data	1
8	Configure Host IP, subnet mask and default gateway in a system lab.	1
9	Implement a Cyclic redundancy check (CRC) to detect error in transmission.	1
10	Configuring Windows Firewall and Network Access Protection	1

**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, 6<sup>th</sup> MGH 2022 by B. A. Forouzan.

**Reference Books:**

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

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<b>Program: Bachelor of Computer Applications</b>		<b>Semester – III</b>
<b>Course Title: Database Management Systems</b>		<b>Course Code: 22EBCC202</b>
<b>L-T-P: 4-0-0</b>	<b>Credits: 4</b>	<b>Contact Hours: 4hrs/week</b>
<b>ISA Marks: 50</b>	<b>ESA Marks: 50</b>	<b>Total Marks: 100</b>
<b>Teaching Hours: 50</b>	<b>Tutorial/Practical: --</b>	<b>Exam Duration: 3hrs</b>
<b>Unit I</b>		
<b>1</b>	<b>Conceptual Data Modeling Using Entities and Relationships</b> 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.	<b>10 hrs</b>
<b>2</b>	<b>Relational Data Model and Relational Algebra</b> 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.	<b>06 hrs</b>
<b>3</b>	<b>SQL</b> SQL Data Definition and Data Types; SQL constraints; DDL and DML statements; JOIN Operations; Complex SQL Queries.	<b>04 hrs</b>
<b>Unit II</b>		
<b>4</b>	<b>Database Design</b> Informal Design Guidelines for Relation Schemas; Functional Dependencies; Normal Forms Based on Primary Keys; Boyce-Codd Normal Form.	<b>10 hrs</b>
<b>5</b>	<b>Introduction to Transaction Processing</b> Introduction to Transaction Processing; Transactions and System concepts; Desirable Properties of Transactions; Characterizing Schedules Based on- Recoverability, Serializability.	<b>10 hrs</b>
<b>Unit III</b>		
<b>6</b>	<b>Concurrency Control Techniques</b> Introduction, Two-phase Locking Techniques for Concurrency Control, Dealing with Dead-lock and Starvation, Concurrency control based on Time stamp Ordering.	<b>05 hrs</b>
<b>7</b>	<b>Database Security</b> Introduction to DB Security Issues, Discretionary Access Control, Mandatory Access Control And Role-Based Access Control, SQL Injections, SQL Attacks.	<b>05 hrs</b>

**Text Books**

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

**Reference Books:**

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.

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<b>Program: Bachelor of Computer Applications</b>		<b>Semester – III</b>
<b>Course Title: Java Programming</b>		<b>Course Code: 22EBCC203</b>
<b>L-T-P: 3-0-1</b>	<b>Credits: 4</b>	<b>Contact Hours: 5hrs/week</b>
<b>ISA Marks: 50</b>	<b>ESA Marks: 50</b>	<b>Total Marks: 100</b>
<b>Teaching Hours: 40</b>	<b>Tutorial/Practical: 24</b>	<b>Exam Duration: 3hrs</b>
<b>Unit I</b>		
<b>1</b>	<b>Introduction</b> 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	<b>05 hrs</b>
<b>2</b>	<b>Introducing Classes, Objects, and Methods</b> 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.	<b>08 hrs</b>
<b>Unit II</b>		
<b>3</b>	<b>Inheritance</b> 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, final Prevents Overriding, final Prevents Inheritance, Using final with Data Members, the Object Class	<b>06 hrs</b>
<b>4</b>	<b>Packages and Interfaces</b> 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.	<b>06 hrs</b>
<b>5</b>	<b>Exception Handling</b> 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.	<b>05 hrs</b>
<b>Unit III</b>		
<b>6</b>	<b>Multithread Programming</b> Multithreading Fundamentals, The Thread Class and Runnable Interface, creating a Thread, Creating Multiple Threads, Determining When a Thread Ends, Thread Priorities, Synchronization, Using Synchronized	<b>05 hrs</b>

7	<b>Collections</b> 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.	<b>05 hrs</b>
<b>Text Books</b> 1. Herbert Schildt, Java: A Beginner's Guide Ninth Edition, 9th Edition, McGraw Hill; Eighth edition(2022).Herbert Schildt, JAVA The Complete Reference 11th edition, Tata McGraw Hill 2019.		
<b>Reference Books:</b> 1. Kathy Sierra: Head First Java: A Brain-Friendly Guide, Third Edition, Shroff/O'Reilly; Third edition (1 June 2022).		

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<b>Program: Bachelor of Computer Applications</b>		<b>Semester – III</b>
<b>Course Title: Database Management Systems Lab</b>		<b>Course Code: 22EBCP201</b>
<b>L-T-P: 0-0-1.5</b>	<b>Credits: 1.5</b>	<b>Contact Hours: 3hrs/week</b>
<b>ISA Marks: 50</b>	<b>ESA Marks: 50</b>	<b>Total Marks: 100</b>
<b>Teaching Hours: --</b>	<b>Tutorial/Practical: 36</b>	<b>Exam Duration: 3hrs</b>
<b>Expr. No</b>	<b>Demonstration</b>	<b>Session</b>
<b>1</b>	Introduction to RDBMS and Constructing an Entity Relationship Diagram for a given statement.	<b>1</b>
<b>2</b>	Basic SQL commands – i) DDL: CREATE, DROP, ALTER, TRUNCATE, and RENAME. ii) DML: INSERT, UPDATE, and DELETE commands. iii) DQL: SELECT command.	<b>2</b>
<b>Exercises</b>		
<b>3</b>	i) Queries for creating tables for the given schema. ii) Specifying entity integrity constraints and foreign key constraints for the schema.	<b>1</b>
<b>4</b>	i) Specifying other constraints (CHECK, DEFAULT) on relations. ii) Solving simple queries for data retrieval using operators – IN, LIKE, BETWEEN, ALIASES.	<b>1</b>
<b>5</b>	i) Solving aggregate functions for the given schema using GROUP BY and HAVING clause. ii) Queries for sorting the data in the relation.	<b>1</b>
<b>6</b>	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.	<b>2</b>
<b>Structured Enquiry</b>		
<b>7</b>	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.	<b>2</b>
<b>Open Ended Experiment</b>		
<b>8</b>	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. iv) Populating the database with data. v) Solving simple, complex and nested queries on the database.	<b>2</b>

<b>Program: Bachelor of Computer Applications</b>		<b>Semester – III</b>
<b>Course Title: Full StackWeb Development</b>		<b>Course Code: 22EBCP202</b>
<b>L-T-P: 0-1-2</b>	<b>Credits: 3</b>	<b>Contact Hours: 6hrs/week</b>
<b>ISA Marks: 80</b>	<b>ESA Marks: 20</b>	<b>Total Marks: 100</b>
<b>Teaching Hours: --</b>	<b>Tutorial/Practical: 36</b>	<b>Exam Duration: 3hrs</b>
<b>1</b>	<b>Introduction to HTML basics, JavaScript</b> Introduction to World Wide Web, Web Application Architecture, HTML Basics, Cascading Style Sheets, JavaScript Basics, Bootstrap	<b>06 hrs</b>
<b>2</b>	<b>RESTful API using NodeJS and Express</b> 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.	<b>12 hrs</b>
<b>3</b>	<b>React Components and React State</b> 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.	<b>10 hrs</b>
<b>4</b>	<b>MongoDB</b> Introducing MongoDB, Key features of MongoDB, MongoDB shell, MongoDB databases, MongoDB collections, MongoDB CRUD operations	<b>08 hrs</b>
<b>Text Books :</b>		
<b>Reference Books:</b>		
<ol style="list-style-type: none"> <li>1. Robert W. Sebesta. "Programming the World Wide Web", Pearson Publications 8th Edition, 2014.</li> <li>2. Kyle Banker "MongoDB in Action" , Manning Publication co, 2nd Edition, 2016.</li> <li>3. AzatMardan, "Practical Node.js: Building Real-World Scalable Web Apps", 2nd Edition Apress, 2018.</li> <li>4. Den Ward, "<a href="#">React Native Cookbook: Recipes for solving common React Native development problems</a>", 2nd Edition, 2019</li> </ol>		

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<b>Program: Bachelor of Computer Applications</b>		<b>Semester – III</b>
<b>Course Title: Python Programming</b>		<b>Course Code: 22EBCP203</b>
<b>L-T-P: 0-0-1</b>	<b>Credits: 1</b>	<b>Contact Hours: 2hrs/week</b>
<b>ISA Marks: 80</b>	<b>ESA Marks: 20</b>	<b>Total Marks: 100</b>
<b>Teaching Hours: --</b>	<b>Tutorial/Practical: 36</b>	<b>Exam Duration: 3hrs</b>
<b>1</b>	<b>Introduction to Python</b> 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	<b>06 hrs</b>
<b>2</b>	<b>Functions</b> def Statements with Parameters, Return Values and return Statements, None Value, Keyword Arguments, Local and Global Scope, Exception Handling	<b>06 hrs</b>
<b>3</b>	<b>Classes and Objects</b> 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	<b>06 hrs</b>
<b>4</b>	<b>Files and Directories</b> 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	<b>08 hrs</b>
<b>Text Books :</b> 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		
<b>Reference Books:</b> 1. Think Python, 2 <sup>nd</sup> 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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<b>Program: Bachelor of Computer Applications</b>		<b>Semester – III</b>
<b>Course Title: Arithmetical Thinking and Analytical Reasoning</b>		<b>Course Code: 22EBCH201</b>
<b>L-T-P: 0.5-0-0</b>	<b>Credits: 0.5</b>	<b>Contact Hours: 1hrs/week</b>
<b>ISA Marks: 100</b>	<b>ESA Marks: --</b>	<b>Total Marks: 100</b>
<b>Teaching Hours: 22</b>	<b>Tutorial/Practical:</b>	<b>Exam Duration: 3hrs</b>
<b>Unit I</b>		
<b>1</b>	<b>Modules:</b> <b>Analytical Thinking:</b> Importance of Sense of Analysis for Engineers, Corporate Methodology of Testing Sense of Analysis, <b>Puzzles for practice:</b> Analytical, Mathematical, Classification Puzzles, Teamwork in Problem Solving <b>Mathematical Thinking:</b> Problems on Finance: Percentages, Gain and Loss, Interest; Distribution and Efficiency Problems: Averages, Time Work, Permutations Combinations <b>Verbal Ability:</b> Comprehension of Passages, Error Detection and Correction Exercises, Common Verbal Ability questions from Corporate Recruitment Tests	<b>22 hrs</b>
<b>Unit III</b>		
<b>Text Books</b> 1. Vikas Modules, Innovations Unlimited Training Services, Bangalore.		
<b>Reference Books:</b> 1. <a href="https://www.indiabix.com/general-knowledge/questions-and-answers/">https://www.indiabix.com/general-knowledge/questions-and-answers/</a>		

