

# **BACHELOR OF COMPUTER APPLICATION**

**Specialization**

**In**

**AR VR**

**Programme Code: BCA AR VR**

**Duration: 3 Years**

**EFFECTIVE FROM SESSION: 2025-2026**



**CBCS**

**Department of Computer Science & Information Technology  
Faculty of Engineering & Technology**

**CHHATRAPATI SHIVAJI MAHARAJ UNIVERSITY PANVEL,  
NAVI MUMBAI**

	BCA- AR VR 1 Year - Semester I										
Type	Course Code	Course Title	Hours/Week			Theory Marks		Practical Marks		Total Marks	Credit
			L	T	P	IA	ESE	IA	ESE		
DC	CSAB1010	C Programming	3	-	-	30	70	-	-	100	3
DC	CSAB1020	Computer Fundamentals & Office Automation	3	1	-	30	70	-	-	100	4
DC	CSAB1030	Fundamentals of AR VR	3	1	-	30	70	-	-	100	3
OE	***	Elective 1	3	-	-	30	70	-	-	100	3
AECC	ENGG1000	English Communication Skills	3	1	-	30	70	-	-	100	4
BS	MTHG1000	Engineering Mathematics - I	3	1	-	30	70	-	-	100	4
DC	CSAB1011	C Programming Lab	-	-	4	-	-	15	35	50	2
DC	CSAB1021	Office Automation Lab	-	-	4	-	-	15	35	50	2
SEC		Soft Skills									
		<b>TOTAL</b>	<b>18</b>	<b>4</b>	<b>8</b>	<b>180</b>	<b>420</b>	<b>30</b>	<b>70</b>	<b>700</b>	<b>26</b>

<b>Elective-1</b> MGTG1000/ BBAB2030
1. Principle Of Management - I
2. Ethics & Corporate Social Responsibility

<b>Course Title</b>	<b>C Programming</b>	<b>Course Code:CSAB1010</b>	
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>	
<b>Lectures</b>	<b>3 Hrs/Week</b>	<b>Internal Assessment Test</b>	<b>30 Marks</b>
<b>Total Credits</b>	<b>3</b>	<b>End-Semester Examination</b>	<b>70 Marks</b>
<b>Course Objectives:</b>			
<ol style="list-style-type: none"> <li>1. It aims to train the student to the basic concepts of the C-programming language and provide exposure to problem-solving through programming.</li> <li>2. To provide the knowledge of control structures in c programming language.</li> <li>3. Use and implement data structures like arrays and pointers to obtain solutions.</li> <li>4. Implement different programming constructs such as structures and decomposition of problems into functions.</li> <li>5. Define and use of strings and file functions in C programming language.</li> </ol>			
<b>Detailed Syllabus:</b>			
<b>Unit-I</b>			
<b>Introduction to 'C' Language</b> History, Structures of 'C' Programming, Function as building blocks, Language Fundamentals: Character set, C Tokens, Keywords, Identifiers, Variables, Constant, Data Types, Comments, Operators, Built-in Operators and function, Console based I/O and related built-in I/O function, Concept of header files, Preprocessor directives.			
<b>Unit-II</b>			
<b>Control structures</b> Decision making structures- If, If-else, Nested If -else, Switch. Loop Control structures- While, Do-while, for, nested for loop, other statements- break, continue, goto, exit.			
<b>Unit-III</b>			
<b>Arrays and Pointers</b> <b>Arrays:</b> Definition, declaration and initialization of one-dimensional array, accessing array elements, displaying array elements, Two-Dimensional array-declaration and initialization, accessing and displaying, memory representation of array-row major, Column major, Multidimensional array. <b>Pointers:</b> Definition and declaration, Initialization, indirection operator, address of operator, pointer arithmetic, dynamic memory allocation, arrays and pointers, function and pointers			
<b>Unit-IV</b>			
<b>Structures and Functions</b> <b>Structures:</b> Definition and declaration, Variables initialization, accessing fields and structure operations, Nested structures, Union-Definition and declaration, Differentiate between Union and structure.			

<p><b>Functions:</b> Basic types of function, Declaration and definition, Function call, Types of function, Parameter passing- Call by value, Call by reference, Scope of variables, Storage classes, Recursion.</p>
<p style="text-align: center;"><b>Unit-V</b></p>
<p><b>Strings and File Handling</b></p> <p><b>Strings:</b> Definition, declaration and initialization of strings, standard library functions: -strlen (), strcpy( ), strcat( ), strcmp( ), Implementation without using standard library functions.</p> <p><b>File handling:</b> Definition of Files, Opening modes of files, Standard function: -fopen( ), fclose( ), feof( ), fseek( ), rewind( ), Using text files:- fgetc( ), fputc( ), fprintf( ), fscanf( ).</p>
<p><b>Text /Reference Books:</b></p> <ol style="list-style-type: none"> <li>1. Let us C-Yashwant Kanetkar.</li> <li>2. Programming in C- Balguruswamy</li> <li>3. The C Programming Lang, Pearson Ecl – Dennis Ritchie</li> <li>4. Structured programming approach using C-Forouzah &amp;Ceilberg Thomson learning publication.</li> <li>5. Pointers in C – Yashwant Kanetkar</li> <li>6. How to solve it by Computer – R. G. Dromy</li> <li>7. Introduction to algorithms – Cormen, Leiserson, Rivest, Stein</li> </ol>
<p><b>Course Outcomes:</b></p> <p>After completion of this subject students will be able to</p> <ol style="list-style-type: none"> <li>1. CO1: Acquire very basic knowledge about c programming.</li> <li>2. CO2: Apply appropriate control structures to solve problems.</li> <li>3. CO3: Students get detailed information about Arrays &amp; Pointers and its application in C programming.</li> <li>4. CO4: Create Structures and user defined function to solve problems in C programming.</li> <li>5. CO5: Apply functions towards performing operations on Files.</li> </ol>

<b>Course Title</b>	Computer Fundamental & Office Automation	<b>Course Code:CSAB1020</b>	
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>	
<b>Lectures / Tutorial</b>	<b>3 /1 Hrs Week</b>	<b>Internal Assessment Test</b>	<b>30 Marks</b>
<b>Total Credits</b>	<b>4</b>	<b>End-Semester Examination</b>	<b>70 Marks</b>
<b>Course Objectives:</b>			
<ol style="list-style-type: none"> <li>1. To provide the foundational concepts of computer hardware, software, programming languages, operating systems, peripherals, etc. along with how to get the most value and impact from computer technology.</li> <li>2. To make understand the beginners as well as advanced learners the concept of step wise problem solving.</li> <li>3. To make students at a moderate level of expertise in the knowledge of computer basics from where a student can take himself to the next level.</li> <li>4. To help students create the worksheets and perform basic calculations</li> <li>5. To understand how to use software packages in day-to-day activities and learn the essential and use of operating systems.</li> </ol>			
<b>Detailed Syllabus:</b>			
<b>Unit-I</b>			
Introduction of computer, Characteristics of Computers, Block diagram of computer, Block diagram of computer, Types of computer and features, Types of programming languages, Data Organization, Drives, Files, Directories, Types of Memory, Secondary storage devices, I/O devices, Number Systems.			
<b>Unit-II</b>			
<b>Algorithm and Flowcharts</b> Algorithm - Definition of Algorithm, Characteristics of Algorithm, Advantages and disadvantages, Examples. Flowchart- Definition, Define symbols of flowchart, Advantages and disadvantages, Examples.			
<b>Unit-III</b>			
<b>Windows Operating Environment</b> Features of MS –Windows, Control Panel, Taskbar, Desktop, Windows Application, Icons, Windows Accessories, Notepad, Paintbrush. Editors and Word Processors: Basic Concepts, MS-Word, Introduction to desktop publishing.			

<b>Unit-IV</b>
<b>Spreadsheets and Database packages</b> Purpose, usage, commands, MS-Excel, Creation of files in MS-Access, Switching between applications, MS -PowerPoint.
<b>Unit-V</b>
<b>DOS:</b> Introduction to Operating System, DOS - History Files and Directories, Internal and External Commands, Batch Files, Types of O.S. <b>Linux:</b> File system, Linux Commands, Permission, I/O redirection, VI Editor.
<b>Text /Reference Books:</b>
<ol style="list-style-type: none"> <li>1. Fundamentals of computers - V. Rajaraman - Prentice- Hall of India</li> <li>2. Microsoft Office 2007 Bible - John Walkenbach,Herb Tyson,Faithe Wempen,cary N.Prague, Michael R.groh, Peter G.Aitken, and Lisa a.Bucki -Wiley India pvt.ltd.</li> <li>3. The complete reference Linux - Richard Retersen - Tata McGraw - Hill Edition</li> <li>4. A Conceptual Guide to OpenOffice.org 3 - R. Gabriel Gurley- CreateSpace Independent Publishing Platform, 2008</li> <li>5. Introduction to Information Technology - Alexis Leon, Mathews Leon, and Leena Leon, Vijay Nicole Imprints Pvt. Ltd., 2013.</li> <li>6. Computer Fundamentals - P. K. Sinha Publisher: BPB Publications</li> </ol>
<b>Course Outcomes:</b>
After completion of this subject students will be able to <ol style="list-style-type: none"> <li>1. CO1: Remember the basic knowledge about computers.</li> <li>2. CO2: Understand &amp; Apply knowledge of flowcharts with algorithm concepts.</li> <li>3. CO3: Utilize Windows operating environment with additional knowledge of word processors.</li> <li>4. CO4: Understand the basic database applications &amp; create spreadsheets which will be used in daily work life.</li> <li>5. CO5: Execute the Linux operating system commands.</li> </ol>

<b>Course Title</b>	Fundamentals of AR-VR	<b>Course Code:CSAB1030</b>	
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>	
<b>Lectures / Tutorial</b>	<b>3/1 Hrs Week</b>	<b>Internal Assessment Test</b>	<b>30 Marks</b>
<b>Total Credits</b>	<b>4</b>	<b>End-Semester Examination</b>	<b>70 Marks</b>
<b>Course Objectives:</b>			
<ol style="list-style-type: none"> <li>1. To introduce the basic concepts, definitions, and evolution of Augmented Reality (AR) and Virtual Reality (VR), along with their differences and use cases across industries.</li> <li>2. To provide foundational knowledge of 3D graphics, coordinate systems, and transformation techniques used in immersive environments.</li> <li>3. To familiarize students with various AR systems, tracking technologies, and development platforms like Vuforia and ARCore.</li> <li>4. To explore the architecture and working of VR systems, including head-mounted displays, controllers, and interaction methods using game engines like Unity.</li> <li>5. To enable students to understand and apply user experience (UX) principles, accessibility standards, and ethical considerations in AR/VR application development.</li> </ol>			
<b>Detailed Syllabus:</b>			
<b>Unit-I: Introduction to AR and VR</b>			
Definition and evolution of AR & VR, Differences between AR, VR, MR, and XR, Key components: hardware (HMDs, sensors, trackers), software, input devices, Applications in various domains: education, gaming, healthcare, architecture, retail, Current trends and future scope			
<b>Unit-II Technology Foundations</b>			
Basics of 3D graphics and coordinate systems, Transformations: translation, rotation, scaling (using matrices), Understanding rendering pipelines, Sensors and tracking technologies: gyroscopes, accelerometers, GPS, camera-based tracking, Latency, frame rate, and real-time constraints			
<b>Unit-III Augmented Reality (AR) Systems</b>			
Types of AR: Marker-based, Markerless, Location-based, and Projection-based, AR development platforms: Vuforia, ARCore, ARKit, Image recognition and tracking, Use cases and demo apps, Challenges in AR: lighting, occlusion, tracking errors			
<b>Unit-IV Virtual Reality (VR) Systems</b>			
VR hardware: HMDs (Oculus Rift, HTC Vive), input controllers, motion tracking, VR system architecture and pipeline, Building immersive environments in Unity, Navigation and interaction in VR, Human factors: motion sickness, immersion, presence			

## Unit-V Development Tools and Ethical Considerations

Introduction to Unity and Unreal Engine for AR/VR, Creating a basic AR/VR application (lab-based overview), Interaction design and user experience (UX) in AR/VR, Privacy, data handling, accessibility in immersive tech, Ethical and social implications of immersive technologies

### Case Studies (Any two):

#### 1) AR-Based Campus Navigation App

**Title:** *SmartAR Campus Guide: Navigating College with Augmented Reality*

**Objective:** Create an AR mobile app to help new students navigate the campus using their smartphone camera.

**Tools:** Unity, Vuforia SDK, Android Studio

**Highlights:**

3D arrows and building names overlaid on real-time camera feed

Voice guidance or text pop-ups

Integrated with GPS and compass sensors

**Outcome:** Improved campus orientation experience for new students

#### 2. AR App for Object Recognition and Learning

**Title:** *SmartLearn AR: Real-World Object Recognition for Kids*

**Objective:** Use AR and machine learning to help children identify and learn about objects around them.

**Tools:** TensorFlow Lite, Unity, ARCore, MobileNet

**Highlights:**

Camera recognizes objects like fruits, animals, or vehicles

Speaks out the name and shows facts

Game mode with quizzes

**Outcome:** Fun and effective way for young learners to interact with the world

#### 3. AR-Based Historical Tour App

**Title:** *TimeLens AR: Experience History in Real Time*

**Objective:** Create an AR app that overlays historical information and 3D reconstructions at real-world locations.

**Tools:** Unity, ARKit/ARCore, Mapbox SDK

**Highlights:**

Historical events pop up when visiting key landmarks

AR visualization of structures as they were in the past

Multi-language support for tourists

**Outcome:** Educational and engaging cultural tourism experience

#### 4. VR E-Commerce Store Simulation

**Title:** *ShopVR: Enhancing Online Shopping Through Virtual Reality*

**Objective:** Build a prototype of a virtual shopping mall to explore future trends in e-commerce.

**Tools:** Unity, Oculus/HTC Vive, 3D product models

**Highlights:**



Pick up, inspect, and add items to cart  
Virtual dressing rooms or furniture placement demos  
**Outcome:** Study how immersive shopping can affect user decisions and satisfaction

### **Text /Reference Books:**

1. "Augmented Reality: Principles and Practice" Authors: Dieter Schmalstieg, Tobias Hollerer
2. "Understanding Virtual Reality: Interface, Application, and Design" Authors: William R. Sherman, Alan B. Craig
3. "Unity in Action: Multiplatform Game Development in C# with Unity" Author: Joe Hocking
4. "Virtual Reality" Author: Steven M. LaValle
5. "Learning Virtual Reality: Developing Immersive Experiences and Applications for Desktop, Web, and Mobile" Authors: Tony Parisi

### **Course Outcomes:**

1. Understand the fundamental concepts and evolution of Augmented Reality (AR) and Virtual Reality (VR), including their key components and real-world applications.
2. Apply knowledge of 3D graphics, coordinate systems, and transformation techniques essential for immersive environment development.
3. Explain the different types of AR systems and utilize AR platforms like Vuforia or ARCore to design simple AR-based applications.
4. Describe the architecture of VR systems and develop basic VR environments using tools such as Unity, focusing on user interaction and navigation.
5. Demonstrate proficiency in using AR/VR development tools and evaluate ethical, social, and design considerations for creating inclusive immersive experiences.

Elective 1			
<b>Course Title</b>	Principle Of Management - I	<b>Course Code:MGTG1000</b>	
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>	
<b>Lectures</b>	<b>3 Hrs Week</b>	<b>Internal Assessment Test</b>	<b>30 Marks</b>
<b>Total Credits</b>	<b>3</b>	<b>End-Semester Examination</b>	<b>70 Marks</b>
<b>Course Objectives:</b>			
<ol style="list-style-type: none"> <li>1. This subject is primarily meant for all those students of Management who aspire to enter the corporate world.</li> <li>2. To make a handy reference guide for professionals who have started their career and want to become successful managers in future.</li> </ol>			
<b>Detailed Syllabus:</b>			
<b>Unit-I</b>			
<b>Overview of Management</b> Definition, Management, Role of managers, Evolution of Management thought, Organization and the environmental factors, Trends and Challenges of Management in Global Scenario.			
<b>Unit-II</b>			
<b>Planning</b> Nature and purpose of planning, Planning process, Types of plans, Objectives, managing by objective (MBO) Strategies, Types of strategies, Policies, Decision Making, Types of decision, Decision Making Process, Rational Decision Making			
<b>Unit-III</b>			
<b>Organizing</b> Nature and purpose of organizing, Organization structure, Formal and informal groups in organization, Line and Staff authority, departmentation, Span of control, Centralization and Decentralization, Delegation of authority, Staffing, Selection and Recruitment, Orientation, Career Development, Career stages, Training, Performance Appraisal			
<b>Unit-IV</b>			
<b>Directing</b> Creativity and Innovation, Motivation and Satisfaction, Motivation Theories, Leadership Styles, Leadership theories, Communication, Barriers to effective communication, Organization Culture, Elements and types of culture, Managing cultural diversity.			

## Unit-V

### Controlling

Process of controlling, Types of control, Budgetary and non-budgetary control Q techniques , Managing Productivity , Cost Control , Purchase Control , Maintenance Control , Quality Control , Planning operations.

### Text /Reference Books:

1. Stephen P. Robbins and Mary Coulter, 'Management', Prentice Hall of India, 8th edition.
2. Charles W L Hill, Steven L McShane, 'Principles of Management', Mcgraw Hill Education, Special Indian Edition, 2007.
2. Hellriegel, Slocum & Jackson, ' Management - A Competency Based Approach', Thomson South Western, 10th edition, 2007.
3. Harold Koontz, Heinz Weihrich and Mark V Cannice, 'Management - A global
4. Stephen A. Robbins & David A. Decenzo & Mary Coulter, "Fundamentals of Management" 7th Edition, Pearson Education, 2011.
5. Robert Kreitner & Mamata Mohapatra, "Management", Biztantra, 2008.
6. Harold Koontz & Heinz Weihrich "Essentials of management" Tata Mc Graw Hill, 1998.
7. Tripathy PC & Reddy PN, "Principles of Management", Tata McGraw Hill, 1999.

### Course Outcomes:

CO1: Understand Management Fundamentals

CO2: Developing Analytical Skills to planning process

CO3: Enhancing organizing skills and acquire leadership Abilities

CO4: Promote Ethical and Social Responsibility

CO5: Prepare for professional roles for controlling in organization.

<b>Course Title</b>	Ethics & Corporate Social Responsibility	<b>Course Code:BBAB2030</b>	
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>	
<b>Lectures</b>	<b>3 Hrs Week</b>	<b>Internal Assessment Test</b>	<b>30 Marks</b>
<b>Total Credits</b>	<b>3</b>	<b>End-Semester Examination</b>	<b>70 Marks</b>
<b>Course Objectives:</b>			
<ol style="list-style-type: none"> <li>1. Gain familiarity with fundamental concepts of ethics, corporate governance, and CSR, including sustainability, stakeholder theory, and social justice.</li> <li>2. Examine the impact of global business practices on ethics and CSR, including cultural differences and regulatory environments.</li> </ol>			
<b>Detailed Syllabus:</b>			
<b>Unit-I</b>			
<b>Introduction:</b> Values-Concept, types and formation of values, Values of Indian Managers, Ethics-development of ethics, ethical decision making and decision-making process, relevance of ethics and values in business.			
<b>Unit-II</b>			
<b>Management of Ethics:</b> Management process and ethics, managerial performance, ethical issues, ethos of Vedanta in management, Code of Ethics, Benefits of Ethical codes, AIMA Code of conduct for professional managers.			
<b>Unit-III</b>			
<b>Corporate Governance:</b> Concept, need to improve corporate governance standards, Features of good governance, Role played by regulators to improve corporate governance, accounting standards and corporate governance, corporate disclosure, insider trading.			
<b>Unit-IV</b>			
<b>Corporate Social Responsibility &amp; Consumer Protection:</b> Corporate responsibility of business: employees, consumers and comm. Moduley, Corporate Governance, Code of Corporate Governance, Consumerism, unethical issues, in sales, marketing and technology.			
<b>Unit-V</b>			
<b>Understanding Success:</b> Definitions of success, Principles for competitive success, prerequisites to create blueprint for success. Successful stories of business gurus.			

<b>Text /Reference Books:</b>
<ol style="list-style-type: none"> <li>1. Bhanumurthy K V: Ethics and Social Responsibility of Business, Pearson Education India.</li> <li>2. Kaur, Tripat; Values &amp; Ethics in Management, Galgotia Publishers. • Manuel G Velasquez : Business ethics- concepts and cases Pearson.</li> <li>3. Kaur, Tripat; Values &amp; Ethics in Management, Galgotia Publishers.</li> <li>4. Chakraborty, S.K.; Human values for Managers</li> <li>5. Dr. F.C. Sharma Business Values &amp; Ethics, Shree Mahavir Book Depot (Publisher)</li> </ol>
<b>Course Outcomes:</b>
<p>C01 Define types of ethics.</p> <p>C02 Understand the concept of Business Ethics.</p> <p>C03 Use different concepts of ethics.</p> <p>C04 Analyse reasons to follow workplace Ethics.</p> <p>C05 Recommend Ethics in Advertising &amp; Marketing.</p>

<b>Course Title</b>	English Communication Skills	<b>Course Code:ENGG1000</b>	
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>	
<b>Lectures/ Tutorial</b>	<b>3/1 Hrs Week</b>	<b>Internal Assessment Test</b>	<b>30 Marks</b>
<b>Total Credits</b>	<b>4</b>	<b>End-Semester Examination</b>	<b>70 Marks</b>
<b>Course Objectives:</b>			
<ol style="list-style-type: none"> <li>1. To acquaint the students with appropriate language skills with the purpose of improving the existing ones-LSRW.</li> <li>2. To make the learners understand the importance and effective use of non-verbal communication.</li> <li>3. To make the learner proficient in public speaking and presentation skills.</li> <li>4. To guide and teach the students to utilize the principles of professional business and technical writing for effective communication in the global world.</li> </ol>			
<b>Detailed Syllabus:</b>			
<b>Unit-I</b>			
<b>Communication and Communication Process</b> Introduction to Communication, Forms and functions of Communication, Barriers to Communication ((linguistic and semantic, psychological, physical, mechanical, cultural), and overcoming them, Types of communication: verbal and non-verbal communication. Reading: Introduction to Reading, Barriers to Reading, Types of Reading: Skimming, Scanning, Fast Reading, Strategies for Reading, Comprehension. Listening: Importance of Listening, Types of Listening, and Barriers to Listening.			
<b>Unit-II</b>			
<b>Writing Skills, Reading Skills &amp; Listening Skills</b> Features of Good Language, Technical Style of writing, Writing Emails and it's etiquettes, Technical Reports: Report Writing: Types, Format and Structure of reports.			
<b>Unit-III</b>			
<b>Letter Writing</b> Types of letters: Job application letter, complaint letter, enquiry letter, reply to enquiry, sales letter, Essential and non-essential parts of letters, formats of letters.			
<b>Unit-IV</b>			
<b>Grammar</b> Types of sentences, Antonyms and Synonyms, Use of Auxiliaries and Modal Auxiliaries, Synonyms and Antonyms, Pairs of confused words, Common Errors in sentences			

## Unit-V

**Soft Skills** Body language, Teamwork and skills, Decision making ability, Negotiation skills and Interview skills.

### **Dialogues Writing and Speaking**

Greeting someone and responding to greet, thanking someone and responding to thanks, making inquiry and responding to enquiry on telephone, making request and responding to request.

