



ACADEMIC REGULATIONS & SYLLABUS 2025 -26

**Faculty of Computer Science & Applications
Smt. Chandaben Mohanbhai Patel Institute of
Computer Applications
Bachelor of Computer Applications (ONLINE B.C.A.)
Programme**



Charotar University of Science and Technology (CHARUSAT)

CHARUSAT Campus, At Post: Changa – 388421, Taluka: Petlad, District: Anand

Phone: 02697-247500, Fax: 02697-247100, Email: info@charusat.ac.in

www.charusat.ac.in

ACADEMIC RULES

To ensure uniform system of education, duration of under graduate programmes, eligibility criteria for and mode of admission, credit load requirement and its distribution between course and system of examination and other related aspects, following academic rules and regulations are recommended.

1. System of Education

The Semester system of education should be followed across the Charotar University of Science and Technology (CHARUSAT) at Master's levels. Each semester will be at least 90 working days duration. Every enrolled student will be required to take a specified load of course work in the chosen course of specialization and also complete a project/dissertation if any.

2. Duration of Programme

Undergraduate Programme	Bachelor of Computer Applications(BCA)
Minimum	6 Semesters (3 Academic years)
Maximum	10 Semesters (5 Academic years)

3. Eligibility & Mode of Admissions

Eligibility of a candidate and mode of admission to the programme will be according to the regulations for admission committee decided by Government of Gujarat from time to time.

4. Programme structure and Credits

A student admitted to a program should study the course and earn credits specified in the course structure.

5. Attendance

- 5.1 All activities prescribed under these regulations and listed by the course faculty members in their respective course outlines are compulsory for all students pursuing the courses. No exemption will be given to any student from attendance except on account of serious personal illness or accident or family calamity that may genuinely prevent a student from attending a particular session or a few sessions. However, such unexpected absence from classes and other activities will be required to be condoned by the Dean/Principal.

6. Course Evaluation

- 6.1 The performance of every student in each course will be evaluated as follows:

6.1.1 Internal evaluation by the course faculty member(s) based on continuous assessment, for 30% of the marks for the course; and

6.1.2 Final examination by the University through written paper or practical test or oral test or presentation by the student or a combination of any two or more of these, for 70% of the marks for the course.

6.2 University Examination

6.2.1 The final examination by the University for 70% of the evaluation for the course will be through written paper or practical test or oral test or presentation by the student or a combination of any two or more of these.

6.2.2 In order to earn the credit in a course a student has to obtain grade other than FF.

6.2.3 Performance at Internal & University Examination will be done on the relative grading system.

7. Grading

The student's performance in any semester will be assessed by the

Semester Grade Point Average (SGPA). Similarly, his performance at the end of two or more consecutive semesters will be denoted by the Cumulative Grade Point Average (CGPA). The SGPA and CGPA are defined as follows:

Grading Scheme

Grading Scheme Range of Marks (%)	96.0-100	86.0-95.9	76.0-85.9	66.0-75.9	56.0-65.9	46.0-55.9	36.0-45.9	Below 36.0	Absent
Letter Grade	O (Outstanding)	A+ (Excellent)	A (Very Good)	B+ (Good)	B (Above Average)	C (Average)	P (Pass)	F (Fail)	Ab (Absent)
Grade Point	10	9	8	7	6	5	4	0	0

$SGPA = \sum C_i G_i / \sum C_i$ where C_i is the number of credits of course i
 G_i is the Grade Point for the course
 i and $i = 1$ to n , n = number of courses in the semester
 $CGPA = \sum C_i G_i / \sum C_i$ where C_i is the number of credits of course i
 G_i is the Grade Point for the course
 i and $i = 1$ to n , n = number of courses of all semesters up to which CGPA is computed.

8. Detention Rule

A student will be promoted to next year only if he/she has cleared all the courses of the year he/she is studying in. Awards of Degree.

8.1 Every student of the programme who fulfils the following criteria will be eligible for the award of the degree:

8.1.1 He should have earned at least minimum required credits as

prescribed in course structure; and

8.1.2 He should have cleared all evaluation components in every course; and

8.2 The student who fails to satisfy minimum requirement of CGPA will be allowed to improve the grades so as to secure a minimum CGPA for the award of degree. Only latest grade will be considered.

9. Award of Class

The class awarded to a student in the programme is decided by the final CGPA as per the following scheme:

Distinction:	CGPA ≥ 7.0 & ≤ 10.0
First class:	CGPA ≥ 6.0 & < 7.0
Second Class:	CGPA ≥ 5.0 & < 6.0
Pass Class:	CGPA ≥ 3.60 & < 5.0

10. Transcript

The transcript issued to the student at the time of leaving the University will contain a consolidated record of all the courses taken, credits earned, grades obtained, SGPA, CGPA, class obtained, etc.

CHOICE BASED CREDIT SYSTEM

The choice based credit system provides flexibility in designing curriculum and assigning credits based on the course content and hour of teaching. The choice based credit system provides an opportunity for the students to choose courses from the prescribed courses comprising core, elective and open elective courses. The CBCS provides a cafeteria type approach in which the students can take courses of their choice and adopt an interdisciplinary approach to learning. The courses shall be evaluated on the grading system, which is considered to be better than the conventional marks system.

CBCS – Conceptual Definitions / Key Terms (Terminologies)

Types of Courses: The Programme Structure consist of 3 types of courses:

Foundation Courses, Core Courses and Elective Courses.

Foundation Course

These courses are offered by the institute in order to prepare students for studying courses to be offered at higher levels.

Core Courses

A Course which shall compulsorily be studied by a candidate to complete the requirements of a degree / diploma in a said programme of study is defined as a core course. Following core courses are incorporated in CBCS structure:

A. University Core Courses(UC):

University core courses are compulsory courses which are offered across university and must be completed in order to meet the requirements of programme.

B. Programme Core Courses(PC):

Programme core courses are compulsory courses offered by respective programme owners, which must be completed in order to meet the requirements of programme.

Elective Courses

Generally, a course which can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline of study or which provides an extended scope or which enables an exposure to some other discipline / domain or nurtures the candidates

proficiency / skill is called an elective course. Following elective courses are incorporated in CBCS structure:

A. University Elective Courses(UE):

The pool of elective courses offered across all faculties / programmes.

B. Institute Elective Course (IE)

Institute elective courses are those courses which any students of the University/Institute of a Particular Level (PG/UG) will choose as offered or decided by the University/Institute from time-to-time irrespective of their Programme /Specialization.

C. Programme Elective Courses(PE):

The programme specific pool of elective courses offered by respective programme.

Vision, Mission, PEOs, POs and PSOs

Vision

To become a leading institution in the field of computer applications and contribute in national efforts of computerizing public systems

Mission

To produce competent computer professionals with the ability to face future challenges.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

The graduates will:

PEO1: Be able to understand the requirement of computing problem and implement an effective solution.

PEO2: Be able to successfully take up various available career options.

PEO3: Be able to continuously learn in their preferred domains.

PEO4: Be able to acquit themselves in ethical and professional manner while demonstrating effective skills.

PROGRAM OUTCOMES (POs)

The Graduate of Computer Science and Applications will be able to:

PO1: Computational Knowledge: Apply knowledge of computing fundamentals, computing specialization, mathematics, and domain knowledge to provide effective solution in the area of computing.

PO2: Problem Analysis: Identify, formulate, and solve complex computing problems reaching substantiated conclusions using fundamental principles of mathematics, computing sciences, and relevant domain disciplines.

PO3: Design /Development of Solutions: Design and evaluate solutions for computing problems, and design and evaluate systems, components, or

processes that meet specified needs by considering several societal aspects.

PO4: Modern Tool Usage: Create, select, adapt and apply appropriate techniques, resources, and modern computing tools for any computing activities, with an understanding of the limitations.

PO5: Professional Ethics: Understand and commit to professional ethics, responsibilities, and norms of professional computing practice.

PO6: Life-long Learning: Recognize the need, and have the ability, to engage in independent learning for continual development as a computing professional.

PO7: Project management: Demonstrate knowledge and understanding of the computing and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO8: Communication Efficacy: Communicate effectively with the computing community, and with society at large, about complex computing activities by being able to comprehend and write effective reports, design documentation, make effective presentations, and give and understand clear instructions.

PO9: Societal and Environmental Concern: Understand and assess societal and environmental issues within local and global contexts, and the consequential responsibilities relevant to professional computing practice.

P10: Individual and Team Work: Function effectively as an individual and as a member or a leader in diverse teams and in multidisciplinary environments.

P11: Innovation and Entrepreneurship: Identify a timely opportunity and using innovation to pursue that opportunity to create value and wealth for the betterment of the individual and society at large.

PROGRAM SPECIFIC OUTCOMES

At the end of the programme, the student should be able to

PSO1: Analyze, evaluate and formulate workable computing solutions to real world problems using computing methods.

PSO2: Apply proficiencies of communication, teamwork and management skills with spirit of entrepreneurship.

SALIENT FEATURES

- Programme is designed based on Choice Based Credit System(CBCS).
- Right blend of fundamentals and latest technologies related courses.
- Exposure of humanities courses in every semester for holistic development of students.
- Interdisciplinary exposure in form of university elective courses.
- Unique methodologies in form of case study and project based learning for teaching-learning.
- Inclusion of environmental awareness through environment science courses.
- Coverage of emerging technologies through expert sessions, seminar and workshop.

Total Credits of Programme (6 Semesters): 132

**TEACHING SCHEME AND
EXAMINATION SCHEME

FOR

ONLINE BCA PROGRAMME

EFFECTIVE FROM
ACADEMIC YEAR 2025-26**

Online BCA Semester-I

Course Code	Course Name	Theory/ Practical / Others	Marks (Theory)		Marks (Practical)		Credit	NEP - 2020 Classification
			CCE	SEE	CCE	SEE		
CAOC101	Foundation of Programming	Theory and Practical	30	70	30	70	06 (04-Theory) (02-Practical)	Major Core
CAOC102	Fundamentals of Web Designing	Practical	-	-	30	70	02	Major Core
CAOE101	Elective-I	Theory	30	70	-	-	04	Minor
CAOD101	Digital Electronics	Theory	30	70	-	-	04	MDC
CAOS101	Mathematics for Computer Science	Theory	30	70	-	-	02	SEC
CLOV101	Environmental Sciences	Practical	-	-	30	70	02	VAC
HSOA101	Communicative English	Practical	-	-	30	70	02	AEC
*CCE- Continuous and Comprehensive Evaluation (Assignments, Unit Tests, Sessional Test, Case Study, Attendance, Practical Test, Viva etc.) *SEE- Semester –End- Evaluation								

Elective-I	
Course Code	Course Title
CAOE101	Computer Essentials and Information Technology
SWAYAM courses will be included as electives and updated periodically	

Online BCA Semester-II

Course Code	Course Name	Theory/ Practical/ Others	Marks (Theory)		Marks (Practical)		Credit	NEP -2020 Classification
			CCE	SEE	CCE	SEE		
CAOC103	Fundamentals of Object Oriented Programming	Theory and Practical	30	70	30	70	06 (04-Theory) (02-Practical)	Major Core
CAOC104	Database Fundamentals	Practical	-	-	30	70	02	Major Core
CAOE103	Elective-II	Theory	30	70	-	-	04	Minor
CAOD102	Data Communications and Networks	Theory	30	70	-	-	04	MDC
CAOV101	Fundamentals of Accounting	Theory	30	70	-	-	02	VAC
CAOS102	Digital Marketing	Practical	-	-	30	70	02	SEC
CAOA101	Presentation Skills	Practical	-	-	30	70	02	AEC
*CCE- Continuous and Comprehensive Evaluation (Assignments, Unit Tests, Sessional Test, Case Study, Attendance, Practical Test, Viva etc.)								
*SEE- Semester –End- Evaluation								

Elective-II	
Course Code	Course Title
CAOE103	Fundamentals of E-Commerce
SWAYAM courses will be included as electives and updated periodically	

Online BCA Semester-III

Course Code	Course Name	Theory/ Practical/ Others	Marks (Theory)		Marks (Practical)		Credit	NEP -2020 Classification
			CCE	SEE	CCE	SSE		
CAOC201	Fundamentals of Data Structures and Algorithms	Theory and Practical	30	70	30	70	06 (04-Theory) (02-Practical)	Major Core
CAOC202	Fundamentals of Operating Systems	Theory and Practical	30	70	30	70	06 (04-Theory) (02-Practical)	Major Core
CAOS201 CAOS202	(Select any one) 1. Computer Oriented Management System 2. Computer Oriented Numerical Methods	Theory	30	70	-	-	04	SEC
CAOA201	Life Management	Theory	30	70	-	-	02	AEC
	University Elective-I	Practical	-	-	30	70	02	MDC
*CCE- Continuous and Comprehensive Evaluation (Assignments, Unit Tests, Sessional Test, Case Study, Attendance, Practical Test, Viva etc.) *SEE- Semester –End- Evaluation								

University Elective-I	
Course Code	Course Title
CAUD203	Human Computer Interactions
SWAYAM courses will be included as electives and updated periodically	

Online BCA Semester-IV

Course Code	Course Name	Theory/ Practical / Others	Marks (Theory)		Marks (Practical)		Credit	NEP -2020 Classification
			CCE	SEE	CCE	SSE		
CAOC203	System Analysis and Design	Theory	30	70	-	-	04	Major Core
CAOC204	Programming the Internet	Practical	-	-	30	70	02	Major Core
CAOC205	Open Source Technology	Theory and Practical	30	70	30	70	06 (04-Theory) (02-Practical)	Major Core
CAOE201 CAOE202	(Select any one) 1. Advanced Networking 2. Artificial Intelligence (AI) Fundamentals	Theory	30	70	-	-	04	Minor
CAOA202	Social Media and Blog Writing	Practical	-	-	30	70	02	AEC
	University Elective-II	Practical	-	-	30	70	02	MDC
HSOV203	Indian Knowledge System	Practical	-	-	30	70	02	VAC
*CCE- Continuous and Comprehensive Evaluation (Assignments, Unit Tests, Sessional Test, Case Study, Attendance, Practical Test, Viva etc.) *SEE- Semester –End- Evaluation								

University Elective-II	
Course Code	Course Title
CAUD204	Modern Application Development
SWAYAM courses will be included as electives and updated periodically	

Online BCA Semester-V

Course Code	Course Name	Theory/ Practical/ Others	Marks (Theory)		Marks (Practical)		Credit	NEP - 2020 Classification
			CCE	SEE	CCE	SEE		
CAOC301	Object Oriented Programming Using JAVA	Theory and Practical	30	70	30	70	06 (04-Theory) (02-Practical)	Major Core
CAOC302	Fundamentals of Visual Programming	Theory and Practical	30	70	30	70	06 (04-Theory) (02-Practical)	Major Core
CAOE301	Software Engineering	Theory	30	70	-	-	04	Minor
CAOE302	Python Programming	Practical	-	-	30	70	02	Minor
CAOE303 CAOE304	(Select any one) 1. Introduction to Data warehousing 2. Geographical Information System	Theory	30	70	-	-	02	Minor
HSOS301	French	Practical	-	-	30	70	02	SEC
*CCE- Continuous and Comprehensive Evaluation (Assignments, Unit Tests, Sessional Test, Case Study, Attendance, Practical Test, Viva etc.) *SEE- Semester –End- Evaluation								

Online BCA Semester-VI

Course Code	Course Name	Theory/ Practical/ Others	Marks (Theory)		Marks (Practical)		Credit	NEP -2020 Classification
			CC E	SEE	CCE	SSE		
CAOC303	Project Work	VIVA	-	-	90	210	14	Major Core
CAOE305 CAOE306	(Select any one) 1. Introduction to Data Science 2. Fundaments of Digital Image Processing	Theory	30	70	-	-	04	Minor
CAOS301	Mobile Application Development	Theory and Practical	30	70	30	70	04 (02-Theory) (02-Practical)	SEC
HSOA302	Professional Communication, Soft Skills and Personality Development	Practical	-	-	30	70	02	AEC
*CCE- Continuous and Comprehensive Evaluation (Assignments, Unit Tests, Sessional Test, Case Study, Attendance, Practical Test, Viva etc.) *SEE- Semester –End- Evaluation								



DETAILED SYLLABUS

Faculty of Computer Science & Applications
Smt. Chandaben Mohanbhai Patel Institute of
Computer Applications

ONLINE BCA PROGRAMME
AS PER NEP-2020



TEACHING SCHEME & DETAILED SYLLABUS

FOR

**ONLINE BCA PROGRAMME
(1st SEMESTER)
AS PER NEP 2020**

**EFFECTIVE FROM
ACADEMIC YEAR 2025-26**

Online BCA Semester-I

Course Code	Course Name	Theory/ Practical / Others	Marks (Theory)		Marks (Practical)		Credit	NEP - 2020 Classification
			CCE	SEE	CCE	SEE		
CAOC101	Foundation of Programming	Theory and Practical	30	70	30	70	06 (04-Theory) (02-Practical)	Major Core
CAOC102	Fundamentals of Web Designing	Practical	-	-	30	70	02	Major Core
CAOE101	Elective-I	Theory	30	70	-	-	04	Minor
CAOD101	Digital Electronics	Theory	30	70	-	-	04	MDC
CAOS101	Mathematics for Computer Science	Theory	30	70	-	-	02	SEC
CLOV101	Environmental Sciences	Practical	-	-	30	70	02	VAC
HSOA101	Communicative English	Practical	-	-	30	70	02	AEC
*CCE- Continuous and Comprehensive Evaluation (Assignments, Unit Tests, Sessional Test, Case Study, Attendance, Practical Test, Viva etc.) *SEE- Semester –End- Evaluation								

Elective-I	
Course Code	Course Title
CAOE101	Computer Essentials and Information Technology
SWAYAM courses will be included as electives and updated periodically	

CAOC101: Foundation of Programming

Credit	Component	Instruction/Contact Hours(Per Week)	Instruction/Contact Hours(Per Course)	Experiential Learning Hours(Per Course)	Total Notional Hours
04	Theory	04	60	50	110
02	Practical	04	60	40	100
Experiential Learning Components (Theory): Unit Tests, Assignments, Case Study etc. Experiential Learning Components (Practical): Lab Assignments, Practical Test, VIVA , certification courses, development of projects etc.					