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### Semester – IV

<b>Program: Bachelor of Computer Applications</b>		<b>Semester – IV</b>
<b>Course Title: Programming with C# and .Net</b>		<b>Course Code: 22EBCC204</b>
<b>L-T-P: 3-0-1</b>	<b>Credits: 4</b>	<b>Contact Hours: 5hrs/week</b>
<b>ISA Marks: 50</b>	<b>ESA Marks: 50</b>	<b>Total Marks: 100</b>
<b>Teaching Hours: 40</b>	<b>Tutorial/Practical: 24</b>	<b>Exam Duration: 3hrs</b>
<b>Unit I</b>		
<b>1</b>	<b>The Philosophy of .NET</b> Understand the motivation behind the .NET platform, common language Infrastructure, The Common Type System, The Common Language Specification (CLS) and the Common Language Runtime, Understand the assembly, metadata, namespace, type distinction, contrast single-file and multi-file assemblies, The Common Intermediate Language (CIL), Platform independent .NET (Mono / Portable .NET distributions).	<b>05 hrs</b>
<b>2</b>	<b>Chapter 2: Object-Oriented Programming with C#</b> Understanding the C# Class Type, Reviewing the Pillars of OOP, The First Pillar: C#'s Encapsulation Services, The Second Pillar: C#'s Inheritance Support, Programming for Containment/Delegation, The Third Pillar: C #'s Polymorphic Support, C# Casting rules, Understanding C# Partial types.	<b>06 hrs</b>
<b>Unit II</b>		
<b>3</b>	<b>Object-Oriented Programming with C#</b> Understanding the C# Class Type, Reviewing the Pillars of OOP, The First Pillar: C#'s Encapsulation Services, The Second Pillar: C#'s Inheritance Support, Programming for Containment/Delegation, The Third Pillar: C #'s Polymorphic Support, C# Casting rules, Understanding C# Partial types.	<b>04 hrs</b>
<b>4</b>	<b>Object Lifetime and Exception Handling.</b> Classes, Objects and References, the basics of Object Lifetime, Ode to Errors, Bugs, and Exceptions, The Role of .NET Exception Handling, The Simplest possible example, Application-Level Exception (System.ApplicationException), The Finally Block.	<b>05 hrs</b>
<b>5</b>	<b>Interfaces and Collections</b> Defining Interfaces in C#, Implementing an Interface in C#, Contrasting Interfaces to Abstract Base Classes, Invoking Interface Members at the Object Level, Interfaces As Parameters, Interfaces As Return Values, Arrays of Interfaces Types, Understanding Explicit Interface Implementation.	<b>05 hrs</b>
<b>Unit III</b>		

<b>6</b>	<b>Programming Window Forms Applications</b> Anatomy of a Form, Component Class, Control Class, Control Events, Responding to Keyboard Events, Form Class, Building Menus with Windows Forms, building your Menu System, Creating Pop-Up Menu, Adding Controls to Forms (IDE-Free), Adding Controls to Forms (via VS.NET), Working with Basic Controls like Buttons, Configuring Tab Order.	<b>05 hrs</b>
<b>7</b>	<b>Working with Database</b> Introduction to ADO.NET, Connecting to a database, Understanding DataTables, creating a DataAdapter, referencing fields in a DataRow, navigating records, Adding, editing, and deleting records, Building an ADO.NET example.	<b>05 hrs</b>
<b>Text Books</b> <ol style="list-style-type: none"> <li>1. Andrew Troelsen: Pro C# with .NET 3.0, Special Edition, Dream tech Press, India, 2007.Chapters: 1 to 11 (up to pp.389, except Chapter 10)</li> <li>2. Herbert Schildt, "The Complete Reference C# 4.0", Tata McGraw –Hill, 2010</li> </ol>		
<b>Reference Books:</b> <ol style="list-style-type: none"> <li>1. .NET 4.0 Programming (6-in-1), Black Book,Kogent Learning Solutions Inc.Wiely-Dream Tech Press</li> <li>2. Tom Archer: Inside C#, WP Publishers, 2001.</li> <li>3. Pro C# 9 with .NET 5, Foundational Principles and Practices in Programming, Apress, Troelsen, Andrew, Japikse, Philip, 10 editions.</li> </ol>		

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<b>Program: Bachelor of Computer Applications</b>		<b>Semester – IV</b>
<b>Course Title: Machine Learning</b>		<b>Course Code: 22EBCC205</b>
<b>L-T-P: 3-0-1.5</b>	<b>Credits: 4.5</b>	<b>Contact Hours: 6hrs/week</b>
<b>ISA Marks: 80</b>	<b>ESA Marks: 20</b>	<b>Total Marks: 100</b>
<b>Teaching Hours: 40</b>	<b>Tutorial/Practical: 24</b>	<b>Exam Duration: 3hrs</b>
<b>Unit I</b>		
<b>1</b>	<b>Introduction and Regression:</b> Fundamentals of ML, Linear, Ridge, Lasso, Elastic-net Regression, evaluation	<b>08 hrs</b>
<b>2</b>	<b>Classification:</b> Linear Discriminant Analysis, Logistic Regression, Support Vector Machines, Decision Tree, Bayesian Networks, evaluation.	<b>10 hrs</b>
<b>Unit II</b>		
<b>3</b>	<b>Ensemble learning:</b> Bagging, boosting, stacking, random forest, resampling methods	<b>08 hrs</b>
<b>4</b>	<b>Neural Networks:</b> Perceptron, gradient descent, optimization algorithms, backpropagation, hyper parameters, regularization.	<b>08 hrs</b>
<b>Unit III</b>		
<b>5</b>	<b>Deep Neural Networks:</b> Convolutional Neural Networks, various CNN architectures, model selection and evaluation, Bias-Variance Trade-of.VS.NET), Working with Basic Controls like Buttons, Configuring Tab Order.	<b>06 hrs</b>
<b>Sl. No.</b>	<b>Lab Practice</b>	<b>Session</b>
<b>1</b>	Introduction to PyTorch platform	<b>1</b>
<b>2</b>	Introduction to Regression & Regularization	<b>2</b>
<b>3</b>	Classification – Logistic Regression, Support Vector Machines (SVM), Naïve Bayesian	<b>3</b>
<b>4</b>	Perceptron Networks, Neural Network training	<b>2</b>
<b>5</b>	Convolution Neural Networks Application	<b>2</b>
<b>6</b>	Course Project Implementation	<b>4</b>

**Text Books****Reference Books:**

1. . Tom Mitchell., Machine Learning, Mc Graw Hill, McGraw-Hill Science, 3rd edition.
2. Ian Goodfellow and Yoshua Bengio and Aaron Courville: Deep Learning, MIT Press, 2016.
3. 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.
4. Luca Pietro Giovanni Antiga, Thomas Viehmann, Eli Stevens, Deep Learning with PyTorch Manning Publications, 2020

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<b>Program: Bachelor of Computer Applications</b>		<b>Semester –IV</b>
<b>Course Title: DevOps Lab</b>		<b>Course Code: 22EBCP205</b>
<b>L-T-P: 0-0-2</b>	<b>Credits: 2</b>	<b>Contact Hours: 4hrs/week</b>
<b>ISA Marks: 80</b>	<b>ESA Marks: 20</b>	<b>Total Marks: 100</b>
<b>Teaching Hours: --</b>	<b>Tutorial/Practical: 40</b>	<b>Exam Duration: 3hrs</b>
<b>Sl. No.</b>	<b>Demonstration</b>	<b>Lab Slots</b>
<b>1</b>	Web application development using python for event handling	<b>1</b>
<b>2</b>	Agile practices in DevOps such as Scrum, Kanban	<b>1</b>
<b>3</b>	Version control system and Branching using Git	<b>1</b>
<b>4</b>	Containerization using Docker and automation testing using Selenium	<b>1</b>
<b>Exercise</b>		
<b>5</b>	<b>Continuous Integration:</b> <ol style="list-style-type: none"> <li>1. Practice Git commands for code commits on GitHub Repository</li> <li>2. Automate the process of build generation and execution using Jenkins.</li> <li>3. Automate the integration of dependency management and Jenkins.</li> </ol>	<b>3</b>
<b>6</b>	<b>Continuous Deployment:</b> <ol style="list-style-type: none"> <li>1. Docker commands to create a containerized application</li> <li>2. Automate the Integration of Docker and Kubernetes infrastructure</li> <li>3. Configuration management using Puppet</li> </ol> Automate the test cases for the containerized application using selenium	<b>4</b>
<b>Structured Enquiry</b>		
<b>7</b>	Applications developed as Mini Project must undergo DevOps practices.	<b>2</b>
<b>6</b>	<b>Serverless computing and event processing</b> 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	<b>05 hrs</b>
<b>Text Books :</b>		
<b>Reference Books:</b>		

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<b>Program: Bachelor of Computer Applications</b>		<b>Semester –IV</b>
<b>Course Title: Software Testing</b>		<b>Course Code: 22EBCP206</b>
<b>L-T-P: 0-1-2</b>	<b>Credits: 3</b>	<b>Contact Hours: 6hrs/week</b>
<b>ISA Marks: 80</b>	<b>ESA Marks: 20</b>	<b>Total Marks: 100</b>
<b>Teaching Hours: --</b>	<b>Tutorial/Practical: 36</b>	<b>Exam Duration: 3hrs</b>
<b>Unit I</b>		
<b>1</b>	<b>Software Testing Fundamentals</b> Testing and need of testing, Objectives of software Testing, Software Testing Types, STLC (Software Testing Life Cycle), Quality assurance	<b>06 hrs</b>
<b>2</b>	<b>Levels of testing</b> Unit Testing, Integration Testing, Functional Testing, System Testing Types, Test environment	<b>06 hrs</b>
<b>3</b>	<b>Test Case Development</b> Test Documentation, Test Scenario, Write Test Cases, Test Analysis, Requirements Traceability Matrix, Test Data Generation.	<b>07 hrs</b>
<b>Unit II</b>		
<b>4</b>	<b>Selenium</b> Introduction to Selenium, selenium Components & Brief Introduction to each component, Selenium Web Driver, Synchronization in WebDriver, Handling Alerts & Windows, configuring other Browsers, Data Driven Testing	<b>09 hrs</b>
<b>5</b>	<b>TestNG</b> 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	<b>08 hrs</b>
<b>S.No</b>	<b>Demonstration</b>	<b>Slot</b>
<b>1</b>	Writing test plan	<b>1</b>
<b>2</b>	Writing test cases	<b>1</b>
<b>3</b>	Execution of test cases	<b>1</b>
<b>Exercises</b>		
<b>4</b>	Write the test plan and test cases for the below scenarios <b>Flipkart Ecommerce Site.</b> 1. Test Scenario: Check Login Functionality. 2. Test Scenario: Check the Search Functionality 3. Test Scenario: Check the Product Description Page 4. Test Scenario: Check the Order History	<b>1</b>

<b>5</b>	<b>Banking Site</b> <ol style="list-style-type: none"> <li>1. Test Scenario: Check the Login and Authentication Functionality</li> <li>2. Test Scenario: Check Money Transfer can be done</li> <li>3. Test Scenario: Check Account Statement can be viewed</li> </ol> Test Scenario: Check Fixed Deposit/Recurring Deposit can be created.	<b>1</b>
<b>6</b>	<b>Food delivery app</b> <ol style="list-style-type: none"> <li>1. User registration</li> <li>2. Ordering food</li> <li>3. Delivery tracking</li> <li>4. Payment processing</li> <li>5. User Feedback</li> </ol>	<b>1</b>
<b>7</b>	Using Selenium and TestNG execute test cases for the above scenarios	<b>6</b>
<b>Text Books :</b> <b>1.</b> Navneesh Garg, "Test Automation using Selenium WebDriver with Java: Step by Step Guide – 11 December 2014.		
<b>Reference Books:</b>		