### **Text /Reference Books:**

1. Communication in Organizations by Dalmar Fisher, Jaico Publishing House
2. Communication Skills by Meenakshi Raman & Sangeeta Sharma, Oxford University Press
3. Business Correspondence & Report-writing by R.C. Sharma& Krishna Mohan, Tata McGraw- Hill Education
4. Effective Technical Communication by Ashraf Rizvi, Tata McGraw-Hill.
5. Technical Writing & Professional Communication for non-native speakers of English by Thomas N. Huckin & Leslie A. Olsen, McGraw –Hill.
6. Mastering Communication by Nicky Stanton, Palgrave Master Series

### **Course Outcomes:**

After completion of this subject students will be able to

C01: Understand and evaluate information they listen to and express their ideas with greater clarity.

C02: Comprehend language effectively along the various channels of communication in a business organization.

C03: Apply the Communication through result-oriented writing and reading techniques both within and outside the organization.

C04: Speak convincingly before an audience with the help of an expanded vocabulary and enhanced digital content.

C05: Develop soft skills, dialog writing and speaking skills to understand technical description and instructions.

<b>Course Title</b>	Engineering Mathematics - I	<b>Course Code:MTHG1000</b>	
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>	
<b>Lectures / Tutorial</b>	<b>3/1 Hrs Week</b>	<b>Internal Assessment Test</b>	<b>30 Marks</b>
<b>Total Credits</b>	<b>4</b>	<b>End-Semester Examination</b>	<b>70 Marks</b>
<b>Course Objectives:</b>			
<ol style="list-style-type: none"> <li>1. To make the students familiarize with concepts and techniques in Calculus, Complex number and Matrices.</li> <li>2. The aim is to equip them with the techniques to understand advanced level mathematics and its applications that would enhance analytical thinking power, useful in their disciplines</li> </ol>			
<b>Detailed Syllabus:</b>			
<b>Unit-I</b>			
Review on matrices: Definition of matrix, types of matrices, Algebra of matrices, Adjoint of matrix, inverse of matrix, Unitary & Orthogonal matrices, Echelon form, Rank of a matrix, Normal form, PAQ normal form. System of homogeneous & non homogeneous equations, Conditions of their consistency & Inconsistency & solutions. Solution of system of linear algebraic equations, by (1) Gauss Elimination Method (2) Gauss Jordan Method (3) Jacobi iteration (4) Gauss Seidel Method			
<b>Unit-II</b>			
<b>Complex Numbers</b> Definition of Complex number, Algebra of complex number, Representation of complex number on complex plane, D'Moivre's Theorem., Powers and roots of Exponential & Trigonometric functions., Expansion of $\sin^n\theta$ , $\cos^n\theta$ in terms of sines and cosines of multiples of $\theta$ and Expansion of $\sin n\theta$ , $\cos n\theta$ in powers of $\sin\theta$ , $\cos\theta$ . Circular functions of complex numbers and Hyperbolic functions, Inverse Circular and Inverse Hyperbolic functions, Logarithmic functions. Separation of real and Imaginary parts of all types of Functions			
<b>Unit-III</b>			
<b>Numerical Integration</b> Numerical Integration-Different types of operators such as shift, forward, backward difference and their relation. Interpolation, Newton Interpolation, Integration by (a) Trapezoidal (b) Simpson's 1/3rd (c) Simpson's 3/8th rule.			



Unit-IV
<b>Partial Differential Equation</b> Partial derivatives of first and higher order, total differentials, differentiation of composite and implicit functions, Euler's Theorem on Homogeneous functions with two and three independent variables (with proof). Deductions from Euler's Theorem
Unit-V
<b>Application of Partial Differentiation, Indeterminate forms and curve fitting</b> Maxima and Minima of a function of two independent variables, Indeterminate forms, L-Hospital rule, Fitting of curves by least square method for line, parabola and exponential.
<b>Text /Reference Books:</b>
<ol style="list-style-type: none"> <li>1. A text book of Applied Mathematics, P.N.Wartikar and J.N.Wartikar,Vol – I and –II by Pune Vidyarthi Graha.</li> <li>2. Higher Engineering Mathematics, Dr.B.S.Grewal, Khanna Publication</li> <li>3. Advanced Engineering Mathematics, Erwin Kreyszig, Wiley Eastern Limited,9thEd.</li> <li>4. Matrices by Shanti Narayan.</li> <li>5. Numerical by S.S.Sastry, Prentice Hall</li> </ol>
<b>Course Outcomes:</b>
<p>After completion of this subject students will be able to</p> <p>C01: Recall the principles of basic operations of matrices.</p> <p>C02: Illustrate the concepts of complex numbers to engineering problems.</p> <p>C03: Solve the problems using different integration operators.</p> <p>C04: Apply the basic principles of partial differentiation.</p> <p>C05: Apply concepts of partial differentiation (maxima and minima), expansion of functions as an application of successive differentiation.</p>

<b>Course Title</b>	C Programming Lab	<b>Course Code:CSAB1011</b>	
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>	
<b>Lectures</b>	<b>4 Hrs Week</b>	<b>Internal Assessment Test</b>	<b>15 Marks</b>
<b>Total Credit</b>	<b>2</b>	<b>End-Semester Examination</b>	<b>35 Marks</b>
<b>Course Objectives:</b>			
<ol style="list-style-type: none"> <li>1. To understand the fundamentals of programming concepts and structured programming techniques using the C language.</li> <li>2. To develop the ability to write efficient, modular, and reusable code using functions, loops, conditionals, and arrays in C.</li> <li>3. To introduce the concepts of pointers, memory management, and dynamic allocation for efficient programming.</li> <li>4. To enable students to implement data structures such as strings, structures, and unions using C language features.</li> <li>5. To prepare students for problem-solving and logical thinking through practical implementation of algorithms and real-world programming exercises.</li> </ol>			
<b>Tools:</b> Turbo C++ / VS Code Editor / Dev C			
<ol style="list-style-type: none"> <li>1. Write a C program to display "This is my first C Program.</li> <li>2. Write a C program to add two numbers and display its sum.</li> <li>3. Write a C program to multiply two numbers (4 and 5) and display its product.</li> <li>4. Write a C program to calculate area and circumference of a circle.</li> <li>5. Write a C program to perform addition, subtraction, division and multiplication of two numbers. Write a Program to Check Whether a Number is Prime or not.</li> <li>6. Write a program to find the largest and smallest among three entered numbers and also display whether the identified largest/smallest number is even or odd.</li> <li>7. Write a program to check whether the entered year is a leap year or not (a year is leap if it is divisible by 4 and divisible by 100 or 400.)</li> <li>8. Write a program to find the factorial of a number.</li> <li>9. Write a program to check if the number is Armstrong or not. (Hint: A number is Armstrong if the sum of cubes of individual digits of a number is equal to the number itself).</li> <li>10. Write a program to print day names using switch cases.</li> <li>11. Write a program to determine whether the input character is capital or small letter, digits or special symbol.</li> <li>12. Write a program to reverse a given integer.</li> <li>13. Write a program to print numbers in reverse order with a difference of 2.</li> <li>14. Write a program to print the sum of digits of a number using a for loop.</li> <li>15. Write a program to check whether a number is Palindrome or not.</li> <li>16. Write a program to generate Fibonacci series.</li> </ol>			

17. Write a Program to Search an element in an array.
18. Write a Program to find the largest and smallest element in Array.
19. Write a program to add, subtract, multiply and divide two integers using user defined type function with return type.
20. Write a program to calculate the sum of the first 20 natural numbers using a recursive function.
21. Write a program to swap values of two variables using a pointer.
22. Write a program to add two numbers using pointers.
23. C Program to list all files and sub-directories in a directory.
24. C Program to count the number of lines in a file.
25. C Program to print contents of file.
26. C Program to copy contents of one file to another file.

**Course Outcomes:**

After completion of this subject students will be able to

CO1: Evaluate different approaches and algorithms to solve problems efficiently.

CO2: Create solutions using structured programming techniques to address various programming challenges.

CO3: Develop programs to perform tasks like identifying the largest and smallest numbers, checking for palindromes, generating Fibonacci series, etc.

CO4: Apply problem-solving skills and critical thinking to develop robust and efficient solutions.

CO5: Apply higher-order thinking skills to optimize code, improve algorithm efficiency, and handle edge cases effectively.

<b>Course Title</b>	Office Automation Lab	<b>Course Code:CSAB1021</b>	
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>	
<b>Lectures</b>	<b>4 Hrs Week</b>	<b>Internal Assessment Test</b>	<b>15 Marks</b>
<b>Total Credit</b>	<b>2</b>	<b>End-Semester Examination</b>	<b>35 Marks</b>

### Course Objectives:

1. To introduce the basic concepts of computer hardware, software, and operating systems and enable students to operate a computer system effectively.
2. To develop proficiency in using essential applications such as word processors, spreadsheets, and presentation tools through hands-on practical sessions.
3. To familiarize students with file management and internet browsing, including safe and efficient use of email and search engines.
4. To build foundational skills in basic programming or scripting (e.g., using Scratch, Python, or shell commands) as part of computer problem-solving.
5. To promote digital literacy and responsible computing practices, including cyber hygiene, data backup, and understanding of basic security features.

### Suggested list of experiments:

#### MS-WORD

1. Text Manipulation: Write a paragraph about your institution and change the font size and type, Spell check, Aligning and justification of Text
2. Bio data: Prepare a Bio-data.
3. Find and Replace: Write a paragraph about yourself and do the following. Find and Replace - Use Numbering Bullets, Footer and Headers.
4. Tables and manipulation: Creation, Insertion, Deletion (Columns and Rows). Create a mark sheet.
5. Mail Merge: Prepare an invitation to invite your friends to your birthday party. Prepare at least five letters.

#### MS-EXCEL

1. Data Sorting-Ascending and Descending (both numbers and alphabets)
2. Mark list preparation for a student
3. Individual Pay Bill preparation.
4. Invoice Report preparation. 5. Drawing Graphs. Take your own table.

#### MS-POWERPOINT

1. Create a slideshow presentation for a seminar.
2. Preparation of Organization Charts
3. Create a slideshow presentation to display percentage of marks in each semester for all students
  - A. Use a bar chart (X-axis: Semester, Y-axis: % marks).
  - B. Use different presentation templates and different transition effects for each slide.

### MS-ACCESS

1. Create a new database, save it on the desktop and name it "School Database"
2. Create a Table in the School Database with the following:

Field Name	Data Type	Field Size
ID	Number	10
Name	Text	15
Surname	Text	15
Telephone	Number	Number Long Integer
Date of Birth	Date/Time	Medium Date
Stipend	Currency	Currency
Foreigner	Yes/No	Yes/No

Make the "ID Number" Field as the Primary Key& Save the table as "Student's Table".

3. Open the "Students Table" and enter 5 complete records, Sort the table in ascending order by surname. Delete the last Record you have entered.
4. Create a Report: Use the Report Wizard to create a report having the following requirements:
  - a. Select the LastName field from the Author table.
    - Select the Title and Price fields from the Book table.
    - Select the PubName field from the Publisher table.
    - View the data by Publisher.
    - Add a grouping level using Last Name.
    - Sort the report by the Title field in ascending order.
    - Choose Stepped layout and Portrait orientation.
    - Type Book List as the report's title.
  - b. Switch to Layout view and adjust each column's width as necessary.

### Course Outcomes:

After completion of this subject students will be able to

C01: Apply database design principles to create tables, define fields, and set relationships.

C02: Analyze data requirements and design database structures to efficiently store and retrieve information.

C03: Create and populate tables with relevant data, applying sorting and filtering techniques as needed.

C04: Demonstrate proficiency in creating reports using Report Wizard, incorporating grouping, sorting, and formatting options.

C05: Apply critical thinking to ensure database efficiency, data accuracy, and report readability.

	BCA- AR VR 1 Year - Semester II										
Type	Course Code	Course Title	Hours/ Week			Theory Marks		Practical Marks		Total Marks	Credit
			L	T	P	IA	ESE	IA	ESE		
DC	CSAB2010	Data Structure using C	3	1	-	30	70	-	-	100	4
DC	CSAB2020	Database Management System (DBMS)	3	1	-	30	70	-	-	100	4
DC	CSAB2040	Introduction to C# Programming	3	1	-	30	70	-	-	100	4
AECC	EVSG2000	Environmental Studies (EVS)	3		-	30	70	-	-	100	3
DC	CSAB2030	Software Engineering	3		-	30	70	-	-	100	3
BS	MTHG2010	Element of Statistics	3	1		30	70			100	4
DC	CSAB2011	Data Structure using C Lab	-	-	4	-	-	15	35	50	2
DC	CSAB2021	Database Management System Lab	-	-	4	-	-	15	35	50	2
SEC		Aptitude Building									
		<b>TOTAL</b>	<b>18</b>	<b>4</b>	<b>8</b>	<b>180</b>	<b>420</b>	<b>30</b>	<b>70</b>	<b>700</b>	<b>26</b>

<b>Course Title</b>	Data Structure using C	<b>Course Code:CSAB2010</b>	
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>	
<b>Lectures / Tutorial</b>	<b>3/1 Hrs Week</b>	<b>Internal Assessment Test</b>	<b>30 Marks</b>
<b>Total Credits</b>	<b>4</b>	<b>End-Semester Examination</b>	<b>70 Marks</b>
<b>Course Objectives:</b>			
<ol style="list-style-type: none"> <li>1. Understand and remember algorithms and its analysis procedure.</li> <li>2. Introduce the concept of data structures through ADT including List, Stack, and Queues.</li> <li>3. To design and implement various data structure algorithms.</li> <li>4. To introduce various techniques for representation of the data in the real world.</li> <li>5. To develop applications using data structure algorithms.</li> <li>6. Compute the complexity of various algorithms.</li> </ol>			
<b>Detailed Syllabus:</b>			
<b>Unit-I</b>			
<b>Introduction</b> Introduction: Basic Terminology, Elementary Data Organization, built in Data Types in C. Algorithm, Efficiency of an Algorithm, Time and Space Complexity, Asymptotic notations: Big Oh, Big Theta and Big Omega, Time-Space trade-off. Abstract Data Types (ADT).			
<b>Unit-II</b>			
<b>Arrays and Linked List</b> Arrays: Definition, Single and Multidimensional Arrays, Representation of Arrays: Row Major Order, and Column Major Order, Derivation of Index Formulae for 1-D,2-D,3-D and Application of arrays, Sparse Matrices and their representations. Linked lists: Array Implementation and Pointer Implementation of Singly Linked Lists, Doubly Linked List, Circularly Linked List, Operations on a Linked List. Insertion, Deletion, Traversal, Polynomial Representation and Addition Subtraction & Multiplications of Single variable & Two variables Polynomial.			
<b>Unit-III</b>			
<b>Searching and Sorting</b> Searching: Concept of Searching, Sequential search, Index Sequential Search, Binary Search. Concept of Hashing & Collision resolution Techniques used in Hashing. Sorting: Insertion Sort, Selection, Bubble Sort, Quick Sort, Merge Sort, Heap Sort and Radix Sort.			

Unit-IV
<p><b>Stacks and Queues</b></p> <p>Stacks: Abstract Data Type, Primitive Stack operations: Push &amp; Pop, Array and Linked Implementation of Stack in C, Application of stack: Prefix and Postfix Expressions, Evaluation of postfix expression, Queues: Operations on Queue: Create, Add, Delete, Full and Empty, Circular queues, Array and linked implementation of queues in C, Dequeue and Priority Queue.</p>
Unit-V
<p><b>Graphs</b></p> <p>Graphs: Terminology used with Graph, Data Structure for Graph Representations: Adjacency Matrices, Adjacency List, Adjacency. Graph Traversal: Depth First Search and Breadth First Search, Connected Component, Spanning Trees, Minimum Cost Spanning Trees: Prims and Kruskal algorithm. Transitive Closure and Shortest Path algorithm: Warshal Algorithm and Dijkstra Algorithm.</p>
Text /Reference Books:
<ol style="list-style-type: none"> <li>1. Aaron M. Tanenbaum, Yedidyah Langsam and Moshe J. Augenstein, "Data Structures Using C and C++",</li> <li>2. Horowitz and Sahani, "Fundamentals of Data Structures", Galgotia Publications Pvt Ltd Delhi India.</li> <li>3. Lipschutz, "Data Structures" Schaum's Outline Series, Tata McGraw-hill Education (India) Pvt. Ltd.</li> <li>4. Thareja, "Data Structure Using C" Oxford Higher Education.</li> <li>5. AK Sharma, "Data Structure Using C", Pearson Education India.</li> <li>6. Rajesh K. Shukla, "Data Structure Using C and C++" Wiley Dreamtech Publication.</li> </ol>
Course Outcomes:
<p>At the end of this course students will be able to:</p> <p>CO1: Understand the role and applications of data structure in real life.</p> <p>CO2: Demonstrate proficiency in core programming language concepts.</p> <p>CO 3: Understand &amp; apply basic data structure operations like searching, insertion, and deletion, traversing mechanism etc. on various problem domains.</p> <p>CO 4: Design and implement advanced data structures, including non-linear ones, and assess their efficiency in solving complex problems.</p> <p>CO5: Analyze the efficiency of algorithm.</p>



<b>Course Title</b>	Database Management System (DBMS)	<b>Course Code:CSAB2020</b>	
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>	
<b>Lectures / Tutorial</b>	<b>3/1 Hrs Week</b>	<b>Internal Assessment Test</b>	<b>30 Marks</b>
<b>Total Credits</b>	<b>4</b>	<b>End-Semester Examination</b>	<b>70 Marks</b>
<b>Course Objectives:</b>			
<ol style="list-style-type: none"> <li>1. To make the students learn and practice data modeling using the entity-relationship and developing database designs.</li> <li>2. To make students understand the use of Structured Query Language (SQL) and learn SQL syntax.</li> <li>3. To illustrate students how to apply normalization techniques to normalize the database</li> <li>4. To make students understand the needs of database processing and learn techniques for controlling the consequences of concurrent data access.</li> </ol>			
<b>Detailed Syllabus:</b>			
<b>Unit-I</b>			
<b>Introduction to DBMS:</b> Introduction, Characteristics of databases, File system v/s Database system, Users of Database system Data Independence, DBMS system architecture, Database Administrator			
<b>Unit-II</b>			
<b>Entity-Relationship Data Model</b> The Entity-Relationship (ER) Model: Entity types: Weak and strong entity sets, Entity sets, Types of Attributes, Keys, Relationship constraints: Cardinality and Participation, Extended Entity-Relationship (EER) Model: Generalization, Specialization and Aggregation			
<b>Unit-III</b>			
<b>Relational Model and Relational Algebra</b> Introduction to the Relational Model, relational schema and concept of keys, Mapping the ER and EER Model to the Relational Model Relational Algebra – unary and set operations, Relational Algebra Queries.			
<b>Unit-IV</b>			
<b>Structured Query Language (SQL)</b> Overview of SQL, Data Definition Commands, Data Manipulation commands, Data Control commands, Transaction Control Commands. Set and string operations, aggregate function - group by,			

having, Views in SQL, joins, Nested and complex queries, Integrity constraints: - key constraints, Domain Constraints, Referential integrity, check constraints Triggers
<b>Unit-V</b>
<b>Relational-Database Design and Transaction Management</b> Pitfalls in Relational-Database designs, Concept of normalization, Function Dependencies, First Normal Form, 2nd , 3rd , BCNF, multi valued dependencies , 4NF. Transaction concept, Transaction states, ACID properties, Concurrent Executions, Serializability – Conflict and View.
<b>Text /Reference Books:</b>
<ol style="list-style-type: none"> <li>1. G. K. Gupta —Database Management Systems, McGraw – Hill.</li> <li>2. Korth, Slberchatz, Sudarshan, —Database System Concepts, 6th Edition, McGraw – Hill</li> <li>3. Elmasri and Navathe, —Fundamentals of Database Systems, 5th Edition, Pearson education.</li> <li>4. Peter Rob and Carlos Coronel, —Database Systems Design, Implementation and Management, Thomson Learning, 5th Edition.</li> </ol>
<b>Course Outcomes:</b>
<p>At the end of this course students will be able to:</p> <p>CO1: Understand the fundamentals of a database systems.</p> <p>CO 2: Design and draw ER and EER diagrams for real life problems.</p> <p>CO 3: Understand relational model basics, schema with keys, ER/EER mapping to relations, and apply relational algebra for queries.</p> <p>CO 4: Design and querying databases using SQL.</p> <p>CO 5: Analyze and apply concepts of normalization to relational database design.</p>

<b>Course Title</b>	Introduction to C# Programming	<b>Course Code:</b> CSAB2040	
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>	
<b>Lectures / Tutorial</b>	3 / 1 Hrs Week	<b>Internal Assessment Test</b>	<b>30 Marks</b>
<b>Total Credits</b>	4	<b>End-Semester Examination</b>	<b>70 Marks</b>
<b>Course Objectives:</b>			
<ol style="list-style-type: none"> <li>1. To introduce students to the fundamentals of C# programming within the .NET and Unity environment.</li> <li>2. Understand the fundamentals of object-oriented programming using C#.</li> <li>3. To understand how to control objects and user actions in Unity using C#.</li> <li>4. Develop interactive applications for AR/VR using Unity and C#.</li> <li>5. To guide students in creating simple AR/VR projects using C# and Unity.</li> </ol>			
<b>Detailed Syllabus:</b>			
<b>Unit-I Introduction to C# and .NET Framework</b>			
<p>Overview of .NET ecosystem ,Introduction to C# language features ,Setting up the development environment (Visual Studio, Unity integration) ,First C# program ,Data types, variables, and constants.  <b>Control Structures:</b>Conditional statements (if, else, switch) ,Loops (for, while, do-while, foreach) ,Jump statements (break, continue, return) ,Debugging and error handling (try-catch)</p>			
<b>Unit-II Object-Oriented Programming in C#</b>			
<p>Classes and Objects ,Constructors and Destructors ,Inheritance and Polymorphism ,Encapsulation and Abstraction ,Access Modifiers ,Static vs Instance members.</p>			
<b>Unit-III C# and Unity for AR/VR</b>			
<p>Unity interface and integration with C# ,GameObjects, Components, and Scripts ,Basic physics and animation with scripts ,Handling user input (keyboard, mouse, touch, gestures) ,Scripting camera movement and interactions in AR/VR.</p>			
<b>Unit-IV Collections and File Handling</b>			
<p>Arrays, Lists, Dictionaries , String manipulation , File I/O using C# ,Reading/Writing to JSON (used in Unity configurations).</p>			
<b>Unit-V Events, Delegates, and UI Programming</b>			
<p>Delegates and Events , Lambda expressions , Unity UI (buttons, text, panels) with C# scripts , Event-driven programming for user interaction , Implementing user feedback in AR/VR applications (e.g., visual/audio response).</p>			

## Assignment / Project Work / Mini-Project

1. Building a basic AR/VR experience using Unity and C# , Implementing interactive features using C#

**Example projects:** Virtual product showcase , Simple VR game interaction , AR user interface navigation.

### AR-Based Human Anatomy Viewer

**Objective:** Create a basic Unity app using C# scripts to display 3D human organs (heart, brain, lungs) with interactive buttons to show/hide parts.