Pre-requisite: None

Methodology, Pedagogy & Andragogy: In theory lectures, students will develop problem-solving skills through algorithms and flowcharts, understanding C programming's structure to create basic programs. The curriculum covers conditional and iterative statements, array manipulation, and user-defined functions, with advanced topics like pointers and structures. Emphasis is placed on hands-on experience, focusing on algorithmic thinking and creating flowcharts. Students will learn to write effective C code, mastering variables, input/output operations, and advanced concepts, promoting independent learning and real-world application.

Outline of the course:

Unit Number	Title of the Unit	Minimum Number of Theory Hours
1	Programming Basics	08
2	Introduction to C	12
3	Expressions and Control Statements	10
4	Arrays and Strings	10
5	Introduction to Functions	10
6	Pointers & Basic of the structures	10

Total Hours (Theory): 60
Total hours (Practical): 60
Total Contact Hours:120

Detail Syllabus:

Unit I: Programming Basics

Hours 08

Introduction to algorithm, Key features of algorithm, Introduction to flow charts, Significance of flow chart, Advantages and limitation of flow chart, Introduction to programming languages, Introduction to editor, compiler, and translator.

Unit II: Introduction to C

Hours 12

Introduction, characteristics of C, Structure of C Program, writing first C program, Files used in C program, Compiling and Executing C program. Basic data types in C, User define data types, Variables in C, Declaring and initializing variables in C, Constants, Input / Output statements in C, Operators - arithmetic, relational, logical, assignment, increment - decrement, conditional, Bitwise, comma operator, size-of operator, operator precedence chart.

Unit III: Expressions and Control Statements

Hours 10

Arithmetic expressions, evaluation of expressions, type conversions in expressions, operator precedence and associativity, mathematical functions. Type conversion and casting; Introduction to decision control statements, Conditional and branching statements, loop, nested loop, Break, continue and go to statement.

Unit IV: Arrays and Strings

Hours 10

Arrays: One-dimensional, two-dimensional, Handling of Character Strings: Declaring and initializing string variables, reading string from terminal, writing string to screen, string handling functions, table of strings.

Unit V: Introduction to Functions

Hours 10

Need for user-defined functions, the form of c function, return values and their types, calling a function, category of functions, handling of non-integer functions, nesting of Functions, recursion, functions with arrays.

Unit VI Pointers & Basic of the structures

Hours 10

Understanding the Computer's Memory, Introduction to Pointers, Declaring Pointer Variables, Pointer Expressions and Pointer Arithmetic, Null Pointers, Generic Pointers, passing arguments to Function using Pointers, Pointers and Arrays, passing an Array to a Function, Difference between Array name and Pointer, Pointers and Strings, Array of

Pointers, defining a structure, declaring structure variables, accessing structure members, structure initialization.

Outline of the Course:

Week No	Practical	Description
1	Introduction to Programming and IDE	Overview of programming languages, algorithms, flowchart, Setting up the development environment, Introduction of development environment.
2-3	Basic of C programming	Structure of C Program, writing first C program, Files used in C program, Compiling and Executing C program; Basic data types in C. Variables in C, Declaring and initializing variables in C, Constants, Input / Output statements in C
4-5	Operators, Expressions evaluation & type conversions.	Operators - arithmetic, relational, logical, assignment, increment - decrement, conditional, Bitwise and special, comma operator, size-of operator, operator precedence chart. Arithmetic expressions, evaluation of expressions, type conversions.
6-7	Decision-making statements and looping statements	Decision-making statements (if, else if, else) and nested decision-making statements, Switch statement, Looping statements (for, while, do-while), nested looping statements Break and continue statements.
8-9	Arrays	Understanding arrays, one-dimensional array, two-dimensional arrays, practical exercises of one-dimensional and two-dimensional array.
10-11	String and String functions	Declaring and initializing string variables, reading string from terminal, writing string to screen, string-handling functions.
12-13	User defined functions	Introduction to functions, Function declaration, definition, and calling, Parameters and return values. Scope and lifetime of variables, Recursion.
14-15	Pointers & Structures	Introduction to pointers, Pointers and arrays, Pointer arithmetic, Defining and declaring structures, Accessing structure members

Core Books:

1. ReemaThareja: Computer Fundamentals and Programming in C, 2nd Edition, Oxford University press, 2017
2. PradipDey and Manas Ghosh. "Programming in C", Second Edition, Oxford University Press.
3. E. Balagurusamy: Programming in C, 7th Edition.

Reference Books:

1. Brian W. Kerighan and Dennis M. Ritchie : The C Programming Language, Prentice Hall.
2. Pradip Dey, Manas Ghosh: Programming in C, 4th Edition, Oxford University press.
3. Herbert Schildt: The complete reference C, Fourth edition, Tata McGraw Hill
4. Yashwant Kanetkar: Let us C, 13th Edition, BPB publication.

Web References:

1. <https://cprogrampracticals.blogspot.com/p/basic-concepts.html> [For basic c programming practical]
2. <https://www.programtopia.net/c-programming/docs/operators-expressions> [For operators and expressions in C]
3. <https://www.javatpoint.com/functions-in-c> [For functions]
4. <https://www.programiz.com/c-programming> [For basic c programming practical]
5. <https://www.javatpoint.com/c-pointers> [pointers in c]
6. <https://www.programiz.com/c-programming/c-structures> [structures in c]

Course Outcomes: Upon successful completion of the course, students will be,

CO1 :	Be able to solve problems using algorithms and flowcharts.
CO2 :	Learn about the structure of C program and able to develop simple programs using the C Programming language with data types, variables and constants.
CO3 :	Gain the knowledge of different conditional and iterative statements and expressions.
CO4 :	Explore the utilization and manipulation of numbers and characters arrays both.
CO5 :	Be able to understand user define function. Also, learn Programming-using Array with Pointer and Structure.

Course Outcomes Mapping:

Unit No.	Unit Name	Course Outcomes				
		CO1	CO2	CO3	CO4	CO5
1	Programming Basics	√				
2	Introduction to C		√			
3	Expressions and Control Statements			√		
4	Arrays and Strings		√	√	√	
5	Introduction to Functions		√	√		√
6	Pointers & Basic of the structures		√			√

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	3	2	2	1	2	2	2	1	1	3	3
CO2	3	3	3	3	3	3	3	3	3	3	3	3	3
CO3	2	2	3	3	2	2	2	2	2	1	1	3	2
CO4	3	3	3	3	3	3	3	3	3	2	3	3	2
CO5	3	3	3	3	3	3	3	3	3	2	3	3	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation “-”

CAOC102: Fundamentals of Web Designing

Credit	Component	Instruction/Contact Hours(Per Week)	Instruction/Contact Hours(Per Course)	Experiential Learning Hours(Per Course)	Total Notional Hours
02	Practical	04	60	40	100
Experiential Learning Components: Lab Assignments, Practical Test, VIVA					

Prerequisites: Basic concepts of web.

Methodology, Pedagogy & Andragogy: This course focuses on providing hands-on experience to students for design and develop entire web sites using several web designing tools and HTML scripting language.

Outline of the Course:

Week No	Practical	Description
1	Basic Construction of an HTML & HTML5 Page, HTML Text Editors, HTML Building blocks.	Learn basic concepts of web page design.
2	Basic HTML tags – Text formatting tags, Heading tags, paragraph tags, division tag, Span tags, Break line tag, Binding space in HTML.	Get familiar with different tags and attributes which is used to add the text in a web page.
3	Controlling Font size and color, Adding Table – Table tag.	Learn user interface designing using Table Layout, change font style, color etc.
4	Grouping and merging table rows and columns. Adding List – ordered, unordered and definition list.	Able to display the data in various formats and design different types of list in the table.
5	Adding Image, Adding links - Changing link colors, Email link.	Learn to add images and link in the web page.
6	Embedding audio and video, Adding Field sets.	Able to add multimedia in web page using internal and external methods.
7	Adding Form: Form tag, Action, Method. Basic	Learn basic form elements and when and where to apply it.

	form controls.	
8	Textbox, Password field, Radio Button, Checkbox, Multiple line text area, file upload.	Use various types basic form controls with types of form input elements.
9	Various types of buttons – submit, reset, image, simple button.	Learn various types of buttons to make it more interactive.
10	HTML5 input elements - Color, Number, Date, Month.	Learn new input types in HTML5.
11	Week, Time, date time-local, Email, url, range, search.	Learn to add defining inputs and minimum and maximum range to make the form attractive.
12	Data list, output, progress, meter.	Learn to add list and provide progress horizontal view and range with output.
13	Regular expression, HTML5 new attributes – Placeholder, Required.	Learn HTML 5 form element to provide user side web form validation.
14	Pattern, Autocomplete, Autofocus, novalidate, form novalidate.	Learn HTML 5 new form properties.
15	Form action, form method, spellcheck, content editable.	Learn HTML 5 to user submit the form and redirect the form data to selective method.

Total hours: 60

Text Books:

1. Powel Thomas: HTML - The Complete Reference, 3rd Edition, McGraw-Hill Education – Europe,2018.
2. DT Editorial Services: HTML 5 Black Book,2nd Edition, Dreamtech Press, 2016
3. Matt West: HTML 5 Foundations, Wiley publication, 2013
4. Farrar: HTML Example book, BPB,2007.

Reference Books:

1. David DuRocher : HTML and CSS QuickStart Guide, Paperback,2021.
2. Laura Lemay, Rafe Colburn, Jennifer Kyrnin : Mastering Html, CSS & JavaScript Web Publishing, Paperback, 2016.
3. Whyte: Basic HTML, 2nd Edition, Payne-Gallway, Oxford, 2003.
4. Shelly Woods: HTML introductory concepts and techniques, 5th Edition, Course Technology,2009.
5. Jon Duket: Beginning Web Programming with HTML, XHTML and CSS, Wrox Publication.

Web References:

1. www.w3schools.com/html [For HTML tutorials]
2. html.net/tutorials/html/ [For HTML tutorials]
3. www.htmlgoodies.com/ [For HTML resources]
4. <https://developer.mozilla.org/en-US/learn/html> [For HTML best practices]

Course Outcome: Upon successful completion of the course, student will:

CO1:	Able to understand basic construction of HTML & HTML5 document and started using basic tags.
CO2:	Able to Add content using various tags and format the content in table & list.
CO3:	Able to design links and multimedia elements such as image, audio, video.
CO4:	Able to design a web page form using HTML & HTML5.
CO5:	Able to apply validation using HTML5 attributes.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	1	2	1	3	2	2	1	1	-	1	1	1	1
CO2	-	1	2	3	1	3	1	-	-	2	2	2	2
CO3	1	1	2	3	1	3	1	-	-	2	2	2	2
CO4	1	1	2	3	1	1	1	1	-	1	-	1	1
CO5	2	2	3	3	2	3	3	2	1	2	2	3	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation “-”

CAOE101: Computer Essentials and Information Technology

(100 Marks)

(CCE-50 Marks, SEE-50 Marks)

CCE- Continuous and Comprehensive Evaluation (Theory Assignments, Unit Tests, Sessional Examination, Attendance etc.)

SEE- Semester –End- Evaluation

Credit	Component	Instruction/Contact Hours (Per Week)	Instruction/Contact Hours (Per Course)	Experiential Learning Hours (Per Course)	Total Notional Hours
04	Theory	04	60	50	110
Experiential Learning Components : Unit Tests, Assignments, Case Study etc.					

Pre-requisite: None

Methodology, Pedagogy & Andragogy: During theory lectures emerging trends of information technology will be introduced to students. Emphasis will be given on acquisition, storage and processing of data to generate meaningful information. Students will be made familiar with applications related to information technology. Emerging trends and societal impacts of information technology will be discussed to students.

Outline of the course:

Unit Number	Title of the Unit	Minimum Number of Theory Hours
1	Information Technology Essentials	09
2	Internet Applications	11
3	Internet Service Trends	09
4	Data Analytics Trends	11
5	GPS and GIS Trends	09
6	Emerging Trends and Societal Impact of IT	11

Total Hours (Theory): 60
Total Contact Hours:60

Detail Syllabus:

Unit I : Information Technology Essentials

Hours 09

Introduction to Information Technology, Acquisition of various types of data- Introduction to Number and Textual Data, Image Data, Audio and Video Data Numbers and Textual Data, Data Storage and Organization

Unit II : Internet Applications

Hours 11

Internet: Introduction, Internet basics, Internet protocols, Internet addressing, Browser WWW, E-mail, telnet, FTP, application, benefits and limitation of internet, electronic conferencing, and teleconferencing.

Unit III : Internet Service Trends

Hours 09

Fundamentals of Cloud Computing, Types of Cloud based Services, Varieties of Cloud Computing, Types of Cloud Computing, Advantages and Disadvantage of Cloud Computing, Cloud Computing Providers, Application of Cloud Computing in Business Area. E-commerce, E-Marketing, E-Branding, E-Advertising.

Unit IV : Data Analytics Trends

Hours 11

Types of Data – Qualitative and Quantitative, Data Analytics basics, Types of Analytics, Common technologies used in data analytics, Tools for Data Analytics

Unit V : GPS and GIS Trends

Hours 09

What is GPS, Key uses of GPS, How it is applied, What is GIS, Key Uses of GIS, Industries uses of GIS, Future of GPS and GIS.

Unit VI : Emerging Trends and Societal Impact of IT

Hours 11

Internet of Things, Virtual and Augmented Reality, Industry 4.0, Image Processing; Introduction to Societal Impact, Social Use of World Wide Web, Privacy, Security and Integration of Information, Disaster Recovery, Intellectual Property Right, Career in IT

Core Books:

1. V Rajaraman : Introduction to Information Technology, 2nd Edition, PHI Learning Private Limited, 2013.
2. P.T. Joseph, S.J.: E-Commerce An Indian Perspective, 5th Edition, PHI Learning Private Limited, 2015.
3. R. Kalakota & M. Robinson, e-Business 2.0, 2nd Edition, Pearson Publisher, 2012.
4. Thomas Erl, Z. Mahmood and R. Puttini: Cloud Computing Concepts, Technology & Architecture, Pearson Publication, 2014

Reference Books:

1. Syed Muhammad Fahad Akhtar, Big Data Architect's Handbook, Packt Publishing Ltd, 2018.
2. Kamlesh K. Bajaj, Debjani Nag: E-Commerce, The Cutting Edge of Business, 2nd Edition, McGraw-Hill Education, 2014.