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<b>Program: Bachelor of Computer Applications</b>		<b>Semester –IV</b>
<b>Course Title: Minor Project-1</b>		<b>Course Code: 22EBCP207</b>
<b>L-T-P: 0-0-5</b>	<b>Credits: 5</b>	<b>Contact Hours: 10hrs/week</b>
<b>ISA Marks: 80</b>	<b>ESA Marks: 20</b>	<b>Total Marks: 100</b>
<b>Teaching Hours: --</b>	<b>Tutorial/Practical: 150</b>	<b>Exam Duration: 3hrs</b>
<p><b>Project Theme:</b>  <b>Dynamic Client-Server Web Applications: Delivering Rich Interactive Experiences</b>  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.</p> <p><b>Objectives:</b></p> <ol style="list-style-type: none"> <li>1. Able to carry out the survey of the given real-world problem and prepare the SRS as per the industry standard (IEEE standard).</li> <li>2. Work effectively and collectively in a team.</li> <li>3. Identify various design components and suitable architecture for the system development by applying knowledge of Object Oriented Design.</li> <li>4. Use CASE tools to design various models required for the given problem also documentation tools.</li> </ol> <p><b>Learning Outcomes:</b>  At the end of the course, students will be able to:</p> <ol style="list-style-type: none"> <li>1. Identify and define the problem statement and justify scope of the proposed problem</li> <li>2. Gather and analyze system requirements</li> <li>3. Propose an optimized solution among the existing solutions and practice software analysis and design techniques.</li> <li>4. Apply coding, debugging and testing tools to enhance the quality of the software</li> <li>5. Prepare the proper documentation of software projects following the standard guidelines to develop technical report writing and oral presentation.</li> </ol> <p><b>Methodology:</b>  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.</p>		

Expt No.	Experiment/job	Lab Slots
1	Discussion on Problem statements by the Faculty	1
2	The presentation by the students should include: Problem Statement, Problem Definition, Relevance & Literature Survey, Scope & Objectives.	1
3	Discussion on the SRS template (IEEE Standard format) by the Faculty	
4	The presentation by the students should include: Block diagram, Functional Requirements, Non-functional Requirements, , External interface requirements, General constraints, and Design constraints.	1
5	Discussion on System design by the Faculty	1
6	The presentation by the students should include:	1
7	Discussion on Detailed design by the Faculty	1
8	The presentation by the students should include the following:	1
9	Discussion on modular coding part	1
10	Discussion on coding part	1
11	Discussion on unit, Integration, system and acceptance tastings.	1
12	Discussion on Report writing by the Faculty	1
13	Final Report should be submitted in IEEE standard format.	1
<b>Text Books :</b> 1. Navneesh Garg, "Test Automation using Selenium WebDriver with Java: Step by Step Guide – 11 December 2014.		
<b>Reference Books:</b>  <i>Materials and Resources Required:</i> <ol style="list-style-type: none"> <li>Books/References: Relevant Text Books of Previous Semesters</li> <li>Document: IEEE SRS Template</li> </ol>		

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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 Hours: 3hrs/week		
ISA Marks: 50		ESA Marks: 50		Total Marks: 100		
Teaching Hours: 40		Tutorial/Practical: 150		Exam Duration: 1.5hrs		
Unit I						
1	Arithmetical Reasoning				10 hrs	
2	Analytical Thinking				04 hrs	
3	Syllogistic Logic				03 hrs	
Unit II						
4	Verbal Logic				09 hrs	
5	Non-Verbal Logic				06 hrs	
Unit III						
6	Lateral Thinking				08 hrs	
Course Unitization for Minor Exams and Semester End Examination						
Unit	Chapter		Teaching Hours	Number of Questions in		Number of Questions in SEE
				Minor 1	Minor 2	
1	1	Arithmetical Reasoning	10	Objective type questions -30 Nos *	Objective type questions-30 Nos *	Objective type questions-50
	2	Analytical Thinking	4			
	3	Syllogistic Logic	3			
2	1	Verbal Logic	9			
	2	Non-Verbal Logic	6			
3	1	Lateral Thinking	8			
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						

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<b>Program: Bachelor of Computer Applications</b>		<b>Semester -IV</b>
<b>Course Title: Industry Readiness and Leadership Skills</b>		<b>Course Code: 23EHS204</b>
<b>L-T-P: 0.5-0-0</b>	<b>Credits: 0.5</b>	<b>Contact Hours: 1hrs/week</b>
<b>ISA Marks: 100</b>	<b>ESA Marks: --</b>	<b>Total Marks: 100</b>
<b>Teaching Hours: 22</b>	<b>Tutorial/Practical: --</b>	<b>Exam Duration: --</b>
<b>Unit I</b>		
<b>1</b>	<b>Modules:</b> <b>Written Communication:</b> Successful Job Applications, Résumé Writing, Emails, Letters, Business Communication, Essay and Paragraph Writing for Recruitment Tests <b>Interview Handling Skills:</b> Understanding Interviewer Psychology, Common Questions in HR Interviews, Grooming, Interview Etiquette <b>Lateral &amp; Creative Thinking:</b> Lateral Thinking by Edward de Bono, Fractionation and Brain Storming, Mind Maps, Creativity Enhancement through Activities <b>Team Building &amp; Leadership Skills:</b> Communication in a Team, Leadership Styles, Playing a Team member, Ethic	<b>22 hrs</b>
<b>Text Books :</b> <b>1.</b> Vikas Modules, Innovations Unlimited Training Services, Bangalore		
<b>Reference Books:</b> <b>1.</b> <a href="https://www.indiabix.com/general-knowledge/questions-and-answers/">https://www.indiabix.com/general-knowledge/questions-and-answers/</a>		

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### Semester - V

<b>Program: Bachelor of Computer Applications</b>		<b>Semester - V</b>
<b>Course Title: Cloud computing</b>		<b>Course Code: 22EBCC301</b>
<b>L-T-P: 3-0-1</b>	<b>Credits: 4</b>	<b>Contact Hours: 5hrs/week</b>
<b>ISA Marks: 50</b>	<b>ESA Marks: 50</b>	<b>Total Marks: 100</b>
<b>Teaching Hours: 40</b>	<b>Tutorial/Practical: 24</b>	<b>Exam Duration: 3hrs</b>
<b>Unit I</b>		
<b>1</b>	<b>Introduction:</b> 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	<b>05 hrs</b>
<b>2</b>	<b>Virtualization and containerization :</b> 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 Dockerfile. Monolithic applications in a data center	<b>10 hrs</b>
<b>Unit II</b>		
<b>3</b>	<b>Automation</b> Automation in data centers, levels of automation, zero touch provisioning and infrastructure as code, automation tools	<b>07 hrs</b>
<b>4</b>	<b>Orchestration</b> 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	<b>08 hrs</b>
<b>Unit III</b>		
<b>5</b>	<b>Microservices</b> The Microservices approach, advantages and disadvantages of Microservices, Microservices Granularity, Communication protocols used for Microservices, communication among Microservices, creating a Microservices, server mesh proxy	<b>05 hrs</b>
<b>6</b>	<b>Serverless computing and event processing</b> 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	<b>05 hrs</b>

**Text Books**

1. Douglas Comer, "The Cloud Computing: The Future of Computing", 1<sup>st</sup> 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

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<b>Program: Bachelor of Computer Applications</b>		<b>Semester - V</b>
<b>Course Title: Advanced JAVA Programming</b>		<b>Course Code: 22EBCC302</b>
<b>L-T-P: 3-0-1</b>	<b>Credits: 4</b>	<b>Contact Hours: 5hrs/week</b>
<b>ISA Marks: 50</b>	<b>ESA Marks: 50</b>	<b>Total Marks: 100</b>
<b>Teaching Hours: 40</b>	<b>Tutorial/Practical: 24</b>	<b>Exam Duration: 3hrs</b>
<b>Unit I</b>		
<b>1</b>	<b>Database Programming</b> 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	<b>05 hrs</b>
<b>2</b>	<b>Servlets</b> 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	<b>10 hrs</b>
<b>3</b>	<b>Session Management</b> HTTP as a stateless protocol, Hidden form fields, Cookies, session tracking Http Session, Exception handling and error pages, Directives.	<b>03 hrs</b>
<b>Unit II</b>		
<b>4</b>	<b>Java Server Pages</b> JSP Technologies, Configuring the JSP Server, Handling JSP Errors, JSP Translation Time Errors, JSP Request Time Errors, Creating a JSP Error Page.	<b>07 hrs</b>
<b>5</b>	<b>Java Beans</b> Concepts of Java Beans, Developing Java Beans, Controls and Properties of a Bean, Types of Properties.	<b>04 hrs</b>
<b>6</b>	<b>RMI</b> RMI Architecture, Designing RMI application, Executing RMI application	<b>08 hrs</b>
<b>Unit III</b>		
<b>7</b>	<b>Spring Framework</b> Introduction to spring 3.0, spring configuration, Aspect oriented programming and ADO, Data Access, Spring Web, Spring Security, Spring integration.	<b>05 hrs</b>
<b>8</b>	<b>Hibernate.</b> Introduction to Hibernate 3.0, Hibernate Architecture, First Hibernate Application.	<b>05 hrs</b>

**Text Books**

1. Herbert Schildt, Java the Complete Reference, 12th Edition Paperback, Tata McGraw-Hill, 2022.
2. Java 8 Programming Black Book, Dreamtech Press, 2018.

**Reference Books:**

1. [www.javatpoint.com](http://www.javatpoint.com)
2. [www.tutorialspoint.com](http://www.tutorialspoint.com)

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<b>Program: Bachelor of Computer Applications</b>		<b>Semester - V</b>
<b>Course Title: Big Data Analytics</b>		<b>Course Code: 22EBCC303</b>
<b>L-T-P: 3-0-1</b>	<b>Credits: 4</b>	<b>Contact Hours: 5hrs/week</b>
<b>ISA Marks: 50</b>	<b>ESA Marks: 50</b>	<b>Total Marks: 100</b>
<b>Teaching Hours: 40</b>	<b>Tutorial/Practical: 24</b>	<b>Exam Duration: 3hrs</b>
<b>Unit I</b>		
<b>1</b>	<b>Introduction:</b> What is Big Data? Data Analytics, Data Analytics Life Cycle, Big Data Characteristics, Different Types of Data.	<b>04 hrs</b>
<b>2</b>	<b>Big Data Storage</b> Clusters, File Systems and Distributed File Systems, NoSQL, Sharding, Replication, Combining Sharding and Replication. On Disk Storage Devices, In-memory Storage Devices.	<b>06 hrs</b>
<b>3</b>	<b>Big Data Processing</b> Parallel Data Processing, Distributed Data Processing, Hadoop, Map Reduce.	<b>05 hrs</b>
<b>Unit II</b>		
<b>4</b>	<b>Big Data Modeling</b> Data Model Structures, Data Model Operations, Processing Workloads, Processing in Batch Mode, Processing in Real-time Mode.	<b>08 hrs</b>
<b>5</b>	<b>Big Data Technologies</b> MongoDB - What is MongoDB? Why MongoDB? Terms Used in RDBMS and MongoDB, Data Types in MongoDB, MongoDB Query Language.	<b>07 hrs</b>
<b>Unit III</b>		
<b>6</b>	<b>Hive</b> What is Hive?, Hive Architecture, Hive Data Types, Hive File Format, Hive Query Language (HQL), RCFile Implementation, User-Defined Function (UDF).	<b>05 hrs</b>
<b>7</b>	<b>Big Data Visualization</b> 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.	<b>05 hrs</b>

**Text Books:**

1. "Big Data Fundamentals Concepts, Drivers & Techniques " by Thomas Erl, Wajid Khattak and Paul Buhler, Prentice Hall, 2015
2. "Big Data and Analytics" by Seema Acharya, Subhashini Chellappan, Wiley India Pvt Ltd 2014.