**Learn:** Unity integration, UI controls, object manipulation

**Human Relevance:** Medical education or self-learning tool

### Speech-Controlled Avatar Interaction

**Objective:** Use C# to connect a speech recognition API and trigger avatar actions like waving, greeting, etc.

**Learn:** API usage in C#, conditional logic

**Human Relevance:** Enhancing accessibility in AR/VR

### Text /Reference Books:

1. "C# 9.0 in a Nutshell" – Joseph Albahari
2. "Learning C# by Developing Games with Unity" – Harrison Ferrone
3. "Beginning C# and .NET"--Benjamin Perkins, Jacob Vibe Hammer, Jon D. Reid.
4. "Learning C# by Developing Games with Unity"--Harrison Ferrone
5. "Unity in Action: Multiplatform Game Development in C# with Unity"--Joe Hocking

### Course Outcomes:

1. CO1:Understand and apply C# syntax, data types, and control structures in Unity-based environments.
2. CO2:Develop modular and reusable code using object-oriented programming principles in C#.
3. CO3:Script interactive behaviors and UI elements in Unity using C# to enhance user experience in AR/VR applications.
4. CO4:Apply file handling and data management techniques for storing user preferences and scene configurations.
5. CO5:Build and deploy a basic interactive AR/VR prototype demonstrating human-centric interaction using C# scripting.

<b>Course Title</b>	Environmental Studies (EVS)	<b>Course Code:</b> EVSG2000	
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>	
<b>Lectures / Tutorial</b>	<b>3 Hrs Week</b>	<b>Internal Assessment Test</b>	<b>30 Marks</b>
<b>Total Credits</b>	<b>3</b>	<b>End-Semester Examination</b>	<b>70 Marks</b>
<b>Course Objectives:</b>			
<ol style="list-style-type: none"> <li>1. Recognize the interconnectedness of multiple factors in environmental challenges</li> <li>2. Engage constructively with diverse forms of knowledge and experience</li> <li>3. Identify the multiple scales, actors, and stakes of an issue</li> <li>4. Recognize and apply methodological approaches of the social sciences, natural sciences, and humanities</li> <li>5. Identify assumptions inherent in arguments and perspectives</li> </ol>			
<b>Detailed Syllabus:</b>			
<b>Unit-I</b>			
<b>Multidisciplinary nature of environmental studies</b> Multidisciplinary nature of environmental studies Definition, scope and importance Need for public awareness.			
<b>Unit-II</b>			
<b>Natural Resources</b> Renewable and non-renewable resources: Natural resources and associated problems, Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people. Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies. Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer- pesticide problems, water logging, salinity, case studies. Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies. Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification, Role of an individual in conservation of natural resources, Equitable use of resources for sustainable lifestyles.			
<b>Unit-III</b>			
<b>Ecosystems</b> Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flows in the ecosystem, Ecological succession, Food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of the following ecosystem: - a. Forest ecosystem b. Grassland ecosystem c. Desert ecosystem d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).			
<b>Unit-IV</b>			

## **Biodiversity and its conservation**

Introduction – Definition: genetic, species and ecosystem diversity. Biogeographical classification of India • Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values • Biodiversity at global, National and local levels. • India as a mega-diversity nation V • Hot-spots of biodiversity. • Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. • Endangered and endemic species of India • Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

### **Unit-V**

#### **Environmental Pollution Definition**

Cause, effects and control measures of: - a. Air pollution b. Water pollution c. Soil pollution d. Marine pollution e. Noise pollution f. Thermal pollution g. nuclear hazards • Solid waste Management: Causes, effects and control measures of urban and industrial wastes. • Role of an individual in prevention of pollution. • Pollution case studies. • Disaster management: floods, earthquake, cyclone and landslides.

#### **Text /Reference Books:**

1. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
2. Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad – 380 013, India, Email: mapin@icenet.net (R)
3. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p
4. Clark R.S., Marine Pollution, Clanderson Press Oxford (TB)
5. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopaedia, Jaico Publ. House, Mumabai, 1196p
6. De A.K., Environmental Chemistry, Wiley Eastern Ltd.
7. Down to Earth, Centre for Science and Environment (R)
8. Gleick, H.P. 1993. Water in crisis, Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute Oxford Univ. Press. 473p
9. Hawkins R.E., Encyclopaedia of Indian Natural History, Bombay Natural History Society, Bombay (R)

#### **Course Outcomes:**

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

- CO1: Understand key concepts in the life and physical sciences, and will apply them to environmental issues.
- CO2: Understand and apply the scientific process, as well as appreciate both the potential and limitations of the process.
- CO3: Understand, evaluate and synthesize information from the scientific literature.
- CO4: Analyze data using appropriate statistical methods, and will be able to evaluate the use of statistics by others in a variety of contexts.
- CO5: Apply knowledge of the sciences within an interdisciplinary context in solving environmental issues

<b>Course Title</b>	Software Engineering	<b>Course Code:CSAB2030</b>	
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>	
<b>Lectures</b>	<b>3 Hrs Week</b>	<b>Internal Assessment Test</b>	<b>30 Marks</b>
<b>Total Credits</b>	<b>3</b>	<b>End-Semester Examination</b>	<b>70 Marks</b>
<b>Course Objectives:</b>			
<ol style="list-style-type: none"> <li>1. To make the students familiarize with system analysis and design is the backbone of Application software development.</li> <li>2. To illustrate students the steps in analysis and design of the system.</li> <li>3. It includes the knowledge of preparing projects systematically.</li> <li>4. It is important to know about various aspects of the system analysis and design so that the students will be able to understand the responsibilities while designing and implementing the project.</li> </ol>			
<b>Detailed Syllabus:</b>			
<b>Unit-I</b>			
Introduction to Software Engineering, System Concepts: Types of systems: (open, closed, static and dynamic systems). Introduction, Programmes v/s Software Products Emergence of Software Engineering- Early Computer Programming, High-level Language Programming, Control flow-based Design, Data Structure Oriented Design, Object Oriented Design			
<b>Unit-II</b>			
Software Life Cycle Models, Requirement of Life Cycle Model, Classic Waterfall Model, Prototyping Model, Evolutionary Model, Spiral Model, introduction to agile methodology. Comparison of different Life Cycle Models			
<b>Unit-III</b>			
Software Planning, Responsibilities of Software Project Manager - Metrics for Project Size Estimation- LOC (Lines of Code), Function Point Metric - Project estimation Techniques- Using COCOMO Model.			
<b>Unit-IV</b>			
Requirement Analysis and Specification, Requirement gathering and Analysis, Software Requirement Specifications (SRS), Characteristics of good SRS			
<b>Unit-V</b>			
Software Testing, Concept of Testing, Testing type cycle (V-Model), Verification v/s Validations, Unit Testing, Black Box Testing, White Box Testing, Integration testing, System testing, Configuration management, Overview of test cases.			

<b>Text /Reference Books:</b>
<ol style="list-style-type: none"> <li>1. Software Engineering by Rajib Mall, PHI Publishers, New Delhi</li> <li>2. An Integrated Approach to Software Engineering by Pankaj Jalote, Narosa Publishing House Pvt Ltd, Darya Ganj, New Delhi 110002</li> <li>3. Software Engineering, Sangeeta Sabharwal, New Age International, Delhi</li> <li>4. Software Engineering by KK Aggarwal and Yogesh Singh</li> <li>5. Software Engineering – A Practitioner’s Approach by RS Pressman, Tata McGraw Hill Publishers, New Delhi</li> </ol>
<b>Course Outcomes:</b>
<p>At the end of this course students will be able to:</p> <p>CO1: Understand the problem and corresponding requirement for development of software.</p> <p>CO2: Demonstrate the various phases of the system development life cycle.</p> <p>CO3: Identify the expected benefits and scope of the projects.</p> <p>CO4: Prepare and develop data flow diagrams and decision tables.</p> <p>CO5: Apply different testing techniques on software.</p>



<b>Course Title</b>	Element of Statistics	<b>Course Code:</b> MTHG2010	
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>	
<b>Lectures / Tutorial</b>	<b>3/1 Hrs Week</b>	<b>Internal Assessment Test</b>	<b>30 Marks</b>
<b>Total Credits</b>	<b>4</b>	<b>End-Semester Examination</b>	<b>70 Marks</b>
<b>Course Objectives:</b>			
<ol style="list-style-type: none"> <li>1. To demonstrate knowledge of probability and the standard statistical distributions.</li> <li>2. To demonstrate knowledge of fixed-sample and large-sample statistical properties of point and interval estimators.</li> <li>3. To demonstrate knowledge of the properties of parametric, semi-parametric and nonparametric testing procedures.</li> <li>4. To demonstrate the ability to perform complex data management and analysis.</li> </ol>			
<b>Detailed Syllabus:</b>			
<b>Unit-I</b>			
<b>Introduction to Statistics:</b> Introduction, Definitions of Statistics, Importance of Statistics, Scope of Statistics			
<b>Unit-II</b>			
<b>Data:</b> Introduction: Nature of Subject, Language of Statistics: Population, Variables, Size of Population, Discrete and Continuous Variables, Classification of data: Classification by attributes, Classification of variables, Graphical representation of data: Histogram, Frequency polygon, Ogive curves, Diagrammatic representation of data: Simple bar diagram, Subdivided bar diagram, Pie diagram.			
<b>Unit-III</b>			
<b>Measures of Central Tendency:</b> Introduction, Arithmetic mean: Properties of arithmetic mean, Merits and Demerits of mean, Median: Merits and Demerits of median, Mode: Merits and Demerits of mode.			
<b>Unit-IV</b>			
<b>Measures of Dispersion:</b> Introduction, Range, Mean Deviation, Variance, Standard Deviation, Absolute and Relative Measure of Dispersion, Coefficient of Variation			
<b>Unit-V</b>			
<b>Correlation and Linear Regression:</b> <b>Correlation:</b> Introduction, Positive & Negative Correlation Covariance, Coefficient of Correlation: Properties of Correlation Coefficient, Interpretation of the value of Correlation Coefficient, Computing Correlation Coefficient for Ungrouped Data.			

**Linear Regression:** Introduction, Line of Regression, Equation of Line of Regression by the Method of Least Squares, Interpretation of Coefficient of Regression, Properties of Coefficient of Regression.

**Text /Reference Books:**

1. "Probability and Statistics" by M H DeGroot.
2. "Introduction to the Practice of Statistics" by David S Moore and George P McCabe
3. Mathematical Statistics by Ray, Sharma and Choudhary
4. Business Statistics By V. K. Kapoor, pub: S. Chand
5. Schaum's outline of theory and problems of statistics Murray R. Spiegel, Larry J. Stephens

**Course Outcomes:**

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

- C01: Understand the key terminology, concepts, tools and techniques used in statistical analysis.
- C02: Analyze the effectiveness of different graphical representations in conveying information about the dataset.
- C03: Apply different measures of central tendency to analyze and interpret real-life data.
- C04: Discuss critically the uses and limitations of statistical analysis.
- C05: Analyze the properties of correlation coefficient and regression coefficient.

<b>Course Title</b>	Data Structure using C Lab	<b>Course Code:CSAB2011</b>	
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>	
<b>Lectures</b>	<b>4 Hrs/Week</b>	<b>Internal Assessment Test</b>	<b>15 Marks</b>
<b>Total Credits</b>	<b>2</b>	<b>End-Semester Examination</b>	<b>35 Marks</b>
<b>Course Objectives:</b>			
<ol style="list-style-type: none"> <li>1. To understand the basic concepts of data structures such as arrays, linked lists, stacks, queues, trees, and graphs.</li> <li>2. To develop skills in writing and debugging C programs that utilize various data structures to solve real-world problems efficiently.</li> <li>3. To demonstrate the ability to apply dynamic memory allocation</li> <li>4. To enable students to analyze and compare the performance of different data structures</li> </ol>			
<b>Detailed Syllabus:</b>			
<ol style="list-style-type: none"> <li>1. Implementation of Insertion Sorting Algorithm.</li> <li>2. Implementation of Merge Sorting Algorithm.</li> <li>3. Implementation of Selection sorting algorithm.</li> <li>4. Implementation of Sequential Searching Algorithm.</li> <li>5. Implementation of Binary search.</li> <li>6. Implementation of Stack using Array.</li> <li>7. Implementation of Queue using Array.</li> <li>8. Implementation of Circular Queue using Array.</li> <li>9. Implementation of Linked List: create, insert, delete, update.</li> <li>10. Implementation of Queue using Linked List.</li> <li>11. Implementation of Circular Queue using Linked List.</li> <li>12. Implementation of graph representation using linked list and matrix</li> </ol>			
<b>Course Outcomes:</b>			
<p>After completion of this subject students will be able to</p> <p>CO1: Demonstrate proficiency in implementing algorithms such as insertion sort, merge sort, selection sort.</p> <p>CO2: Analyze problem requirements and design algorithmic solutions to efficiently manage data and perform operations like sorting, searching, and traversal.</p> <p>CO3: Create and implement algorithms using appropriate data structures such as arrays, linked lists, and matrices.</p> <p>CO4: Apply critical thinking to evaluate algorithm efficiency, optimize code, and handle edge cases effectively.</p> <p>CO5: Develop algorithms for complex data structures like graphs, considering factors such as connectivity, traversal, and representation.</p>			

<b>Course Title</b>	<b>Database Management System Lab</b>	<b>Course Code: CSAB2021</b>	
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>	
<b>Lectures</b>	<b>4 Hrs/Week</b>	<b>Internal Assessment Test</b>	<b>15 Marks</b>
<b>Total Credits</b>	<b>2</b>	<b>End-Semester Examination</b>	<b>35 Marks</b>
<b>Course Objectives:</b>			
<ol style="list-style-type: none"> <li>1. To impart hands-on experience with database design and implementation using SQL and relational database management systems like MySQL or Oracle.</li> <li>2. To enable students to create and manipulate database schemas through DDL, DML, DCL, and TCL commands for managing data effectively.</li> <li>3. To develop skills in writing complex queries, including nested queries, joins, and set operations to retrieve meaningful insights from data.</li> <li>4. To introduce normalization techniques and integrity constraints to ensure data consistency, efficiency, and reduce redundancy.</li> <li>5. To familiarize students with PL/SQL programming constructs such as cursors, triggers, stored procedures, and functions to build robust database applications.</li> </ol>			
<b>Detailed Syllabus:</b>			
<ol style="list-style-type: none"> <li>1. Creating a Table with constraints.</li> <li>2. Writing SQL statements Using ORACLE <ol style="list-style-type: none"> <li>1. Writing basic SQL SELECT statements.</li> <li>2. Restricting and sorting data.</li> <li>3. Displaying data from multiple tables.</li> <li>4. Aggregating data using group functions.</li> <li>5. Creating and managing tables.</li> </ol> </li> <li>3. Normalization in ORACLE.</li> <li>4. Creating a cursor in oracle.</li> <li>5. Creating procedure and functions in oracle.</li> <li>6. Creating packages and triggers in oracle.</li> <li>7. Design a Database and create required tables. For e.g. Bank, College Database</li> <li>8. Apply the constraints like Primary Key, Foreign key, NOT NULL to the tables.</li> <li>9. Write a sql statement for implementing ALTER, UPDATE and DELETE</li> <li>10. Write the queries to implement the joins</li> <li>11. Write the query for implementing the following functions: MAX (), MIN (), AVG (), COUNT ()</li> <li>12. Write the query to implement the concept of Integrity constraints</li> <li>13. Write the query to create the views</li> <li>14. Perform the queries for triggers</li> <li>15. Perform the following operation for demonstrating the insertion, updation and deletion using the referential integrity constraints</li> <li>16. Write the query for creating the users and their role.</li> </ol>			

	BCA- AR VR 2 Year - Semester III										
Type	Course Code	Course Title	Hours/Week			Theory Marks		Practical Marks		Total Marks	Credit
			L	T	P	IA	ESE	IA	ESE		
DC	CSAB3010	Computer Organization & Architecture	3	1	-	30	70	-	-	100	4
DC	CSAB3020	Object Oriented Programming with C++	3	1	-	30	70	-	-	100	4
DC	CSAB3030	Operating System	3	1	-	30	70	-	-	100	4
DC	CSAB3040	Software Testing and Quality Assurance	3	1	-	30	70	-	-	100	4
DC	CSAB3050	Fundamentals of Animation	3	1	-	30	70	-	-	100	4
OE	****	Elective 2	3		-	30	70	-	-	100	3
DC	CSAB3021	Object Oriented Programming with C++ Lab	-	-	4	-	-	15	35	50	2
DC	CSAB3031	Operating System Lab	-	-	4	-	-	15	35	50	2
SEC		Quantitative Aptitude & Logical Reasoning-1									
		<b>TOTAL</b>	<b>18</b>	<b>5</b>	<b>8</b>	<b>180</b>	<b>420</b>	<b>30</b>	<b>70</b>	<b>700</b>	<b>27</b>

<b>Elective-2</b> MGTG3100/CSEB3040
1. Financial Accounting & Management
2. Management Information System

<b>Course Title</b>	Computer Organization & Architecture	<b>Course Code:CSAB3010</b>	
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>	
<b>Lectures / Tutorial</b>	<b>3/1 Hrs Week</b>	<b>Internal Assessment Test</b>	<b>30 Marks</b>
<b>Total Credits</b>	<b>4</b>	<b>End-Semester Examination</b>	<b>70 Marks</b>
<b>Course Objectives:</b>			
<ol style="list-style-type: none"> <li>1. To make students conceptualize the basics of organizational and architectural issues of a digital computer.</li> <li>2. To make students learn the various methods for data representation.</li> <li>3. To analyze the processor and memory design of a digital computer.</li> <li>4. To understand various data transfer techniques in digital computers to learners.</li> <li>5. To make the students analyze processor performance improvement using instruction level parallelism.</li> </ol>			
<b>Detailed Syllabus:</b>			
<b>Unit-I</b>			
<b>Digital Logic Circuits:</b> Basic Logic Functions, Synthesis of Logic Functions Using AND, OR, and NOT Gates, Minimization of Logic Expression, Synthesis with NAND and NOR Gates, Flip-Flops, Registers and Shift Registers, Counters, Decoders, Multiplexers, Programmable Logic Devices (PLDs), Basic Structure of Computers: Functional units, Basic operational concepts, Bus structures, Software, Performance, multiprocessors and multi computers			
<b>Unit-II</b>			
<b>Data Representation:</b> Data types, Complements, Other binary codes, Error Detection codes, Register and Micro operations: Register Transfer language, Register Transfer Bus and memory transfers, Arithmetic Micro operations, logic micro-operations, Shift micro-operations, Arithmetic logic shift unit			
<b>Unit-III</b>			
<b>Processing Unit:</b> Instruction Codes, Computer Registers, Computer Instructions, Instruction Cycle, Memory Reference Instructions, Hardwired Control, Micro Programmed Control, register organization, Stack organization, Instruction formats Addressing modes, Data Transfer and manipulations, RISC, CISC, Computer Arithmetic: Addition, subtraction, multiplication and division operations, Floating point Arithmetic operations			
<b>Unit-IV</b>			
<b>Input-Output Organization:</b> Peripheral Devices, Input Output Interface, Asynchronous data transfer, Modes of Transfer, Priority Interrupt, Direct memory Access, Input-Output Processor, Serial communication, Parallel and Vector Processing: Parallel processing, Pipelining, Arithmetic pipeline, Instruction pipeline, RISC Pipeline, Vector Processing, Array Processors			

Unit-V
<b>Memory Organization:</b> Memory Hierarchy, Main memory, Auxiliary memory, Associative memory Virtual memory, Cache memory, Memory management hardware
<b>Text /Reference Books:</b>
<ol style="list-style-type: none"> <li>1. John L. Hennessy and David A. Patterson, "Computer Architecture a quantitative approach", 4th Edition Elsevier, ISBN:10:0123704901</li> <li>2. William Stallings, "Computer Organization and Architecture", 6th Edition, Pearson/PHI, ISBN:10:0- 13-609704-9</li> <li>3. Donald e Givone, "Digital Principles and Design", TMH.</li> <li>4. A.Anandkumar, "Fundamentals of digital circuits", 4th edition, PHI.</li> </ol>
<b>Course Outcomes:</b>
<p>CO1: Create logic circuit designs.</p> <p>CO2: Understand the data types, codes and register, ALU and shift microoperations.</p> <p>CO3: Understand the intricacies of processing unit.</p> <p>CO4: Explain concept of data transfer between io devices and memory unit and the types data processing.</p> <p>CO5: Analyze Memory Hierarchy to describe the memory hierarchy, including registers, cache memory, main memory (RAM), and secondary storage (e.g., hard disk drives, solid-state drives).</p>

<b>Course Title</b>	Object Oriented Programming with C++	<b>Course Code:</b> CSAB3020	
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>	
<b>Lectures / Tutorial</b>	<b>3/1 Hrs Week</b>	<b>Internal Assessment Test</b>	<b>30 Marks</b>
<b>Total Credits</b>	<b>4</b>	<b>End-Semester Examination</b>	<b>70 Marks</b>
<b>Course Objectives:</b>			
<ol style="list-style-type: none"> <li>1. To make students understand Object Oriented Programming concepts using the C++ language.</li> <li>2. To illustrate students the concepts of classes and objects.</li> <li>3. To explain the concept of c++ principles of data abstraction, inheritance to the learner.</li> <li>4. To introduce the principles of virtual functions and polymorphism.</li> <li>5. To make the students familiarize with the concept of exception handling.</li> </ol>			
<b>Detailed Syllabus:</b>			
<b>Unit-I</b>			
Object-Oriented Thinking: Different paradigms for problem solving, need for OOP paradigm, differences between OOP and Procedure oriented programming, Overview of OOP concepts- Abstraction, Encapsulation, Inheritance and Polymorphism.			
<b>Unit-II</b>			
C++ Basics: Structure of a C++ program, Data types, Declaration of variables, Expressions, Operators, Operator Precedence, Evaluation of expressions, Type conversions, Pointers, Arrays, Pointers and Arrays, Strings, Structures, References. Flow control statement- if, switch, while, for, do, break, continue, goto statements. Functions - Scope of variables, Parameter passing, Default arguments, inline functions, Recursive functions, Pointers to functions. Dynamic memory allocation and de-allocation operators-new and delete, Preprocessor directives.			
<b>Unit-III</b>			
C++ Classes and Data Abstraction: Class definition, Class structure, Class objects, Class scope, this pointer, Friends to a class, Static class members, Constant member functions, Constructors and Destructors, Dynamic creation and destruction of objects, Data abstraction, ADT and information hiding.			
<b>Unit-IV</b>			
Inheritance: Defining a class hierarchy, Different forms of inheritance, Defining the Base and Derived classes, Access to the base class members, Base and Derived class construction, Destructors, Virtual base class.			