Web References:

1. <https://blog.k2datascience.com/the-basics-of-data-analytics-77e5cc7ea741> [For Data Analytics]
2. <https://www.investopedia.com/terms/c/cloud-computing.asp> [For Cloud Computing]
3. <https://www.javatpoint.com/cloud-computing-applications> [For Cloud Computing]
4. <https://www.geeksforgeeks.org/difference-between-e-commerce-and-e-business/> [For E-business vs E-Commerce]
5. <https://www.temok.com/blog/what-is-e-business/> [For E- business]
6. <https://files.eric.ed.gov/fulltext/ED536788.pdf> [For Data Analytics]
7. <https://vdocument.in/introduction-to-e-scm.html> [For E-SCM]
8. <http://nek.istanbul.edu.tr:4444/ekos/TEZ/42370.pdf> [For E-CRM]
9. https://wps.prenhall.com/wps/media/objects/10704/10961611/Online_Appendix_B.pdf [For E-CRM]

Course Outcomes: Upon successful completion of the course, students will be,

CO1 :	Understand the essentials of Information Technology.
CO2 :	Aware about Internet based Applications and their uses in real life.
CO3 :	Understand trends of Internet services.
CO4 :	Understands basics of Data Analytics, E-Business, GIS, and GPS related concepts
CO5 :	Understand emerging trends and societal Impact of Information Technology.

Course Outcomes Mapping:

Unit No.	Unit Name	Course Outcomes				
		CO1	CO2	CO3	CO4	CO5
1	Information Technology Essentials	√				
2	Internet Applications		√	√		
3	Internet Service Trends		√	√		
4	Data Analytics Trends				√	
5	GPS and GIS Trends				√	
6	Emerging Trends and Societal Impact of IT					√

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	1	1	-	-	2	-	-	-	-	-	2	2
CO2	3	1	2	1	-	3	-	-	-	-	2	2	2
CO3	3	1	2	1	-	3	-	-	-	-	2	2	2
CO4	3	1	2	1	-	3	-	-	-	-	2	2	2
CO5	3	1	2	1	2	2	-	-	2	-	-	2	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation “-”

CAOD101 : Digital Electronics

Credit	Component	Instruction/ Contact Hours (Per Week)	Instruction/ Contact Hours (Per Course)	Experiential Learning Hours (Per Course)	Total Notional Hours
04	Theory	04	60	50	110
Experiential Learning Components: Unit Tests, Assignments, Case Study etc.					

Pre-requisite: None

Methodology, Pedagogy & Andragogy: In order to achieve the course objectives, students will be introduced to digital technologies. Various digital modules used to create digital computer devices like gates, flip flops, decoder, encoder etc. are to be studied. Mathematical base is created to understand the organization of digital computer.

Outline of the course:

Unit Number	Title of the Unit	Minimum Number of Theory Hours
1	Digital Systems and Binary Numbers	12
2	Boolean Algebra and Logic Gates	12
3	Combinational Circuit Designing	10
4	Sequential Circuit Designing	10
5	Memory Interfaces and Data Representation	08
6	The Arithmetic Logic Unit and Control Unit	08

Total Hours (Theory): 60

Total Contact Hours:60

Detail Syllabus:

Unit I: Digital Systems and Binary Numbers

Hours 12

Introduction and Evolution of Digital computers, Major components of digital computer, Interfaces and Buses, compiler, interpreter, Assembler, Introduction to various number systems (Decimal, Binary, Octal, Hexadecimal, BCD), Conversion of number system, Binary operations, signed binary numbers, 1's complement and 2's complement.

Unit II: Boolean Algebra and Logic Gates

Hours 12

Fundamental concepts and rules of Boolean algebra, , Boolean Algebra Laws, Boolean expressions and its simplification with and without Truth Tables, Canonical form and standard form, D-Morgan's Theorem, Basic duality laws, Derivation of Boolean expressions, Introduction to logic gates (AND, OR, NOT, NAND, NOR, XOR, XNOR), Implementation of Boolean expressions using logic gates, Sum of product and Product of Sum forms, Universal gates, Implementation of other gates using universal gates, Karnaugh Map method for two, three, four and five variables, K-map with don't care conditions, Tabulation method, determination and selection of prime applicants.

Unit III: Combinational Circuit Designing

Hours 10

Introduction to combinational circuits, Design procedures, Adders, Subtractors, code conversion circuits, Analysis procedures, Multilevel NAND circuits, Multilevel NOR circuits, EX-OR functions, Binary adder and Subtractors, Decimal adder and Subtractors, Magnitude comparator, Decoder and encoders, Multiplexer and de-multiplexer.

Unit IV: Sequential Circuit Designing

Hours 10

Introduction to Sequential circuits, Concepts of Flip-flops, triggering flip-flops, Clock signals, Analysis of clock sequential circuits, State Reduction and assignments, Flip flop excitation table, Design procedure of asynchronous and synchronous counters (Ripple counter, Binary counter, BCD counter), Design of registers, Shift registers, Timing sequences.

Unit V: Memory Interfaces and Data Representation

Hours 08

Memory, Types of ROM, Design of ROM, Types of RAM, Magnetic disc memory, Magnetic tape, Digital recording techniques, Linear-select memory organization, Types of digital codes (Gray code, 8421 code, Alphanumeric codes), Parity checking codes, Floating point representation, Fixed point representation.

Unit VI: The Arithmetic Logic Unit and Control Unit

Hours 08

Basic operations of Arithmetic Logic Unit, Construction of the Arithmetic Logic Unit, Representation of Instruction word, Control registers, Instruction and execution cycles of Control registers, Sequence operation of Control Registers.

Core Books:

1. M. Morris Mano: Digital Logic and Computer Design, Third Edition, Pearson Education, 2016.
2. Thomas C. Bartee: Digital Computer Fundamentals, Sixth Edition, Tata McGraw Hill Publishing, 2012.
3. M. Morris Mano: Computer System Architecture, Third Edition, Pearson Education, 2011.

Reference Books:

1. Andrew S. Tanenbaum: Structured Computer Organization, Fourth Edition, Pearson Education, 2005.
2. Albert Paul Malvino and Jerald A. Brown: Digital Computer Electronics, Third Edition, Tata McGraw Hill Publishing, 2008.

Web References:

1. https://www.tutorialspoint.com/digital_circuits/index.htm [Digital Circuits Tutorial]
2. <https://www.geeksforgeeks.org/digital-electronics-logic-design-tutorials/> [Digital Electronics and Logic Design Tutorials]
3. <https://studymaterialz.in/digital-logic-and-computer-design-by-morris-mano/> [Digital Logic and Computer Design book]
4. <https://cupola.gettysburg.edu/oer/1/> [Digital Circuit Projects]

Course Outcomes: Upon successful completion of the course, students will be,

CO1 :	Able to get the idea about digital system and numbering system.
CO2 :	Able to study logic gates for digital circuit designing.
CO3 :	Able to learn to design various combinational circuits.
CO4 :	Able to learn to design various sequential circuits.
CO5 :	Able to learn memory design concepts and to study computer Arithmetic Logic Unit and Control Unit.

Course Outcomes Mapping:

Unit No.	Unit Name	Course Outcomes				
		CO1	CO2	CO3	CO4	CO5
1	Digital Systems and Binary Numbers	√				
2	Boolean Algebra and Logic Gates		√			
3	Combinational Circuit Designing			√		
4	Sequential Circuit Designing				√	
5	Memory Interfaces and Data Representation					√
6	The Arithmetic Logic Unit and Control Unit					√

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	2	-	3	2	-	-	2	1	3	2
CO2	3	2	2	2	-	3	2	-	-	2	1	3	2
CO3	3	3	3	2	-	2	2	-	-	2	2	3	2
CO4	3	3	3	2	-	2	2	-	-	2	2	3	2
CO5	3	3	3	2	-	3	2	-	-	2	2	3	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation “-”

CAOS101 : Mathematics for Computer Science

Credit	Component	Instruction/ Contact Hours(Per Week)	Instruction/ Contact Hours(Per Course)	Experiential Learning Hours(Per Course)	Total Notional Hours
02	Theory	02	30	25	55
Experiential Learning Components: Unit Tests, Assignments, Case Study etc.					

Pre-requisite: Basic algebra and geometry, as well as a good understanding of logic and proofs, mathematical statistics.

Methodology, Pedagogy & Andragogy: During theory lectures the emphasis will be given on the fundamentals of mathematics and statistics. Problem solving: Students will demonstrate the ability to solve problems, including applications outside of mathematics. Mathematical communication: Students will demonstrate the ability to communicate mathematical ideas clearly. They will use correct mathematical terminology and proper mathematical notation.

Outline of the course:

Unit Number	Title of the Unit	Minimum Number of Theory Hours
1	Sets and functions	04
2	Vectors and Matrices	04
3	Measure of Central Tendency & Dispersion	06
4	Permutation & Combination	05
5	Probability	06
6	Graph Theory	05

Total Hours (Theory): 30
Total Contact Hours:30

Detail Syllabus:

Unit I : Sets and Functions

Hours 04

Introduction to set theory, methods of representation of a set, operations on set, algebra of sets, De 'Morgan's law, function definition, domain, range, one-to-one function, onto function.

Unit II : Vectors and Matrices

Hours 04

Definition of vector, addition and subtraction of vector, magnitude of a vector, unit vectors, dot product and cross product, definition of matrix, equal matrices, diagonal elements of matrix, row matrix, column matrix, Symmetric matrix, skew symmetric matrix, orthogonal matrix, diagonal matrix, identity matrix, operations on matrix.

Unit III : Measure of central tendency and dispersion

Hours 06

Definition, Ungrouped Data, Grouped Data (Discrete and Continuous Grouped data). Mean: Arithmetic Mean, Geometric Mean and Harmonic Mean for ungrouped data, Combined Mean, Weighted Mean. Median, Quartiles, Deciles, Percentiles and Mode. Different measure of dispersion. Quartile Deviation, Mean Deviation, Standard Deviation, Combined Standard Deviation, Coefficient of Variation.

Unit IV : Permutation and Combination

Hours 05

Meaning of permutation, Formula of permutation, Permutation of n different things, Permutation of similar things, Permutation of repeated things, Circular Permutation, Combination: Meaning of Combination, Formula of Combination.

Unit V : Probability

Hours 06

Probability: Random Experiment, Sample Space, Event, Mutually exclusive event, Exhaustive event, Equally likely event, Probability Classical definition. (Simple examples of Probability).

Unit VI : Graph Theory

Hours 05

Introduction to Graph, Graph Definition, Vertices, Edges, Loops, Parallel Edges, Simple Graph, Finite Graph, Adjacent vertices, Incidence between vertex and edge, Degree of a vertex, Isolated Vertex, Pendent Vertex, Null Graph. Isomorphism, Labeled Graph

Core Books:

1. D. C. Sancheti, V. K. Kapoor: Business Mathematics, Sultan Chand & sons.
2. Lipschutz & Marc Lipson: DISCRETE MATHEMATICS, Tata McGraw Hill
3. Narsingh Deo: Graph Theory with application to engineering and computer science, Prentice Hall of India Pvt. Ltd

Reference Books:

1. Gupta and Gupta: Business Statistics, Sultan Chand and Sons.

Web References:

1. <https://www.statlect.com/matrix-algebra/vectors-and-matrices>
2. <https://www.geeksforgeeks.org/permutations-and-combinations/>
3. <https://www.khanacademy.org/math/statistics-probability/probability-library/basic-theoretical-probability/a/probability-the-basics>

Course Outcomes: Upon successful completion of the course, students will be,

CO1 :	Students will learn basics of sets and functions
CO2 :	The students will be familiar with various linear algebra.
CO3 :	Students will be well equipped to measure accurate description of data
CO4 :	Students will be able to define a permutation and explain how to calculate probability
CO5 :	Students will be able to understand and apply the fundamental concepts in graph theory

Course Outcomes Mapping:

Unit No.	Unit Name	Course Outcomes				
		CO1	CO2	CO3	CO4	CO5
1	Sets and Functions	√				
2	Vectors and Matrices		√			
3	Measure of central tendency and dispersion			√		
4	Permutation and Combination				√	
5	Probability				√	
6	Graph Theory					√

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	3	2	-	2	1	-	-	-	-	2	-
CO2	3	3	3	2	-	2	1	-	-	-	-	2	-
CO3	3	3	3	2	-	2	1	-	-	-	-	2	-
CO4	3	3	3	2	-	2	1	-	-	-	-	2	-
CO5	3	3	3	2	-	2	1	-	-	-	-	2	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation “-”

**TEACHING SCHEME &
DETAILED SYLLABUS**

FOR

**ONLINE BCA PROGRAMME
(2nd SEMESTER)
AS PER NEP 2020**

**EFFECTIVE FROM
ACADEMIC YEAR 2025-26**

Online BCA Semester-II

Course Code	Course Name	Theory/ Practical/ Others	Marks (Theory)		Marks (Practical)		Credit	NEP -2020 Classification
			CCE	SEE	CCE	SEE		
CAOC103	Fundamentals of Object Oriented Programming	Theory and Practical	30	70	30	70	06 (04-Theory) (02-Practical)	Major Core
CAOC104	Database Fundamentals	Practical	-	-	30	70	02	Major Core
CAOE103	Elective-II	Theory	30	70	-	-	04	Minor
CAOD102	Data Communications and Networks	Theory	30	70	-	-	04	MDC
CAOV101	Fundamentals of Accounting	Theory	30	70	-	-	02	VAC
CAOS102	Digital Marketing	Practical	-	-	30	70	02	SEC
CAOA101	Presentation Skills	Practical	-	-	30	70	02	AEC
*CCE- Continuous and Comprehensive Evaluation (Assignments, Unit Tests, Sessional Test, Case Study, Attendance, Practical Test, Viva etc.) *SEE- Semester –End- Evaluation								

Elective-II	
Course Code	Course Title
CAOE103	Fundamentals of E-Commerce
SWAYAM courses will be included as electives and updated periodically	

CAOC103: Fundamentals of Object Oriented Programming

Credit	Component	Instruction/ Contact Hours (Per Week)	Instruction/ Contact Hours (Per Course)	Experiential Learning Hours (Per Course)	Total Notional Hours
04	Theory	04	60	50	110
02	Practical	04	60	50	110
Experiential Learning Components (Theory): Unit Tests, Assignments, Case Study etc. Experiential Learning Components (Practical): Lab Assignments, Practical Test, VIVA					

Pre-requisite: Foundation of Programming

Methodology, Pedagogy & Andragogy: The theory sessions will use real-world examples to demonstrate how object-oriented programming (OOP) enhances problem-solving, covering concepts such as classes, objects, inheritance, polymorphism, and exception handling. Students will engage in self-directed learning through case studies, assignments, and unit tests to assess their progress. During practical sessions, students will apply these OOP concepts through various assignments and case studies, further developing their understanding of how OOP efficiently addresses complex problems. Independent learning will be emphasized to ensure students grasp and progress in their comprehension of OOP principles.

Outline of the course:

Unit Number	Title of the Unit	Minimum Number of Theory Hours
1	Introduction to Object Oriented Programming	08
2	Classes and Objects	11
3	Polymorphism	10
4	Inheritance	13
5	Exception Handling and Type cast operators	10
6	Managing I/O formats and operations	08

Total Hours (Theory): 60

Total Contact Hours:60

Detailed Syllabus:

Unit - I: Introduction to Object Oriented Programming

Hours: 08

Structured programming vs. object oriented programming, Introduction to C++: structure of a C++ program Tokens, inline function, pass by reference, default arguments, OOP characteristics.

Unit - II: Classes and Objects

Hours: 11

Define class, objects, visibility modes, static members, friend function, Constructors and Destructors, Default Constructor, Copy constructors, Parameterized Constructor, this keyword.