**Reference Books:**

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

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<b>Program: Bachelor of Computer Applications</b>		<b>Semester - V</b>
<b>Course Title: Cyber Security</b>		<b>Course Code: 22EBCE301</b>
<b>L-T-P: 3-0-1</b>	<b>Credits: 4</b>	<b>Contact Hours: 5hrs/week</b>
<b>ISA Marks: 50</b>	<b>ESA Marks: 50</b>	<b>Total Marks: 100</b>
<b>Teaching Hours: 40</b>	<b>Tutorial/Practical: 24</b>	<b>Exam Duration: 3hrs</b>
<b>Unit I</b>		
<b>1</b>	<b>Introduction to Cybercrime, Cyber offences, Cybercrime</b> 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.	<b>08 hrs</b>
<b>2</b>	<b>Tools and Methods used in Cybercrime, Phishing and identity Theft</b> 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.	<b>08 hrs</b>
<b>Unit II</b>		
<b>3</b>	<b>Cybercrimes and Cyber security: The Legal PerspectivesOrganizational Implications.</b> 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.	<b>08 hrs</b>
<b>4</b>	<b>Understanding computer Forensics, Forensics of Hand-held devices</b> 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.	<b>08 hrs</b>
<b>Unit III</b>		
<b>5</b>	<b>Social, Political, Ethical and Psychological Dimensions</b> Intellectual property at the Cyberspace; Ethical dimension of Cybercrimes; Psychology, Mindset and Skills of hackers and other cybercriminals; Sociology of cybercriminals.	<b>04 hrs</b>
<b>6</b>	<b>Cybercrime: Illustrations, Examples and Mini Cases</b> Introduction, Real-Life Examples, Case Studies: Illustrations of Financial Frauds in Cyber Domain, Digital Signature-Related Crime Scenarios, Digital forensics case illustrations Online Scams.	<b>04 hrs</b>

**Text Books:**

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

**Reference Books:**

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.

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<b>Program: Bachelor of Computer Applications</b>		<b>Semester - V</b>
<b>Course Title: Mobile Application Development</b>		<b>Course Code: 22EBCE309</b>
<b>L-T-P: 3-0-1</b>	<b>Credits: 4</b>	<b>Contact Hours: 5hrs/week</b>
<b>ISA Marks: 50</b>	<b>ESA Marks: 50</b>	<b>Total Marks: 100</b>
<b>Teaching Hours: 40</b>	<b>Tutorial/Practical: 24</b>	<b>Exam Duration: 3hrs</b>
<b>Unit I</b>		
<b>1</b>	<b>Introducing Flutter And Getting Started</b> 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.	<b>10 hrs</b>
<b>2</b>	<b>Creating A Hello World App</b> 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.	<b>06 hrs</b>
<b>Unit II</b>		
<b>3</b>	<b>Learning Dart Basics</b> 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.	<b>08 hrs</b>
<b>4</b>	<b>Creating A Starter Project Template</b> 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.	<b>08 hrs</b>
<b>Unit III</b>		
<b>5</b>	<b>Learning Dart Basics</b> 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.	<b>04 hrs</b>

6	<b>Creating A Starter Project Template</b> 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.	<b>04 hrs</b>
<b>Text Books:</b> <ol style="list-style-type: none"> <li>1. Flutter® A Hands On Guide To App Development by Marco L. Napoli.</li> <li>2. Beginning App Development with Flutter: Create Cross-Platform Mobile Apps, 1st Edition, by Rap Payne.</li> </ol>		
<b>Reference Books:</b> <ol style="list-style-type: none"> <li>1. Flutter for Beginners: An Introductory Guide to Building Cross-platform Mobile Applications with Flutter and Dart by Alessandro Biessek</li> <li>2. Flutter Cookbook - Second Edition: 100+ real-world recipes to build cross-platform applications by <u>Simone Alessandria</u>.</li> </ol>		

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<b>Program: Bachelor of Computer Applications</b>		<b>Semester - V</b>
<b>Course Title: Minor Project-2</b>		<b>Course Code: 22EBCP301</b>
<b>L-T-P: 0-0-5</b>	<b>Credits: 5</b>	<b>Contact Hours: 10hrs/week</b>
<b>ISA Marks: 50</b>	<b>ESA Marks: 50</b>	<b>Total Marks: 100</b>
<b>Teaching Hours: 150</b>	<b>Tutorial/Practical:--</b>	<b>Exam Duration: 3hrs</b>
<p><b>Project Theme: Machine Learning, Big Data, and IoT Integration for Real-Time Applications</b></p> <p>The projects under this theme focus on integrating Machine Learning, Big Data, and Internet of Things (IoT) technologies to create real-time applications capable of processing large data streams and making intelligent decisions based on analytics. The objective is to leverage real-time data collection from IoT devices and apply machine learning algorithms for predictive analytics, decision-making, or automation in sectors such as agriculture, climate monitoring, and smart cities. Students will explore how to handle massive data sets, implement machine learning models, and utilize IoT sensors for continuous data flow.</p> <p><b>Key technologies</b> include machine learning frameworks (such as TensorFlow or Scikit-learn), Big Data tools (like Hadoop and Spark), and IoT platforms for data collection and real-time monitoring. Projects could involve tasks such as forecasting weather patterns using IoT data, predictive maintenance in smart factories, or designing automated agricultural systems based on sensor data.</p> <p><b>Objectives:</b></p> <ol style="list-style-type: none"> <li>1. Conduct a comprehensive survey of real-world problems related to ML, Big Data, and IoT and prepare an SRS as per the IEEE standard.</li> <li>2. Collaborate effectively in teams to solve real-time data challenges.</li> <li>3. Identify suitable machine learning models, data processing pipelines, and IoT architecture for project development.</li> <li>4. Use machine learning, data processing, and IoT tools to design and implement a solution.</li> <li>5. Implement real-time data analytics using Big Data frameworks and IoT technologies.</li> </ol> <p><b>Learning Outcomes:</b></p> <p>At the end of the course, students will be able to:</p> <ol style="list-style-type: none"> <li>1. Identify and define a problem statement related to ML, Big Data, and IoT integration and justify the scope of the proposed solution.</li> <li>2. Gather and analyze real-time system requirements from IoT devices.</li> <li>3. Propose optimized machine learning models and real-time data handling techniques.</li> <li>4. Apply coding, debugging, and testing tools to enhance the quality of integrated solutions.</li> <li>5. Document and present real-time machine learning and IoT solutions following industry-standard guidelines.</li> </ol> <p><b>Methodology:</b></p> <p>Students will form teams of 3-4 members and select project categories such as real-time IoT monitoring systems, predictive analytics with Big Data, or automated decision systems based</p>		

on machine learning models. Projects should incorporate real-time data from IoT devices and apply machine learning algorithms to process and derive insights from the data.

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## VI semester

### Course Content

<b>Program: Bachelor of Computer Applications</b>		<b>Semester - VI</b>
<b>Course Title: Capstone Project</b>		<b>Course Code: 22EBCP302</b>
<b>L-T-P: 0-0-10</b>	<b>Credits: 10</b>	<b>Contact Hours: 20hrs/week</b>
<b>ISA Marks: 50</b>	<b>ESA Marks: 50</b>	<b>Total Marks: 100</b>
<b>Teaching Hours: 240</b>	<b>Tutorial/Practical:--</b>	<b>Exam Duration: 3hrs</b>
<b>Theme :</b> 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.		
<b>Objectives</b>		
<b>1</b>	Investigate and evaluate prominent literature connected to the Capstone project	
<b>2</b>	Showcase the skills and knowledge gained throughout the BCA program, including programming, software development, database management, and software development life cycle.	
<b>3</b>	Address a real-world problem or challenge relevant to the field of computer application and develop a solution using appropriate methodologies and technologies.	
<b>4</b>	Design, develop, and implement a software application, system, or tool, adhering to software engineering principles and best practices.	
<b>Learning Outcomes:</b> At the end of the capstone project, students will be able to: <div><div>1. Identify and define the problem statement and justify scope of the proposed problem</div><div>2. Gather and analyze system requirements</div><div>3. Propose an optimized solution among the existing solutions and practice software analysis and design techniques.</div><div>4. Apply coding, debugging and testing tools to enhance the quality of the software</div><div>5. Prepare the proper documentation of software projects following the standard guidelines to develop</div><div>6. Technical report writing and oral presentation.</div></div>		

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<b>Program: Bachelor of Computer Applications</b>		<b>Semester - VI</b>
<b>Course Title: Industry Training</b>		<b>Course Code: 22EBCI301</b>
<b>L-T-P: 0-0-8</b>	<b>Credits: 8</b>	<b>Contact Hours: 16hrs/week</b>
<b>ISA Marks: 200</b>	<b>ESA Marks: --</b>	<b>Total Marks: 200</b>
<b>Teaching Hours: --</b>	<b>Tutorial/Practical:--</b>	<b>Exam Duration: 3hrs</b>
<b>Overview of the Course:</b> <p>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.</p> <p>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.</p>		

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<b>Program: Bachelor of Computer Applications</b>		<b>Semester - VI</b>
<b>Course Title: Industry Project</b>		<b>Course Code: 22EBCI302</b>
<b>L-T-P: 0-0-10</b>	<b>Credits: 10</b>	<b>Contact Hours: 20hrs/week</b>
<b>ISA Marks: 50</b>	<b>ESA Marks: 50</b>	<b>Total Marks: 100</b>
<b>Teaching Hours: --</b>	<b>Tutorial/Practical:--</b>	<b>Exam Duration: 3hrs</b>
<b>Overview of the Course:</b> <p>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.</p> <p>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.</p>		

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### Elective Groups- Cyber Security

<b>Program: Bachelor of Computer Applications</b>		<b>Semester – V /VI</b>
<b>Course Title: Cyber Security</b>		<b>Course Code: 22EBCE301</b>
<b>L-T-P: 3-0-1</b>	<b>Credits: 4</b>	<b>Contact Hours: 5hrs/week</b>
<b>ISA Marks: 50</b>	<b>ESA Marks: 50</b>	<b>Total Marks: 100</b>
<b>Teaching Hours: 40</b>	<b>Tutorial/Practical: 24</b>	<b>Exam Duration: 3hrs</b>
<b>Unit I</b>		
<b>1</b>	<b>Introduction to Cybercrime, Cyber offences, Cybercrime</b>  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.	<b>08 hrs</b>
<b>2</b>	<b>Tools and Methods used in Cybercrime, Phishing and identity Theft</b> 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	<b>08 hrs</b>
<b>Unit II</b>		
<b>3</b>	<b>Cybercrimes and Cyber security: The Legal PerspectivesOrganizational Implications.</b> 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.	<b>08 hrs</b>
<b>4</b>	<b>Understanding computer Forensics, Forensics of Hand-held devices</b>  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.	<b>08 hrs</b>
<b>Unit III</b>		

5	<b>Social, Political, Ethical and Psychological Dimensions</b> Intellectual property at the Cyberspace; Ethical dimension of Cybercrimes; Psychology, Mindset and Skills of hackers and other cybercriminals; Sociology of cybercriminals.	<b>04 hrs</b>
6	<b>Cybercrime: Illustrations, Examples and Mini Cases</b> Introduction, Real-Life Examples, Case Studies: Illustrations of Financial Frauds in Cyber Domain, Digital Signature-Related Crime Scenarios, Digital forensics case illustrations Online Scams..	<b>04 hrs</b>
<b>Text Books:</b> 1. Nina Godbole & Sunit Belapure, “Cyber Security”, Wiley India, 2011 and Reprint 2018.		
<b>Reference Books:</b> 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		