## Unit-V

Virtual Functions and Polymorphism: Static and Dynamic binding, virtual functions, Dynamic binding through virtual functions, Virtual function call mechanism, Pure virtual functions, Abstract classes, Implications of polymorphic use of classes, Virtual destructors.

### Text /Reference Books:

1. Object Oriented Programming in C++ -Robert Lafore, edition, Galgotia publications
2. The Complete Reference C++, Herbert Schildt, 4th Edition, TMH
3. Y. Kanetkar, 'Let's C++', BPB publications
4. E Balagurusamy, 'Object oriented programming with C++', 4th edition, TMH
5. Sourav Sahay , 'Object-Oriented Programming with C++' , Oxford University Press, 2006.

### Course Outcomes:

At the end of this course students will able to

- CO1: Evaluate the difference between object-oriented programming & procedure-oriented programming
- CO2: Design C++ program to solve problems using basic C++ constructs.
- CO3: Create programs using Classes and Objects in C++.
- CO4: Understand inheritance in object-oriented programming
- CO5: Understand the concept of virtual functions, polymorphism in object-oriented programming, including static polymorphism (compile-time polymorphism) and dynamic polymorphism (runtime polymorphism)

<b>Course Title</b>	Operating System	<b>Course Code: CSAB3030</b>	
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>	
<b>Lectures / Tutorial</b>	<b>3/1 Hrs Week</b>	<b>Internal Assessment Test</b>	<b>30 Marks</b>
<b>Total Credits</b>	<b>4</b>	<b>End-Semester Examination</b>	<b>70 Marks</b>
<b>Course Objectives:</b>			
<ol style="list-style-type: none"> <li>1. To make students learn the evolution of OS.</li> <li>2. To make the learners introduce basic concepts of Operating System, its functions and services.</li> <li>3. To familiarize the students with various views and management policies adopted by O.S. as pertaining with processes, Deadlock, memory, File and I/O operations.</li> <li>4. To make students understand functionality of various OS like Unix, Linux and Windows XP as Pertaining to resource management.</li> <li>5. To provide the knowledge of basic concepts towards process synchronization and related Issues to the students.</li> </ol>			
<b>Detailed Syllabus:</b>			
<b>Unit-I</b>			
<b>Introduction:</b> Operating system and functions, Classification of Operating systems- Batch, Interactive, Time-sharing, Real-Time System, Multiprocessor Systems, Multiuser Systems, Multiprocessing Systems, Multithreaded Systems, Operating System Structure- Layered structure, System Components, Operating System services, Monolithic and Microkernel Systems.			
<b>Unit-II</b>			
<b>Concurrent Processes:</b> Process Concept, Principle of Concurrency, Producer / Consumer Problem, Mutual Exclusion, Critical Section Problem, Dekker's solution, Peterson's solution, Semaphores, Test and Set operation; Classical Problem in Concurrency- Dining Philosopher Problem, Inter Process Communication models.			
<b>Unit-III</b>			
<b>CPU Scheduling:</b> Scheduling Concepts, Performance Criteria, Process States, Process Transition Diagram, Schedulers, Process Control Block (PCB), Process address space, Process identification information, Threads and their management, Scheduling Algorithms, Multiprocessor Scheduling. <b>Deadlock:</b> System model, Deadlock characterization, Prevention, Avoidance and detection, Recovery from deadlock			
<b>Unit-IV</b>			
Basic bare machine, Resident monitor, Multiprogramming with fixed partitions, Multiprogramming with variable partitions, Protection schemes, Paging, Segmentation, Paged			

segmentation, Virtual memory concepts, Demand paging, Performance of demand paging, Page replacement algorithms, Thrashing, Cache memory organization, Locality of reference.
<b>Unit-V</b>
<b>I/O Management and Disk Scheduling:</b> I/O devices and I/O subsystems, I/O buffering, Disk storage and disk scheduling, RAID. File System: File concept, File organization and access mechanism, File directories, and File sharing, file system implementation issues, File system protection and security
<b>Text /Reference Books:</b>
<ol style="list-style-type: none"> <li>1. Silberschatz, Galvin and Gagne, "Operating Systems Concepts", Wiley</li> <li>2. Sibsankar Halder and Alex A Aravind, "Operating Systems", Pearson Education</li> <li>3. Harvey M Dietel, " An Introduction to Operating System", Pearson Education</li> <li>4. D M Dhamdhere, "Operating Systems : A Concept based Approach", 2nd Edition, TMH</li> <li>5. William Stallings, "Operating Systems: Internals and Design Principles", 6th Edition, Pearson Education</li> <li>6. A.S Tanenbaum "Modern Operating Systems" Pearson Education</li> </ol>
<b>Course Outcomes:</b>
<p>At the end of this course students will able to</p> <p>CO1: Understand the role of operating system as System software</p> <p>CO2: Analyze the various algorithms for management of memory and apply various concepts related with Deadlock to solve problems related with resources allocation</p> <p>CO3: Discuss various algorithms of CPU scheduling and Deadlock system model.</p> <p>CO4: Understand the concepts of memory management, paging, virtual memory.</p> <p>CO5: Understand the I/O Management and Disk Scheduling.</p>

<b>Course Title</b>	Software Testing and Quality Assurance	<b>Course Code:</b> CSAB3040	
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>	
<b>Lectures / Tutorial</b>	<b>3/1 Hrs Week</b>	<b>Internal Assessment Test</b>	<b>30 Marks</b>
<b>Total Credits</b>	<b>4</b>	<b>End-Semester Examination</b>	<b>70 Marks</b>
<b>Course Objectives:</b>			
<ol style="list-style-type: none"> <li>1. To provide learners knowledge in Software Testing techniques.</li> <li>2. To make students understand how testing methods can be used as effective tools in providing quality assurance concerning software.</li> <li>3. To make students understand the concept of software metrics and management process.</li> <li>4. To provide skills to design test case plans for testing software to the students.</li> </ol>			
<b>Detailed Syllabus:</b>			
<b>Unit-I</b>			
<b>Software Testing and Introduction to quality:</b> Introduction, Nature of errors, an example for Testing, Definition of Quality, QA, QC, QM and SQA, Software Development Life Cycle, Software Quality Factors Verification and Validation: Definition of V&V, Different types of V & V Mechanisms, Concepts of Software Reviews, Inspection and Walkthrough.			
<b>Unit-II</b>			
<b>Software Testing Techniques:</b> Testing Fundamentals, Test Case Design, White Box Testing and its types, Black Box Testing and its types.			
<b>Unit-III</b>			
<b>Software Testing Strategies:</b> Strategic Approach to Software Testing, Unit Testing, Integration Testing, Validation Testing, System Testing			
<b>Unit-IV</b>			
<b>Metrics:</b> Concept and Developing Metrics, Different types of Metrics, Complexity metrics <b>Defect Management:</b> Definition of Defects, Defect Management Process, Defect Reporting, Metrics Related to Defects, Using Defects for Process Improvement.			

## Unit-V

### Software Quality Assurance:

Quality Concepts, Quality Movement, Background Issues, SQA activities, Software Reviews, Formal Technical Reviews, Formal approaches to SQA, Statistical Quality Assurance, Software Reliability, The ISO 9000 Quality Standards, SQA Plan, Six sigma, Informal Reviews 15L

### Text /Reference Books:

1. Software Engineering for Students, A Programming Approach, Douglas Bell, 4 th Edition,, Pearson Education, 2005
2. Software Engineering – A Practitioner's Approach, Roger S. Pressman, 5 th Edition, Tata McGraw Hill, 2001
3. Quality Management, Donna C. S. Summers, 5 th Edition, Prentice-Hall, 2010. 4. Total Quality Management, Dale H. Besterfield, 3 rd Edition, Prentice Hall, 2003

### Course Outcomes:

- CO1: Discuss the concept of Software testing and software quality factors.
- CO2: Understand various software testing methods and strategies.
- CO3: Create & Design test cases for different software techniques.
- CO4: Understand a variety of software metrics and identify defect management
- CO5: Understand the software quality concepts.

<b>Course Title</b>	Fundamentals of Animation	<b>Course Code:</b> CSAB3050	
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>	
<b>Lectures / Tutorial</b>	3 / 1 Hrs Week	<b>Internal Assessment Test</b>	<b>30 Marks</b>
<b>Total Credits</b>	4	<b>End-Semester Examination</b>	<b>70 Marks</b>
<b>Course Objectives:</b>			
<ol style="list-style-type: none"> <li>1. Understand the fundamental principles and history of animation.</li> <li>2. Familiarize students with various types of animation techniques.</li> <li>3. Develop practical knowledge in 2D and 3D animation tools.</li> <li>4. Explore storyboarding and character development for animation.</li> <li>5. Introduce students to the production pipeline of animation.</li> </ol>			
<b>Detailed Syllabus:</b>			
<b>Unit-I</b>			
Introduction to Animation :Definition and origin of animation, History and evolution of animation,Importance and scope of animation in various fields, Types of animation: 2D, 3D, Stop Motion, etc.			
<b>Unit-II</b>			
<b>Principles and Techniques of Animation</b> 12 Principles of Animation (e.g., squash and stretch, anticipation, staging), Frame rates and timing, Storyboarding and pre-visualization, Traditional vs. digital techniques.			
<b>Unit-III</b>			
<b>2D Animation Tools and Techniques</b> Introduction to 2D animation software (e.g., Adobe Animate, Toon Boom), Drawing and rigging characters, Keyframes, tweening, and layers, Creating simple 2D animated sequences			
<b>Unit-IV</b>			
<b>Unit IV: 3D Animation Basics</b> Introduction to 3D animation software (e.g., Blender, Maya), Modelling basics: objects, meshes, and surfaces, Keyframing, rigging and animating 3D characters, Rendering and lighting in 3D animation			
<b>Unit-V</b>			
<b>Animation Production Process</b> Stages of animation production: Pre-production, Production, Post-production, Role of director, animator, layout artist, editor, Sound and music in animation, Project management in animation pipeline.			

<b>Text /Reference Books:</b>
1. The Animator's Survival Kit – Richard Williams 2. Cartoon Animation – Preston Blair 3. Principles of 3D Animation – Michael O'Rourke 4. The Art of 3D Computer Animation and Effects – Isaac Victor Kerlow 5. Exploring 3D Animation – Peter Lord and Brian Sibley
<b>Course Outcomes:</b>
CO1: Demonstrate understanding of animation history and principles. CO2: Identify and apply key techniques of 2D and 3D animation. CO3: Create basic animation sequences using industry-standard tools. CO4: Design characters and storyboards for animation projects. CO5: Illustrate knowledge of the production pipeline in the animation industry.

<b>Elective-II</b>			
<b>Course Title</b>	Financial Accounting & Management	<b>Course Code:MGTG3100</b>	
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>	
<b>Lectures / Tutorial</b>	<b>3 Hrs Week</b>	<b>Internal Assessment Test</b>	<b>30 Marks</b>
<b>Total Credits</b>	<b>3</b>	<b>End-Semester Examination</b>	<b>70 Marks</b>
<b>Course Objectives:</b>			
<p>The objectives of this course are</p> <ol style="list-style-type: none"> <li>1. To equip the students with the skill of preparing accounts and financial statements of various types of business units other than corporate undertakings.</li> </ol>			
<b>Detailed Syllabus:</b>			
<b>Unit-I</b>			
<p><b>Financial Accounting</b>  An Introduction: Introduction, Meaning of Accountancy, book-keeping and Accounting, Accounting Process, Objectives for accounting, Differences between book-keeping and accounting Users of accounting information, Limitations of Accounting, Basic terminologies.</p>			
<b>Unit-II</b>			
<p><b>Accounting Concepts</b>  Principles, Bases and Policies: Introduction , Accounting Concepts, Principles, Policies and Standards, Types of accounting concepts - Business Separate entity concept - Going concern concept - Money measurement concept - Periodicity concept - Accrual concept, Accounting Principles - Principle of Income recognition - Principle of expense - Principle of matching cost and revenue - Principle of Historical costs - Principle of full disclosure - Double aspect principle - Modifying Principle - Principle of materiality - Principle of consistency - Principle of conservatism or prudence, Accounting Policies - Changes in Accounting Policies - Disclosure in case of changes in Accounting Policies, Accounting Standards - Scope and functions of Accounting Standards Board - International Financial Reporting System.</p>			
<b>Unit-III</b>			
<p><b>Double Entry Accounting</b>  Introduction, meaning of double entry accounting, Classification of accounts under Traditional approach, Classification of accounts under Accounting Equation approach, Comparison of traditional approach with Modern approach equal approach, Accounting Trail, Transactions and events, Meaning and roles of debit and credit, Accounting equation.</p>			
<b>Unit-IV</b>			
<p><b>Secondary Books</b>  Introduction, Secondary books, Purchases Book/Purchases Day book - Cash discount, Trade discount - Difference between cash discount and trade discount, Sales Book or Sales Day book -</p>			



Purchase Returns Book - Sales Returns Book, bills receivable book - Bills payable book - Cash book, posting to Ledger Accounts Posting to Ledger.
<b>Unit-V</b>
<p><b>Trial Balance</b> Introduction, Meaning, Objectives of preparing a trial balance, Methods of preparing a trial balance, Preparation of Trial balance, Adjusting Entries, Errors and their rectification, Errors disclosed by Trial Balance, Errors not disclosed by Trial Balance, steps to locate the errors.</p> <p><b>Final Accounts</b> Introduction, Adjustments before preparing final accounts, Depreciation, Bad Debts and accounting treatment of bad debts, Provision for doubtful debts, Reserves for Discount on Debtors, Reserve for Discount on Creditors, Closing Stock, Trading Account, Profit and Loss Account, Balance Sheet.</p>
<b>Text /Reference Books:</b>
<ol style="list-style-type: none"> <li>1. Principles of Accounting: J.R. Batlibuoy</li> <li>2. Advance Accounting and Auditing: Shukla and Grewal</li> <li>3. "Financial Accounting" by T S Reddy and A Murthy</li> <li>4. "Financial Accounting" by Goyal V K</li> </ol>
<b>Course Outcomes:</b>
<p>At the end of this course students will able to</p> <p>CO1: Define the concept of bookkeeping and accounting.</p> <p>CO2: Understand the general purposes and functions of accounting.</p> <p>CO3: Explain the differences between management and financial accounting.</p> <p>CO4: Describe the main elements of financial accounting information – assets, liabilities, revenue and expenses.</p> <p>CO5: Create the main financial statements and their purposes.</p>

<b>Course Title</b>	Management Information System	<b>Course Code:CSEB3040</b>	
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>	
<b>Lectures / Tutorial</b>	<b>3 Hrs/Week</b>	<b>Internal Assessment Test</b>	<b>30 Marks</b>
<b>Total Credits</b>	<b>3</b>	<b>End-Semester Examination</b>	<b>70 Marks</b>
<b>Course Objectives:</b>			
<ol style="list-style-type: none"> <li>1. Provide students with comprehensive knowledge and technical skills needed to successfully participate in and support the increasingly applied role of information technology in corporate decision making,</li> <li>2. Enable graduates to conceptualize and manage the specification, design and implementation of applied information systems,</li> <li>3. Provide the knowledge of contemporary issues related to the field of managing information systems</li> <li>4. Develop knowledge and skills required to work effectively in a profession,</li> <li>5. Enhance self-confidence, ability to make proper decisions and effective communication, and Pursue lifelong learning and continuing education.</li> </ol>			
<b>Detailed Syllabus:</b>			
<b>Unit-I</b>			
<b>Organizations and Computing:</b> Introduction, Modern Organization-IT enabled- Networked-Dispersed-Knowledge Organization, Information Systems in Organizations- what are information systems?, Brief history of computing- ENIAC: Way to commercial computers- Advent of artificial intelligence- advent of personal computing-Free Software Movement- Advent of Internet, The role of internet- Internet and Web: they are different-the internet changes everything			
<b>Unit-II</b>			
<b>Managing Information Systems in Organizations:</b> Introduction, Managing in the Internet Era, Managing Information Systems in Organization the IT interaction model, Challenges for the manager-what information to build? -how much to spend on information systems? -what level of capabilities should be created with information systems? -how centralized should the services be? -what security levels are required? - Technology road map for the organization.			
<b>Unit-III</b>			
<b>Data and Information:</b> Introduction, data and information- measuring data, information as a resource, information in organizational functions, types of information technology, types of information systems-transaction processing systems management information systems.			
<b>Unit-IV</b>			
<b>Business Process Integration with IT:</b> Introduction, Business Process Integration- Business processes-example of a complex process, Motivation for Enterprise Systems, Enterprise Resource Planning systems- finance and accounting module-human resource management module-manufacturing and operations module- sales and marketing module.			

<b>Unit-V</b>
<b>Managing Data Resources:</b> Introduction , The Need for Data Management- History of data use, Challenges of Data Management- data independence- reduced data redundancy- data consistency- data access- data administration- managing concurrency-managing security- recovery from crashes-application development, Database Concepts- fields, records and files- basic architecture, Data Warehouses- data mining uses.
<b>Text /Reference Books:</b>
<ol style="list-style-type: none"> <li>1. Management Information Systems, A O'Brien.</li> <li>2. Management Information System, W S Jawadekar.</li> <li>3. Management Information Systems, Laaudon and Ludon.</li> <li>4. Management Information Systems , Robert Schultheis and Mary Summer</li> </ol>
<b>Course Outcomes:</b>
<p>CO1: Apply modern tools, techniques, and technology in a functional and productive manner in their professional activities,</p> <p>CO2: Analyze, design, construct, implement and maintain, usable, reliable, and cost-effective Information Systems (IS) that support operational, managerial, and strategic activities of organizations,</p> <p>CO3: Analyze, design, manipulate, and implement relational databases on which most IS are built upon,</p> <p>CO4: Plan, coordinate, monitor, and control IS development projects,</p> <p>CO5: Study and evaluate existing manual and automated business processes, and identify opportunities for reengineering and/or automation,</p>

<b>Course Title</b>	Object Oriented Programming with C++Lab	<b>Course Code:CSAB3021</b>	
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>	
<b>Lectures / Tutorial</b>	<b>4 Hrs/Week</b>	<b>Internal Assessment Test</b>	<b>15 Marks</b>
<b>Total Credits</b>	<b>2</b>	<b>End-Semester Examination</b>	<b>35 Marks</b>

#### Course Objectives:

1. **To provide hands-on experience in writing and executing C++ programs** using basic constructs like variables, operators, control structures, and functions.
2. **To introduce object-oriented programming (OOP) concepts** such as classes, objects, encapsulation, inheritance, and polymorphism through practical implementation.
3. **To enable students to develop modular and reusable code** using functions, templates, and operator overloading in C++.
4. **To train students in handling data using arrays, pointers, structures, and file operations** for problem-solving.
5. **To develop debugging, logical reasoning, and problem-solving skills** by implementing real-time applications using C++.

#### List of Experiments:

1. WAP to swap two numbers.
2. WAP to display the grade of students using switch cases.
3. WAP to check whether the given string is palindrome or not.
4. WAP to find LCM and HCF of two numbers using a while loop.
5. WAP to print following alphabet pattern
 

A  
 A B  
 A B C  
 A B C D
6. WAP to calculate the sum of 10 elements of an array.
7. WAP to implement linear search.
8. WAP to implement bubble sort.
9. WAP to perform addition of two matrices.
10. WAP to implement an array of structures. Declare structure as Student with variables as rollno, name, and branch. Create an array of structure of size 10 and display information of all students.
11. WAP to declare a class Student having data members roll\_no and name. Accept and display this data for 3 objects.

12. WAP to declare a class Time having data members as hrs, min and sec. Write a constructor and destructor for class Time and display for 3 objects. (Default constructor, parameterized constructor, copy constructor).
13. Create two classes as AB and XY. Declare one variable of each class. Swap the contents of variables of two classes using the friend function.
14. WAP to implement single inheritance.  
Parent class- Employee, data members- emp\_id, name. Member Functions- void get1(), void put1(). Child class-Fitness, data members- height, weight. Member Functions- void get2(), void put2().
15. WAP to implement multilevel inheritance.
16. WAP to implement Multiple inheritance.
17. WAP to implement hierarchical inheritance.
18. WAP to implement hybrid inheritance using virtual base class.

**Course Outcomes:**

After completion of this subject students will be able to

- CO1: Develop programs using control structures like switch cases, loops, and conditional statements to handle various scenarios and requirements.
- CO2: Analyze problem requirements and design algorithmic solutions to solve programming tasks effectively.
- CO3: Create and implement efficient algorithms to solve complex problems, such as palindrome checking, matrix addition, and array of structures.
- CO4: Develop object-oriented programming solutions by designing and implementing classes and inheritance relationships to model real-world scenarios.
- CO5: Apply problem-solving skills to design and implement programs that involve multiple layers of abstraction and complexity, such as multiple inheritance and hybrid inheritance.