Unit - III: Polymorphism

Hours: 10

Introduction of Static Binding, Function Overloading and ambiguity raised in function overloading, Operator overloading through member function and friend functions, type conversions from primitive to class, class to primitive and class to class.

Unit - IV: Inheritance

Hours: 13

Objective of Inheritance, types of inheritance, impact of access modes during inheritance, Virtual base classes, Dynamic Binding, Virtual functions, Pure virtual functions, Abstract class, Early vs. Late binding.

Unit - V: Exception Handling and Type Cast Operators

Hours: 10

Introduction to Exception handling, catching class types, using multiple catch statements, exception handling options, creating custom exceptions, introduction to cast operators, const cast, static cast, reinterpret cast, dynamic cast.

Unit - VI: Managing I/O Formats and Operations

Hours: 08

Understand and apply concepts from various header files like iostream, iomanip, fstream, etc. opening and closing file, reading and writing text files and binary files, performing random access on files, handle command line arguments.

Core Books:

1. Herbert Schildt: C++: A Beginner's Guide, 2nd Edition Paperback, McGraw-Hill, 2003.
2. E Balagurusamy: Object Oriented Programming with C++ Paperback, McGraw Hill India, 2017.

Reference Books:

1. Yashavant Kanetkar: Let Us C++, Paperback, BPB Publications, 2020.
2. Robert Lafore: Object Oriented Programming in C++, 4th Edition, Sams Publications, 2002.
3. Bruce Eckel: Thinking in C++, Volume 1, 2nd Edition, Pearson Education, 2006.

Web References:

1. <https://www.geeksforgeeks.org/c-plus-plus/> [For Entire Syllabus]
2. <https://google.github.io/styleguide/cppguide.html> [For coding standards and concepts]
3. http://www.tutorialspoint.com/cplusplus/cpp_basic_input_output.htm [For Practicals]

Course Outcomes: Upon successful completion of the course, the students will:

CO1 :	Understand the basic structure of C++ program and understand the concept of object oriented programming characteristics.
CO2 :	Understand the concept of Constructor and Destructor and able to create class and objects.
CO3 :	Understand the need of Polymorphism and implement static polymorphism
CO4:	Understand the purpose of Inheritance, identify relations between classes, implement inheritance and perform dynamic binding.
CO5 :	Able to handle the runtime errors or exceptions in C++ and use type cast operators. Able to read input from device, file, command line arguments and apply formats to input and output.

Course Outcomes Mapping:

Unit No.	Unit Name	Course Outcomes				
		Co1	Co2	Co3	Co4	Co5
1	Introduction to Object Oriented Programming	√				
2	Classes and Objects		√			
3	Polymorphism			√		
4	Inheritance				√	
5	Exception Handling and Type cast operators					√
6	Managing I/O formats and operations					√

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	2	2	2	2	2	2	2	2	2	3	2
CO2	3	3	3	2	2	2	3	2	2	2	2	3	2
CO3	3	2	3	2	2	2	3	2	2	2	2	3	2
CO4	3	3	3	2	2	2	3	2	2	2	2	3	2
CO5	3	2	3	2	2	2	2	2	2	2	2	3	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation “-”

CAOC104: Database Fundamentals

Credit	Component	Instruction/ Contact Hours (Per Week)	Instruction/ Contact Hours (Per Course)	Experiential Learning Hours (Per Course)	Total Notional Hours
02	Practical	04	60	40	100
Experiential Learning Components: Lab Assignments, Practical Test, VIVA , certification courses, development of projects etc.					

Prerequisites: Basic knowledge of working with computer

Methodology, Pedagogy & Andragogy: Learn about computer data. Understand what data is, learn its meaning, examine the types of data sources, and see the difference between data and information. The database applications used in the real world will be discussed with necessary examples. During the laboratory hours' students' will implement the concepts. Apply SQL commands to mine data from databases and data visualization techniques to address organization information needs.

Outline of the Course:

Week No	Practical	Description
1	Introduction to Database System	Overview of data, information, file, database, database systems, DBMS, Purpose of DBMS over file system.
2-3	Data modelling and architecture	Various data models: ER model and Relational model, Three level architecture, structure of DBMS and database actors and workers
4-5	Database Design Methodology	CODD Rules, Functional Dependency and Normalization for Database Informal Design Guidelines for Relational Schemas, Functional Dependencies, Normal Forms (1NF, 2NF, 3NF, BCNF, 4NF, 5NF)
6-7	Schema Definition, Constraints, Queries – I	Basic Data types, Create Table Command, Modifying the structure of tables, renaming table, truncating table, destroying table, Insert, Delete and Update Statements in SQL
8	Schema Definition, Constraints, Queries –	Data Constraints and Functions: - Pseudo columns, Null values, TAB table, DUAL table

	II	Operators, Data constraints, Type of data constraints, modifying constraints, working with data dictionary and use of USER_CONSTRAINTS Functions introduction
9	Inbuilt functions	Merits and demerits of functions, Types of functions: Numeric functions, Character functions, Date functions, Conversion functions, Aggregate functions
10-11	Querying the data	Different operators: logical range, searching and pattern matching, Viewing Data in the tables, sorting
12-13	Advanced Query Processing-I	Co-related Nested Queries, Group By clause, having clause
14-15	Advanced Query Processing-II	Joins (Inner Join, Outer Join, Self-Join, Equi Join, Cross Join), Creation and manipulation of database objects indexes, views, sequences and synonym.

Total hours: 60

Text Books:

1. Ivan Bayross : SQL, PL/SQL The programming Language Oracle.
2. Ramkrishnan, Gehrke : Database Management Systems, 3 rd Edition, McGrawHill Publication.
3. RamezElmasri, Shamkant B. Navathe : Fundamentals of Database Systems , 5th Edition, , Pearson Publication.

Reference Books:

1. Silberschatz, Korth, Sudarshan : Database System Concepts, 5th Edition, McGraw Hill.
2. C.J.Date, a Kannan, S Swaminathan : An Introduction to Database Systems, 8th Edition, Pearson Education,(Equivalent Reading).
3. Scoot Urban : Oracle 9i, PL/SQL Programming, Oracle Press.
4. S. K. Singh : Database Systems: Concepts, Design and Applications, Pearson Education
5. Peter Rob, Carlos Coronel: Database Systems: Design, Implementation and Management, 7th Edition, Cengage Learning, 2007.
6. Leon and Leon : Database management Systems, Vikas Publication.

Web References:

1. <https://www.javatpoint.com/er-model-vs-relational-model> [For difference of ER and Relational model]
2. http://www.microsoftvirtualacademy.com/trainingcourses/databasefundamentals#?fbid=bZ92pOp_Tt [For overall subject]
3. http://www.ntu.edu.sg/home/ehchua/programming/sql/Relational_Database_Design.html [for relational database design]
4. http://docs.oracle.com/cd/A97335_02/apps.102/a81358/o5_dev1.htm [For ER Diagram]

Course Outcome: Upon successful completion of the course, student will:

CO1:	Understand basic concepts regarding data, database systems and various data models.
CO2:	Understand various data modeling techniques and entity relationship models.
CO3:	Learn about relational data model and related concepts.
CO4:	Gain insights into database design, SQL and normalization concepts.
CO5:	Advanced query processing

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	3	1	1	-	3	-	-	-	-	-	2	-
CO2	1	3	3	3	-	3	1	-	-	-	-	1	3
CO3	3	3	3	3	-	3	2	-	-	2	-	2	
CO4	-	3	3	3	-	3	3	-	-	3	3	-	3
CO5	2	3	3	3	2	3	3	-	-	-	3	2	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation “-”

CAOE103: Fundamentals of E-Commerce

Credit	Component	Instruction/ Contact Hours (Per Week)	Instruction/ Contact Hours (Per Course)	Experiential Learning Hours (Per Course)	Total Notional Hours
04	Theory	04	60	50	110
Experiential Learning Components: Unit Tests, Assignments, Case Study etc.					

Pre-requisite: None

Methodology, Pedagogy & Andragogy: During theory lectures the emphasis will be given on the fundamentals of E-commerce. Students will be introduced to E-Commerce, E-Marketing, E-Security and E-Payment, Mobile Commerce, CRM and ERP, and E-Commerce Applications. Students will give practical exposure in form of case study and by visit to E-commerce / Digital Marketing company and/or supply chain Centre.

Outline of the course:

Unit Number	Title of the Unit	Minimum Number of Theory Hours
1	Introduction to E-Commerce	09
2	E-Marketing	11
3	E-Security and E-Payment	09
4	Mobile Commerce	11
5	CRM and ERP	09
6	E-Commerce Applications	11

Total Hours (Theory): 60

Total Contact Hours:60

Detail Syllabus:

Unit I : Introduction to E-Commerce

Hours 09

Emergence and use of Internet, origin of web and world wide web, advantages and disadvantages of E-commerce, Features of E-Commerce, Electronic Commerce over the Internet, Types of Ecommerce.

Unit II : E-Marketing

Hours 11

Traditional Marketing, Online Marketing, E- advertising, Internet Marketing Trends and strategies, E-branding.

Unit III : E-Security and E-Payment

Hours 09

Security on the Internet, E-Business risk management issues, Digital token based E-Payment System, Properties of Electronic Cash, Digital Signature.

Unit IV : Mobile Commerce

Hours 11

Definition of M-Commerce, Features of M-Commerce, Advantages and Disadvantages of M-Commerce, Areas of M-Commerce Applications, Payment Systems and Models in M-Commerce.

Unit V : CRM and ERP

Hours 09

Customer Relationship Management, CRM capabilities and Customer life cycle, Introduction to ERP, Reasons for the growth of the ERP Market, Advantages and Disadvantages of ERP.

Unit VI : E-Commerce Applications

Hours 11

Retail and Wholesale, Finance, Manufacturing, Online Booking, Online Publishing, Digital Advertising, Digital Shopping, Digital Media, Auctions, A case study need to be discussed for these application. Hands-on experience in setting up and managing an e-commerce store. Developing a business plan for an ecommerce start-up.

Core Books:

1. P.T.Joseph, S.J.: E-Commerce- An Indian Perspective, 3rd Edition, PHI learning Private Limited.
2. Kamlesh K. Bajaj, Debjani Nag: E-Commerce, The Cutting Edge of Business, 2nd Edition, McGraw-Hill Education.

Reference Books:

1. Anita Rosen: The e-commerce Question and Answer Book: A Survival Guide for Business Managers, 2nd Edition, Amacom.
2. Janice Reynolds: The Complete E-Commerce Book: Design, Build & Maintain a Successful Web-based Business, 2nd Edition, CRC Press.
3. By Philippe Humeau&Matthieu Jung : The White Book of Ecommerce Solutions, NBS System.
4. IshitaLahiri and Sujit Kumar Ghose : Principals of Marketing and E-Commerce

Web References:

1. <http://www.ecommercetutorial.net/> [For Tutorial]

Course Outcomes: Upon successful completion of the course, students will be,

CO1 :	To understand basic of Electronic Commerce and its Application
CO2 :	Getting knowledge of E-marketing and its Strategies.
CO3 :	Learn E-security and E-Payment in Detail and its term. Also, learn Encryption and decryption in basic
CO4 :	To gain understanding of Mobile Commerce and its Application through real life examples.
CO5 :	To learn concepts of Customer Relationship Management and various solutions of E-Commerce (Software and Framework).

Course Outcomes Mapping:

Unit No.	Unit Name	Course Outcomes				
		CO1	CO2	CO3	CO4	CO5
1	Introduction to E-Commerce	√				
2	E-Marketing	√	√			
3	E-Security and E-Payment		√	√		
4	Mobile Commerce		√	√		
5	CRM and ERP				√	
6	E-Commerce Applications					√

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	3	2	2	1	2	2	2	1	1	3	3
CO2	3	3	3	3	3	3	3	3	3	3	3	3	3
CO3	2	2	3	3	2	2	2	2	2	1	1	3	2
CO4	3	3	3	3	3	3	3	3	3	2	3	3	2
CO5	3	3	3	3	3	3	3	3	3	2	3	3	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation “-”

CAOD102 : Data Communications and Networking

Credit	Component	Instruction/ Contact Hours (Per Week)	Instruction/ Contact Hours (Per Course)	Experiential Learning Hours (Per Course)	Total Notional Hours
04	Theory	04	60	50	110
Experiential Learning Components: Unit Tests, Assignments, Case Study, Certification courses, etc.					

Pre-requisite: Basic knowledge of computers and their working.

Methodology, Pedagogy & Andragogy: During the lecture sessions, the students will learn about role of computer network in modern communication systems, underlying principles of network communication, need for standardization through network reference model. The teacher will also discuss communication issues at different layers and concepts related to network security. The students will adopt the latest certification courses from reputed and recognized platforms. Furthermore, the students will be engaged in problem-solving, emphasizing real-world applications and relevance.

Outline of the course:

Unit Number	Title of the Unit	Minimum Number of Theory Hours
1	Introduction to Computer Networks	10
2	Basics of network communication	08
3	Network reference model	11
4	Data Link Layer Functions and Protocol	12
5	Network Layer Functions and Protocol	10
6	Network security	09

Total Hours (Theory):60
Total Contact Hours:60

Detail Syllabus:

Unit I: Introduction to computer network

Hours 10

Definition of computer network, aim and objective of computer network: applications of computer network, merits & demerits of computer network, examples of computer network, components of computer network, types of networks, network topologies, network devices: hub, switch, repeater, router, gateway, bridge.

Unit II: Basics of network communication

Hours 08

Parallel & serial communication, synchronous & asynchronous communication, modes of communication: simple, half-duplex, full-duplex, multiplexing, de-multiplexing: frequency division multiplexing (FDM), time division multiplexing (TDM), communication media: guided media, unguided media, switching techniques: circuit switching, message switching, packet switching.

Unit III: Network reference model

Hours 11

Need for network reference model, history of TCP/IP and OSI model, layers of OSI and TCP/IP model, comparison between TCP/IP and OSI model, Protocol Hierarchy, Network Protocols: Simple Mail Transfer Protocol (SMTP), File Transfer Protocol (FTP), Multiple Internet Mail Extension (MIME), Post Office Protocol (POP), Telnet, Domain Name Service (DNS), Dynamic Host Configuration Protocol (DHCP), Address Resolution Protocol (ARP), Reverse Address Resolution Protocol (RARP).

Unit IV: Data Link Layer Functions and Protocol

Hours 12

Definition of Framing, framing methods, Error detection techniques, Error correction techniques, Flow control mechanisms- Simplex protocol, Stop and Wait ARQ, Go-Back-N ARQ, Point to Point protocol.

Unit V: Network Layer Functions and Protocol

Hours 10

Connection oriented vs Connectionless services, Definition of Routing, Routing algorithms, IP protocol, IP addresses, ARP, RARP

Unit VI: Network security

Hours 09

Introduction to cryptography, symmetric key and public key encryption systems, digital signature and key management concepts, communication security.

Core Books:

1. Andrew S. Tanenbaum: Computer Networks, 6th edition, Pearson Publication: 2021.
2. Behrouz Forouzan: Data communications and networking, 4th Edition, McGraw Hill, 2018.
3. William Stallings: Data and computer communication: 5th Edition, Pearson Publication, 2019.

Reference Books:

1. James F. Kurose, Keith W. Ross: Computer networking – A top-down approach: 3rd Edition: Pearson Publication: 2017
2. Narsimha Karumanchi: Elements of computer networking: An Integrated Approach: 1st Edition: Careermonk Publication: 2014
3. Ed Tittel: Computer networking: 1st Edition, Schum's Publication: 2020

Web References:

1. <https://computer.howstuffworks.com/computer-networking-channel.htm> [How Stuff Works]
2. [https://learn.microsoft.com/en-us/previous-versions/windows/it-pro/windows-server-2012-R2-and-2012/dn313100\(v=ws.11\)?redirectedfrom=MSDN](https://learn.microsoft.com/en-us/previous-versions/windows/it-pro/windows-server-2012-R2-and-2012/dn313100(v=ws.11)?redirectedfrom=MSDN) [Microsoft Networking]
3. https://help.sap.com/docs/SAP_COMMERCE/do224eca81e249cb821f2cdf45a82ace/8c74877b866910148cc9ba5f39a2fd28.html?version=6.7.0.0 [For multicast and unicast]

Course Outcomes: Upon successful completion of the course, students will be,

CO1 :	Student will be able to understand role of computer network in digital communication
CO2 :	Student will grasp underlying concepts related with network communication
CO3 :	Student will understand role of reference models in standardizing communication
CO4 :	Students will learn about intra and inter network communication and technology behind it.
CO5 :	Students will learn about different aspects of network security.