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<b>Program: Bachelor of Computer Applications</b>		<b>Semester – V /VI</b>
<b>Course Title: Security Operations and Incident Response</b>		<b>Course Code: 22EBCE302</b>
<b>L-T-P: 3-0-1</b>	<b>Credits: 4</b>	<b>Contact Hours: 5hrs/week</b>
<b>ISA Marks: 50</b>	<b>ESA Marks: 50</b>	<b>Total Marks: 100</b>
<b>Teaching Hours: 40</b>	<b>Tutorial/Practical: 24</b>	<b>Exam Duration: 3hrs</b>
<b>Unit I</b>		
<b>1</b>	<b>Introduction to Security Operations</b> Overview of cyber security threats and challenges; Introduction to security operations and incident response; Frameworks and standards (e.g., NIST, ISO/IEC); Roles and responsibilities in security operations teams;	<b>05 hrs</b>
<b>2</b>	<b>Incident Detection and Analysis</b> Techniques for detecting security incidents; Log analysis and monitoring tools; Threat intelligence and indicator of compromise (IOC) analysis; Incident classification and prioritization	<b>10 hrs</b>
<b>Unit II</b>		
<b>3</b>	<b>Incident Response Process</b> Incident response lifecycle; Incident response plan development and implementation; Communication and coordination during incident response; Legal and regulatory considerations;	<b>07 hrs</b>
<b>4</b>	<b>Incident Containment and Eradication</b> Containment strategies and tactics; Malware analysis and remediation; System and network forensic techniques; Post-incident activities and lessons learned	<b>08 hrs</b>
<b>Unit III</b>		
<b>5</b>	<b>Security Tools and TechnologiesPart 1</b> Introduction to security tools (SIEM, IDS/IPS, EDR, etc.);	<b>05 hrs</b>
<b>6</b>	<b>Security Tools and TechnologiesPart 2</b> Integration of security tools into incident response processes;	<b>05 hrs</b>

**Text Books:**

1. "Incident Response & Computer Forensics" by Jason T. Luttgens, Matthew Pepe, Kevin Mandia.
2. "Security Operations Center - Building, Operating, and Maintaining Your SOC" by Joseph Muniz, Gary McIntyre, and Nadhem AlFardan

**Reference Books:**

1. "Computer Security Incident Handling Guide" by NIST
  2. "Blue Team Handbook: Incident Response Edition" by Don Murdoch
  3. "Practical Incident Response and Digital Forensics" by Nadean H. Tanner
  4. "The Incident Response Pocket Guide" by N. K. McCarthy
  5. "Security Operations Center - Building, Operating, and Maintaining Your SOC" by Joseph Muniz, Gary McIntyre, and Nadhem AlFardan
  6. "The Practice of Network Security Monitoring" by Richard Bejtlich
- "Incident Response: Investigating Computer Crime" by Chris Prosise and Kevin Mandia

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<b>Program: Bachelor of Computer Applications</b>		<b>Semester – V /VI</b>
<b>Course Title: Ethical Hacking and Penetration Testing</b>		<b>Course Code: 22EBCE303</b>
<b>L-T-P: 3-0-1</b>	<b>Credits: 4</b>	<b>Contact Hours: 5hrs/week</b>
<b>ISA Marks: 50</b>	<b>ESA Marks: 50</b>	<b>Total Marks: 100</b>
<b>Teaching Hours: 40</b>	<b>Tutorial/Practical: 24</b>	<b>Exam Duration: 3hrs</b>
<b>Unit I</b>		
<b>1</b>	<b>Introduction to Ethical Hacking &amp; Penetration testing</b> Overview of ethical hacking, Legal and ethical considerations, Different types of hackers, Introduction to penetration testing methodologies (e.g., reconnaissance, scanning, exploitation, post-exploitation)	<b>05 hrs</b>
<b>2</b>	<b>Information Gathering and Footprinting</b> Passive and active reconnaissance techniques, Using tools like Nmap, Wireshark, and OSINT (Open Source Intelligence), Footprinting and fingerprinting	<b>05 hrs</b>
<b>3</b>	<b>Scanning and Enumeration</b> Network scanning techniques (e.g., port scanning, vulnerability scanning), Host discovery and enumeration, Service enumeration, Banner grabbing	<b>05 hrs</b>
<b>Unit II</b>		
<b>4</b>	<b>Vulnerability Assessment</b> Understanding vulnerabilities and exploits; Vulnerability assessment tools (e.g., Nessus, OpenVAS); Exploit frameworks (e.g., Metasploit);	<b>05 hrs</b>
<b>5</b>	<b>Exploitation and Post-Exploitation</b> Exploiting vulnerabilities ethically; Privilege escalation, techniques; Maintaining access and covering tracks; Post-exploitation activities (e.g., data exfiltration, lateral movement)	<b>10 hrs</b>
<b>Unit III</b>		
<b>6</b>	<b>Web Application Security</b> Common web vulnerabilities (e.g., SQL injection, XSS, CSRF); Web application testing methodologies; Tools for web application security testing (e.g., Burp Suite, OWASP ZAP)	<b>05 hrs</b>
<b>7</b>	<b>Wireless Network Security</b> Wireless security concepts (e.g., WEP, WPA, WPA2); Wireless attacks (e.g., deauthentication attacks, rogue access points); Wireless security testing tools (e.g., Aircrack-ng, Kismet)	<b>05 hrs</b>
<b>8</b>	<b>Social Engineering and Physical Security</b> Understanding social engineering tactics; Phishing attacks and countermeasures Physical security assessment techniques	

**Text Books:**

1. Sanjib Sinha, "Beginning Ethical Hacking with Python" Apress, 2018
2. Sanjib Sinha, "Beginning Ethical Hacking with Kali, Computational Techniques for resolving security issues" Apress, 2018
3. "The Hacker Playbook" by Peter Kim
4. Penetration Testing: A Hands-On Introduction to Hacking" by Georgia Weidman

**Reference Books:**

1. Patrick Engebretson, "Basics of Hacking and Penetration Testing", Second Edition, Elsevier.
2. Introduction to Ethical Hacking:  
[https://www.tutorialspoint.com/ethical\\_hacking/index.htm](https://www.tutorialspoint.com/ethical_hacking/index.htm)

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<b>Program: Bachelor of Computer Applications</b>		<b>Semester – V /VI</b>
<b>Course Title: Blockchain Technologies</b>		<b>Course Code: 22EBCE304</b>
<b>L-T-P: 3-0-1</b>	<b>Credits: 4</b>	<b>Contact Hours: 5hrs/week</b>
<b>ISA Marks: 50</b>	<b>ESA Marks: 50</b>	<b>Total Marks: 100</b>
<b>Teaching Hours: 40</b>	<b>Tutorial/Practical: 24</b>	<b>Exam Duration: 3hrs</b>
<b>Unit I</b>		
<b>1</b>	<b>Introduction:</b> Overview of block chain, Digital Money to Distributed Ledgers, Design Primitives: Protocols, Security, Consensus, Types of block chain, block chain platforms, Block chain Architecture, Block chain Use Cases: Finance, E-Governance, Supply chain management, Healthcare management and cyber security.	<b>08 hrs</b>
<b>2</b>	<b>Cryptography Basics:</b> Introduction to cryptography, Public key crypto: Introduction, RSA, Public key infrastructure, Hash Functions: Properties of Hash Functions, SHA, Digital signature Schemes, Merkle trees.	<b>08 hrs</b>
<b>Unit II</b>		
<b>3</b>	<b>Consensus Mechanisms and Mining</b> Consensus in Distributed Systems, Consensus mechanisms in Permission less block chain: Proof of Work, Proof of Stake (POS), Proof of Activity, Delegated POS, Proof of Elapsed Time. Consensus mechanisms in Permissioned Block chain: RAFT, Practical Byzantine Fault Tolerance (PBFT), Scalability of consensus algorithms.	<b>08 hrs</b>
<b>4</b>	<b>Ethereum and Smart Contracts :</b> Ethereum transactions, accounts, smart contracts, smart contract development, Solidity basics, basic contracts, distributed storage and IPFS, Ethereum scaling, Applications of Ethereum Smart contracts: Tokens and Token Standards, Fungible and Non-Fungible Tokens, crowd funding	<b>08 hrs</b>
<b>Unit III</b>		
<b>5</b>	<b>Enterprise Block chain Platforms</b> Hyperledger Fabric: Introduction, Architecture, Identity, Membership and Peer Management, Chain codes. Corda: Principal Features, Architecture, CorDapp. Consensus Mechanisms in Hyperledger Fabric and Corda.	<b>08 hrs</b>
<b>Text Books:</b> 1. Imran Bashir "Mastering Blockchain ", 3st Edition, Packt Media, 2020.		
<b>Reference Books:</b> 1. Melanie Swan, "Blockchain: Blueprint for New Economy", 1st Edition, O'Reilly Media, 2014. 2. ArshdeepBhaga, Vijay Madiseti, "Blockchain Applications: A Hands-On Approach", 1st Edition, VPT, January 31, 2017.		

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<b>Program: Bachelor of Computer Applications</b>		<b>Semester – V /VI</b>
<b>Course Title: Digital Forensics</b>		<b>Course Code: 22EBCE305</b>
<b>L-T-P: 3-0-1</b>	<b>Credits: 4</b>	<b>Contact Hours: 5hrs/week</b>
<b>ISA Marks: 50</b>	<b>ESA Marks: 50</b>	<b>Total Marks: 100</b>
<b>Teaching Hours: 40</b>	<b>Tutorial/Practical: 24</b>	<b>Exam Duration: 3hrs</b>
<b>Unit I</b>		
<b>1</b>	<b>Forensic Science:</b> Forensics science, Computer forensics, and digital forensics. Computer Crime: Criminalistics as it relates to the investigative process, analysis of cyber Criminalistics area, holistic approach to cyber-forensics	<b>05 hrs</b>
<b>2</b>	<b>Digital forensic:</b> Understanding computer forensics, computer forensics versus other related disciplines, A brief History of computer Forensics, Understanding case laws, Developing computer forensics resources, Preparing for computer investigations, Understanding law enforcement agency investigations, Following the legal process, Understanding corporate investigations, Establishing company policies, Displaying warning Banners.	<b>10 hrs</b>
<b>Unit II</b>		
<b>3</b>	<b>Incident- Cyber Crime Scene Analysis:</b> Discuss the various court orders etc., methods to search and seizure electronic evidence, retrieved and un-retrieved communications	<b>07 hrs</b>
<b>4</b>	<b>Data Forensics:</b> Recovering deleted files and deleted partitions, deleted file recovery tools deleted partitioned recovery tools, data acquisition and duplication, data acquisition tools hardware tools, backing up and duplicating data.	<b>08 hrs</b>
<b>Unit III</b>		
<b>5</b>	<b>Digital Forensics Introduction to Digital Forensics, Forensic Software and Hardware, Analysis and Advanced Tools, Forensic Technology and Practices, Forensic Ballistics and Photography, Face, Iris and Fingerprint Recognition, Audio Video Analysis</b>	<b>05 hrs</b>
<b>6</b>	<b>Windows System Forensics, Linux System Forensics, WIFI Security (War-driving), Network Forensics, Mobile Forensics, Cloud Forensics.</b>	<b>05 hrs</b>

**Text Books:**

1. Cory Altheide, Harlan Carvey, Digital Forensics with Open Source Tools, Syngress imprint of Elsevier.

**Reference Books:**

1. Guide to Computer Forensics and Investigations, Bill Nelson, Amelia Phillips, Christopher Steuart, Fourth Edition, Course Technology
2. Digital forensics: Digital evidence in criminal investigation, Angus M.Marshall, John – Wiley and Sons, 2008.
3. Cybercrime and Digital Forensics, , Anthony Reyes, Jack Wiles, Syngress Publishers, Elsevier 2007
4. The Basics of Digital Forensics, John Sammons, Elsevier 2012