<b>Course Title</b>	Operating System Lab	<b>Course Code:CSAB3031</b>	
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>	
<b>Lectures / Tutorial</b>	<b>4 Hrs/Week</b>	<b>Internal Assessment Test</b>	<b>15 Marks</b>
<b>Total Credits</b>	<b>2</b>	<b>End-Semester Examination</b>	<b>35 Marks</b>
<b>Course Objectives:</b>			
<ol style="list-style-type: none"> <li>1. To provide hands-on experience with key operating system concepts</li> <li>2. To develop the ability to write and simulate programs</li> <li>3. To introduce students to system-level programming using C or shell scripting</li> <li>4. To familiarize students with Linux/Unix commands and shell scripting</li> <li>5. To cultivate problem-solving and debugging skills</li> </ol>			
<b>List of Experiments:</b>			
<ol style="list-style-type: none"> <li>1. Installation Process of various Operating System.</li> <li>2. Commands for files &amp; directories: cd, ls, cp, md, rm, mkdir, rmdir.</li> <li>3. Creating and viewing files using cat. File comparisons. Disk related commands: checking disk free spaces.</li> <li>4. Given the list of processes, their CPU burst times and arrival times, display/print the Gantt chart for FCFS and SJF. For each of the scheduling policies, compute and print the average waiting time and average turnaround time. (2 sessions).</li> <li>5. Given the list of processes, their CPU burst times and arrival times, display/print the Gantt chart for Priority and Round robin. For each of the scheduling policies, compute and print the average waiting time and average turnaround time. (2 sessions).</li> <li>6. Study of Inter Process communication (using shared memory, pipes or message queues).</li> <li>7. Implement some memory management schemes – I</li> <li>8. Implement some memory management schemes – II</li> <li>9. Implement any file allocation technique (Linked, Indexed or Contiguous).</li> <li>10. To write simple shell programs by using conditional, branching and looping statements</li> </ol>			
<b>Course Outcomes:</b>			
<p>After completion of this subject students will be able to</p> <p>C01: Apply knowledge of different installation processes for various operating systems, including Windows, Linux, and macOS.</p> <p>C02: Analyze the functionality and usage of various file and various commands</p> <p>C03: Create and manipulate files using commands like cat, and perform file comparisons to identify differences.</p>			

CO4: Analyze disk-related commands to check disk free space and perform disk management tasks efficiently.

CO5: Develop shell scripts or programs using conditional statements, loops, and branching

BCA- AR VR 2 Year- Semester IV											
Type		Course Title	Hours/Week			Theory Marks		Practical Marks		Total Marks	Credit
			L	T	P	IA	ESE	IA	ESE		
DC	CSAB4010	Python Programming	3	1	-	30	70	-	-	100	4
DC	CSAB4020	JAVA Programming	3	1	-	30	70	-	-	100	4
DC	CSAB4030	Design Analysis & Algorithm	3	1	-	30	70	-	-	100	4
DC	CSAB4040	Computer Networks	3	1	-	30	70	-	-	100	4
DC	CSAB4050	3D Animation & Modelling	3	1	-	30	70			100	4
DE	**	Elective 1	3	-	-	30	70	-	-	100	3
DC	CSAB4011	Python Programming Lab	-	-	4	-	-	15	35	50	2
DC	CSAB4021	JAVA Programming Lab	-	-	4	-	-	15	35	50	2
SEC		Verbal Ability									
		<b>TOTAL</b>	<b>18</b>	<b>5</b>	<b>8</b>	<b>180</b>	<b>420</b>	<b>30</b>	<b>70</b>	<b>700</b>	<b>27</b>

**Elective-1 CSAB4620/ CSAB4930**

**1. Data Warehousing and Data Mining**

**2. E-Commerce**

<b>Course Title</b>	Python Programming	<b>Course Code:</b> CSAB4010	
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>	
<b>Lectures / Tutorial</b>	<b>3 / 1 Hrs Week</b>	<b>Internal Assessment Test</b>	<b>30 Marks</b>
<b>Total Credits</b>	<b>4</b>	<b>End-Semester Examination</b>	<b>70 Marks</b>
<b>Course Objectives:</b>			
<ol style="list-style-type: none"> <li>1. To make the students understand the concepts of programming before actually starting to write programs.</li> <li>2. To train the students to develop logic for Problem Solving.</li> <li>3. To make the students familiar with the basic constructs of programming such as data, operations, conditions, loops, functions etc.</li> <li>4. To develop among students' problem-solving skills using syntactically simple language i.e. Python (version: 3.X or higher).</li> </ol>			
<b>Detailed Syllabus:</b>			
<b>Unit-I</b>			
<b>Introduction to Python:</b> The basic elements of python, basic syntax, Writing and executing simple programs, Basic Data Types such as numbers, strings, declaring variables, Performing assignments, arithmetic operations, Simple input-output, Features.			
<b>Unit-II</b>			
<b>Python Program Flow Control:</b> Conditional blocks using if, else and elif, Simple for loops in python, for loop using ranges list and dictionaries Use of while loops in python Loop manipulation using pass, continue, break and else, Programming using Python conditional and loops block.			
<b>Unit-III</b>			
<b>Functions, Scoping and Abstraction:</b> Functions and scoping, Specifications, Recursion, Global variables, Modules, Files, System Functions and Parameters.			
<b>Unit-IV</b>			
<b>Structured Types, Mutability and Higher-Order Functions:</b> Strings, Tuples, Lists and Dictionaries Lists and Mutability, Functions as Objects.			
<b>Unit-V</b>			
<b>Exception handling:</b> What is an exception, various keywords to handle exceptions such try, catch, except, else, finally, raise. <b>Regular Expressions:</b> Concept of regular expression, various types of regular expressions, using match function, Plotting using PyLab.			



<b>Text /Reference Books:</b>
<ol style="list-style-type: none"> <li>1. John V Guttag. "Introduction to Computation and Programming Using Python", Prentice Hall of India.</li> <li>2. Paul Gries , Jennifer Campbell, Jason Montojo, Practical Programming: An Introduction to Computer Science Using Python 3, Pragmatic Bookshelf, 2/E 2014.</li> <li>3. James Payne , Beginning Python: Using Python 2.6 and Python 3, Wiley India, 2010 2. <ol style="list-style-type: none"> <li>a. Lukaszewski, MySQL for Python: Database Access Made Easy, Pact Publisher, 2010</li> </ol> </li> <li>4. R. Nageswara Rao, "Core Python Programming", dreamtech.</li> <li>5. Wesley J. Chun. "Core Python Programming - Second Edition", Prentice Hall.</li> <li>6. Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, "Data Structures and Algorithms in Pyhon", Wiley.</li> <li>7. Kenneth A. Lambert, "Fundamentals of Python – First Programs", CENGAGE Publication.</li> <li>8. Luke Sneeringer, "Professional Python", Wrox.</li> </ol>
<b>Course Outcomes:</b>
<p>CO1: Understand the basics of python programming before actually starting to write programs.</p> <p>CO2: Familiar with the basic constructs of programming such as data, operations, conditions, loops, functions etc.</p> <p>CO3: Create functions in Python programming</p> <p>CO4: Store data in advanced structures such lists, tuples, dictionaries, etc., and apply exception handling.</p> <p>CO5: Apply the problem-solving skills using syntactically simple language i.e. Python (version: 3.X or higher).</p>

<b>Course Title</b>	JAVA Programming	<b>Course Code:</b> CSAB4020	
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>	
<b>Lectures / Tutorial</b>	<b>3 / 1 Hrs Week</b>	<b>Internal Assessment Test</b>	<b>30 Marks</b>
<b>Total Credits</b>	<b>4</b>	<b>End-Semester Examination</b>	<b>70 Marks</b>
<b>Course Objectives:</b>			
<ol style="list-style-type: none"> <li>1. To make students understand the concept of Object-Oriented Programming.</li> <li>2. To help students to understand the use of programming languages such as JAVA</li> <li>3. To guide and teach the students problems understanding, analyzing skills in order to formulate Algorithms.</li> <li>4. To provide knowledge about JAVA fundamentals: data types, variables, keywords and Control structures to the students.</li> <li>5. To understand methods, arrays, inheritance, Interface, package and multithreading and Concept of Applet</li> </ol>			
<b>Detailed Syllabus:</b>			
<b>Unit-I</b>			
<b>Fundamental Concepts of object-oriented programming:</b> Overview of object-oriented programming, classes, objects, messages, abstraction, encapsulation, inheritance, polymorphism, exception handling, and object-oriented containers, Differences and similarity between C++ and JAVA.			
<b>Unit-II</b>			
<b>Fundamental of Java programming:</b> Features of Java, JDK Environment & tools, structure of Java program, Keywords, data types, variables, operators, expressions, decision making, looping, type casting, Input output using scanner class.			
<b>Unit-III</b>			
<b>Classes and objects:</b> Creating classes and objects, Memory allocation for objects, passing parameters to Methods, returning parameters, Method overloading, Constructor, types of constructors and finalize (), Arrays: Creating an array, one dimensional Array, Two-Dimensional array.			
<b>Unit-IV</b>			
<b>Inheritance, interface and package:</b> Types of inheritance: Single Inheritance, Multilevel Inheritance, Method overriding, super keyword, final keyword, abstract class, Virtual Functions, Interface, Packages			
<b>Unit-V</b>			
<b>Multithreading and Applet:</b>			

Life cycle of thread, Methods, Multithreading, Priority in multithreading, Applet life cycle, creating applet

**Text /Reference Books:**

9. The Complete Reference -Java by Herbert Schild, TMH Publication.
10. Programming with Java- A Primer by E. Balagurusamy, 3rd Edition, TMH Publication.
11. The Complete Reference- JAVA.
12. 3rd Edition By Patrick Naughton, TMH Publ.
13. Java 6, Programming Black Book by Kogent Solution Inc., Dreamtech Press Publ.
14. Java 2, Black Book by Steve Holzner, Paraglyph Press, 2nd Ed.

**Course Outcomes:**

1. CO1: Use the syntax and semantics of java programming language and basic concepts of OOP.
2. CO2: Design reusable programs using the concepts of inheritance, polymorphism, interfaces and packages.
3. CO3: Apply the concepts of Multithreading to perform multitasking activity.
4. CO4: Implement the Exception handling to develop efficient and error free codes.
5. CO5: Design event driven GUI and web related applications which mimic the real-world scenarios.

<b>Course Title</b>	<b>Design Analysis &amp; Algorithm</b>	<b>Course Code:</b> CSAB4030	
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>	
<b>Lectures / Tutorial</b>	<b>3 / 1 Hrs Week</b>	<b>Internal Assessment Test</b>	<b>30 Marks</b>
<b>Total Credits</b>	<b>4</b>	<b>End-Semester Examination</b>	<b>70 Marks</b>
<b>Course Objectives:</b>			
1. To teach various problem-solving strategies to the students. 2. To make the students study background for algorithm analysis and implementation of various strategies like divide and conquer, Greedy method, Dynamic programming, Backtracking, branch and bound. 3. To enable students, solve the complex networking problems using graph algorithms. 4. To make the learners study different string-matching algorithms and network flow theorem.			
<b>Detailed Syllabus:</b>			
<b>Unit-I</b>			
<b>Algorithm Design Techniques</b> Divide and Conquer: Basic method, use, Examples – Binary Search, Merge Sort, Quick Sort and their complexity. Heap Sort and its complexity, Dynamic Programming: Basic method, use, Examples – Matrix Chain Manipulation, All pair shortest paths, single source shortest path. Backtracking: Basic method, use, Examples – 8 queens’ problem, Graph coloring problem. Greedy Method: Basic method, use, Examples – Knapsack problem, Job sequencing with deadlines.			
<b>Unit-II</b>			
<b>Lower Bound Theory</b> $O(n \log n)$ bound for comparison sort, Disjoint set manipulation: Set manipulation algorithm like UNION- FIND, union by rank.			
<b>Unit-III</b>			
<b>Graph traversal algorithm</b> Recapitulation, Breadth First Search (BFS) and Depth First Search (DFS) – Classification of edges - tree, forward, back and cross edges – complexity and comparison.			
<b>Unit-IV</b>			
<b>String matching problem</b> Different techniques – Naive algorithm, string matching using finite automata, and Knuth, Morris, Pratt (KMP) algorithm with their complexities.			
<b>Unit-V</b>			
<b>Network Flow</b>			

Ford Fulkerson algorithm, Max-Flow Min-Cut theorem (Statement and Illustration).

**Text /Reference Books:**

1. T. H. Cormen, C. E. Leiserson, R. L. Rivest and C. Stein, "Introduction to Algorithms".
2. A. Aho, J. Hopcroft and J. Ullman "The Design and Analysis of Algorithms".

**Course Outcomes:**

1. CO1: Select appropriate problem-solving strategies.
2. CO2: Calculate time complexity and space complexity of different algorithms and apply set manipulation algorithms.
3. CO3: Comprehend real world networking problems using graph algorithms.
4. CO4: Apply different string-matching algorithms.
5. CO5: Understand the Network flow algorithms.

<b>Course Title</b>	Computer Networks	<b>Course Code:</b> CSAB4040	
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>	
<b>Lectures / Tutorial</b>	<b>3 / 1 Hrs Week</b>	<b>Internal Assessment Test</b>	<b>30 Marks</b>
<b>Total Credits</b>	<b>4</b>	<b>End-Semester Examination</b>	<b>70 Marks</b>
<b>Course Objectives:</b>			
<ol style="list-style-type: none"> <li>1. To make students understand computer networking basics.</li> <li>2. To develop an understanding of different components of computer networks, various protocols, modern technologies and their applications to the students.</li> <li>3. To impart the knowledge about the functions of various networking layers.</li> </ol>			
<b>Detailed Syllabus:</b>			
<b>Unit-I</b>			
<b>Introduction to Networking</b> Introduction to computer network, network application, network software and hardware components (Interconnection networking devices), Network topology, protocol hierarchies, design issues for the layers, connection oriented and connectionless services, Reference models: Layer details of OSI, TCP/IP models. Communication between layer.			
<b>Unit-II</b>			
<b>Physical Layer</b> Electromagnetic Spectrum, Guided Transmission Media: Twisted pair, Coaxial, Fiber optics. Unguided, media (Wireless Transmission): Radio Waves, Microwave.			
<b>Unit-III</b>			
<b>Data Link Layer</b> DLL Design Issues (Services, Framing, Error Control, Flow Control), Error Detection and Correction (Hamming Code, CRC, Checksum), Elementary Data Link protocols, Stop and Wait, Sliding Window (Go Back N, Selective Repeat). Access Control sublayer, Channel Allocation problem, Multiple , access Protocol (Aloha, Carrier Sense Multiple Access (CSMA/CD), (CSMA/CA).			
<b>Unit-IV</b>			
<b>Network Layer</b> Network Layer design issues, Communication Primitives: Unicast, Multicast, Broadcast. IPv4 Addressing (classfull and classless), Subnetting, Supernetting design problems, IPv4 Protocol, Network Address Translation (NAT), Routing algorithms: Shortest Path(Dijkastra's), Distance Vector Routing, Protocols - ARP,RARP,Token & Leaky bucket algorithms.			
<b>Unit-V</b>			
<b>Transport &amp; Application Layer</b>			

Connection management (Handshake), UDP, TCP, DNS, HTTP, SMTP, Telnet, FTP
<b>Text /Reference Books:</b>
<ol style="list-style-type: none"> <li>1. Forouzen, "Data Communication and Networking", TMH</li> <li>2. A.S. Tanenbaum, Computer Networks, Pearson Education</li> <li>3. W. Stallings, Data and Computer Communication, Macmillan Press</li> <li>4. Bhavneet Sidhu, An Integrated approach to Computer Networks, Khanna Publishing House</li> <li>5. Gary R.Wright,W.Richard Stevens "TCP/IP Illustrated,Volume2 The Implementation" Addison- Wesley</li> <li>6. Michael A. Gallo and William M. Hancock "Computer Communication and Networking Technology" Cengage Learning</li> <li>7. Anuranjan Misra, "Computer Networks", Acme Learning</li> <li>8. G. Shanmugarathinam," Essential of TCP/ IP", Firewall Media.</li> </ol>
<b>Course Outcomes:</b>
<ol style="list-style-type: none"> <li>1. CO1:Define basic networking terminologies such as LAN, WAN, TCP/IP, DNS, etc.</li> <li>2. CO2:Understand layers of the OSI model and their functions</li> <li>3. CO3:Recognize different types of network devices and their roles.</li> <li>4. CO4:Discuss different types of protocols and technologies in different layers of OSI model.</li> <li>5. CO5:Proficiency in subnetting and super netting techniques for efficient IP address allocation and management within networks.</li> </ol>

<b>Course Title</b>	3D Animation and Modeling	<b>Course Code: CSAB4050</b>	
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>	
<b>Lectures / Tutorial</b>	3 / 1 Hrs Week	<b>Internal Assessment Test</b>	<b>30 Marks</b>
<b>Total Credits</b>	4	<b>End-Semester Examination</b>	<b>70 Marks</b>
<b>Course Objectives:</b>			
<ol style="list-style-type: none"> <li>1. To introduce the principles and workflow of 3D modeling and animation.</li> <li>2. To familiarize students with industry-standard 3D software (e.g., Blender, Maya).</li> <li>3. To provide hands-on skills in modeling, rigging, texturing, lighting, animation, and rendering.</li> <li>4. To build foundational skills for AR/VR applications in 3D environments.</li> <li>5. To encourage creativity in designing 3D characters and objects for immersive environments.</li> </ol>			
<b>Detailed Syllabus:</b>			
<b>Unit-I</b>			
Introduction to 3D Animation: Overview of 3D computer graphics, Concepts of modeling, texturing, lighting, rigging, animation, Types of animation: keyframe, procedural, motion capture, Coordinate systems and transformations, Introduction to animation software: Blender, Autodesk Maya			
<b>Unit-II</b>			
3D Modeling Techniques: Polygonal modeling: vertices, edges, faces, NURBS and Subdivision surface modeling, Modifiers and mesh editing tools, Hard-surface modeling vs. organic modeling, Object hierarchy and grouping			
<b>Unit-III</b>			
Texturing and Materials: UV mapping and unwrapping, Image textures vs. procedural textures, Materials and shaders, Bump, Normal, and Displacement mapping, Texture painting and PBR workflow			
<b>Unit-IV</b>			
Lighting and Rendering: Types of lights: point, directional, area, HDRI lighting, Three-point lighting setup, Camera setup and movement, Rendering engines: Eevee vs. Cycles (in Blender), Render settings and output formats			
<b>Unit-V</b>			
<p>Animation and Rigging</p> <p>Timeline and keyframe animation, Graph editor and dope sheet, Rigging basics: armatures, bones, inverse kinematics, Character animation principles (12 principles of animation), Exporting animated models for AR/VR use</p>			



## Case Study (Any Two):

### 1. Modeling a Low-Poly City for AR Navigation App

#### Scenario:

A startup is developing an **AR navigation app** for smart cities. The app overlays city maps with 3D models of important landmarks and streets.

#### Problem:

You are hired to design a **low-poly 3D city model** that includes roads, traffic lights, parks, and buildings for real-time AR rendering.

**Tasks:** Create modular low-poly assets in **Blender** (to reduce file size).

Use **object hierarchy** to group road elements, buildings, etc.

#### Learning Outcome:

Students learn **polygonal modeling**, modular asset creation, and **file optimization for real-time AR use**.

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### Case Study 2: Character Rigging and Animation for VR Storytelling

#### Scenario:

An indie game studio is developing a **VR short story experience** in which the user interacts with animated characters.

#### Problem:

You are assigned to **rig and animate a humanoid character** who guides the user through a virtual environment.

**Tasks:** Rig the character using armatures and apply **Inverse Kinematics (IK)**.

Animate facial expressions and body gestures using **keyframes**.

Integrate the animated character in a VR storytelling application using Unity.

#### Learning Outcome:

Students learn **rigging**, **character animation**, and how animations enhance immersion in VR.

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### Case Study 3 : Designing a Virtual Museum Exhibit

#### Scenario:

A local museum wants to create a **virtual reality museum** where users can walk through exhibits and view 3D replicas of artifacts.

#### Problem:

You are responsible for designing the **entire VR scene**, including environment modeling, lighting, and artifact animation.

**Tasks:** Model the **museum interior**, including walls, lights, and frames.

Create 3D artifacts (e.g., statues, tools) using **organic and hard-surface modeling**.

Animate rotating exhibits and add **interactive lighting**.

Export and implement the scene into a VR engine like **Unity or Unreal**.

#### Learning Outcome:

Students apply end-to-end skills: **modeling, texturing, lighting, animation, and integration** into an immersive VR setup.

**Text /Reference Books:**

1.**D Animation Essentials:** Author: Andy Beane, Publisher: Wiley (John Wiley & Sons), Edition & Formats: 1st edition (e-book and paperback), Publication Date:E-Book ISBN 978-1-118-23905-6 – January 2012.