Course Outcomes Mapping:

Unit No.	Unit Name	Course Outcomes				
		CO1	CO2	CO3	CO4	CO5
1	Introduction to Computer Networks	√				
2	Basics of network communication		√			
3	Network reference model			√		
4	Data Link Layer Functions and Protocol				√	
5	Network Layer Functions and Protocol				√	
6	Network security					√

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	3	2	1	-	1	1	1	-	-	1	2	-
CO2	2	3	3	2	-	1	1	1	-	-	1	3	1
CO3	3	3	3	2	-	1	1	1	1	-	1	3	3
CO4	1	3	3	2	-	1	1	1	1	-	1	3	2
CO5	3	3	3	2	-	1	1	1	1	-	1	3	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation “-”

CAOV101: Fundamentals of Accounting

Credit	Component	Instruction/ Contact Hours (Per Week)	Instruction/ Contact Hours (Per Course)	Experiential Learning Hours (Per Course)	Total Notional Hours
02	Theory	02	30	20	50
Experiential Learning Components: Unit Tests, Assignments, Case Study etc.					

Pre-requisite: None

Methodology, Pedagogy & Andragogy: During the classroom sessions, the emphasis will be given on the fundamentals of accounting. Students will be introduced to book keeping systems in modern accounting, financial accounting, and cost accounting. Students will prepare financial statements such as journal, ledger, trail balance, trading and profit and loss account, and balance sheet. Students will also get hands on exposure in make or buy decisions in cost accounting. Same concepts will be made concrete through assignments, case studies, and unit tests.

Outline of the course:

Unit Number	Title of the Unit	Minimum Number of Theory Hours
1	Introduction to Accounting	05
2	Book Keeping System	05
3	Financial Accounting - I	05
4	Financial Accounting - II	07
5	Cost Accounting - I	04
6	Cost Accounting - II	04

Total Hours (Theory): 30

Total Contact Hours:30

Detail Syllabus:

Unit I : Introduction to Accounting

Hours 05

Introduction and users of Accounting, Branches of Accounting, Objectives, Accounting Concepts and Conventions, Accounting Terms.

Unit II : Book Keeping System

Hours 05

Single and Double Entry Book Keeping Systems, Advantages of Double Entry Book Keeping System, Limitations of Double Entry Book Keeping System, Types of Accounts: Personal, Real, and Nominal, Terms of Book Keeping Systems.

Unit III : Financial Accounting – I

Hours 05

Stages of Accounting Cycle, Types of Transactions, Forms of Economic Transactions, Cash and Credit Transactions, Introduction to Journal, Journal Entries.

Unit IV : Financial Accounting – II

Hours 07

Introduction to Ledger, Relationship Between Journal and Ledger, Rules of Ledger Posting, Balancing of the Accounts in Ledger, Trial Balance, Objectives of Preparing Trial Balance, Trading and Profit and Loss Account, Balance Sheet, Difference between Trial Balance and Balance Sheet.

Unit V : Cost Accounting – I

Hours 04

Introduction to Cost Accounting: Cost, Costing, and Cost Accounting, Limitations of Financial Accounting, Difference Between Cost Accounting and Financial Accounting, Objectives of Cost Accounting.

Unit VI : Cost Accounting – II

Hours 04

Elements of Cost: Material Cost, Labor Cost, and Expenses, Techniques of Costing, Marginal Costing, Make or Buy Decision, Breakeven Analysis

Core Books:

1. Dr. S. N. Maheshwari: Principles of Management Accounting, Sultan Chand Publication.
 - a. Eighteenth Edition, 2021
2. M. Pande: Financial Management, Vikas Publishing House, 2015
3. M.N. Arora: Cost Accounting, Vikas Publishing House, 2013

Reference Books:

1. Dr. S.N. Maheshwari: Advanced Accountancy, Volume 1, Eleventh & Revised Edition, Vikas Publishing House, 2017

Web References:

- <https://www.accountingtools.com/articles/basics-of-accounting.html>
[For Basics of Accounting]
- https://www.youtube.com/watch?v=vuetn_PQOvM
[For Journal Entries – 1]
- <https://www.youtube.com/watch?v=3xCzh3-bm4o&list=RDCMUCNh1egMomGI3hjJoDHExdUg&index=3>
[For Journal Entries – 2]
- https://www.youtube.com/watch?v=z_KO49Pk3DM
[For Ledger Posting & Trial Balance]
- <https://www.youtube.com/watch?v=Y4azRCTTWoU>
[For Trading A/c & Profit & Loss A/c]

Course Outcomes: Upon successful completion of the course, students will be,

CO1 :	Students will get basic understanding of the field of Accounting
CO2 :	Students will be familiar with Accounting Book Keeping Systems
CO3 :	Students will learn concepts of financial accounting and different types of accounts with rules of debit and credit
CO4 :	Students will be able to generate Journal, Ledger, Trial Balance, and Final Accounts
CO5 :	Students will get basic understanding of the field of Cost Accounting

Course Outcomes Mapping:

Unit No.	Unit Name	Course Outcomes				
		CO1	CO2	CO3	CO4	CO5
1	Introduction to Accounting	√				
2	Book Keeping System		√			
3	Financial Accounting – I			√		
4	Financial Accounting – II				√	
5	Cost Accounting – I					√
6	Cost Accounting – II					√

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	1	1	-	-	2	2	3	1	2	1	1	1	1
CO2	1	2	-	-	2	2	3	1	2	1	1	-	-
CO3	3	3	2	1	1	2	3	-	2	2	1	2	-
CO4	3	3	3	1	1	2	3	-	2	2	1	2	-
CO5	2	3	2	1	3	2	3	1	2	3	1	2	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation “-”

CAOS102 - Digital Marketing

Credit	Component	Instruction/ Contact Hours (Per Week)	Instruction/ Contact Hours (Per Course)	Experiential Learning Hours (Per Course)	Total Notional Hours
02	Practical	04	60	40	100
Experiential Learning Components: Lab Assignments, Practical Test, VIVA					

Prerequisites: None.

Methodology, Pedagogy & Andragogy: This course focuses on providing hands-on experience to students for understanding social media marketing strategies and BLOG writing skills.

Outline of the Course:

Week No	Practical	Description
1	Introduction to Digital Marketing - Understanding digital marketing - Traditional marketing vs. digital marketing - Facets of digital marketing - Roles of social media in digital marketing	Learn basics of digital marketing
2	Introduction to Social Media Platforms for social media marketing Roles of social media in digital marketing	Learn basics of Social Media
3	Optimizing for Social Media Platforms - Facebook - Instagram - X (formerly Twitter)	Learn about various social media platforms and optimizing for them.
4	Content Calendar for Social Media Creating content calendar with different focus	
5	Content creation and Management in Meta Business Suite Understanding and Managing Meta Business Suite	
6	Paid Marketing in Meta Platforms – I - Understanding Ads Manager - Understanding Billing	Understanding paid marketing in Meta platforms
7	Paid Marketing in Meta Platforms – II - Brand awareness campaign - Traffic campaign - Engagement campaign	Understanding paid marketing in Meta platforms with different objectives
8	Paid Marketing in Meta Platforms – III Lead generation campaign	Understand to embed Social Media with website

	• Conversion campaign	
9	• Getting data from Social Media Paid Advertisement using Meta Pixel	For custom audiences and lookalike audiences
10	Search Engine Optimization • SERP • On-the-page Optimization • Off-the-page Optimization	Understanding Search Engine Result Page, and learn about On-the-Page and Off-the-Page Optimization
11	Case Study	-

Total hours: 60

Text Books:

1. Damian Ryan and Calvin Jones: Understanding Digital Marketing, Kogan Page, 2014
2. Stephanie Diamond: Digital Marketing All-in-One for Dummies, Wiley Publication, 2019
3. Amy Lupold Bair, Blogging for Dummies, 7th Edition, Wiley Publication, 2020

Reference Books:

1. Philip Kotler, Hermawan Kartajaya, and Iwan Setiawan: Marketing 4.0: Moving from Traditional to Digital, Wiley Publication, 2016
2. Jan Zimmerman and Deborah Ng: Social Media Marketing All-in-One for Dummies, Wiley Publication, 2017

Web References:

1. <https://www.simplilearn.com/tutorials/digital-marketing-tutorial/>
2. https://www.tutorialspoint.com/digital_marketing/index.htm
3. <https://intellipaat.com/blog/digital-marketing-tutorial/>
4. <https://www.javatpoint.com/digital-marketing>
5. <https://www.javatpoint.com/blog>

Course Outcome: Upon successful completion of the course, student will:

CO1 :	Able to understand digital marketing and its importance.
CO2 :	Able to create and manage content using social media platforms
CO3 :	Able to understand paid advertisements on social media platforms.
CO4 :	Able to understand SEO and its importance in digital marketing.
CO5 :	Able to use generative AI in Digital Marketing.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	1	2	1	3	2	2	1	1	-	1	1	1	1
CO2	-	1	2	3	1	3	1	-	-	2	2	2	2
CO3	1	1	2	3	1	3	1	-	-	2	2	2	2
CO4	1	1	2	3	1	1	1	1	-	1	-	1	1
CO5	2	2	3	3	2	3	3	2	1	2	2	3	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation “-”

CAOA101: PRESENTATION SKILLS

Credit	Component	Instruction/ Contact Hours (Per Week)	Instruction/ Contact Hours (Per Course)	Experiential Learning Hours (Per Course)	Total Notional Hours
02	Practical	02	30	20	50
Experiential Learning Components: Lab Assignments, Practical Test, VIVA					

Prerequisites: Basic computer skills and knowledge of English.

Methodology, Pedagogy & Andragogy: The aim of this course is to develop effective presentation skills in students. Students will be taken systematically through the key stages of giving presentations, from planning and introducing to concluding and handling questions. The topics for the presentation will range from academic presentations to research presentations.

Outline of the Course:

Week No	Practical	Description
1	Introduction	Knowing the Purpose, Knowing the Audience, Internal and External Presentation, Presentation to Heterogenic Group, Greetings, Introducing self and peers, Asking and sharing information
2	ICT tools for presentation – Brief introduction	Microsoft PowerPoint, Canva, Prezi, AI-powered presentation tools
3	Presentation using Canva	Introduction to Canva, Creating, presenting, sharing and downloading presentation
4	Presentation design in Canva	Templates, layouts, Presenter Notes, Duration, Timer
5	Basic design elements in Canva	Shapes, Graphics, Charts, Tables
6	Advanced design elements in Canva	Photos, Videos, Audio, Frames, Grids, Stickers
7	Intermediate features of PowerPoint	Using Screenshot, Inserting objects, video and audio in presentation, Screen recording
8	Advanced features of PowerPoint	Using Hyperlink and Action, Slide Show Set-up, Presenter View, Master views

9	Cloud-based presentation using Google Slides	Creating a new presentation, importing slides, Sharing, Printing, Downloading in different formats, Version History
10	Basic features of Google Slides	Slideshow, Motion, Theme Builder, Inserting image, audio, video, shape
11	Advanced features of Google Slides	Spell-check, Linked objects, Q-A History, Notification Settings, Accessibility, Activity Dashboard
12	Engaging audience using feedback-gathering tools	Use of menitimeter for Word Clouds, Live Polls, Scales, Ranking and Pin It
13	Ethical practices	Using Citations/References for texts, images and other type of information, Plagiarism check
14	AI and Presentation	Use of Generative AI tools such as ChatGPT, CoPilot etc. in presentations
15	Select case-study	Examples of best presentations.
Total hours: 30		

Text Books:

1. The Presentation Book : How to Create It, Shape It and Deliver It! Improve Your Presentation Skills Now, 2nd Edition, Pearson Education.
2. Beginners Guide for Canva 2024, by Karla J Kane. ISBN: 979-8875801853

Reference Books:

1. Microsoft PowerPoint Guide for Success by Kevin Pitch, Top Notch International. ISBN:978-1915331489
2. Getting Started With Google Slides: A Practical Guide to Cloud-Based Presentations by Scott La Counte, SL Editions ISBN:978-1629179513

Web References:

1. <https://www.canva.com/education/students/>
2. <https://support.microsoft.com/en-us/powerpoint>
3. <https://support.google.com/a/users/answer/9282488>
4. <https://www.mentimeter.com/features>

Course Outcome: Upon successful completion of the course, student will be able to:

CO1:	understand key elements of an effective presentation and ICT tools for presentation.
CO2:	acquire in-depth knowledge of one of the popular presentation tools.
CO3:	develop intermediate and advanced skills in alternative presentation tool.
CO4:	familiarize with cloud-based presentation tool.
CO5:	create effective presentation with ethical practices and enhance it with AI tools.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	1	3	-	2	1	-	-	2	-	-
CO2	2	-	3	-	2	1	-	-	2	2	3	1	1
CO3	-	3	-	2	-	1	3	2	-	-	-	3	2
CO4	2	1	2	2	2	1	2	-	2	-	2	3	2
CO5	-	2	2	3	1	-	2	2	2	2	-	2	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation “-”

TEACHING SCHEME & DETAILED SYLLABUS

FOR

**Online BCA PROGRAMME
(3rd SEMESTER)
AS PER NEP 2020**

**EFFECTIVE FROM
ACADEMIC YEAR 2025-26**

Online BCA Semester-III

Course Code	Course Name	Theory/ Practical/ Others	Marks (Theory)		Marks (Practical)		Credit	NEP -2020 Classification
			CCE	SEE	CCE	SSE		
CAOC201	Fundamentals of Data Structures and Algorithms	Theory and Practical	30	70	30	70	06 (04-Theory) (02-Practical)	Major Core
CAOC202	Fundamentals of Operating Systems	Theory and Practical	30	70	30	70	06 (04-Theory) (02-Practical)	Major Core
CAOS201 CAOS202	(Select any one) 1. Computer Oriented Management System 2. Computer Oriented Numerical Methods	Theory	30	70	-	-	04	SEC
CAOA201	Life Management	Theory	30	70	-	-	02	AEC
	University Elective-I	Practical	-	-	30	70	02	MDC
*CCE- Continuous and Comprehensive Evaluation (Assignments, Unit Tests, Sessional Test, Case Study, Attendance, Practical Test, Viva etc.) *SEE- Semester –End- Evaluation								

CAOC201: Fundamentals of Data Structures and Algorithms

Credit	Component	Instruction/Contact Hours (Per Week)	Instruction /Contact Hours (Per Course)	Experiential Learning Hours (Per Course)	Total Notional Hours
04	Theory	04	60	50	110
02	Practical	04	60	40	100
Experiential Learning Components (Theory): Unit Tests, Assignments, Case Study etc. Experiential Learning Components (Practical): Lab Assignments, Practical Test, VIVA					

Pre-requisite: Foundation of C and C++ Programming, Fundamentals of Object Oriented Programming.

Methodology, Pedagogy & Andragogy: Theory lectures focus on fundamental concepts of data structures and algorithms, emphasizing the selection of the most efficient structures for various applications. Andragogical principles are integrated to promote self-directed and practical learning for learners. For practical teaching of Data Structures and Algorithms, the approach combines hands-on programming exercises with real-world case studies to reinforce the selection of efficient structures for various applications. This blended method enhances both theoretical understanding and practical skills, ensuring learners can effectively apply concepts in real-world scenarios.