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<b>Program: Bachelor of Computer Applications</b>		<b>Semester – V /VI</b>
<b>Course Title: Cyber Attacks and Counter Measures</b>		<b>Course Code: 22EBCE306</b>
<b>L-T-P: 3-0-1</b>	<b>Credits: 4</b>	<b>Contact Hours: 5hrs/week</b>
<b>ISA Marks: 50</b>	<b>ESA Marks: 50</b>	<b>Total Marks: 100</b>
<b>Teaching Hours: 40</b>	<b>Tutorial/Practical: 24</b>	<b>Exam Duration: 3hrs</b>
<b>Unit I</b>		
<b>1</b>	<b>Introduction to Cybersecurity:</b> Definition and importance of cyber security, Security: Basics, User Access Controls, Authentication, Access Control: Framework, Techniques and Technologies, Cyber security terminologies and concepts: confidentiality, integrity, and availability (CIA triad), risk management, threat modeling, and vulnerability assessment. Technical Security Controls: Preventive, Detective, Corrective. Protection from malicious attacks	<b>08 hrs</b>
<b>2</b>	<b>Cyber Attacks:</b> Introduction, Types of attacks: Malware (viruses, worms, trojans), phishing, ransomware, denial-of-service (DoS) attacks, and man-in-the-middle (MITM) attacks. Impact of cyber-attacks: Discuss the consequences of cyber-attacks on individuals, organizations, and society, including financial losses, data breaches, and reputational damage. Assets: Identification, Accountability. Vulnerability and Threats.	<b>04 hrs</b>
<b>3</b>	<b>Cyber security Laws and Ethics:</b> Overview of cybersecurity laws and regulations: General Data Protection Regulation (GDPR), the Computer Fraud and Abuse Act (CFAA), and the Cybersecurity Information Sharing Act (CISA). Ethical considerations in cybersecurity: Discuss ethical principles and dilemmas related to cybersecurity practices, including privacy, data ownership, and the responsible disclosure of vulnerabilities.	<b>04 hrs</b>
<b>Unit II</b>		
<b>4</b>	<b>Security Measures:</b> Encryption and data protection: Introduce encryption algorithms and protocols for securing data, including AES, RSA, and SSL/TLS. Security policies and procedures: Discuss the importance of developing and enforcing security policies, including acceptable use policies, incident response plans, and disaster recovery plans. Network Security: Firewalls, VPNs, and intrusion detection systems (IDS) Data Security: Data protection strategies, Backup and recovery.	<b>08 hrs</b>
<b>5</b>	<b>Cyber Attack Detection and Prevention:</b> Intrusion detection and prevention systems: IDS and IPS for detecting and mitigating cyber-attacks. Incident response and management: Discuss the process of responding to cybersecurity incidents, including incident detection, analysis, containment, eradication, and recovery.	<b>08 hrs</b>
<b>Unit III</b>		

<b>6</b>	<b>Cryptography:</b> Objectives, Type, OS Encryption, Public key Cryptography	<b>04 hrs</b>
<b>7</b>	<b>Cyber security Tools:</b> Overview of cyber security tools and software: antivirus programs,	<b>04 hrs</b>
<b>Text Books:</b> <ol style="list-style-type: none"> <li>1. "Principles of Computer Security" by Wm. Arthur Conklin, Gregory White, Chapters-1,4,6</li> <li>2. "Cyber security Essentials" by Charles J. Chapter-1,2,4</li> <li>3. "Computer Security Basics" by Rick Lehtinen, Deborah Russell, and G.T. Gangemi Sr. Chapter-1</li> <li>4. "Introduction to Computer Security" by Michael T. Goodrich and Roberto Tamassia Chapter-4,6</li> <li>5. "Security in Computing" by Charles P. Pfleeger and Shari Lawrence Pfleeger Chapter-1,2,6</li> <li>6. Sunit Belapure and Nina Godbole, "Cyber Security: Understanding Cyber Crimes, Computer Forensics And Legal Perspectives", Wiley India Pvt Ltd, ISBN: 978-81- 265-21791, 2011, First Edition (Reprinted 2018)</li> </ol>		
<b>Reference Books:</b> <ol style="list-style-type: none"> <li>5. Roberta Bragg, Mark Rhodes Ousley, Keith Strassberg, The Complete Reference – Network Security, TMH 2014</li> </ol>		

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### Elective Groups- Software Engineering

<b>Program: Bachelor of Computer Applications</b>		<b>Semester – V /VI</b>
<b>Course Title: User Interface Design</b>		<b>Course Code: 22EBCE307</b>
<b>L-T-P: 3-0-1</b>	<b>Credits: 4</b>	<b>Contact Hours: 5hrs/week</b>
<b>ISA Marks: 50</b>	<b>ESA Marks: 50</b>	<b>Total Marks: 100</b>
<b>Teaching Hours: 40</b>	<b>Tutorial/Practical: 24</b>	<b>Exam Duration: 3hrs</b>
<b>Unit I</b>		
<b>1</b>	<b>What Users Do</b> The Basics of User Research ,Users’ Motivation to Learn, The Patterns.	<b>05 hrs</b>
<b>2</b>	<b>Organizing the Content: Information Architecture and Application Structure</b> The Big Picture, The Patterns:- Feature, Search, and Browse, News Stream, Picture Manager, Dashboard, Canvas Plus Palette, Wizard.	<b>05 hrs</b>
<b>3</b>	<b>Getting Around: Navigation, Signposts, and Wayfinding</b> 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.	<b>06 hrs</b>
<b>Unit II</b>		
<b>4</b>	<b>Organizing the Page: Layout of Page Elements</b> The Basics of Page Layout, The Patterns:- Visual Framework, Center Stage, Grid of Equals, Titled Sections, Module Tabs, Collapsible Panels, Movable Panels, Right/Left Alignment, Diagonal Balance.	<b>05 hrs</b>
<b>5</b>	<b>Lists of Things</b> 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.	<b>05 hrs</b>
<b>6</b>	<b>Doing Things: Actions and Commands</b> Pushing the Boundaries, The Patterns:- Button Groups, Hover Tools, Action Panel, Smart Menu Items, Preview, Progress Indicator, Macros.	<b>06 hrs</b>
<b>Unit III</b>		
<b>6</b>	<b>Showing Complex Data: Trees, Charts, and Other Information Graphics</b> 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, Treemap.	<b>04 hrs</b>

<b>7</b>	<b>Getting Input from Users: Forms and Controls</b> The Basics of Form Design, Control Choice, The Patterns:- Forgiving Format, Structured Format, Fill-in-the-Blanks, Input Hints, Input Prompt, Password Strength Meter, Autocompletion, Dropdown Chooser, Same-Page Error Messages.	<b>04 hrs</b>
<b>Text Books:</b> 1. Jenifer Tidwell , Designing Interfaces, 2nd Edition,O'Reilly ,2010		
<b>Reference Books:</b> 1. Laws of UX, Jon Yablonski, O'Reilly, April 2020. 2. 100 Things Every Designer Needs to Know About People, Susan Weinschenk, New Riders, 2011. 3. Jodie Moule., Killer UX Design, SitePoint,2012		

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<b>Program: Bachelor of Computer Applications</b>		<b>Semester – V /VI</b>
<b>Course Title: ASP.NET MVC Framework</b>		<b>Course Code: 22EBCE308</b>
<b>L-T-P: 3-0-1</b>	<b>Credits: 4</b>	<b>Contact Hours: 5hrs/week</b>
<b>ISA Marks: 50</b>	<b>ESA Marks: 50</b>	<b>Total Marks: 100</b>
<b>Teaching Hours: 40</b>	<b>Tutorial/Practical: 24</b>	<b>Exam Duration: 3hrs</b>
<b>Unit I</b>		
<b>1</b>	<b>Introduction to ASP.NET MVC</b> 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	<b>08 hrs</b>
<b>2</b>	<b>MVC Application</b> 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, Completing the Example.	<b>08 hrs</b>
<b>Unit II</b>		
<b>3</b>	<b>The MVC Pattern</b> 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.	<b>08 hrs</b>
<b>4</b>	<b>Essential Language Features</b> 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	<b>08 hrs</b>
<b>Unit III</b>		

<b>5</b>	<b>Essential Tools for MVC</b> Preparing the Example Project, Creating the Model Classes, Adding the Controller, Adding the View, Using Ninject, Understanding the Problem, Adding Ninject to the <b>Visual Studio</b> Project, Getting Started with Ninject,	<b>04 hrs</b>
<b>6</b>	<b>Unit Testing with Visual Studio</b> 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.	<b>04 hrs</b>
<b>Text Books:</b> <ol style="list-style-type: none"> <li>1. Pro ASP.NET MVC 5, Publisher Apress, 5th ed. 13 January 2014</li> <li>2. Beginning ASP.NET 4.5 in C#, Matthew Mac Donald, Dreamtech Press; Apress Special Priced edition (1 January 2012).</li> <li>3. Pro C# 9 with .NET 5, Foundational Principles and Practices in Programming, Apress, Troelsen, Andrew, Japikse, Philip, 10 editions.</li> </ol>		
<b>Reference Books:</b> <ol style="list-style-type: none"> <li>1. ASP.NET Developer's Guide Publisher: McGraw Hill Education (1 July 2017).</li> <li>2. Professional ASP.NET 4.5 in C# and VB" by Jason N. Gaylord, Christian Wenz, Pranav Rastogi, Todd Miranda, and Scott Hanselman, 2016.</li> </ol>		

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<b>Program: Bachelor of Computer Applications</b>		<b>Semester – V/VI</b>
<b>Course Title: Mobile Application Development</b>		<b>Course Code: 22EBCE309</b>
<b>L-T-P: 3-0-1</b>	<b>Credits: 4</b>	<b>Contact Hours: 5hrs/week</b>
<b>ISA Marks: 50</b>	<b>ESA Marks: 50</b>	<b>Total Marks: 100</b>
<b>Teaching Hours: 40</b>	<b>Tutorial/Practical: 24</b>	<b>Exam Duration: 3hrs</b>
<b>Unit I</b>		
<b>1</b>	<b>Introducing Flutter And Getting Started</b> 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.	<b>10 hrs</b>
<b>2</b>	<b>Creating A Hello World App</b> 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 StatelessWidget and StatefulWidget Widgets, Using External Packages, Searching for Packages, Using Packages.	<b>06 hrs</b>
<b>Unit II</b>		
<b>3</b>	<b>Learning Dart Basics</b> 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.	<b>08 hrs</b>
<b>4</b>	<b>Creating A Starter Project Template</b> 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.	<b>08 hrs</b>
<b>Unit III</b>		
<b>5</b>	<b>Learning Dart Basics</b> 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.	<b>04 hrs</b>

6	<b>Creating A Starter Project Template</b> 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.	04 hrs
<b>Text Books:</b> <ol style="list-style-type: none"> <li>1. Flutter® A Hands On Guide To App Development by Marco L. Napoli.</li> <li>2. Beginning App Development with Flutter: Create Cross-Platform Mobile Apps, 1st Edition, by Rap Payne.</li> </ol>		
<b>Reference Books:</b> <ol style="list-style-type: none"> <li>1. Flutter for Beginners: An Introductory Guide to Building Cross-platform Mobile Applications with Flutter and Dart by Alessandro Biessek</li> <li>2. Flutter Cookbook - Second Edition: 100+ real-world recipes to build cross-platform applications by <u>Simone Alessandria</u>.</li> </ol>		

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<b>Program: Bachelor of Computer Applications</b>		<b>Semester – V/VI</b>
<b>Course Title: Agile Project Management</b>		<b>Course Code: 22EBCE310</b>
<b>L-T-P: 3-0-1</b>	<b>Credits: 4</b>	<b>Contact Hours: 5hrs/week</b>
<b>ISA Marks: 50</b>	<b>ESA Marks: 50</b>	<b>Total Marks: 100</b>
<b>Teaching Hours: 40</b>	<b>Tutorial/Practical: 24</b>	<b>Exam Duration: 3hrs</b>
<b>Unit I</b>		
<b>1</b>	<b>Introduction</b> Need of Agile software development, agile context– Manifesto, Principles, Methods, Values, Roles, Artifacts, Stakeholders, and challenges. Business benefits of software agility.	<b>07 hrs</b>
<b>2</b>	<b>Project Planning</b> 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.	<b>07 hrs</b>
<b>Unit II</b>		
<b>3</b>	<b>Project Design</b> Fundamentals, Design principles–Single responsibility, Open-closed, Liskov substitution, Dependency-inversion, Interface-segregation.	<b>08 hrs</b>
<b>4</b>	<b>Design Methodologies</b> 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.	<b>06 hrs</b>
<b>Unit III</b>		
<b>5</b>	<b>Extreme Programming and Testing</b> 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	<b>07 hrs</b>
<b>6</b>	<b>Impact on Testing</b> verifying stories, writing a user acceptance test, Developing effective test suites, Continuous integration, Code refactoring. Risk based testing, Regression tests, Test automation.	<b>04 hrs</b>



**Text Books:**

1. Ken Schawber, Mike Beedle, “Agile Software Development with Scrum”, International Edition, Pearson.
2. Robert C. Martin, “Agile Software Development, Principles, Patterns and Practices”, First International Edition, Prentice Hall.
3. Pedro M. Santos, Marco Consolaro, and Alessandro Di Gioia, “Agile Technical Practices Distilled: A
4. learning journey in technical practices and principles of software design”, First edition, Packt Publisher.