2.**Digital Modeling:** Author: William Vaughan, Publisher: New Riders (Imprint of Pearson)  
Edition & Format: 1st edition, paperback, Publication Date: January 2012 (also listed as early 2011 in some editions) [dl.softgozar.com+15Amazon+15eBay+15Mission Valley+5ThriftBooks+5Goodreads+5eBay+1Wiley+1](http://dl.softgozar.com+15Amazon+15eBay+15Mission+Valley+5ThriftBooks+5Goodreads+5eBay+1Wiley+1), ISBN: 978-0-321-70089-6 / ISBN-10 0321700899

**Course Outcomes:**

**CO1:** Understand the basic concepts and workflow of 3D animation and modeling

**CO2:** Apply modeling techniques to create 3D objects using professional tools

**CO3:** Create textured and lit 3D scenes ready for rendering

**CO4:** Animate 3D objects and characters using rigging and keyframing

**CO5:** Integrate 3D assets in AR/VR environments and render final outputs

<b>Elective-I</b>			
<b>Course Title</b>	<b>Data Warehousing and Data Mining</b>	<b>Course Code:CSAB4620</b>	
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>	
<b>Lectures / Tutorial</b>	<b>3 Hrs/Week</b>	<b>Internal Assessment Test</b>	<b>30 Marks</b>
<b>Total Credits</b>	<b>3</b>	<b>End-Semester Examination</b>	<b>70 Marks</b>
<b>Course Objectives:</b>			
<ol style="list-style-type: none"> <li>1. To make students understand the basic concepts of data warehousing.</li> <li>2. To make students extract knowledge from a data repository for data analysis, frequent pattern, classification and prediction.</li> <li>3. To guide and teach the students to solve business problems by data analysis.</li> <li>4. To help students to perform predictions based on the given data that can help in long term decision making.</li> </ol>			
<b>Detailed Syllabus:</b>			
<b>Unit-I</b>			
<b>Data Warehousing</b> Introduction, Data lakes, Data marts, Data warehousing Components, Building a Data warehouse, Data warehouse architecture, ETL process, Data Extraction, Cleanup, and Transformation Tools, Metadata Repository. Introduction to Online Analytical Processing (OLAP), Multidimensional Data Model, Stars, Snowflakes, and Fact Constellations Schemas for multidimensional data models, Multidimensional versus Multi Relational OLAP, OLAP tools operations. Difference between OLTP and OLAP.			
<b>Unit-II</b>			
<b>Data mining:</b> Introduction, What Kinds of Data can be mined, Data mining functionalities, Technologies used, Interestingness of Patterns, Integration of a Data Mining System with a Data Warehouse, Issues, Data preprocessing – Data cleaning – Data Integration and Transformation – Data Reduction – Discretization, Data Mining Task Primitives.			
<b>Unit-III</b>			
<b>Association Rule Mining:</b> Market basket analysis, Mining Frequent Patterns, Associations and Correlations, Apriori algorithm, Association Rule generation. Introduction to Mining Multilevel Association Rules and Mining Multidimensional Association rules			

<b>Unit-IV</b>
<b>Cluster Analysis – Introduction</b> A categorization of Major clustering methods - Partitioning methods, Hierarchical methods, Grid-based methods, Density-based methods.
<b>Unit-V</b>
<b>Classification and Prediction:</b> Basic Concepts, Decision Tree, Rule Based Classification, Classification by Back propagation, Associative Classification, Lazy Learners, Other Classification Methods, Prediction.
<b>Text /Reference Books:</b>
<ol style="list-style-type: none"> <li>1. Ralph Kimball, "The Data Warehouse Lifecycle toolkit', 2nd edition, Wiley India.</li> <li>2. Han, Kamber, "Data Mining Concepts and Techniques", 2nd edition, Elsevier</li> <li>2. Reema Theraja “Data warehousing”, Oxford University Press.</li> <li>3. “Introduction to Data Mining”, 1/e Pang-Ning Tan, Vipin Kumar, Michael Steinbach Pearson</li> <li>4. Education</li> <li>5. M.H. Dunham, "Data Mining Introductory and Advanced Topics", Pearson</li> <li>6. Education.</li> <li>6. Paulraj Ponniah, "Data Warehousing Fundamentals", Wiley Student edition.</li> <li>7. “Data Mining For Business Intelligence” Galit Shmueli, Nitin Patel, Peter Bruce; Wiley Student Edition.</li> <li>8. “Data Warehousing, Data Mining &amp; OLAP " Alex Berson &amp; Stephen J Smith, Tat McGraw Hill.</li> <li>9. “Data Mining with SQL Server 2008” Jamie McLennan &amp; others, Wiley Indian Edition.</li> <li>10. "Mastering Data Mining”, M Berry and G. Linoff, Wiley Student Edition.</li> <li>6) R. Kimball, "The Data Warehouse Toolkit', John Wiley.</li> </ol>
<b>Course Outcomes:</b>
<p>At the end of this course students will able to</p> <p>C01: Explain the principles behind data warehousing architectures, including the differences between enterprise data warehouses and data marts.</p> <p>C02: Illustrate the basics of data mining, technologies used and the steps in data pre-processing.</p> <p>C03: Interpret the various techniques used in data mining, such as classification, clustering, association rule mining, and anomaly detection.</p> <p>C04: Acquire satisfactory competency in applying clustering techniques, classification and prediction.</p> <p>C05: Create predictive models using data mining techniques to support decision-making processes in various domains, such as marketing, finance, or healthcare.</p>

<b>Course Title</b>	<b>E-Commerce</b>	<b>Course Code:CSAB4930</b>	
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>	
<b>Lectures / Tutorial</b>	<b>3 Hrs Week</b>	<b>Internal Assessment Test</b>	<b>30 Marks</b>
<b>Total Credits</b>	<b>3</b>	<b>End-Semester Examination</b>	<b>70 Marks</b>
<b>Course Objectives:</b>			
<ol style="list-style-type: none"> <li>1. Discuss fundamentals of e-commerce, types and applications with learners.</li> <li>2. To make students evaluate the network infrastructure of ecommerce.</li> <li>3. Assess business models and EDI of e-commerce.</li> <li>4. To help students identify the major management challenges for building and using ecommerce websites and learn how to find appropriate solutions to those challenges.</li> <li>5. To make students learn strategies for e-commerce and electronic payments.</li> </ol>			
<b>Detailed Syllabus:</b>			
<b>Unit-I</b>			
<b>Introduction</b> Definition of Electronic Commerce, E-Commerce: technology and prospects, incentives for engaging in electronic commerce, needs of E-Commerce, advantages and disadvantages, framework, Impact of E-commerce on business, E-Commerce Models.			
<b>Unit-II</b>			
<b>Network Infrastructure for E-commerce</b> Internet and Intranet based E-commerce- Issues, problems and prospects, Network Infrastructure, Network Access Equipments, Broadband telecommunication (ATM, ISDN, FRAME RELAY). Mobile Commerce: Introduction, Wireless Application Protocol, WAP technology, Mobile Information device.			
<b>Unit-III</b>			
<b>Business Models of E-Commerce</b> Characteristics of Business to Business(B2B), Business to Consumers (B2C), C2C (Consumer-toConsumer), Business to Government (B2G)			
<b>Concepts of other models of E-commerce</b> Business to Consumer E-Commerce process, Business to Business E-Commerce Need and Importance, alternative models of B2B E-Commerce. E-Commerce Sales Product Life Cycle (ESLC) Model			

Unit-IV
<p><b>World Wide Web and E-enterprise</b> World Wide Web-Reasons for building own website, Benefits of Website, registering a Domain Name, Role of web site in B2C E-commerce; push and pull approaches; Web site design principles.</p> <p>EDI and paperless trading; Pros &amp; Cons of EDI; Related new technologies use in Ecommerce. Applications of E-commerce and E-enterprise - Applications to Customer Relationship Management- Types of E-CRM, Functional Components of E-CRM.</p>
Unit-V
<p><b>Electronic Payments</b> Overview, The SET protocol, Payment Gateway, certificate, digital Tokens, Smart card, credit card, magnetic strip card, E-Checks, Credit/Debit card-based EPS, online Banking, EDI Application in business, E- Commerce Law, Forms of Agreement, Govt. policies and Agenda.</p>
Text /Reference Books:
<p>1. Ravi Kalakota, Andrew Winston, "Frontiers of Electronic Commerce", Addison Wesley.</p> <p><b>Reference books:</b></p> <ol style="list-style-type: none"> <li>1. Pete Lohsin , John Vacca "Electronic Commerce", New Age International</li> <li>2. Goel, Ritendra "E-commerce", New Age International</li> <li>3. Laudon, "E-Commerce: Business, Technology, Society", Pearson Education</li> <li>4. Bajaj and Nag, "E-Commerce the cutting edge of Business", TMH</li> <li>5. Turban, "Electronic Commerce 2004: A Managerial Perspective", Pearson Education</li> </ol>
Course Outcomes:
<p>At the end of the course student will be able to:</p> <p>C01: Define key e-commerce concepts such as online transactions, digital marketing, and electronic funds transfer.</p> <p>C02: Identify the network infrastructure for e-commerce and mobile commerce</p> <p>C03: Explore various e-commerce business models such as B2B (Business-to-Business), B2C (Business-toConsumer), C2C (Consumer-to-Consumer), and their respective advantages, challenges, and applications.</p> <p>C04: Acquire skills in designing, developing, and maintaining e-commerce websites</p> <p>C05: Understand the various algorithms applied for e-commerce and mobile commerce transactions.</p>

<b>Course Title</b>	Python Programming Lab	<b>Course Code:CSAB4011</b>	
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>	
<b>Lectures / Tutorial</b>	<b>4 Hrs Week</b>	<b>Internal Assessment Test</b>	<b>15 Marks</b>
<b>Total Credits</b>	<b>2</b>	<b>End-Semester Examination</b>	<b>35 Marks</b>
<b>Course Objectives:</b>			
<ol style="list-style-type: none"> <li><b>To introduce the fundamentals of Python programming</b> including syntax, variables, data types, and operators, laying the foundation for developing simple applications.</li> <li><b>To provide hands-on experience with control structures</b> such as loops and conditional statements for implementing logic-based solutions.</li> <li><b>To enable students to design and implement functions and modules</b> to promote modularity, code reusability, and structured programming practices.</li> <li><b>To familiarize students with Python data structures</b> such as lists, tuples, dictionaries, and sets for efficient data manipulation.</li> <li><b>To develop problem-solving and debugging skills through practical assignments</b>, enhancing students' ability to apply programming logic to real-world scenarios.</li> </ol>			
<ol style="list-style-type: none"> <li>Python program to print "Hello Python".</li> <li>Python program to do arithmetical operations.</li> <li>Python program to find the area of a triangle.</li> <li>Python program to solve quadratic equations.</li> <li>Python program to swap two variables.</li> <li>Python program to generate a random number.</li> <li>Python program to convert kilometers to miles.</li> <li>Python program to convert Celsius to Fahrenheit.</li> <li>Python program to display calendar.</li> <li>Python Program to Check if a Number is Positive, Negative or Zero.</li> <li>Python Program to Check if a Number is Odd or Even.</li> <li>Python Program to Check Leap Year.</li> <li>Python Program to Check Prime Number.</li> <li>Python Program to Print all Prime Numbers in an Interval.</li> <li>Python Program to Find the Factorial of a Number.</li> <li>Python Program to Display the multiplication Table.</li> <li>Python Program to Print the Fibonacci sequence.</li> <li>Python Program to Check Armstrong Number.</li> <li>Python Program to Find Armstrong Number in an Interval.</li> <li>Python Program to Find the Sum of Natural Numbers.</li> <li>Python program to check if the given number is a disarium Number.</li> <li>Python program to print all disarium numbers between 1 to 100.</li> <li>Python program to check if the given number is Happy Number.</li> <li>Python program to print all happy numbers between 1 and 100.</li> <li>Python program to find the frequency of each element in the array.</li> </ol>			

26. Python program to left rotate the elements of an array.
27. Python program to print the duplicate elements of an array.
28. Python program to print the elements of an array.
29. Python program to print the elements of an array in reverse order.
30. Python program to print the elements of an array present in an even position.
31. Python program to print the elements of an array present in an odd position.

**Course Outcomes:**

After completion of this subject students will be able to

- C01: Apply Python syntax and programming constructs to solve basic and intermediate level problems.
- C02: Develop programs using conditional statements, loops, and functions to handle different scenarios and requirements.
- C03: Create Python programs to solve complex problems such as finding the area of a triangle, solving quadratic equations, and checking for prime numbers.
- C04: Apply critical thinking to evaluate program logic, identify potential errors, and optimize code for performance and readability.
- C05: Develop programs to perform advanced operations such as generating random numbers, converting units, and working with arrays efficiently.



<b>Course Title</b>	Java Programming Lab	<b>Course Code:CSAB4021</b>	
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>	
<b>Lectures / Tutorial</b>	<b>4 Hrs/Week</b>	<b>Internal Assessment Test</b>	<b>15 Marks</b>
<b>Total Credits</b>	<b>2</b>	<b>End-Semester Examination</b>	<b>35 Marks</b>

### Course Objectives:

1. **To provide hands-on experience with core Java programming concepts**, including variables, data types, control structures, and arrays.
2. **To develop object-oriented programming (OOP) skills** using Java features like classes, objects, inheritance, polymorphism, abstraction, and encapsulation.
3. **To familiarize students with exception handling, file I/O operations, and multithreading** in Java applications.
4. **To introduce GUI development and event-driven programming** using Java Swing or JavaFX.
5. **To build problem-solving abilities by developing real-world applications** using Java and applying debugging and testing techniques.

### List of Experiments

32. Swapping of two numbers without accepting numbers from the user.
33. Find out the largest of two numbers using command line arguments.
34. Print class of students according to given range using switch case.
35. Find GCD and LCM of two positive numbers using a while loop.
36. Display table of given number using for loop.
37. Java Program to check whether input character is vowel or consonant
38. Print the upper triangle using a nested for loop.  

```

      *
     * *
    * * *
   * * * *

```
39. Java Program to calculate simple interest and compound interest.
40. Java program to find occurrence of a character in a String.
41. Write a class Circle with methods getdata() and area(). Create an object of that class, find the area and display the result.
42. Calculate absolute value of given number using method overloading.
43. Calculate addition of two numbers using constructor overloading.
44. Write a program to accept n integers from user into an array and display the average of these numbers.
45. Write a program to sort elements of an array in ascending order using bubble sort.

46. Write a program to find and display the sum of diagonal elements of a square matrix.
47. Write a program to implement single inheritance using super keywords.
48. Write a program to add two numbers using single inheritance such that the base class method must accept 2 numbers from the user and the derived class method must add these numbers and display the sum.
49. Write a program to find the area of a circle using single inheritance such that the base class method must accept the radius from the user and the derived class method must calculate and display the area.
50. Write a program to implement multiple inheritance.
51. Write a program to print 1A2B3C4D5E6F7G8H9I10J using thread.

**Course Outcomes:**

After completion of this subject students will be able to

CO1: Demonstrate proficiency in implementing Java programs to perform various tasks such as swapping numbers, finding the largest number, calculating interest, and manipulating arrays.

CO2: Develop programs using control structures like loops, conditionals, and methods to handle different scenarios and requirements.

CO3: Create Java programs to solve complex problems such as calculating GCD and LCM, sorting arrays, and working with matrices.

CO4: Develop programs to perform advanced operations such as working with inheritance, threads, and method overloading efficiently.

CO5: Apply problem-solving skills to design and implement programs that involve mathematical calculations, data manipulation, and object-oriented concepts.

	<b>BCA- AR VR 3 Year- Semester V</b>										
Type		Course Title	Hours/ Week			Theory Marks		Practical Marks		Total Marks	Credit
			L	T	P	IA	ESE	IA	ESE		
DC	CSAB5050	Open Source Technology	3	1	-	30	70	-	-	100	4
DC	CSAB5060	Internet of Things	3	-	-	30	70	-	-	100	3
DC	CSAB5030	Cloud Computing	3	-	-	30	70	-	-	100	3
DC	CSAB5070	Network Security	3	-	-	30	70	-	-	100	3
DC	CSAB5080	Extended Reality (XR)	3	1	-	30	70			100	4
DE	**	Elective 1	3	-	-	30	70	-	-	100	3
DC	CSAB5031	Cloud Computing Lab	-	-	4	-	-	15	35	50	2
DC	CSAB5051	Open Source Technology Lab	-	-	4	-	-	15	35	50	2
DC	CSAB5083	Project Work-I			8			15	35	50	4
SEC		Verbal Ability									
		<b>TOTAL</b>	<b>18</b>	<b>2</b>	<b>16</b>	<b>180</b>	<b>420</b>	<b>45</b>	<b>105</b>	<b>750</b>	<b>28</b>

<b>Elective-2 CSAB 5410/CSAB5420</b>
<b>1. Software Project Management</b>
<b>2. ERP(Enterprise Resource planning)</b>

<b>Course Title</b>	Open Source Technologies	<b>Course Code:</b> CSAB5050	
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>	
<b>Lectures / Tutorial</b>	<b>3 / 1 Hrs Week</b>	<b>Internal Assessment Test</b>	<b>30 Marks</b>
<b>Total Credits</b>	<b>4</b>	<b>End-Semester Examination</b>	<b>70 Marks</b>
<b>Course Objectives:</b>			
<ol style="list-style-type: none"> <li>1. To make students understand the difference between open source software and commercial software.</li> <li>2. Familiarity with Linux operating system.</li> <li>3. To guide students in development of web applications using open source web technologies like Apache, MySql and PHP (LAMP/XAMP).</li> </ol>			
<b>Detailed Syllabus:</b>			
<b>Unit-I</b>			
<b>BASIC PHP</b> Web Server, Apache, PHP, Data Types, User defined Variables, Constants, Operators, Control Structures, User defined Functions, Directory Functions, File system Functions, Arrays, String Functions, Date and Time Functions, Mathematical Functions, Miscellaneous Functions.			
<b>Unit-II</b>			
<b>Advanced PHP with MySQL</b> Exceptions handling, Error Handling Functions, Predefined Variables, Cookies, Sessions, COM, DOM, CURL, SOAP, Classes and Objects-Mail Function, URL Functions. PHP with MySQL: PHP MySQL Functions, Database driven application.			
<b>Unit-III</b>			
<b>Advanced PHP with AJAX, SEO and CMS</b> PHP with AJAX: Introducing Ajax-Ajax Basics-PHP and Ajax-Database Driven Ajax. PHP with SEO: Basic SEO-Provocative SE Friendly URLs-Duplicate Content- CMS: Word press Creating an SE-Friendly Blog.			
<b>Unit-IV</b>			
<b>Basic PERL</b> Introduction-Scalar Data- Lists and Arrays -Subroutines-Input and Output- Hashes-Regular Expressions Control Structures-Perl Modules-File Tests.			
<b>Unit-V</b>			
<b>Advanced PERL</b> Directory Operations-Strings and Sorting-Smart Matching-Process Management- Advanced Perl Techniques.			

**Text /Reference Books:**

1. James Lee and Brent Ware , "Open Source Web Development with LAMP using Linux, Apache, MySQL, Perl and PHP" , , Dorling Kindersley(India) Pvt. Ltd, 2008.
2. Eric Rosebrock, Eric Filson , "Setting Up LAMP: Getting Linux, Apache, MySQL, and PHP and working Together", Published by John Wiley and Sons, 2004.

**Course Outcomes:**

1. CO1: Apply basic PHP scripts to perform tasks using the concepts covered, such as handling user input, manipulating files and directories, working with arrays, strings, and dates.
2. CO2: Develop dynamic web applications that interact with MySQL databases using PHP scripts.
3. CO3: Analyze SEO strategies and implement them in PHP websites to improve search engine rankings and visibility.
4. CO4: Understand how Perl language constructs and features enable various programming tasks.
5. CO5: Develop Perl scripts that leverage advanced techniques to solve complex problems efficiently.

<b>Course Title</b>	Internet of Things	<b>Course Code: CSAB5060</b>	
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>	
<b>Lectures / Tutorial</b>	<b>3 Hrs Week</b>	<b>Internal Assessment Test</b>	<b>30 Marks</b>
<b>Total Credits</b>	<b>3</b>	<b>End-Semester Examination</b>	<b>70 Marks</b>
<b>Course Objectives:</b>			
<p>The objectives of this course are:</p> <ol style="list-style-type: none"> <li>1. In this course, students will explore various components of the Internet of things such as Sensors, internetworking and cyber space. In the end they will also be able to design and implement IoT circuits and solutions.</li> </ol>			
<b>Detailed Syllabus:</b>			
<b>Unit-I</b>			
What is the IoT and why is it important? Elements of an IoT ecosystem, Technology drivers, Business drivers, Trends and implications, Overview of Governance, Privacy and Security Issues.			
<b>Unit-II</b>			
Protocol Standardization for IoT – Efforts – M2M and WSN Protocols – SCADA and RFID Protocols – Issues with IoT Standardization – Unified Data Standards – Protocols – IEEE802.15.4–BACNet Protocol– Modbus – KNX – Zigbee– Network layer – APS layer – Security			
<b>Unit-III</b>			
<b>Architecture</b> IoT Open source architecture (OIC)- OIC Architecture & Design principles- IoT Devices and deployment models- IoTivity : An Open source IoT stack - Overview- IoTivity stack architecture- Resource model and Abstraction.			
<b>Unit-IV</b>			
<b>Web of things</b> Web of Things versus Internet of Things – Two Pillars of the Web – Architecture Standardization for WoT– Platform Middleware for WoT – Unified Multi Tier WoT Architecture – WoT Portals and Business Intelligence.			
<b>Unit-V</b>			
<b>Applications</b> IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications. Study of existing IoT platforms /middleware, IoT- A, Hydra etc.			
<b>Text /Reference Books:</b>			
<ol style="list-style-type: none"> <li>1. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, “From Machine-to-Machine to the Internet of Things: Introduction to a New Age of</li> </ol>			

Intelligence”, 1st Edition, Academic Press, 2014. Syllabus for Bachelor of Technology Computer Engineering.

2. Vijay Madisetti and Arshdeep Bahga, “Internet of Things (A Hands-on Approach)”, 1st Edition, VPT, 2014.
3. Francis daCosta, “Rethinking the Internet of Things: A Scalable Approach to Connecting Everything”, 1st Edition, Apress Publications, 2013
4. Cuno Pfister, Getting Started with the Internet of Things, O’Reilly Media, 2011, ISBN: 978-1-4493-9357-1.

**Course Outcomes:**

1. CO1: Understand concepts of Internet of Things (IoT).
2. CO2: Discuss the challenges and obstacles faced in standardizing protocols for IoT.
3. CO3: Identify the design principles behind IoT architecture.
4. CO4: Analyze the strengths and limitations of WoT compared to traditional IoT architectures.
5. CO5: Analyze the potential impact of Future Factory Concepts on industrial operations, productivity, and sustainability.

<b>Course Title</b>	Cloud Computing	<b>Course Code: CSAB5030</b>	
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>	
<b>Lectures / Tutorial</b>	<b>3 Hrs Week</b>	<b>Internal Assessment Test</b>	<b>30 Marks</b>
<b>Total Credits</b>	<b>3</b>	<b>End-Semester Examination</b>	<b>70 Marks</b>
<b>Course Objectives:</b>			
<p>The objectives of this course are</p> <ol style="list-style-type: none"> <li>1. This course gives students an insight into the basics of cloud computing along with virtualization, cloud computing is one of the fastest growing domains from a while now. It will provide the students basic understanding about cloud and virtualization along with how one can migrate over it.</li> </ol>			
<b>Detailed Syllabus:</b>			
<b>Unit-I</b>			
<b>Introduction to Cloud Computing:</b> Virtualization Concepts, Cloud Computing Fundamental: Overview of Computing Paradigm, Evolution of cloud computing, Defining cloud computing, Components of a computing cloud, Essential Characteristics of Cloud Computing, Cloud Taxonomy.			
<b>Unit-II</b>			
<b>Cloud Computing Architectural Framework:</b> Cloud architectural principles, Role of Networks in Cloud computing, Role of Web services, Benefits and challenges to Cloud architecture, Cloud Service Models, cloud computing vendors, Cloud Services Management, Performance and scalability of services, tools and technologies used to manage cloud services deployment.			
<b>Unit-III</b>			
<b>Exploiting Cloud Services:</b> Software as a Service(SaaS): Introduction to SaaS, Inspecting SaaS technologies, Implementing web services, Deploying Infrastructure as a Service(IaaS): Introduction to IaaS, Scalable server clusters, Machine Image, Virtual Machine (VM). Elastic storage devices, Data storage in cloud computing, Delivering Platform as a Service(PaaS): Introduction to PaaS, Service Oriented Architecture (SOA), Cloud Platform and Management, Hardware-as-a-service: HaaS.			
<b>Unit-IV</b>			
<b>Cloud Application Development:</b> Role of business analyst, Technical architecture considerations, Service creation environments to develop cloud based applications, Technologies and the processes required when deploying web services; Deploying a web service from inside and outside a cloud architecture, advantages and disadvantages, Cloud Economics.			