Outline of the course:

Unit Number	Title of the Unit	Minimum Number of Theory Hours
1.	Fundamentals of Data Structures and Algorithms	06
2.	Arrays and Linear Data Structures	10
3.	Advanced Dynamic Data Structures	12
4.	Tree-Based Data Structures	11
5.	Graph Theory and Applications	11
6.	Sorting and Searching Techniques	10

Total Hours (Theory) : 60

Total hours (Practical) : 60

Total Contact Hours : 120

Detail Syllabus:

Unit I: Fundamentals of Data Structures and Algorithms

Hours 06

Atomic and composite data, Data type, Data object, Data Structure, Abstract Data type, Types of Data Structures, Introduction to Algorithms, Relationship among Data, Data Structures and Algorithms, Analysis of Algorithms, space and time complexity algorithm

Unit II: Arrays and Linear Data Structures

Hours 10

Linear Data Structures using sequential organization, Representation of Stacks using sequential organization, Applications of Stack, Application of Recursion, Concepts of Queues, Realization of Queues using sequential organization, circular queue, Multiqueue, Deque, Priority Queue, Applications of Queue.

Unit III: Advanced Dynamic Data Structures

Hours 12

Linked list, Comparison of sequential and linked organizations, Dynamic Memory Management, types of link list, Applications of linked list, operation on link list.

Unit IV: Tree-Based Data Structures

Hours 11

Basic Terminologies, Definition and concepts, Representation of Binary Tree, Operations on Binary Tree and algorithms, Types of Binary Trees, AVL trees,

Unit V: Graph Theory and Applications

Hours 11

Graph Terminology, Representation of Graph, Operations on Graph, Applications of Graph Structure, minimum spanning tree.

Unit VI: Sorting and Searching Techniques

Hours 10

Sorting Notations and Concepts, Sorting Techniques, Sequential Searching, Binary Searching, Search Trees.

Outline of the Course (Practical):

Week No	Practical	Description
1	Basic of C and C++	foundational concepts in C and C++.
2	Two dimension array	Understand and utilize arrays effectively.
3	Stack	Implement stack operations including push, pop, and peek.
4	Stack and its application	Cover infix, prefix, and postfix notations.
5	Queue and Circular queue	Implement queue operations such as insert, delete, and display.
6	Linear and Binary Search	Apply various searching techniques on arrays.
7	Merge sort, Bubble Sort	Implement and compare different sorting techniques to sort data.
8	Selection sort , Insertion Sort,	
9	Quick sort	
10	Single Link List	Perform insert and delete operations at the beginning, end, and middle of link list data structures.
11		
12	Double Link List	
13		
14	Circular Single Link List	
15	Circular Double Link List	

Core Books:

1. Jean-Paul Tremblay, Paul G. Sorenson: An introduction to data structures with applications, 2nd Edition, Tata McGraw Hill Publications, 1991.
2. D. Samanta: Classic Data Structures, 2 Edition, PHI Publications, 2002.

Reference Books:

1. Varsha h. Patil : Data Structures Using ndC++, 1st Edition, Oxford University Press, 2012.
2. Yashvant Kanethkar : Data structures through C++, 2nd Edition, BPB Publications,2003.
3. Mark Allen Weiss: Data Structures and Algorithm Analysis in C++, 3rd Edition, Pearson Education, 2009.
4. Reema Thareja: Data Structures using C, 1st Edition, Oxford University Press, 2012.

Web References:

1. https://www.cs.auckland.ac.nz/~jmor159/PLDS210/ds_ToC.html [For materials of Data Structures and Algorithms]
2. <http://www.cs.usfca.edu/~galles/visualization/> [For Data Structures Visualization]
3. <https://www.cs.auckland.ac.nz/~jmor159/PLDS210/mst.html> [For Graph Data Structures]
4. <http://interactivepython.org/runestone/static/pythonds/Trees/trees.html> [For Tree Data Structures]
5. https://www.cs.auckland.ac.nz/~jmor159/PLDS210/niemann/s_man.pdf [For Sorting and Searching Cookbook]
6. <http://www.cs.princeton.edu/~rs/AlgsDS07/10Hashing.pdf> [For Hashing Materials]
7. <http://nptel.ac.in/video.php?subjectId=106102064> [For Data Structures videos]

Course Outcomes: Upon successful completion of the course, students will be,

CO1 :	Understand and explain the basic concepts and importance of data structures and algorithms.
CO2 :	Implement and utilize array-based and linear data structures effectively.
CO3 :	Analyze and apply advanced dynamic data structures such as linked lists.
CO4 :	Construct and manipulate various tree data structures including binary trees and AVL trees.
CO5 :	Apply graph theory concepts to solve complex problems and understand real-world applications.
CO6 :	Implement and compare different sorting and searching algorithms for optimal performance.

Course Outcomes Mapping:

Unit No.	Unit Name	Course Outcomes					
		CO1	CO2	CO3	CO4	CO5	CO6
1	Fundamentals of Data Structures and Algorithms	√					
2	Arrays and Linear Data Structures		√				
3	Advanced Dynamic Data Structures			√			
4	Tree-Based Data Structures				√		
5	Graph Theory and Applications					√	
6	Sorting and Searching Techniques						√

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	3	-	1	3	1	-	-	1	1	2	1
CO2	3	2	3	1	1	3	1	-	-	1	2	2	1
CO3	3	2	3	1	1	3	1	-	-	1	2	2	1
CO4	3	2	3	1	1	3	1	-	-	1	2	2	1
CO5	3	2	3	1	1	3	1	-	-	1	2	2	1
CO6	3	2	3	1	1	3	1			1	3	2	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation “-”

CAOC202 : Fundamentals of Operating Systems

Credit	Component	Instruction/Contact Hours(Per Week)	Instruction/Contact Hours(Per Course)	Experiential Learning Hours(Per Course)	Total Notional Hours
04	Theory	04	60	50	110
02	Practical	04	60	40	100
Experiential Learning Component (Theory): Unit Tests, Assignments, Case Study etc. Experiential Learning Components (Practical): Lab Assignments, Practical Test, VIVA					

Pre-requisite: None

Methodology, Pedagogy & Andragogy: In order to achieve the course objectives, students will be introduced to the basic operating system concepts and basic functions. Students will be offered appropriate case studies in order to provide actual exposure to theoretical operating system ideas. During the practical session, student will commence the learning from MS-DOS commands in windows environment. The student will also get hands on working with basic Linux commands. Finally using base of Linux commands, shell scripts would be written to demonstrate operating system programming.

Outline of the course:

Unit Number	Title of the Unit	Minimum Number of Theory Hours
1	Operating System Fundamentals	09
2	Memory Management	11
3	Processor Management	11
4	Device Management	10
5	File Management	10
6	Introduction to Shell Script	09

Total Hours (Theory): 60
Total hours (Practical): 60
Total Contact Hours:120

Detail Syllabus:

Unit I: Operating System Fundamentals

Hours 09

What is an operating system, Brief history of an operating system, Pyramid structure of an operating system, Operating system hardware and software, Evolution of an operating system, types of operating system, Batch system, Interactive system, Real time system, Hybrid system, Shell, compiler, assembler, interpreter.

Unit II: Memory Management

Hours 11

Memory management of early system, Fixed partition, Dynamic partition, Re-locatable dynamic partition, Best fit and first fit allocation method, De-allocation, Paged memory allocation, Demand paging allocation, segmented memory allocation, Virtual memory, cache memory, Associative memory, Page replacement policies.

Unit III: Processor Management

Hours 11

What is job and Process, Multiprogramming concept, Process scheduler, Job scheduler, various process states, Thread control, Process Control Block (PCB), Processor scheduling policies, FCFS, SJN, SRT, RR, EDF, Multiple level queues.

Unit IV: Device Management

Hours 10

Types of devices, dedicated device, Virtual device, shared device, I/O devices in cloud, Sequential Access Storage Media, Direct access storage media, Device handler seek strategies, FCFS, SSTF, SCAN and LOOK strategies, disk storage.

Unit V: File Management

Hours 10

Fundamentals of File management, File naming conventions, Fixed length and variable length records, Physical file organization, Physical storage allocation, File access methods, File control matrix, File compression.

Unit VI: Introduction to Shell Script

Hours 09

Shell Script, Shell environment, Making Script interactive, Command Line Argument, Evaluating Expression, Operator, Control Statement, Looping statement.

Outline of the Course:

Week No	Practical	Description
1	Disk operating system -Commands	Introduction to MS DOS environment with basic commands
2	Introduction to Linux Editor	Introduction to Cygwin as Linux Editor along with its usage
3	Linux Operating System-Commands	Using basic commands of Linux
4	Linux Operating System-Advanced Commands	Implementation of advanced Linux commands used in industry
5	Vi editor-Create Text file	Practice of writing and modifying various files in Vi editor
6	Introduction of Shell Programming-Create .sh file and Execute file	Creating simple shell script to get introduced with operating system programming
7	Variable and Rules for variable	Creating and using variables, and constants in shell scripts
8	Interactive Shell Script, Working with Command Line Arguments	Practicing shell scripts which are responsive to the user input
9	Working with expression	Arithmetic expressions in shell script
10	Conditional statement-IF, Working with Operator	Learning conditional statements such as if, elif, case. Using arithmetic, relational, and logical operators.
11	Looping Statement-While	Writing shell scripts with while loops with real life examples
12	Looping Statement-Until, For	Writing shell scripts with until and for loops with real life examples

Core Books:

1. Ann McIver McHoes, Ida M Flynn: Understanding Operating System, 7 Edition, Cengage Learning, 2014.
2. William Stallings: Operating Systems Internals and Design Principles, 5th Edition, PHI, 2005.
3. Sumitabha Das: Unix concepts & application, 4th Edition, Tata McGraw Hill, 2010.
4. Kenneth Rosen, Douglas Host, James Farber and Richard Rosinski: The Complete Reference, Tata McGraw Hill, 1999.

Reference Books:

1. Silberschatz: Operating System Concepts, 5th Edition, John Wiley & Sons (ASIA) Ltd., 2008.
2. Mark G. Sobell: A Practical Guide to Linux, Pearson Education, 1997.
3. KJ.George, Operating System Concepts and Principles, Sroff Publishers, 2003.

Web References:

1. <https://study.com/learn/operating-system.html> [Operating System Video Lessons]
2. <https://www.studytonight.com/operating-system/> [Operating System Tutorial]
3. [http://www.ics.uciedu/-ics\] 43/lectures.html](http://www.ics.uciedu/-ics%2043/lectures.html) [Lecture notes of OS]

Course Outcomes: Upon successful completion of the course, students will be,

CO1 :	To understand the fundamental concepts of an operating System
CO2 :	To understand memory allocation and de-allocation methods
CO3 :	To study fundamentals of processor and its scheduling policies
CO4 :	To study various supported device and file access technologies
CO5 :	Learning basic shell programming

Course Outcomes Mapping:

Unit No.	Unit Name	Course Outcomes				
		CO1	CO2	CO3	CO4	CO5
1	Operating System Fundamentals	√				
2	Memory Management		√			
3	Processor Management			√		
4	Device Management				√	
5	File Management				√	
6	Introduction to Shell Script					√

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	1	1	2	2	-	2	2	-	1	1	-	3	2
CO2	3	2	2	2	-	2	2	-	1	1	-	3	2
CO3	3	2	2	2	-	2	2	-	1	1	-	3	2
CO4	3	2	2	2	-	2	2	-	1	1	-	3	2
CO5	2	2	3	3	-	2	3	-	1	1	-	3	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation “-”

CAOS201: Computer Oriented Management System

Credit	Component	Instruction/Contact Hours(Per Week)	Instruction/Contact Hours(Per Course)	Experiential Learning Hours(Per Course)	Total Notional Hours
04	Theory	04	60	50	110
Experiential Learning Components: Unit Tests, Assignments, Case Study etc.					

Pre-requisite: None

Methodology, Pedagogy & Andragogy: The theory sessions will emphasize real-time systems. To enhance comprehension, we will provide illustrations using actual data across various systems. The sessions will meticulously explain the system's functionality through detailed flow descriptions. To bridge the gap between theoretical knowledge and practical application, we have to schedule industrial visits. These visits are designed to offer students a tangible correlation between their studies and real-world practices. Students should be assigned case studies to facilitate the practical application of their acquired knowledge. These case studies aim to deepen understanding and foster the ability to apply theoretical concepts to real-world scenario.

Outline of the course:

Unit Number	Title of the Unit	Minimum Number of Theory Hours
1	Basics of Information System	09
2	Architecture and Design of Information System	08
3	Transaction Processing System	09
4	Management Information System	06
5	Decision Support System & Executive Support System	18
6	Introduction to ERP and trending technologies	10

Total Hours (Theory): 60

Total Contact Hours:60

Detail Syllabus:

Unit I : Basics of Information System

Hours 09

Role of data and information, Types of Systems, Types of information, Quality of Information, what is an Information System, Functions of Information System, classification of an Information System, Major Types of Information Systems, Interrelationship of Information Systems

Unit II : Architecture and Design of Information System

Hours 08

Meaning of Architecture, development and maintenance of information system, centralized and decentralized systems, factors of success and failure in information system and risk involved with information system

Unit III : Transaction Processing System

Hours 09

Introduction of Transaction Processing System (TPS), Transaction Processing System (TPS) Architecture, Transaction Processing System (TPS) Life cycle, Methods of Transaction Processing System (TPS), Information System Availability Control, Illustrations and live demonstration of TPS such as Banking System, Railway reservation system etc.

Unit IV : Management Information System

Hours 06

Introduction to Management: Approaches of Management, Function of Management, System from Functional Perspective, Reports of Management Information System, A business perspective of MIS, Dimensions of MIS, contemporary Approaches to Information System.

Unit V : Decision Support System and Executive Support System

Hours 18

Business value of Improved Decision making, Types of Decision, Decision making Process, The difference between MIS and DSS, Components of DSS, System for Decision Support Group Decision Support System, Business value of GDSS. Important Dimensions of knowledge, Organizational learning and Knowledge Management, The Knowledge Management value chain, Overview of different types of Knowledge Management Systems, Characteristics of ESS, The Role of ESS in the Firm, Business value of ESS, Monitoring Corporate Performance, Working Examples of ESS.

Unit VI : Introduction to ERP and trending technologies

Hours 10

An overview of ERP, Basic ERP Concepts, Risk and Benefits of ERP, ERP and Related Technologies, Business Intelligence, Some case studies on ERP or Information system

Core Books:

1. K. C. Laudon and J. P. Laudon: Management Information Systems, 12th Edition, Pearson Education.
2. Alexis Leon: ERP Demystified, Second Edition, Tata McGraw-Hill.

Reference Books:

1. W.S. Jawadekar: Management Information Systems, 2nd Edition, Tata McGraw-Hill.

Web References:

1. <http://www.slideshare.net/NorazilaMat1/laudon-mis12-ppt01-16595885> [Function of Information system, A business perspective of MIS, Dimensions of MIS, Contemporary Approaches to Information System]
2. <http://www.uh.edu/~mrana/try.htm> [Types and Functions of Information system]
3. <http://bisom.uncc.edu/courses/info2130/Topics/istypes.htm> [Types of Information system]
4. <http://kalyan-city.blogspot.com/2011/05/levels-of-management-top-middle-and.html> [classification of information system]
5. http://my.safaribooksonline.com/book/management/9780470916803/operational-planning-and-control-systems/management_levels_comma_functions_comm [classification of information system]
6. <http://ambarwati.dosen.narotama.ac.id/files/2011/05/FIS-2011-w2.pdf> [Transaction processing system]

Course Outcomes: Upon successful completion of the course, students will be,

CO1 :	To understand basic of data & information, types of information system, function of information system and its quality.
CO2 :	To understand designing and architecture of information system
CO3 :	To understand transaction processing concepts and its working.
CO4 :	Learning Management Information system, its types and its implementation. To gain understanding of Decision Support Systems.
CO5 :	To learn Knowledge Management, Executive Support Systems, ERP and its technology.

Course Outcomes Mapping:

Unit No.	Unit Name	Course Outcomes				
		CO1	CO2	CO3	CO4	CO5
1	Basics of Information System	√				
2	Architecture and Design of Information System		√			
3	Transaction Processing System			√		
4	Management Information System				√	
5	Decision Support System & Executive Support System				√	
6	Introduction to ERP and trending technologies					√

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	1	3	1	-	3	-	1	2	3	3	-	1	1
CO2	1	3	1	-	2	1	-	2	3	3	2	-	1
CO3	1	3	1	1	3	3	-	2	3	3	-	-	1
CO4	1	2	1	-	2	3	1	2	2	2	1	1	1
CO5	1	3	1	-	3	3	-	1	3	3	1	-	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation “-”

CAOS202: Computer Oriented Numerical Methods

Credit	Component	Instruction/Contact Hours(Per Week)	Instruction/Contact Hours(Per Course)	Experiential Learning Hours(Per Course)	Total Notional Hours
04	Theory	04	60	50	110
Experiential Learning Components: Unit Tests, Assignments, Case Study etc.					