**Reference Books:**

1. Lisa Crispin, Janet Gregory, “Agile Testing: A Practical Guide for Testers and Agile Teams”, International edition, Addison Wesley.
2. Alistair Cockburn, “Agile Software Development: The Cooperative Game”, 2nd Edition, Addison-Wesley

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<b>Program: Bachelor of Computer Applications</b>		<b>Semester – V/VI</b>
<b>Course Title: Secure Software Engineering</b>		<b>Course Code: 22EBCE311</b>
<b>L-T-P: 3-0-1</b>	<b>Credits: 4</b>	<b>Contact Hours: 5hrs/week</b>
<b>ISA Marks: 50</b>	<b>ESA Marks: 50</b>	<b>Total Marks: 100</b>
<b>Teaching Hours: 40</b>	<b>Tutorial/Practical: 24</b>	<b>Exam Duration: 3hrs</b>
<b>Unit I</b>		
<b>1</b>	<b>System Complexity &amp; Context</b> 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.	<b>10 hrs</b>
<b>2</b>	<b>Introduction to Properties of Secure Software</b> 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.	<b>06 hrs</b>
<b>Unit II</b>		
<b>3</b>	<b>Importance of Requirements Engineering</b> 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..	<b>08 hrs</b>
<b>4</b>	<b>Requirements Elicitation:</b> 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.	<b>08 hrs</b>
<b>Unit III</b>		
<b>5</b>	<b>Software Security</b> Software Security Knowledge for Architecture and Design Security Principles, Security Guidelines, and Attack Patterns: Security Principles, Security Guidelines, Attack Patterns	<b>04 hrs</b>

6	<b>Software Security Testing:</b> Contrasting Software Testing and Software Security Testing, Functional Testing, Risk-Based Testing.	<b>04 hrs</b>
<b>Text Books:</b> 1. Software Security Engineering A Guide for Project Managers by Julia H.Allen, ean J. Barnum, Robert J. Ellison and Gary McGraw, May 11, 2008.		
<b>Reference Books:</b> 1. John Musa D, "Software Reliability Engineering", 2nd Edition, Tata McGraw-Hill, 2005 <b>e-Learning Resources:</b> 1. <a href="http://study.com/articles/List_of_Free_Online_Software_Engineering_Courses.html">http://study.com/articles/List_of_Free_Online_Software_Engineering_Courses.html</a> <a href="https://www.coursera.org/course/softwaresec">https://www.coursera.org/course/softwaresec</a>		

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<b>Program: Bachelor of Computer Applications</b>		<b>Semester – V/VI</b>
<b>Course Title: Object Oriented Modelling and Design</b>		<b>Course Code: 22EBCE312</b>
<b>L-T-P: 3-0-1</b>	<b>Credits: 4</b>	<b>Contact Hours: 5hrs/week</b>
<b>ISA Marks: 50</b>	<b>ESA Marks: 50</b>	<b>Total Marks: 100</b>
<b>Teaching Hours: 40</b>	<b>Tutorial/Practical: 24</b>	<b>Exam Duration: 3hrs</b>
<b>Unit I</b>		
<b>1</b>	<b>Introduction, modeling concepts, class modeling, Advanced class modeling.</b> 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.	<b>08 hrs</b>
<b>2</b>	<b>State modeling, Advanced state modeling.</b> 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.	<b>08 hrs</b>
<b>Unit II</b>		
<b>3</b>	<b>Interaction modeling ,Advanced interaction modeling's</b> Interaction Modeling; Use case models, Sequence models, Activity models, Advanced interaction modeling: Use case relationships, Procedural sequence models; Special constructs for activity models.	<b>04 hrs</b>
<b>4</b>	<b>Process overview, system conception, domain analysis</b> 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.	<b>06 hrs</b>
<b>5</b>	<b>Application analysis, system design</b> 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.	<b>06 hrs</b>
<b>Unit III</b>		

<b>6</b>	<b>Class design</b> 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.	<b>04 hrs</b>
<b>7</b>	<b>Design Pattern:</b> What is a pattern and what makes a pattern? Relationships between patterns, Pattern description. Pattern categories; Communication	<b>04 hrs</b>
<b>Text Books:</b> 1. Object-Oriented Modeling and Design with UML- Michael Blaha, James Rumbaugh, 2nd Edition, Pearson education, 2005. 2. Pattern–Oriented Software Architecture : A System of Patterns-Volume 1-Frank Busch Mann, Regine Meunier, Hans Rohnert, Peter sommerland, Michael Stal, John Wiley and Sons, 2006		
<b>Reference Books:</b> 1. Object Oriented Analysis and Design with Applications-Grady Booch et al, 3rd Edition, Pearson education, 2007. 2. Object-Oriented Design with UML JAVA- K.Barclay, J. Savage, Elsevier, 2 3. The Unified Modeling Language User Guide- Booch, G., Rumbaugh, J. and Jacobson I, 2nd Edition, Pearson, 2005. 4. Design Patterns: Elements of reusable Object-Oriented software- E. Gamma, R. Helm, R. Johnson, J. Vlissides, Addison-Wesley, 1995.		

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### Elective Group - Data Analytics and Machine Learning

<b>Program: Bachelor of Computer Applications</b>		<b>Semester – V/VI</b>
<b>Course Title: Statistical Techniques for Data Analytics</b>		<b>Course Code: 22EBCE313</b>
<b>L-T-P: 3-0-1</b>	<b>Credits: 4</b>	<b>Contact Hours: 5hrs/week</b>
<b>ISA Marks: 50</b>	<b>ESA Marks: 50</b>	<b>Total Marks: 100</b>
<b>Teaching Hours: 40</b>	<b>Tutorial/Practical: 24</b>	<b>Exam Duration: 3hrs</b>
<b>Unit I</b>		
<b>1</b>	<b>Introduction to Statistics:</b> 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.	<b>08 hrs</b>
<b>2</b>	<b>Statistical Inference:</b> 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.	<b>08 hrs</b>
<b>Unit II</b>		
<b>3</b>	<b>Regression Analysis:</b> 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.	<b>08 hrs</b>
<b>4</b>	<b>Time Series Analysis:</b> Time series data: Components, trends, seasonality, autocorrelation. Forecasting methods: Moving averages, exponential smoothing, ARIMA models.	<b>08 hrs</b>
<b>Unit III</b>		
<b>5</b>	<b>Machine Learning Fundamentals:</b> 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	<b>04 hrs</b>
<b>6</b>	<b>Data Visualization:</b> Principles of effective data visualization. Tools and techniques for creating visualizations (e.g., matplotlib, seaborn, ggplot2). Interpretation of visualizations.	<b>04 hrs</b>

**Text Books:**

1. 1. "An Introduction to Statistical Learning" by Gareth James, Daniela Witten, Trevor Hastie, and Robert Tibshirani.
2. "Introduction to the Practice of Statistics" by David S. Moore, George P. McCabe, and Bruce A. Craig

**Reference Books:**

1. "Applied Predictive Modeling" by Max Kuhn and Kjell Johnson.
2. "Practical Statistics for Data Scientists" by Andrew Bruce and Peter Bruce.
3. "Discovering Statistics Using R" by Andy Field, Jeremy Miles, and Zoe Field

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<b>Program: Bachelor of Computer Applications</b>		<b>Semester – V/VI</b>
<b>Course Title: Internet of Things</b>		<b>Course Code: 22EBCE314</b>
<b>L-T-P: 3-0-1</b>	<b>Credits: 4</b>	<b>Contact Hours: 5hrs/week</b>
<b>ISA Marks: 50</b>	<b>ESA Marks: 50</b>	<b>Total Marks: 100</b>
<b>Teaching Hours: 40</b>	<b>Tutorial/Practical: 24</b>	<b>Exam Duration: 3hrs</b>
<b>Unit I</b>		
<b>1</b>	<b>Introduction to IoT</b> Definition and concepts of IoT, Evolution and history of IoT, Applications and use cases, Challenges and opportunities	<b>08 hrs</b>
<b>2</b>	<b>IoT Architecture</b> 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.	<b>08 hrs</b>
<b>Unit II</b>		
<b>3</b>	<b>IoT Communication Protocols</b> Wireless protocols (e.g., Wi-Fi, Bluetooth, Zigbee), IoT-specific protocols (e.g., MQTT, CoAP, HTTP), Security considerations in IoT communication.	<b>08 hrs</b>
<b>4</b>	<b>IoT Hardware Platforms</b> Introduction to microcontrollers and microprocessors, Evaluation of popular IoT development boards (e.g., Arduino, Raspberry Pi), Sensors and actuators integration	<b>08 hrs</b>
<b>Unit III</b>		
<b>5</b>	<b>IoT Data Processing and Analytics</b> Data collection, storage, and retrieval. Real-time data processing techniques, Data visualization and interpretation <b>IoT Applications and Case Studies:</b> Smart cities, Industrial IoT (IIoT), Healthcare IoT, Agriculture IoT.	<b>04 hrs</b>
<b>6</b>	<b>IoT Security and Privacy</b> Threats and vulnerabilities in IoT systems, Security mechanisms (e.g., encryption, authentication), Privacy concerns and regulations. <b>IoT Project Development :</b> Project planning and management, Hands-on IoT project development, Presentation and documentation	<b>04 hrs</b>

**Text Books:**

1. "Internet of Things (A Hands-on Approach)" by Arshdeep Bahga, Vijay Madisetti. 2015

**Reference Books:**

1. "Building Internet of Things with the Arduino" by Charalampos Doukas 2011
2. "Raspberry Pi IoT Projects: Prototyping Experiments for Makers" by John C. Shovic 2013
3. "Designing Connected Products: UX for the Consumer Internet of Things" by Claire Rowland, Elizabeth Goodman, Martin Charlier, Ann Light 2014
4. "Practical Internet of Things Security" by Brian Russell, Drew Van Duren 2013
5. "Interconnecting Smart Objects with IP: The Next Internet" by Jean-Philippe Vasseur, Adam Dunkels