Unit-V		
<b>Cloud Security and Risk Management:</b> Cloud Security: Understanding cloud based security issues and threats, Data security and Storage, Identity & Access Management, Risk Management in cloud, Governance and Enterprise Risk Management.		
<b>Analysis on Case study:</b> Business Case: Business case evaluation criteria, Business outcomes examples, Case Studies: Case Study on Open Source & Commercial Cloud: Eucalyptus, Microsoft Windows Azure, Amazon EC2, Amazon Elastic Block Storage – EBS. Google Cloud Infrastructure, MapReduce. AWS, Simple Storage Service – S3		
<b>Text /Reference Books:</b>		
<ol style="list-style-type: none"> <li>1. Distributed and Cloud Computing: Clusters, Grids, Clouds, and the Future Internet by Kai Hwang, Jack Dongarra &amp; Geoffrey C. Fox., Morgan Kaufmann Publishers, 2012.</li> <li>2. Cloud Computing Bible, Barrie Sosinsky, WileyIndia, 2010.</li> <li>3. Cloud Computing: Principles and Paradigms, Editors: Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Wile, 2011.</li> <li>4. Cloud Computing: Principles, Systems and Applications, Editors: Nikos Antonopoulos, Lee Gillam, Springer, 2012.</li> <li>5. Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Ronald L. Krutz, Russell Dean Vines, Wiley-India, 2010.</li> <li>6. Gautam Shroff, Enterprise Cloud Computing Technology Architecture Applications [ISBN: 978- 0521137355].</li> </ol>		
<b>Course Outcomes:</b>		
<ol style="list-style-type: none"> <li>1. CO1: Explain the essential characteristics of cloud computing and categorize different components of a computing cloud.</li> <li>2. CO2: Evaluate the benefits and challenges associated with cloud architecture.</li> <li>3. CO3: Implement software as a service (SaaS) and infrastructure as a service (IaaS) technology.</li> <li>4. CO4: Critique the advantages and disadvantages of deploying web services within a cloud architecture.</li> <li>5. CO5: Analyze business case evaluation criteria and business outcomes examples related to cloud computing.</li> </ol>		

<b>Course Title</b>	Network Security	<b>Course Code: CSAB5070</b>
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Teaching Scheme		Evaluation Scheme	
Lectures / Tutorial	3 Hrs Week	Internal Assessment Test	30 Marks
Total Credits	3	End-Semester Examination	70 Marks
<b>Course Objectives:</b>			
<ol style="list-style-type: none"> <li>1. Provide knowledge of Cryptography to the learners.</li> <li>2. To provide students' knowledge of Symmetric and Asymmetric Algorithms.</li> <li>3. Give insight on Message Authentication and Hash Functions.</li> <li>4. To help the students understand the concepts of Security Policies and Security Handshake Pitfalls.</li> </ol>			
<b>Detailed Syllabus:</b>			
<b>Unit-I</b>			
<b>Introduction:</b> Attacks, Services and Mechanisms, Security Attacks, Security Services, Integrity check, digital Signature, authentication, hash algorithms.			
<b>Unit-II</b>			
<b>Key Cryptography:</b> Block Encryption, DES rounds, S-Boxes IDEA: Overview, comparison with DES, Key expansion, IDEA rounds, Uses of Secret key Cryptography; ECB, CBC, OFB, CFB, Multiple encryptions DES.			
<b>Unit-III</b>			
<b>Functions and Message Digests:</b> Length of hash, uses, algorithms (MD2, MD4, MD5, SHA) MD2: Algorithm (Padding, checksum, passes.) MD4 and 5: algorithm (padding, stages, digest computation.) SHA: Overview, padding, stages. <b>Public key Cryptography:</b> Algorithms, examples, Modular arithmetic (addition, multiplication, inverse, and exponentiation) RSA: generating keys, encryption and decryption. Other Algorithms: PKCS, Diffie-Hellman, El-Gamal signatures, DSS, Zero-knowledge signatures.			
<b>Unit-IV</b>			
<b>Authentication:</b> Password Based, Address Based, Cryptographic Authentication. Passwords in distributed systems, on-line vs offline guessing, storing. Cryptographic Authentication: passwords as keys, protocols, KDC's Certification Revocation, Interdomain, groups, delegation. Authentication of People: Verification techniques, passwords, length of passwords, password distribution, smart cards, biometrics.			
<b>Unit-V</b>			

<b>Security Policies and Security Handshake Pitfalls:</b> What is security policy, high and low level policy, user issues? Protocol problems, assumptions, Shared secret protocols, public key protocols, mutual authentication, reflection attacks, use of timestamps, nonce and sequence numbers, session keys, one-and two-way public key based authentication.		
<b>Text /Reference Books:</b>		
<ol style="list-style-type: none"> <li>1. Atul Kahate, Cryptography and Network Security, McGraw Hill. Kaufman, c., Perlman, R., and Speciner, M., Network Security, Private Communication in a public world, 2nd ed., Prentice Hall PTR., 2002.</li> <li>2. Stallings, Cryptography and Network Security: Principles and Practice, 3rd ed., Prentice Hall PTR., 2003.</li> <li>3. Stallings, W. Network security Essentials: Applications and standards, Prentice Hall, 2000.</li> <li>4. Cryptography and Network Security; McGraw Hill; Behrouz A Forouzan.</li> <li>5. Information Security Intelligence Cryptographic Principles and App. Calabrese Thomson.</li> <li>6. Securing A Wireless Network Chris Hurley SPD.</li> </ol>		
<b>Course Outcomes:</b>		
<ol style="list-style-type: none"> <li>1. CO1: Understand the basic concept of network security.</li> <li>2. CO2: Illustrate secret key cryptography algorithms.</li> <li>3. CO3: Apply hash functions and public key cryptography to the plain text.</li> <li>4. CO4: Understand various types of authentication techniques.</li> <li>5. CO5: Evaluate security policies and their pitfalls</li> </ol>		

<b>Course Title</b>	Extended Reality (XR)	<b>Course Code: CSAB5080</b>
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Teaching Scheme		Evaluation Scheme	
Lectures / Tutorial	3 / 1 Hrs Week	Internal Assessment Test	30 Marks
Total Credits	4	End-Semester Examination	70 Marks
<b>Course Objectives:</b>			
<ol style="list-style-type: none"> <li>1. To guide and teach the students the concept of Extended Reality(XR).</li> <li>2. To make them understand the tools needed to put AR, VR, XR into practice in real world (hardware, software).</li> <li>3. To illustrate to students the potential use of XR and the ease it can add to engineering and medical world making visualization a trivial concept.</li> <li>4. To make students understand the range of applications where XR can be put to practice and the tools needed to do so</li> <li>5. To teach strategies visa-a-vis relevant theory &amp; practical approach to put XR into practice in various applications.</li> </ol>			
<b>Detailed Syllabus:</b>			
<b>Unit-I</b>			
<b>Introduction</b> Extended reality a conceptual description What is XR history of X R hardware parameters for extended reality Field of view frames per second softwares used for XR systems applications of XR			
<b>Unit-II</b>			
<b>Characteristics benefits and an explicative Insight on Extended Reality-I</b> Augmented reality, Virtual reality, Mixed reality History of XR Understanding AR, it's hardware displays, input devices tracking, processor etc. softwares for AR. Different AR Interfaces.			
<b>Unit-III</b>			
<b>Characteristics benefits and an explicative Insight on Extended Reality -II</b> Understanding VR, VR hardware input devices VR output devices software in VR of VR No immersive semi immersive Magnetic trackers acoustic trackers examples of AR and VR understanding MR its hardware and software features characteristics of XR interactiveness field of view advantages better or enhanced learning efficient training enhanced customer experience.			
<b>Unit-IV</b>			
Different uses of Extended Reality: Walk through the world of AR, VR and MR. Different uses or Applications of XR Hand Rehabilitation , Industrial applications, remote maintenance, repair and support, Smart factories, Clinical, Pain visualization in dental procedures, Construction support , Gaming , VR in Education. VR, MR in Healthcare and Health Education and Aircraft Maintenance.			
<b>Unit-V</b>			
Future Developments of Extended Reality Bounds and Constraint s in the path VR and MR in Health Care ,.. Cardiology, Ontology, Brain Dynamics, Dentistry etc, VR in Education .. Health , Aviation, and tough Engineering sectors.. potential bottleneck and constraints for future growth. Growth and Evolution of XR. Current Companies using and dealing with XR working in XR domain.			

**Text /Reference Books:**

1. Vohra, Manisha, ed. (2025). *Introduction to Extended Reality (XR) Technologies*. John Wiley & Sons.. First published:21 February 2025 ISBN:9781119857228 |
2. Mann, Steve, and Charles Wyckoff. "Extended reality." Cambridge, Massachusetts: Massachusetts Institute of Technology (1991): 4-405. [Online]. Available: <http://wearcam.org/xr.htm>
3. Marr, Bernard (2021). *Extended reality in practice: 100+ amazing ways virtual, augmented and mixed reality are changing business and society*. John Wiley & Sons ISBN: 978-1-119-69517-2, May 2021
4. Immersive Realm of Extended Reality by Suman Dutta  
ISBN 10: 935551722X ISBN 13: 9789355517227

**Course Outcomes:**

On completion of the course, student will be able to

CO1: Understand the fundamentals and concept of Extended Reality(XR).

CO2: Understand the characteristics , tools needed and apply needed tools to put AR, into practice in real world.

CO3:. Understand the characteristics , tools needed and apply needed tools to put VR, XR into practice in real world

CO4: Realize the potential use of AR and the ease it can add to engineering and medical world making visualization a trivial concept.

CO5:Develop an overall vision to extend the idea of AR, VR and XR to various application areas in future.

**Assignments**

1. What is Extended Reality
2. What is the difference between AR, VR, XR
3. List down 5 potential uses each of AR, VR, XR
4. List down atleast two important tools each to implement AR, VR, XR in the above applications
5. Does present day hardware specifications in computers mostly used , display resolution and processors of todays world support implementation of AR, Vr in the above said applications.
6. What are immersive technologies?
7. What are inherent dangers in making use of XR , VR in predictive analytics and decision making systems in potential applications like health care, engineering outage detection etc
8. Who invented the first VR Device
9. What Google Map, Facebook Horizon .. Does AR, VR has some role in these applications

**Elective - II**

<b>Course Title</b>	<b>Software Project Management</b>	<b>Course Code:</b> CSAB5410	
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>	
<b>Lectures / Tutorial</b>	<b>3 Hrs Week</b>	<b>Internal Assessment Test</b>	<b>30 Marks</b>
<b>Total Credits</b>	<b>3</b>	<b>End-Semester Examination</b>	<b>70 Marks</b>
<b>Course Objectives:</b>			
<ol style="list-style-type: none"> <li>1. To make students understand the Software Project Planning and Evaluation techniques.</li> <li>2. To plan and manage projects at each stage of the software development life cycle (SDLC).</li> <li>3. To learn about the activity planning and risk management principles.</li> <li>4. To make the students manage software projects and control software deliverables.</li> <li>5. To help students develop skills to manage the various phases involved in project management and people management.</li> <li>6. 6. To deliver successful software projects that support organization's strategic goals.</li> </ol>			
<b>Detailed Syllabus:</b>			
<b>Unit-I</b>			
<b>Project Evaluation and Project Planning</b> Importance of Software Project Management – Activities – Methodologies – Categorization of Software Projects – Setting objectives – Management Principles – Management Control – Project portfolio Management – Cost-benefit evaluation technology – Risk evaluation – Strategic program Management – Stepwise Project Planning.			
<b>Unit-II</b>			
<b>Project Life Cycle and Effort Estimation</b> Software process and Process Models – Choice of Process models – Rapid Application development – Agile methods – Dynamic System Development Method – Extreme Programming– Managing interactive processes – Basics of Software estimation – Effort and Cost estimation techniques – COSMIC Full function points – COCOMO II – a Parametric Productivity Model.			
<b>Unit-III</b>			
<b>Activity Planning and Risk Management</b> Objectives of Activity planning – Project schedules – Activities – Sequencing and scheduling – Network Planning models – Formulating Network Model – Forward Pass & Backward Pass techniques – Critical path (CRM) method – Risk identification – Assessment – Risk Planning –Risk Management – – PERT technique – Monte Carlo simulation – Resource Allocation – Creation of critical paths – Cost schedules.			
<b>Unit-IV</b>			
<b>Project Management and Control</b>			

Framework for Management and control – Collection of data – Visualizing progress – Cost monitoring – Earned Value Analysis – Prioritizing Monitoring – Project tracking – Change control – Software Configuration Management – Managing contracts – Contract Management.
<b>Unit-V</b>
<b>Staffing in Software Projects</b> Managing people – Organizational behaviour – Best methods of staff selection – Motivation – The Oldham – Hackman job characteristic model – Stress – Health and Safety – Ethical and Professional concerns – Working in teams – Decision making – Organizational structures – Dispersed and Virtual teams – Communications genres – Communication plans – Leadership
<b>Text /Reference Books:</b>
1. Bob Hughes, Mike Cotterell and Rajib Mall: Software Project Management – Fifth Edition, Tata McGraw Hill, New Delhi, 2012. <b>References:</b> 1. Robert K. Wysocki —Effective Software Project Management – Wiley Publication, 2011. 2. Walker Royce: —Software Project Management- Addison-Wesley, 1998. 3. Gopalaswamy Ramesh, —Managing Global Software Projects – McGraw Hill Education (India), Fourteenth Reprint 2013.
<b>Course Outcomes:</b>
C01: Explain the activities, methodologies, and categorization of software projects. C02: Apply various effort and cost estimation techniques in software projects. C03: Understand the concepts of project schedules, sequencing, and scheduling. C04: Analyze the importance of change control and software configuration management. C05: Analyze stress management techniques and ethical considerations.

<b>Course Title</b>	<b>Enterprise Resource Planning</b>	<b>Course Code:</b> CSAB5420
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>

<b>Lectures / Tutorial</b>	<b>3 Hrs Week</b>	<b>Internal Assessment Test</b>	<b>30 Marks</b>
<b>Total Credits</b>	<b>3</b>	<b>End-Semester Examination</b>	<b>70 Marks</b>
<b>Course Objectives:</b>			
<ol style="list-style-type: none"> <li>1. To make students understand the technical aspects and life cycle of ERP systems.</li> <li>2. To understand the steps and activities in ERP.</li> <li>3. To illustrate students how to identify and describe different types of ERP system.</li> <li>4. To make the learners understand tools and methodology used for designing ERP for an Enterprise.</li> </ol>			
<b>Detailed Syllabus:</b>			
<b>Unit-I</b>			
<b>Introduction to Enterprise Resource Planning (ERP)</b> Information System and Its Components, Value Chain Framework, Organizational Functional Units, Evolution of ERP Systems, Role of ERP in Organization, Three-Tier Architecture of ERP system.			
<b>Unit-II</b>			
<b>ERP and Implementation</b> ERP implementation and strategy, Implementation Life cycle, Pre- implementation task, requirement definition, implementation Methodology.			
<b>Unit-III</b>			
<b>ERP Business Modules</b> Finance, manufacturing, human resources, quality management, material management, marketing, Sales distribution and service. Case study on Supply Chain management (SCM), Customer relationship Management (CRM)			
<b>Unit-IV</b>			
<b>Introduction to ERP related Technologies</b> Business Process Re-engineering (BPR), Data warehousing, Data <b>Mining</b> , On-line Analytical Processing (OLAP), Product Life Cycle Management (PLM), Geographical Information Management ,RFID, QR Code , Bar Coding, E-commerce and their application in Enterprise planning.			
<b>Unit-V</b>			
<b>Extended ERP and security issues</b> Enterprise application Integration (EAI), open source ERP, cloud ERP, Managing ERP Securities: Types of ERP security Issues, System Access security, Data Security and related technology for managing data security.			
<b>Text /Reference Books:</b>			
1. Alexis Leon, ERP Demystified: II Edition, Tata McGraw Hill.			



2. Rajesh Ray, Enterprise Resource Planning, Text and cases, Tata McGraw Hill.
3. Sandeep Desai, Abhishek Srivastava, ERP to E<sup>2</sup> ERP: A Case study approach, PHI.
4. Jyotindra Zaveri, Enterprise Resource Planning, Himalaya Publishing House, 2012.

**Reference Books:**

1. V.K. Garg & N.K. Venkatakrishnan, Enterprise Resource Planning: concepts & practices, by ; PHI.
2. Supply Chain Management Theories & Practices: R. P. Mohanty, S. G. Deshmukh, - Dreamtech Press.
3. Enterprise wide resource planning: Theory & practice: by Rahul Altekar, PHI
4. Customer Relationship Management, Concepts and cases, Second Edition.

**Course Outcomes:**

CO1: Understand the value chain framework and the role of ERP in organizational functional units.

CO2: Understand ERP implementation strategies and methodologies.

CO3: Apply ERP business modules to solve case studies on supply chain management and customer relationship management.

CO4: Understand the applications of technologies such as RFID, QR code, and e-commerce in enterprise planning.

CO5: Understand different types of ERP security issues and their implications.

<b>Course Title</b>	Open Source Technology Lab	<b>Course Code:</b> CSAB5051
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>

<b>Practical per week</b>	<b>4 hrs</b>	<b>Internal Assessment Test</b>	<b>15 Marks</b>
<b>Total Credits</b>	<b>2</b>	<b>End-Semester Examination</b>	<b>35 Marks</b>

#### **List of Experiments:**

1. Linux command line: File System, Process Management User Administration
2. Setting Up Web server, DNS server, FTP Servers
3. Working with IPTABLES, OpenVAS
4. Version Control
5. Working with Drupal
6. Shell Script
7. Android Setup
8. Programming in Android
9. Programming in Android

#### **Course Outcome**

1. CO1: Apply techniques and commands for file system management, process management, user administration, web server setup, DNS server setup, FTP server setup, and firewall management.
2. CO2: Create shell scripts to automate system administration tasks, improve productivity, and enhance system security.
3. CO3: Analyze security vulnerabilities and risks using tools like OpenVAS and implement appropriate measures to mitigate them.
4. CO4: Apply critical thinking to troubleshoot server and network issues, optimize system performance, and enhance security measures.
5. CO5: Develop basic Android applications using programming languages and tools specific to Android development.

<b>Course Title</b>	<b>Cloud Computing Lab</b>	<b>Course Code: CSAB5031</b>
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Teaching Scheme		Evaluation Scheme	
Practicals/Week	4 Hrs Week	Internal Assessment Test	15 Marks
Total Credits	3	End-Semester Examination	35 Marks
<b>Course Objectives:</b>			
<ol style="list-style-type: none"> <li>1. Understand the fundamentals and environment of the R programming language.</li> <li>2. Work with various R data structures and control flow mechanisms.</li> <li>3. Perform data import, cleaning, transformation, and manipulation using R.</li> <li>4. Create effective data visualizations using R libraries like ggplot2.</li> <li>5. Apply basic statistical and machine learning techniques using R for data analysis.</li> </ol>			
<b>List of Experiments:</b>			
<ol style="list-style-type: none"> <li>1. Install Oracle Virtual box and create two VMs on your laptop.</li> <li>2. Install Turbo C in guest OS and execute C program.</li> <li>3. Test ping command to test the communication between the guest OS and Host OS</li> <li>4. Install Hadoop single node setup.</li> <li>5. Hopkinson's test on DC shunt machines</li> <li>6. Develop hadoop application to count no of characters, no of words and each character frequency.</li> <li>7. Develop a hadoop application to process given data and produce results such as finding the year of maximum usage, year of minimum usage.</li> <li>8. Establish an AWS account. Use the AWS Management Console to launch an EC2 instance and connect to it.</li> <li>9. Design a protocol and use Simple Queue Service(SQS)to implement the barrier synchronization after the first phase</li> <li>10. Use the Zookeeper to implement the coordination model in Problem 9.</li> <li>11. Develop a Hello World application using Google App Engine</li> <li>12. Develop a Guestbook Application using Google App Engine</li> <li>13. Develop a Windows Azure Hello World application using.</li> <li>14. Create a Mashup using Yahoo! Pipes.</li> </ol>			
<b>Course Outcomes:</b>			
<p>On successful completion of this course, students will be able to:</p> <ol style="list-style-type: none"> <li>1. CO1: Apply techniques to install and configure virtualization software</li> <li>2. CO2: Create and deploy applications on cloud platforms like AWS, Google App</li> <li>3. CO3: Apply knowledge of distributed computing concepts to design and implement</li> <li>4. CO4: Design and implement distributed applications using technologies like Hadoop</li> <li>5. CO5: Design and implement mashups using services like Yahoo! Pipes to aggregate and manipulate data from multiple sources, providing useful insights or functionalities for end-users.</li> </ol>			

<b>Course Title</b>	<b>Project Work- I</b>	<b>Course Code: CSAB5083</b>	
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>	
<b>Practicals</b>	<b>8 Hrs Week</b>	<b>Internal Assessment Test</b>	<b>15 Marks</b>
<b>Total Credits</b>	<b>4</b>	<b>End-Semester Examination</b>	<b>35 Marks</b>
<b>Course Objectives:</b>			
<ol style="list-style-type: none"> <li>1. To expose students to product development cycle using industrial experience, use of state of art technologies.</li> <li>2. To encourage and expose students to participation in National/International paper presentation activities and funding agencies for sponsored projects.</li> <li>3. Exposure to Learning and knowledge access techniques using Conferences, Journal papers and anticipation in research activities.</li> </ol>			
<p><b>Reviews1:</b> Based on Implementation (30% implementation expected)</p> <p><b>Reviews 2:</b> Complete Project and Testing</p> <p><b>Project Exhibition:</b> All final students must see all the projects in the exhibition The group will submit at the end of semester VI.</p> <p>a) The Workable project.</p> <p>b) Project report (in Latex/Lyx/latest Word) in the form of a bound journal complete in all respects – 1 copy for the Institute, 1 copy for guide and 1 copy for each student in the group for certification. The project report contains the details.</p> <ol style="list-style-type: none"> <li>1. Problem definition</li> <li>2. Requirement specification</li> <li>3. System design details (UML diagrams)</li> <li>4. System implementation – code documentation – data flow diagrams/ algorithm, protocols used.</li> <li>5. Test result and procedure – test report as per ATP.</li> <li>6. Conclusions.</li> <li>7. Appendix a. Tools used b. References c. Papers published/certificates Plagiarism Report of paper and project report from any open source tool One paper should be published in a reputed International conference/International journal</li> </ol>			
<b>Course Outcome</b>			
<p>After the completion of the course, student will be able to</p> <p>C01: Discover potential research areas in the field of IT.</p> <p>C02: Conduct a survey of several available literatures in the preferred field of study</p> <p>C03: Compare and contrast the several existing solutions for research challenges.</p> <p>C04: Demonstrate an ability to work in teams and manage the conduct.</p> <p>C05: Formulate and propose a plan for creating a solution for the research plan identified.</p> <p>C06: Report and present the findings of the study conducted in the preferred domain.</p>			

	BCA- AI ML 3 Year - Semester VI										
Type		Course Title	Hours/ Week			Theory Marks		Practical Marks		Total Marks	Credit
			L	T	P	IA	ESE	IA	ESE		
DC	CSAB6010	IT Infrastructure Management	3	1		30	70			100	4
DC	CSAB6020	Game Design and Development using Unity 3D	3	1		30	70			100	4
DE	**	Elective 3	3	-		30	70			100	3
DC	CSAB6023	Project Work-II			16	-	-	50	50	100	8
		<b>TOTAL</b>	<b>9</b>	<b>2</b>	<b>16</b>	<b>90</b>	<b>210</b>	<b>50</b>	<b>50</b>	<b>400</b>	<b>19</b>

<b>Elective-3 CSAB6910/ CSAB6610</b>
Web Designing
Data Analytics

<b>Course Title</b>	IT Infrastructure Management	<b>Course Code:</b> CSAB6010	
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>	
<b>Lectures / Tutorial</b>	<b>3/1 Hrs Week</b>	<b>Internal Assessment Test</b>	<b>30 Marks</b>
<b>Total Credits</b>	<b>4</b>	<b>End-Semester Examination</b>	<b>70 Marks</b>
<b>Course Objectives:</b>			
<ol style="list-style-type: none"> <li>1. To make students understand research, reporting and presentation approaches using the latest ICT tools to examine and critically analyze a combination of the technical and management issues in contemporary infrastructure management, with a focus on business alignment.</li> <li>2. IT infrastructure Management evaluates new ICTs and case studies in the context of enterprise architecture to the learners.</li> <li>3. It is suitable for combinations of students in information technology, business administration and electronic commerce.</li> </ol>			
<b>Detailed Syllabus:</b>			
<b>Unit-I</b>			
Definitions, Infrastructure, management activities, Evolutions of Systems since 1960s (Mainframes-to- Midrange-to-PCs-to-Client- server computing-to-New age systems) and their management, growth of internet, current business demands and IT systems issues, complexity of today's computing environment, Total cost of complexity issues, Value of Systems management for business.			
<b>Unit-II</b>			
Factors to consider in designing IT organizations and IT infrastructure, Determining customer's Requirements, Identifying System Components to manage, Exist Processes, Data, applications, Tools and their integration, Patterns for IT systems management, Introduction to the design process for information systems, Models, Information Technology Infrastructure Library (ITIL).			
<b>Unit-III</b>			
Service-level management, financial management and costing, IT services continuity management, Capacity management, Availability management.			
<b>Unit-IV</b>			
Configuration Management, Service desk, Incident management, Problem management, Change management, Release management.			
<b>Unit-V</b>			
Introduction Security, Identity management, Single sign-on, Access Management, Basics of network security, LDAP fundamentals, Intrusion detection, firewall, security information management. Introduction to Storage, Backup & Restore, Archive & Retrieve, Space Management, SAN & NAS, Disaster Recovery, Hierarchical space management, Database & Application protection, Bare machine recovery, Data retention.			