Pre-requisite: None

Methodology, Pedagogy & Andragogy: The course covers key topics like finding roots of equations, solving linear equations, interpolation, and solving differential equations. Teaching includes lectures, interactive problem-solving, and project-based assessments with continuous feedback. The focus is on practical applications and real-world problems, using flexible and engaging teaching methods. The aim is to make the content relevant and useful for students' careers and interests.

Outline of the course:

Unit Number	Title of the Unit	Minimum Number of Theory Hours
1	Introduction to Numerical Methods	08
2	Interpolation	09
3	Numerical Integration and Differentiation	10
4	Solution of Linear Equation	12
5	Solution of Differential Equations	11
6	Solution of Partial Differential Equations	10

Total Hours (Theory): 60

Total Contact Hours: 60

Detailed Syllabus:

Unit - I: Numerical Methods

Hours: 08

Introduction to Numerical Methods, Various methods such as Bisection, False-Position and Newton Raphson methods

Unit - II: Interpolation

Hours:09

What is an interpolation, Difference tables, Newton forward and backward Interpolation formula, Lagrange's formula, Newton's Divided Difference Formula?

Unit - III: Numerical Integration and Differentiation

Hours:10

Numerical Integration, Trapezoidal rule, Differentiating Continuous function (Two point and Three-point formula), Tabulated function and its maxima and minima.

Unit - IV: Solution of Linear Equation

Hours:12

Solution of Linear Equation, Gauss-Jordan Elimination methods, Gauss - Seidal and Gauss Jacobi Interactive methods

Unit - V: D Solution of Ordinary Differential Equations

Hours:11

Solution of Ordinary Differential Equations, Taylor Series and Euler Methods, Runge-Kutta Methods.

Unit - VI: Solution of Partial Differential Equations:

Hours:10

Review and examples of partial differential equations, classification of partial differential equations, Difference equation, Laplace's equation and Poisson's equation

Core Books:

1. D. N. Datta: Computer Oriented Numerical Methods, Vikas Pub. House, 2012.
2. S.S. Sastry : Introductory methods of Numerical Analysis, Prentice Hall of India,4th edition 2006

Reference Books:

1. V. Rajaraman Computer Oriented Numerical Methods, 3rd Edition, Prentice-Hall of India Pvt.Ltd, 3 rd edition, 2016

2. M. Ray, Har Swarup Sharma, Sanjay Chaudhary: Mathematical Statistics, Ram Prasad and sons, 11th edition

3. B S Grewal: Numerical Methods In Engineering & Science (With Programs In C, C++ And MATLAB), Khanna Publishers, 10th edition, 2014

Course Outcomes: Upon successful completion of the course, students will be,

CO1 :	Able to use Numerical methods in computer technology
CO2 :	To learn Interpolation
CO3 :	To Learn the concepts of Numerical Integration and Numerical Differentiation
CO4 :	To understand linear equations
CO5 :	To learn techniques to solve ordinary differential and partial differential equations

Course Outcomes Mapping:

Unit No.	Unit Name	Course Outcomes				
		CO1	CO2	CO3	CO4	CO5
1	Introduction to Numerical Methods	√				
2	Interpolation		√			
3	Numerical Integration and Differentiation			√		
4	Solution of Linear Equation				√	
5	Solution of Differential Equations					√
6	Solution of Partial Differential Equations					√

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	1	-	2	-	-	-	2	-	2	1
CO2	3	3	2	1	-	2	-	-	-	2	-	2	1
CO3	3	3	2	1	-	2	-	-	-	2	-	2	1
CO4	3	3	2	1	-	2	-	-	-	2	-	2	1
CO5	3	3	2	1	-	2	-	-	-	2	-	2	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation “-”

CAOA201: Life Management

Credit	Component	Instruction/Contact Hours (Per Week)	Instruction/Contact Hours (Per Course)	Experiential Learning Hours (Per Course)	Total Notional Hours
04	Theory	02	30	25	55
Experiential Learning Components: Unit Tests, Assignments, Case Study etc.					

Pre-requisite: None

Methodology, Pedagogy & Andragogy: During theory lectures the emphasis will be given on the fundamentals of life management. Students will be introduced life styles and its basic, time management, work efficiency, yoga, physical health management, stress and mental health management, and personality skills. Students will give experimental learning exposure in form of assignment and case study.

Outline of the course:

Unit Number	Title of the Unit	Minimum Number of Theory Hours
1	Life Style and its Basics	06
2	Work Efficiency	04
3	Personality Skills	06
4	Time Management for students	05
5	Physical health management	04
6	Stress and mental health management	05

Total Hours (Theory):30

Total Contact Hours:30

Detail Syllabus:

Unit I : Life Style and its Basics

Hours 06

Purpose of life and its dimensions, Importance of Self-Evaluation; (Daily routine, Food habits, Dressing Sense, Habit formation, Company, Etiquettes), Duties and Commitment of Self, Family and Society, Adjustment with Self and Environment

Unit II : Work Efficiency

Hours 04

Positive way of thinking, Tools & techniques for Positive thinking, Karma and Karma Phal Sidhanta, Behavioral Skill

Unit III : Personality Skills

Hours 06

Self-Assessment Techniques, Adjustment Skills, Art of Positive Thinking, Developing Self Confidence,

Unit IV : Time Management for students

Hours 05

Importance, Steps, Barriers and solutions of Time Management, Reading and Writing Skill, Making Notes and Conceptual Clarity of Subject topic.

Unit V : Physical health management

Hours 04

Importance of physical health and exercise, importance of yoga, physical problems, exercise for health improvements

Unit VI : Stress and mental health management

Hours 05

Importance of mental health, spirituality, improving concentration, importance of Dhyan, Memory problem and Memory Boosting techniques, causes and effects of stress, importance of Prathana, Upasna, Sadhna, and Aradhna

Core Books:

1. Time Management, McGraw-Hill, 2003
2. How To Manage Your Life, Vishal Tatwaved, 2012.

Reference Books:

1. Living Stress Free - The Secret of How to Manage Stress and Live Life Fully, Sonali Perera, SP MEDIA MARKETING.
2. TIME MANAGEMENT, BRIAN TRACY, American Management Association, 2013.

Web References:

1. Life management: a holistic approach to make the most of your life, Dr. Hannah Rose
<https://nesslabs.com/life-management>
2. Life Management, <https://www.sciencedirect.com/topics/computer-science/life-management>
3. <https://edynamiclearning.com/course/health-1-life-management-skills/>

Course Outcomes: Upon successful completion of the course, students will be,

CO1 :	Students will learn basics of life managements
CO2 :	The students will be familiar with various styles
CO3 :	Students will get the knowledge of time management and stress management
CO4 :	Students will get various aspects of physical and mental health
CO5 :	They will be able to develop personality and good habits

Course Outcomes Mapping:

Unit No.	Unit Name	Course Outcomes				
		CO1	CO2	CO3	CO4	CO5
1	Life Style and its Basics	√				
2	Work Efficiency		√			
3	Personality Skills					√
4	Time Management for students			√		
5	Physical health management				√	
6	Stress and mental health management				√	

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	1	3	1	-	3	-	1	2	3	3	-	1	1
CO2	1	3	1	-	3	1	-	1	3	3	1	-	1
CO3	1	3	1	1	3	3	-	2	3	3	-	-	1
CO4	1	2	1	-	2	3	1	2	2	2	1	1	1
CO5	1	3	1	-	3	3	-	1	3	3	1	-	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation “-”

**TEACHING SCHEME &
DETAILED SYLLABUS**

FOR

**Online BCA PROGRAMME
(4th SEMESTER)
AS PER NEP 2020**

**EFFECTIVE FROM
ACADEMIC YEAR 2025-26**

Online BCA Semester-IV

Course Code	Course Name	Theory/ Practical / Others	Marks (Theory)		Marks (Practical)		Credit	NEP -2020 Classification
			CCE	SEE	CCE	SSE		
CAOC203	System Analysis and Design	Theory	30	70	-	-	04	Major Core
CAOC204	Programming the Internet	Practical	-	-	30	70	02	Major Core
CAOC205	Open Source Technology	Theory and Practical	30	70	30	70	06 (04-Theory) (02-Practical)	Major Core
CAOE201 CAOE202	(Select any one) 1. Advanced Networking 2. Artificial Intelligence (AI) Fundamentals	Theory	30	70	-	-	04	Minor
CAOA202	Social Media and Blog Writing	Practical	-	-	30	70	02	AEC
	University Elective-II	Practical	-	-	30	70	02	MDC
HSOV203	Indian Knowledge System	Practical	-	-	30	70	02	VAC
*CCE- Continuous and Comprehensive Evaluation (Assignments, Unit Tests, Sessional Test, Case Study, Attendance, Practical Test, Viva etc.) *SEE- Semester –End- Evaluation								

CAOC203 : System Analysis and Design

Credit	Component	Instruction/Contact Hours (Per Week)	Instruction/Contact Hours (Per Course)	Experiential Learning Hours (Per Course)	Total Notional Hours
04	Theory	04	60	50	110
Experiential Learning Components: Unit Tests, Assignments, Case Study etc.					

Pre-requisite: None.

Methodology & Pedagogy: During theory lectures emphasis will be given on understanding how Information Systems are designed and constructed and how major modifications are made to existing systems, analyze business needs for information and develop an appropriate strategy to solve a particular business problem, understand the issues associated with physical design, utilize some of the tools used by systems analysts in the design of Information Systems, a significant portion of the course will deal with computer aided system engineering (CASE) tools and techniques in the context of a case study.

Outline of the course:

Unit Number	Title of the Unit	Minimum Number of Theory Hours
1	Introduction to System Development	08
2	Classical Systems Development Methodology	11
3	Structured Systems Development Methodology	11
4	Prototype Development Methodology and Tools	11
5	Systems Design	10
6	Systems Implementation & Maintenance	09

Total Hours (Theory): 60
Total Contact Hours:60

Detailed Syllabus:

Unit I: Introduction to System Development

Hours: 08

Concept of system, Basic components, Information systems categories, Business Information Systems, Examples of real-life systems, System analyst – meaning, role and need, Users, Need of information system development, Application development portfolio, Integration of portfolio, Controlling and monitoring committees.

Unit II: Classical Systems Development Methodology

Hours: 11

Classical Systems Development Life Cycle (SDLC) method, Requirement determination, Fact finding techniques, Modern methods for determining systems requirements, Joint Application Development Program, Tools for documenting procedures and decisions, Tools for systems development, understanding the format of system requirement specification.

Unit III: Structured Systems Development Methodology

Hours: 11

Structured Analysis Development Strategy, Data Flow Diagrams (DFDs) for analysis and design, Physical and logical DFDs, Data Dictionary.

Unit IV: Prototype Development Methodology and Tools

Hours: 11

Purpose of Application Prototyping, steps in prototype method, Use of prototypes, Tools for prototyping, Strategies for prototype development, misconceptions about prototyping, Role of tools, Categories and use of automated tools, using a CASE tool

Unit V: Systems Design

Hours: 10

Analysis to design transition, Design of output system, Design of input system, Design of security and control, Design of user interface and Design of Database Interaction.

Unit VI: Systems Implementation & Maintenance

Hours: 09

Designing reliable and maintainable systems, design of software, software design and documentation tools, managing quality assurance, user training, training methods and conversion.

Core Books:

1. James A Senn : Analysis and Design of Information System, McGraw Hill International, 2003.
2. Kendall and Kendall: Systems analysis and Design, 5th Edition, Prentice-Hall of India Private Limited, 2003.

Reference Books:

1. V. Rajaraman: Analysis and Design of Information Systems, Prentice-Hall of India Private Limited, 2003.
2. Jeffrey L. Whitten, Lonnie D. Bentely and Kevin C. Dittman : Systems Analysis and Design Methods, Tata McGraw Hill Publishing Co. Ltd., 2001.
3. Tuthill and Leavy: Knowledge Based Systems: Mangers Perspectives: Tab professional and Reference Books, 1991.

Web references:

1. <http://lecture-notes-forstudents.blogspot.in/2010/04/system-analysis-and-design-sad.html>
2. <http://www.slideshare.net/aroravinay/1-introduction-to-ado-infosys>
3. <http://bcastuff.blogspot.in/p/sad-notes.html#.U6uW-ZzWIeo>
4. <http://www.eis.mdx.ac.uk/staffpages/geetha/bis2030/DFD.html>
5. <http://faculty.washington.edu/ytan/is460/notes/LN11.pdf>

Course Outcomes: Upon successful completion of the course, students will be,

CO1	Understand the basics of system, type of information systems, system analyst-meaning, role and need, portfolio development of the system, the methods or ways to review and select the project.
CO2	Understand the concept of SDLC, the fact finding techniques, detailed study of modern methods for collecting the requirements of system to be developed, Decision and procedure documentation and a brief introduction to the SRS document.
CO3	Learn the concept of structured analysis, detail study of DFD and its types and the study of data dictionary.
CO4	Gain understanding of prototypes, its uses and tools for development, clarification of the misconception about the prototype and categories of tools including the use of automated tools like case tools.
CO5	Be able to learn objective of collecting data, methods to collect data for designing the input and output interface, the concept and objective of database design
CO6	Study the designing of reliable and maintainable systems, documentation tool, quality assurance management and need for user training.

Course Outcomes Mapping:

Unit No.	Unit Name	Course Outcomes					
		Co1	Co2	Co3	Co4	Co5	Co6
1.	Introduction to System Development	√					
2.	Classical Systems Development Methodology		√				
3.	Structured Systems Development Methodology			√	√		
4.	Prototype Development Methodology and Tools					√	
5.	Systems Design						√
6.	Systems Implementation & Maintenance						√

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	3	2	2	1	2	2	2	2	2	3	3
CO2	3	3	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	2	3	3	2
CO4	3	3	3	2	3	2	3	2	2	2	2	3	2
CO5	1	2	2	2	3	3	3	2	1	2	2	3	2
CO6	1	2	2	2	3	3	3	2	1	2	2	3	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation “-”

CAOC204: Programming the Internet

Credit	Component	Instruction/Contact Hours(Per Week)	Instruction/Contact Hours(Per Course)	Experiential Learning Hours(Per Course)	Total Notional Hours
02	Practical	04	60	40	100
Experiential Learning Components: Lab Assignments, Practical Test, Case Study					

Prerequisites: CAOC103 – Fundamentals of Web Designing

Methodology, Pedagogy & Andragogy: This subject focuses on hands-on experiments to create dynamic and interactive web sites using HTML5, CSS3 and JavaScript.

Outline of the Course:

Week No	Practical	Description
1	CSS Styling the web - Applying CSS Building blocks –CSS Selectors, Cascade & inheritance, CSS Properties, CSS Box model.	Student can apply various types of CSS with its basic properties.
2	Creating Layout - Header, footer, navigation menu, and sub-navigation. Floats.	Student can create different layout using semantic elements of HTML5 & CSS classification properties.
3	Creating Layout - Flexbox, Introduction to Flexbox, Flex Container and Flex Items, Flexbox Properties and Layout Techniques.	Student can create flexible and responsive web layouts. Its ability to distribute space and align items effectively makes it a vital part of modern web design.
4	Creating Layout - Introduction to CSS Grid Layout- Grid Container and Grid Items, multi column layout	Student can Understand its properties and axes can significantly improve the adaptability and aesthetics of your web pages.
5	Creating Image Gallery and Animation - 2D/3D Transformation, Transitions and Animation,	Student can create layout image gallery & animation.
6	CSS Media Query	<i>Student can create different layouts depending on the size of the viewport.</i>
7	JavaScript – Adding Internal & External JavaScript	Student can write script for basic Programs.
8	,Working with variables, datatype – Number, String, Boolean.	Student can write script for basic programs using different datatypes.