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<b>Program: Bachelor of Computer Applications</b>		<b>Semester – V/VI</b>
<b>Course Title: Natural Language Processing</b>		<b>Course Code: 22EBCE315</b>
<b>L-T-P: 3-0-1</b>	<b>Credits: 4</b>	<b>Contact Hours: 5hrs/week</b>
<b>ISA Marks: 50</b>	<b>ESA Marks: 50</b>	<b>Total Marks: 100</b>
<b>Teaching Hours: 40</b>	<b>Tutorial/Practical: 24</b>	<b>Exam Duration: 3hrs</b>
<b>Unit I</b>		
<b>1</b>	<b>Introduction to Natural Language Processing</b> Overview of NLP and its applications, Historical background and evolution of NLP, Challenges in natural language understanding, Basic components of NLP systems	<b>08 hrs</b>
<b>2</b>	<b>Text Preprocessing</b> Tokenization, Stop word removal, Stemming and Lemmatization, Part-of-speech tagging, Named Entity Recognition (NER)	<b>08 hrs</b>
<b>Unit II</b>		
<b>3</b>	<b>Language Modeling:</b> N-grams, Statistical language models, Neural language models (e.g., Word2Vec, GloVe)	<b>08 hrs</b>
<b>4</b>	<b>Syntax and Parsing:</b> Syntax and grammar rules, Dependency parsing, Constituency parsing, Parsing algorithms (e.g., CYK, Earley)	<b>08 hrs</b>
<b>Unit III</b>		
<b>5</b>	<b>Sentiment Analysis and Text Classification</b> Basics of sentiment analysis, Feature extraction for sentiment analysis, Machine learning algorithms for sentiment analysis, Text classification techniques (e.g., Naive Bayes, SVM)	<b>04 hrs</b>
<b>6</b>	<b>Machine Translation and Language Generation</b> Overview of machine translation, Statistical machine translation vs. neural machine translation, Sequence-to-sequence models, Text generation techniques (e.g., Markov chains, LSTM)	<b>04 hrs</b>

**Text Books:**

1. Tanveer Siddiqui, U.S. Tiwary, "Natural Language Processing and Information Retrieval", Oxford University Press, 2008.
2. Steven Bird, Ewan Klein, and Edward Loper "Natural Language Processing with Python" Published by O'Reilly Media, First Edition.

**Reference Books:**

1. Daniel Jurafsky and James H Martin, "Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition", 2nd Edition, Prentice Hall, 2008.
2. James Allen, "Natural Language Understanding", 2nd edition, Benjamin/Cummings publishing company, 1995.

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<b>Program: Bachelor of Computer Applications</b>		<b>Semester – V/VI</b>
<b>Course Title: Social Network Analysis</b>		<b>Course Code: 22EBCE316</b>
<b>L-T-P: 3-0-1</b>	<b>Credits: 4</b>	<b>Contact Hours: 5hrs/week</b>
<b>ISA Marks: 50</b>	<b>ESA Marks: 50</b>	<b>Total Marks: 100</b>
<b>Teaching Hours: 40</b>	<b>Tutorial/Practical: 24</b>	<b>Exam Duration: 3hrs</b>
<b>Unit I</b>		
<b>1</b>	<b>Introduction to Online Social Networks:</b> Types of social networks, Measurement and Collection of Social Network Data. Techniques to study different aspects of OSNs — Follower-followee dynamics	<b>05 hrs</b>
<b>2</b>	<b>Digital Influence and Content Strategies</b> 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	<b>10 hrs</b>
<b>Unit II</b>		
<b>3</b>	<b>Social Data Analytics :</b> Working with Social Media Data, Topic Models, Modelling social interactions on the Web – Agent Based Simulations, Random Walks and variants	<b>05 hrs</b>
<b>4</b>	<b>Impact of Social Network Influence:</b> Case Study: Social Network Influence on Mode Choice and Carpooling during Special Events: The Case of Purdue Game Day	<b>10 hrs</b>
<b>Unit III</b>		
<b>5</b>	<b>Advanced Text Analytics</b> 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	<b>05 hrs</b>
<b>6</b>	<b>Community Dynamics and Influence in Social Networks</b> 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	<b>05 hrs</b>

**Text Books:**

1. Cioffi-Revilla, Claudio. Introduction to Computational Social Science, Second Edition, Springer, 2017.
2. Matthew A. Russell. Mining the Social Web: Data Mining Facebook, Twitter, LinkedIn, Google+, Github, and More, 2nd Edition, O'Reilly Media, 2013.
3. Networks, Crowds and Markets by David Easley and Jon Kleinberg, Cambridge University Press, 2010

**Reference Books:**

1. Nilanjan Dey Samarjeet Borah Rosalina Babo Amira Ashour, Social Network Analytics – Computational Research Methods and Techniques, First Edition, eBook ISBN: 9780128156414, Imprint: Academic Press, 2018
2. Stephen Borgatti, Martin Everett, Jeffrey Johnson. Analyzing Social Networks, 1st Edition, SAGE Publications Ltd, 2013.
3. Maksim Tsvetovat, Alexander Kouznetsov. Social Network Analysis for Startups: Finding connections on the social web, 1st Edition, O'Reilly Media, 2011.

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<b>Program: Bachelor of Computer Applications</b>		<b>Semester – V/VI</b>
<b>Course Title: Generative Language Modelling</b>		<b>Course Code: 22EBCE317</b>
<b>L-T-P: 3-0-1</b>	<b>Credits: 4</b>	<b>Contact Hours: 5hrs/week</b>
<b>ISA Marks: 50</b>	<b>ESA Marks: 50</b>	<b>Total Marks: 100</b>
<b>Teaching Hours: 40</b>	<b>Tutorial/Practical: 24</b>	<b>Exam Duration: 3hrs</b>
<b>Unit I</b>		
<b>1</b>	<b>Basics of Natural Language Processing</b> Introduction to NLP and its applications, Understanding the structure of language, Overview of text preprocessing techniques.	<b>08 hrs</b>
<b>2</b>	<b>Fundamentals of Generative Language Modeling</b> Definition and purpose of language modeling, Introduction to generative vs. discriminative models, Basic concepts of probability and its application in language modeling.	<b>08 hrs</b>
<b>Unit II</b>		
<b>3</b>	<b>N-gram Models</b> Understanding n-grams and their significance, Implementation of simple n-gram models, Limitations and challenges of n-gram models.	<b>06 hrs</b>
<b>4</b>	<b>Hidden Markov Models (HMMs)</b> Introduction to HMMs and their components, Application of HMMs in language modeling, Training and evaluation of HMMs for text generation.	<b>06 hrs</b>
<b>Unit III</b>		
<b>5</b>	<b>Recurrent Neural Networks (RNNs)</b> Basics of neural networks and their architecture, Introduction to RNNs and their advantages, Training and generating text with RNN-based language models.	<b>06 hrs</b>
<b>6</b>	<b>Introduction to Transformer Models</b> Overview of attention mechanism, Introduction to Transformer architecture, Training and fine-tuning Transformer-based language models for text generation.	<b>06 hrs</b>
<b>Text Books:</b> <ol style="list-style-type: none"> <li>1. "Foundations of Natural Language Processing" by Jurafsky and Martin</li> <li>2. "Deep Learning" by Goodfellow, Bengio, and Courville</li> <li>3. "Attention is All You Need" by Vaswani et al.</li> </ol>		
<b>Reference Books:</b> <ol style="list-style-type: none"> <li>1. "Speech and Language Processing" by Jurafsky and Martin</li> <li>2. "Foundations of Statistical Natural Language Processing" by Manning and Schutze.</li> </ol>		

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<b>Program: Bachelor of Computer Applications</b>		<b>Semester – V/VI</b>
<b>Course Title: Neural Networks and Deep Learning</b>		<b>Course Code: 22EBCE318</b>
<b>L-T-P: 3-0-1</b>	<b>Credits: 4</b>	<b>Contact Hours: 5hrs/week</b>
<b>ISA Marks: 50</b>	<b>ESA Marks: 50</b>	<b>Total Marks: 100</b>
<b>Teaching Hours: 40</b>	<b>Tutorial/Practical: 24</b>	<b>Exam Duration: 3hrs</b>
<b>Unit I</b>		
<b>1</b>	<b>Introduction</b>  Neural Networks-Application Scope of Neural Networks-Artificial Neural Network: An Introduction- Evolution of Neural Networks-Basic Models of Artificial Neural Network- Important Terminologies of ANNs-Supervised Learning Network	<b>08 hrs</b>
<b>2</b>	<b>Associative memory and unsupervised learning networks</b> Training Algorithms for Pattern Association-Autoassociative Memory Network-Heteroassociative Memory Network-Bidirectional Associative Memory (BAM)-Hopfield Networks-Iterative Autoassociative Memory Networks-Temporal Associative Memory Network-Fixed Weight Competitive Nets-Kohonen Self-Organizing Feature Maps-Learning Vector Quantization-Counter propagation Networks-Adaptive Resonance Theory Network.	<b>08 hrs</b>
<b>Unit II</b>		
<b>3</b>	<b>Third-Generation neural networks</b> Spiking Neural Networks-Convolutional Neural Networks-Deep Learning Neural Networks-Extreme Learning Machine Model-Convolutional Neural Networks: The Convolution Operation – Motivation – Pooling – Variants of the basic Convolution Function – Structured Outputs – Data Types – Efficient Convolution Algorithms – Neuroscientific Basis – Applications: Computer Vision, Image Generation, Image Compression.	<b>08 hrs</b>
<b>4</b>	<b>Deep feedforward network</b>  History of Deep Learning- A Probabilistic Theory of Deep Learning- Gradient Learning – Chain Rule and Backpropagation - Regularization: Dataset Augmentation – Noise Robustness -Early Stopping, Bagging and Dropout - batch normalization- VC Dimension and Neural Nets.	<b>08 hrs</b>
<b>Unit III</b>		
<b>5</b>	<b>Recurrent neural networks</b> Recurrent Neural Networks: Introduction – Recursive Neural Networks – Bidirectional RNNs – Deep Recurrent Networks – Applications: Image Generation, Image Compression,	<b>04 hrs</b>

6	<b>Natural Language Processing.</b> Natural language Processing - Complete Auto encoder, Regularized Autoencoder, Stochastic Encoders and Decoders, Contractive Encoders.	<b>04 hrs</b>
<b>Text Books:</b> <ol style="list-style-type: none"> <li>1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, “Deep Learning”, MIT Press, 2016.</li> <li>2. Francois Chollet, “Deep Learning with Python”, Second Edition, Manning Publications, 2021.</li> </ol>		
<b>Reference Books:</b> <ol style="list-style-type: none"> <li>1. Aurélien Géron, “Hands-On Machine Learning with Scikit-Learn and TensorFlow”, Oreilly, 2018.</li> <li>2. Josh Patterson, Adam Gibson, “Deep Learning: A Practitioner’s Approach”, O’Reilly Media, 2017.</li> <li>3. Charu C. Aggarwal, “Neural Networks and Deep Learning: A Textbook”, Springer International Publishing, 1st Edition, 2018.</li> <li>4. Learn Keras for Deep Neural Networks, Jojo Moolayil, Apress, 2018</li> <li>5. Deep Learning Projects Using TensorFlow 2, Vinita Silaparasetty, Apress, 2020</li> <li>6. Deep Learning with Python, FRANÇOIS CHOLLET, MANNING SHELTER ISLAND, 2017.</li> <li>7. S Rajasekaran, G A Vijayalakshmi Pai, “Neural Networks, FuzzyLogic and Genetic Algorithm, Synthesis and Applications”, PHI Learning, 2017.</li> <li>8. Pro Deep Learning with TensorFlow, Santanu Pattanayak, Apress, 2017</li> <li>9. James A Freeman, David M S Kapura, “Neural Networks Algorithms, Applications, and Programming Techniques”, Addison Wesley, 2003.</li> </ol>		

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