### Text /Reference Books:

1. **Title:** *IT Infrastructure and Its Management*  
**Author:** Phalguni Gupta  
**Publisher:** Tata McGraw-Hill Education  
**Year:** 2009  
**Description:** Covers the fundamentals of IT infrastructure including networks, servers, storage, and security from a management perspective.

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2. **Title:** *Foundations of IT Service Management with ITIL 2011*  
**Author:** Brady Orand  
**Publisher:** CreateSpace Independent Publishing  
**Year:** 2011  
**Description:** Provides a strong foundation in IT Service Management concepts and ITIL framework, widely used in infrastructure planning and support.

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3. **Title:** *IT Infrastructure Architecture – Infrastructure Building Blocks and Concepts*  
**Author:** Sjaak Laan  
**Publisher:** Lulu Press  
**Year:** 2017  
**Description:** A practical guide covering hardware, software, and network components,

### Course Outcomes:

1. CO1: Describe the business value and processes of ICT services in an organization and apply that knowledge and skill with initiative to a workplace scenario.
2. CO2: Critically analyze and evaluate the impact of new and current ICT services to an organization.
3. CO3: Understand how effective IT Infrastructure Management requires strategic planning with alignment from both the IT and business perspectives in an organization.
4. CO4: Apply the technical and communications skills that contribute to the operation of ICT services in an organization.
5. CO5: Analyze the theoretical, technical and management issues that deliver ICT services to an organization.

<b>Course Title</b>	Game Design and Development using Unity 3D	<b>Course Code:</b> CSAB6020	
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>	
<b>Lectures / Tutorial</b>	3 / 1 Hrs Week	<b>Internal Assessment Test</b>	<b>30 Marks</b>
<b>Total Credits</b>	4	<b>End-Semester Examination</b>	<b>70 Marks</b>
<b>Course Objectives:</b>			
<ol style="list-style-type: none"> <li>1. Understand the principles of game design and the game development lifecycle.</li> <li>2. Use Unity 3D and C# scripting to create interactive games.</li> <li>3. Implement game mechanics, physics, UI, and animation systems.</li> <li>4. Design engaging levels, characters, and user interfaces.</li> <li>5. Build, test, and deploy games on various platforms..</li> </ol>			
<b>Detailed Syllabus:</b>			
<b>Unit-I</b>			
Introduction to Game Design and Unity Environment: History and Evolution of Video Games, Game Genres and Platforms Game Design Elements: Mechanics, Dynamics, Aesthetics, Unity Interface Overview: Scenes, GameObjects, Components, Prefabs, C# Scripting Basics in Unity (Variables, Loops, Methods), Player Input and Basic Movement.			
<b>Unit-II</b>			
Game Physics, Animation, and User Interaction Unity Physics Engine: Rigidbody, Colliders, Triggers, Materials & Physics Materials (Friction, Bounciness), Introduction to Animation System (Animator, Animation Controller), Character Animation and Transitions, Unity UI System: Canvas, Buttons, Text, Sliders, Handling UI Events and Player Interaction.			
<b>Unit-III</b>			
Level Design, Environment Creation, and Lighting, Fundamentals of Level Design: Flow, Pacing, Progression, Unity Terrain Tools and Environment Assets, Lighting in Unity: Directional, Spot, Point Lights, Lightmapping, Shadows, and Post-processing Effects, Skyboxes and Day/Night Cycles, NavMesh and Basic AI Pathfinding.			
<b>Unit-IV</b>			
Gameplay Mechanics and Advanced Scripting: Game Loop and State Management, Coroutines and Timers in Unity, Object Pooling for Performance, Game Events and Triggers, Scoring System, Power-ups, and Collectibles, Inventory Systems and Player Stats, Saving and Loading Game Data (PlayerPrefs, JSON)			
<b>Unit-V</b>			
Game Deployment, Testing, and Final Project:Game Testing and Bug Fixing Techniques Performance Optimization (Profiler, Occlusion Culling, LOD), Exporting Games to PC, Android, WebGL, Unity Build Settings and Player Settings, Introduction to Publishing (itch.io, Play Store overview), Capstone Project Development and Team Collaboration			



<b>Text /Reference Books:</b>
<ol style="list-style-type: none"> <li>1. Game Programming Patterns by Robert Nystrom</li> <li>2. Unity in Action by Joseph Hocking</li> </ol>
<b>Assignments</b>
<p>List of Practicals</p> <ol style="list-style-type: none"> <li>1. Install Unity Hub &amp; Unity Editor</li> <li>2. Create and organize a new Unity project</li> <li>3. Create a 3D scene with terrain, lights, and basic movement controls</li> <li>4. Develop a simple platformer or rolling ball game</li> <li>5. Animate a character (idle → walk → run)</li> </ol>
<b>Course Outcomes:</b>
<p>C01: Explain game development concepts, genres, and design processes.</p> <p>C02: Use Unity 3D to create 2D and 3D interactive games with scripting in C#.</p> <p>C03: Integrate animations, physics, and sound to enhance game experience.</p> <p>C04: Design levels and develop AI behavior for non-player characters (NPCs).</p> <p>C05: Build, test, optimize, and publish games for different platforms.</p>

<b>Elective-III</b>			
<b>Course Title</b>	<b>Web Designing</b>	<b>Course Code:</b> CSAB6910	
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>	
<b>Lectures / Tutorial</b>	<b>3 Hrs Week</b>	<b>Internal Assessment Test</b>	<b>30 Marks</b>
<b>Total Credits</b>	<b>3</b>	<b>End-Semester Examination</b>	<b>70 Marks</b>
<b>Course Objectives:</b>			
<ol style="list-style-type: none"> <li>1. To provide insight into emerging technologies to design and develop state of - the art web applications using client-side scripting, server-side scripting.</li> <li>2. To study database connectivity from frontend to back-end.</li> <li>3. To make students use the cascaded style sheets for formatting the document.</li> <li>4. To study scripting language.</li> </ol>			
<b>Detailed Syllabus:</b>			
<b>Unit-I</b>			
<b>HTML5:</b> Fundamental Elements of HTML, Formatting Text in HTML, Organizing Text in HTML, Links and URLs in HTML, Tables in HTML, Images on a Web Page, Image Formats, Image Maps, Colors, FORMs in HTML, Interactive Elements, Working with Multimedia - Audio and Video File Formats, HTML elements for inserting Audio / Video on a web page			
<b>Unit-II</b>			
<b>CSS:</b> Understanding the Syntax of CSS, CSS Selectors, Inserting CSS in an HTML Document, CSS properties to work with the background of a Page, CSS properties to work with Fonts and Text Styles, CSS properties for positioning an element.			
<b>Unit-III</b>			
<b>JavaScript:</b> Using JavaScript in an HTML Document, Programming Fundamentals of JavaScript – Variables, Operators, Control Flow Statements, Popup Boxes, Functions – Defining and Invoking a Function, Defining Function arguments, Defining a Return Statement, Calling Functions with Timer, JavaScript Objects - String, RegExp, Math, Date, Browser Objects - Window, Navigator, History, Location, Document, Cookies, Document Object Model, Form Validation using JavaScript.			

Unit-IV
<p><b>XML:</b></p> <p>Comparing XML with HTML, Advantages and Disadvantages of XML, Structure of an XML Document, XML Entity References, DTD.</p>
Unit-V
<p><b>XSLT:</b> XSLT Elements and Attributes - xsl: template, xsl:apply-templates, xsl:import, xsl:call-template, xsl:include, xsl:element, xsl:attribute, e xsl:attribute-set, xsl:value-of.</p>
Text /Reference Books:
<ol style="list-style-type: none"> <li>1) HTML 5 Black Book, Covers CSS 3, JavaScript, XML, XHTML, AJAX, PHP and jQuery, 2ed, Dreamtech Press</li> <li>2) Web Programming and Interactive Technologies, scriptDemics, StarEdu Solutions India.</li> <li>3) PHP: A Beginners Guide, Vikram Vaswani, TMH</li> </ol> <p><b>Additional Reference(s):</b></p> <ol style="list-style-type: none"> <li>1) HTML, XHTML, and CSS Bible Fifth Edition, Steven M. Schafer, WILEY</li> <li>2) Learn to Master HTML 5, scriptDemics, StarEdu Solutions Pvt Ltd.</li> <li>3) Learning PHP, MySQL, JavaScript, CSS &amp; HTML5, Robin Nixon, O'Reilly</li> <li>4) PHP, MySQL, JavaScript &amp; HTML5 All-in-one for Dummies, Steve Suehring, Janet Valade Wiley</li> </ol>
Course Outcomes:
<p>After completion of the course students will be able to:</p> <p>CO1: Recall various HTML tags and their functions.</p> <p>CO2: Describe the relationship between HTML, CSS, and JavaScript in web development.</p> <p>CO3: Utilize HTML, CSS, and JavaScript to create responsive web pages.</p> <p>CO4: Design and develop a fully functional database-driven website from scratch.</p> <p>CO5: Differentiate between HTML, XML and XSLT document.</p>

<b>Course Title</b>	Data Analytics	<b>Course Code:</b> CSAB6610	
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>	
<b>Lectures / Tutorial</b>	<b>3 Hrs Week</b>	<b>Internal Assessment Test</b>	<b>30 Marks</b>
<b>Total Credits</b>	<b>3</b>	<b>End-Semester Examination</b>	<b>70 Marks</b>
<b>Course Objectives:</b>			
<ol style="list-style-type: none"> <li>1. To guide and teach the students the concept of data and big data.</li> <li>2. To apply the data analytics process on given data.</li> <li>3. To illustrate students how to apply algorithmic strategies while solving problems.</li> <li>4. To make students study statistical methods and analytics theory for evaluation</li> <li>5. To teach classification algorithms such as decision trees.</li> </ol>			
<b>Detailed Syllabus:</b>			
<b>Unit-I</b>			
<b>Introduction:</b> Big data overview, state of the practice in Analytics- BI Vs Data Science, Current Analytical Architecture, drivers of Big Data, Emerging Big Data Ecosystem and new approach. Data Analytic Life Cycle: Overview, phase 1- Discovery, Phase 2- Data preparation, Phase 3- Model Planning, Phase 4- Model Building, Phase 5- Communicate Results, Phase 6- Operationalize. Case Study: GINA			
<b>Unit-II</b>			
<b>Statistical Methods for Evaluation</b> Hypothesis testing, difference of means, Wilcoxon rank-sum test, type 1 type 2 errors, power and sample size, ANNOVA. Advanced Analytical Theory and Methods: Clustering- Overview, K means- Use cases, Overview of methods, determining number of clusters, diagnostics, reasons to choose and cautions.			
<b>Unit-III</b>			
<b>Advanced Analytical Theory and Methods:</b> Association Rules- Overview, a-priori algorithm, evaluation of candidate rules, case study-transactions in grocery store, validation and testing, diagnostics. Regression- linear, logistics, reasons to choose and cautions, additional regression models			
<b>Unit-IV</b>			
<b>Decision trees</b> Overview, general algorithm, decision tree algorithm, evaluating a decision tree, Naïve Bayes – Bayes“ Algorithm, Naïve Bayes“ Classifier, smoothing, diagnostics. Diagnostics of classifiers, additional classification methods			

Unit-V
<b>Analytics for unstructured data</b> Use cases, Map Reduce, Apache Hadoop. The Hadoop Ecosystem- Pig, HIVE, HBase, Mahout, NoSQL. An Analytics Project-Communicating, operationalizing, creating final deliverables
<b>Text /Reference Books:</b>
<ol style="list-style-type: none"> <li>1. Maheshwari Anil, Rakshit, Acharya, "Data Analytics", McGraw Hill, ISBN: 789353160258.</li> <li>2. Mark Gardner, "Beginning R: The Statistical Programming Language", Wrox Publication, ISBN: 978-1-118-16430-3</li> <li>3. Luís Torgo, "Data Mining with R, Learning with Case Studies", CRC Press, Talay and Francis Group, ISBN9781482234893</li> <li>4. Carlo Vercellis, "Business Intelligence - Data Mining and Optimization for Decision Making", Wiley Publications, ISBN: 9780470753866.</li> </ol>
<b>Course Outcomes:</b>
<ol style="list-style-type: none"> <li>1. CO1: Understand the fundamentals of big data and its significance in modern analytics.</li> <li>2. CO2: Understand and apply statistical methods for evaluation in big data analytics, including hypothesis testing, difference of means, Wilcoxon rank-sum test, and ANOVA.</li> <li>3. CO3: Explore advanced analytical theory and methods, including association rules mining, using algorithms like the a-priori algorithm.</li> <li>4. CO4: Evaluate decision trees effectively for classification tasks, considering metrics like accuracy, precision, and recall.</li> <li>5. CO5: Apply analytics techniques to unstructured data and communicate findings effectively to stakeholders.</li> </ol>

<b>Course Title</b>	<b>Project Work- II</b>	<b>Course Code: CSAB6023</b>	
<b>Teaching Scheme</b>		<b>Evaluation Scheme</b>	
<b>Practicals/Week</b>	<b>8 Hrs/Week</b>	<b>Internal Assessment Test</b>	<b>15 Marks</b>
<b>Total Credits</b>	<b>8</b>	<b>End-Semester Examination</b>	<b>35 Marks</b>

### **Course Objectives:**

1. To train the learner to independently formulate and solve a social, philosophical, Commercial, or technological problem and present the results in written and oral form.
2. To expose learners to the real-life problems in the World of Work.
3. To provide opportunities to learners to interact with people and understand human relations.

The Bachelor of Computer Applications (BCA) programmed prepares the learners to take up positions as Programmers, Systems Analysts, Systems Designers in the field related to computer application and information technology or learners may go for higher studies in this area.

- The theoretical background of various courses provides you the necessary foundation, principles, and practices to develop effective ways to solve computing problems.
- The hands-on experience gained from the practical courses provide you the knowledge to work with various operating systems, programming languages and software tools.
- This project work is kept in the BCA program to give you an opportunity to develop quality software solutions.
- During the development of the project, you should be involved in all the stages of the software development life cycle (SDLC) like requirements analysis, systems design, software development/coding, testing and documentation, with an overall emphasis on the development of reliable software systems.
- The primary emphasis of the project work is to understand and gain the knowledge of the principles of software engineering practices, and develop a good understanding of SDLC.
- The BCA learners are encouraged to involve themselves completely on the project work in their Fifth semester. It is advised to learners to develop their project for solving problems of the software industry or any research organization.
- Doing this will give more exposure to handling real life problems of project development.

**Learners should take this project work very seriously.**

? Topics selected, should be complex and large enough to justify as a **BCA** project. The project should be genuine and original in nature and should not be copied from anywhere else.

? Learners, who wish to do their Project Report from any organization, are required to take NOC from the concerned organization, to carry out the Code of the Project done.

? The project covers Study of existing system & System Requirements, Analysis, Design and Coding. Learners should submit their Project Reports as per the guidelines.

? **Project Reports which are not as per the guidelines will not qualify for evaluation.**

**Project Scheduling**

Learners are supposed to complete their project work within a period of 6 months.

Activity	Date
Apply for Project	After completed theory courses of 4 <sup>th</sup> Sem
Submission of Project Proposal	Within one month from apply the project work
Approval of Project work	Within 15 days from submission of project synopsis or proposal.
Start the project	Immediately after approval of the project.
Project Reporting	At the end of 5 <sup>th</sup> month from start
Submission of Project Report	On or before 20 days of the end of examination.
Examination of Project Work	Date will be announced by the University.

**About the Project**

- Project carries 10 credit points.
- At the end of the project, learners should prepare a written document of their project report.
- Learners can develop their project in the form of a group of 1 to 2 learners.
- Project work carries marks total 100 marks:

Internal Assessment	50
Project Report	10
Presentation and Demonstration	30
Viva	10

### **A. Understanding the significance of Project**

Most of the learners are under the impression that if a good layout is proposed then it will help them in scoring good marks but the quality of the project is analyzed by proper write-ups. It

provides an opportunity for learners to demonstrate originality and to plan and organize the project work and put the practical approach of all the topics studied in the entire curriculum.

### **B. Meaning of Project**

A project is a study of factual information for comprehending and applying the various concepts of the course into practice. Its main purpose is not to generalize but to study the situation with a practical orientation.

### **C. Steps in Project Formulation**

- a. System Study
- b. System Analysis
- c. System Designing
- d. System Development
- e. Implementation and Testing

### **D. Project Supervisor (Guide) Projects can be guided by any:**

A person having B.E/B.Tech (Computer Science), MCA, M.Sc. (Computer Science) with minimum 2 years' experience in Industry / Teaching.

### **E. Project Proposal**

A proposal as per the format given should be prepared once the topic is selected. It should not be more than 10 pages and need not be sent separately. The format for the same is: a. Title of Project

- b. Name of learner or group
- c. Objectives
- d. Problem Statement
- e. Software platform.
- f. Hardware platform
- g. Methodology and Procedure of Work
- h. Detailed information of Guide (Name, Address, qualification and Experience)

### **F. No Objection Certificate:**

If the project is carried out in a company or organization, then a certificate for no objection of the same needs to be presented. It should mention that the



organization has no objection in publishing the findings of the project study. The certificate should contain the name of authority with signature and company stamp and should be given on the company's letterhead and duly signed by authorized signatory.

#### **G. Format of the project**

##### **a. Preliminary pages**

1. Cover Page
2. Title Page
3. Completion Certificates
4. Acknowledgement
5. Abstract
6. Index
7. Table of Contents
8. List of Tables
9. List of Figures
10. List of Symbols, Abbreviations and Nomenclature

##### **b. Body of the project**

□ Containing textual and graphical contents of the project.

- Requirement Analysis
- Project Analysis
- Data Flow Diagram
- Project Design
- ER Diagram
- Table Design
- Reports

##### **c. Bibliography**

□ Reference List

##### **d. Appendices**

##### **e. Paper Publication Details**

The table and figures shall be introduced in the appropriate places.

#### **H. Suggested list of topics for Project Report**

A sample list of topics for the BCA General Project is provided below. This is just a suggested list and learners are free to choose any other IT project relevant to the BCA curriculum. Learners may choose any programming language such as C, JAVA, PHP,

Android etc. There is no compulsion on choosing the project and the software language for the project.

- Employee Record System
- Library Management System
- Learner Record System
- Hotel Reservation System
- eBook Shopping
- Event Management System
- Hostel Management System
- Bus Ticket Reservation System
- Online Food Ordering Systematic Management
- Leave Management System
- Banking System
- Stock Management System
- Mailing Server
- Social Networking
- Online Discussion Forum
- Call Blocker
- Mobile Sensor
- Call Recorder
- Mobile Thesaurus
- Mobile Invoice
- Group Alarm System • Shop Management etc.

#### **I. Technical Specifications of Project Report Length:**

1. The length of the report should be between 100-150 pages including the cover page, summary, table of contents, list of figures, list of tables, and acknowledgement.
2. **Script and Page Format:** The report should be typed using a Word Processor on standard A4 (210 mm x 297 mm) paper size. A conventional font, size 12-point and line spacing of 1.5 mm should be used.

3. **Margins:** Left-hand margins should have a width of not less than 38 mm to facilitate binding. The right-hand, the top, and the bottom should be 25 mm. Each page must be typed in one side, leaving a wide margin.
4. **Paper and Print Quality:** Paper and print quality are important for successful legibility. The report can be printed on a standard quality paper, (e.g., photocopy paper)
5. **Pagination:** Positioning of page numbers should be on the top right-hand side. Pages starting from the summary until the last list of tables should be numbered using Latin numbers (I, II, III, IV...). Pages starting from the Introduction until the appendices should be numbered using numbers (1, 2, 3...). Pages with figures and tables or illustrations must be also numbered.
6. **Guard pages/blank pages at the front and back.**
7. **Binding:** The report should be hard bound.
8. **Number of copies:** Three copies should be submitted – self copy, University copy, Supervisor (Faculty member in charge) Copy.

### **Project Outcome**

After the completion of the course, student will be able to

C01: Discover potential research areas in the field of IT.

C02: Conduct a survey of several available literatures in the preferred field of study

C03: Compare and contrast the several existing solutions for research challenges.

C04: Demonstrate an ability to work in teams and manage the conduct.

C05: Formulate and propose a plan for creating a solution for the research plan identified.

C06: Report and present the findings of the study conducted in the preferred domain.