9	datatype –Array, Object, Operators, Conditional statements, Looping statements	Student can write script for basic programs using array and object, condition, Loop.
10	Adding Dialog boxes in HTML page – Alert, Confirm and Prompt.	Student can able to use dialog boxes to make website alive.
11	Creating user defined function.	Student can able to use in-build and user defined functions of JavaScript.
12	Adding Mouse and Keyboard Event in HTML page, Manipulating String and Date.	Students can make user interaction using various Events.
13	JavaScript Document Object Model hierarchy – Create find and manipulate HTML Element using Objects and methods	Student can explore the DOM Hierarchy.
14	Form validation, Applying Style using JavaScript.	Student can able to use form validations.
15	Creating New window, Accessing & manipulating History of HTML Pages.	Student can apply various objects to make web page dynamic with user interactions.

Total hours: 60

Text Books:

1. Julie C. Meloni, Jennifer Kyrnin : HTML, CSS, and JavaScript All in One, 3rd Edition, Pearson, 2018.
2. Joseph R. Lewis, Meitar Moscovitz : AdvancED CSS, W3C CSS Working Group, Apress, 2020.
3. Peter Gasston: The Book of CSS3: A Developer's Guide to the Future of Web Design, No Starch Press, April 2011.
4. MArjijn Haverbeke : Eloquent Javascript – A modern Introduction to JavaScript, 3rd Edition, 2018
5. Michael Morrison: Head First JavaScript, O'Reilly, 2014

Reference Books:

1. Andy Budd, Emil Björklund: CSS Mastery 3rd Edition, Apress - Advance Web Standard Solutions.
2. Karl Barksdale, Shane Turner: HTML and Java Scripts Basics, 4th Edition, Course Technology, 2006.
3. Jon Duket: Beginning Web Programming with HTML, XHTML and CSS, Wrox Publication.
4. Richard York: Beginning CSS: Cascading Style sheets for Web Design, Wrox Press (Wiley Publishing), 2005.

Web References:

1. https://www.tutorialspoint.com/css/css3_tutorial.htm [For CSS Basics]
2. <https://www.tutorialrepublic.com/css-tutorial/> [For CSS3 BOX Model & Animation]
3. <https://javascript.info/> [For modern JavaScript tutorials]
4. <https://www.tutorialsteacher.com/javascript/javascript-hoisting> [JavaScript Basics]

Course Outcome: Upon successful completion of the course, student will:

CO1:	Able to apply CSS & its basic properties in web pages.
CO2:	Able to create HTML, CSS layout.
CO3:	Able to apply the transition, transformation and animation in web page.
CO4:	Able to write client side script – JavaScript to perform basic program
CO5:	Able to use DOM objects for dynamic web pages

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	
CO1	1	2	3	3	2	1	2	1	1	2	1	1	1	CO1
CO2	1	3	3	3	2	2	1	1	1	2	3	2	1	CO2
CO3	1	2	2	3	2	1	1	1	1	2	2	1	1	CO3
CO4	2	2	3	3	2	1	1	1	2	1	2	1	1	CO4
CO5	2	2	3	3	2	1	2	1	2	1	2	2	2	CO5

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation “-”

CAOC205 : Open Source Technology

Credit	Component	Instruction/Contact Hours(Per Week)	Instruction/Contact Hours(Per Course)	Experiential Learning Hours(Per Course)	Total Notional Hours
04	Theory	04	60	50	110
02	Practical	04	60	40	100
Experiential Learning Components (Theory): Unit Tests, Assignments, Case Study etc. Experiential Learning Components (Practical): Lab Assignments, Practical Test, VIVA					

Pre-requisite: Working knowledge of HTML and basic knowledge of MYSQL.

Methodology, Pedagogy & Andragogy: During theory and practical sessions, students able to install & configure PHP and prerequisite software(s). Also, students will be emphasized to develop dynamic web applications.

Outline of the course:

Unit Number	Title of the Unit	Minimum Number of Theory Hours
1	Introduction to Web Development and Open Source Technology	08
2	PHP Basics	10
3	Array and Functions	10
4	Handling Form Data	10
5	Database Connectivity with MYSQL	12
6	PHP Utilities	10

Total Hours (Theory): 60
Total hours (Practical): 60
Total Contact Hours:120

Detail Syllabus:

**Unit I: Introduction to Web Development and
Open Source Technology**

Hours 8

Introduction of open source software, Development philosophy of open source software, pros and cons of open source software, open source vs. close source software, Community support in open source, Version Control, Introduction to Webpage and Website, Static and Dynamic Website, Client & Server Side Scripting, Web Hosting: Shared / Cloud / VPS / Dedicated.

Unit II: PHP Basics

Hours 10

Introduction to PHP, Installation of Apache, MySQL and PHP (OOP approach), How PHP code is parsed, Embedding PHP and HTML, Executing PHP and viewing in Browser, Comments in PHP, PHP variables: static and global variables, Data types, Operators, Conditional Statements, Looping Structure.

Unit III: Array and Functions

Hours 10

Array, Types of Array, Array Functions, Miscellaneous Functions: define, constant, include, require, header, die, exit, Overview of built in functions of PHP: String functions, Date and Time, Math functions, File handling functions, User Defined Functions.

Unit IV: Handling Form Data

Hours 10

HTML Form element & its attributes, Send Form data using GET Method & POST Method, Receive Form data using \$_GET, \$_POST & \$_REQUEST variables, Super Global Variables, PHP form validations.

Unit V: Database Connectivity with MYSQL

Hours 12

OOPs Concepts, PHP Data Objects (PDO), Introduction to MYSQL DB, CRUD operations, Handling Errors, State Management Techniques: PHP Sessions, starting session, modifying session variables, Un-registering and deleting session variable, PHP Cookies, Types of Cookies.

Unit VI: PHP Utilities

Hours 10

File Uploading: Upload Single and Multiple file using PHP script, Understanding HTTP requests, Exploring and modifying HTTP responses, getting information from web server, Sending mails.

Outline of the Course:

Week No	Practical	Description
1	Student registration page using HTML and CSS	Revised the concepts of HTML and CSS.
2	Installation of XAMPP & generating basic PHP scripts	Get familiar with echo() and print(). Able to create basic business logic.
3	Variables, Data Types and Casting	Able to work with variables, data types and able perform type casting.
4	User Inputs and Conditional Statements	Deal with user inputs. Use of conditional statements.
5	Looping Structures	Able to work with Looping structures like: for, while, do..while and foreach
6	Inbuilt Functions: string, math and date & time	Use various built-in functions available in PHP.
7	PHP Forms	Creating Forms using GET and POST methods. Also use the super global variables \$_GET, \$_POST and \$_REQUEST.
8	PHP Forms & Validations	Creating Forms with server side validations
9	PHP Array	How to create an array? Array Functions
10	Database Connectivity	Understand MYSQL Dashboard. Implement Database connectivity using PDO (PHP Data Object).
11	Database Connectivity	Implement Database connectivity using PDO (PHP Data Object).
12	File Upload and Download	Able to upload, download and view various kind of files and store path into database using \$_FILES.
13	State Management: Session	Creating Session, modifying session variables, Un-registering and deleting session variable.
14	State Management: Cookies. Super Global Variables	Creating Cookies and learning various super global variables like \$_SERVER, \$GLOBALS and \$_ENV
15	PHP Mail	Sending mail using PHP mail() & PHPMailer

Core Books:

1. Josh Lockhart, Modern PHP, O’Rielly, 2015.
2. Kevin Tatroe, Peter Macintyre, Programming PHP, 4e: Creating Dynamic Web Pages, 4th Edition, O’Rielly, 2020.

Reference Books:

1. Urva Patel, Kaushal Gor, Sanskruti Patel, PHP Hand Book: Crafting Dynamic Web Application, Notion Press Publication, 2024.
2. Matt Zandstra, PHP 8 Objects, Patterns, and Practice: Mastering OO Enhancements, Design Patterns, and Essential Development Tools, Apress, 2021.
3. Luke Welling, Laura Thomson, PHP and MYSQL Web Development, 5th Edition, Pearson Education, 2016.

Web References:

1. <https://www.php.net/> [Official website of PHP]
2. <https://www.geeksforgeeks.org/php-tutorials/> [Lecture notes of PHP]
3. <https://www.w3schools.com/php/default.asp> [Lecture notes of PHP]
4. <https://github.com/PHPMailer/PHPMailer> [PHPMailer Code]

Course Outcomes: Upon successful completion of the course, students will be,

CO1 :	Gain the skills and knowledge for Open Source and Web Hosting.
CO2 :	To utilize knowledge and skills for basics of PHP and configuration of MYSQL Server.
CO3 :	Learn the array and built-In functions in PHP.
CO4 :	Gain understanding of Form handing and utilities in PHP.
CO5 :	Be able to develop dynamic web based application using PHP and MySQL with state management techniques.

Course Outcomes Mapping:

Unit No.	Unit Name	Course Outcomes				
		CO1	CO2	CO3	CO4	CO5
1	Introduction to Web Development and Open Source Technology	√				
2	PHP Basics		√			
3	Array and Functions			√		
4	Handling Form Data				√	
5	Database Connectivity with MYSQL					√
6	PHP Utilities				√	

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	3	-	1	-	1	2	-	-	2	-
CO2	3	3	3	3	-	1	-	1	1	-	-	3	-
CO3	3	3	3	3	-	1	-	1	1	-	-	3	-
CO4	3	3	3	3	-	1	-	1	1	-	-	3	-
CO5	3	3	3	3	2	1	1	1	2	1	1	3	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation “-”

CAOE201 Advanced Networking

Credit	Component	Instruction/Contact Hours (Per Week)	Instruction/Contact Hours (Per Course)	Experiential Learning Hours (Per Course)	Total Notional Hours
04	Theory	04	60	50	110
Experiential Learning Components: Unit Tests, Assignments, Case Study, Certification courses, etc.					

Pre-requisite: Basics of Computer Networks, Topologies.

Methodology, Pedagogy & Andragogy: The methodology for teaching Advanced Networking integrates a blend of theoretical instruction and practical application, employing both pedagogy and andragogy to cater to diverse learning needs. Pedagogically, the course leverages structured lectures, and formative assessments to provide foundational knowledge and skills to less experienced learners. Concurrently, andragogical techniques are employed to engage adult learners, emphasizing experiential learning, problem-solving, and critical thinking. This includes case studies, real-world simulations, collaborative projects, and research-based assignments that draw on the students' existing knowledge and professional experiences. The dual approach ensures a comprehensive understanding of advanced networking concepts, fostering both technical proficiency and strategic thinking necessary for complex network management and innovation.

Outline of the course:

Unit Number	Title of the Unit	Minimum Number of Theory Hours
1	Basic Network Concepts	07
2	Networking Device, media connection and network model	11
3	Network Virtualization	12
4	Adhoc Networking	11
5	Wireless Sensor networks	10
6	Fundamental of Network Security	09

Total Hours (Theory): 60

Total Contact Hours:60

Detail Syllabus:

Unit I: Basic Network Concepts

Hours 07

Introduction to Computer Networks, Element of Network, Type of Network: LAN, MAN, WAN, Network Topologies: Bus, Star, Mesh, Ring, etc, Data communication & Representation, Network Operating System.

Unit II: Networking Device, media connection and Network Model

Hours 11

Common LAN Media: STP, UTP, Coaxial Cable, Optical Fiber, Making and Testing Cable, straight thru cable, Cross over Cable, Connector, Jack, Patch Panels, NIC, Repeater and Hub & its type, Bridges and its Types, Switch and Router. Description of Seven Layers of OSI Model, TCP/IP Model, Comparison of OSI & TCP/IP Model, Physical and Data link Layer, Network and Transport Layer, Presentation and Session Layer, Application Layer

Unit III: Network Virtualization

Hours 12

Need for Virtualization, The Virtual Enterprise, Transport Virtualization- VNs, Central Services Access: Virtual Network Perimeter, A Virtualization Technologies primer: theory, Network Device Virtualization, Data-Path Virtualization, Control-Plane Virtualization, Routing Protocols.

Unit IV: Adhoc Networking

Hours 11

Introduction, application of MANET, challenges, Routing in Ad hoc networks, topology & position-based approaches, Routing protocols: topology based, position based, Broadcasting, Multicasting, & Geocasting, Wireless LAN, Transmission techniques, MAC protocol issues, Wireless PANs, The Bluetooth technology

Unit IV: Wireless Sensor networks

Hours 10

Need and application of sensor networks, sensor networks design considerations, empirical energy consumption, sensing and communication range, design issues, localization scheme, clustering of SNs, Routing layer, Sensor networks in controlled environment and actuators, regularly placed sensors, network issues, RFID as passive sensors.

Unit VI: Market Failures and Price Regulations

Hours 09

Market failures and need for regulation, Regulations and market structure, Firm behavior, Price regulation. More on Externalities, and role of government, importance of competition in market failure and price regulations.

Core Books:

1. Computer Networking: A Top-Down Approach 6th edition, James F. Kurose, Keith W. Ross, Pearson (2012).
2. Network Virtualization, Victor Moreno, Kumar Reddy, Cisco Press (2006).
3. Ad Hoc and Sensor Networks: Theory and Applications 2nd edition; Carlos de Morais Cordeiro, Dharma Prakash Agrawal, World Scientific Publishing Company; 2 edition (2011)

Reference Books:

1. TCP/IP Protocol Suite 4 edition, Behrouz Forouzan, McGraw-Hill Science (2009)
2. Mobile Ad Hoc Networks: Current Status and Future Trends, Jonathan Loo, Jaime Lloret Mauri, Jesús Hamilton Ortiz, CRC Press(2011)
3. Fundamentals of Sensor Network Programming: Applications and Technology, S. Sitharama Iyengar, Nandan Parameshwaran, Vir V. Phoha, N. Balakrishnan, Chuka D. Okoye, Wiley-IEEE Press (2010).

Web References:

1. <https://www.ping.fm/ip/>
2. <https://www.edynamiclearning.com/course/advanced-networking-1a-introduction/>
3. <https://aws.amazon.com/training/learn-about/advanced-networking/>

Course Outcomes: Upon successful completion of the course, students will be,

CO1 :	Demonstrate comprehensive understanding of basic network concepts, including networking devices, media connections, and network models, and their roles in network architecture.
CO2 :	Analyze and implement network virtualization techniques, assessing their benefits and challenges in various networking environments.
CO3 :	Design and manage ad hoc networking solutions, addressing the unique requirements and challenges of decentralized network configurations.
CO4:	Develop and optimize wireless sensor networks, leveraging their capabilities for data collection and transmission in diverse applications.
CO5 :	Evaluate and apply fundamental network security principles to protect network infrastructures from potential threats and vulnerabilities, ensuring robust and secure communication channels.

Course Outcomes Mapping:

Unit No.	Unit Name	Course Outcomes				
		CO1	CO2	CO3	CO4	CO5
1	Basic Network Concepts	√				
2	Networking Device, media connection and network model		√			
3	Network Virtualization			√		
4	Adhoc Networking				√	
5	Wireless Sensor networks					√
6	Fundamental of Network Security					√

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	-	-	1	2	2	-	-	-	1	-	2	1	1
CO2	-	2	2	-	3	2	-	-	1	1	2	2	2
CO3	-	2	3	1	2	2	-	-	-	1	2	3	3
CO4	1	2	2	2	3	3	1	-	1	-	3	2	3
CO5	1	3	3	2	2	3	-	1	-	2	3	3	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation “-”

CAOE202 : Artificial Intelligence (AI) Fundamentals

Credit	Component	Instruction/Contact Hours(Per Week)	Instruction/Contact Hours(Per Course)	Experiential Learning Hours(Per Course)	Total Notional Hours
04	Theory	04	60	50	110
Experiential Learning Components: Unit Tests, Assignments, Case Study etc.					

Pre-requisite: None

Methodology, Pedagogy & Andragogy: The theory sessions will be focused on basics of Artificial Intelligence, problem solving paradigms, and search strategies. Areas of application such as Expert Systems, Software Agents, knowledge representation, natural language processing, expert systems, robotics will be explored.

Outline of the course:

Unit Number	Title of the Unit	Minimum Number of Theory Hours
1	Introduction to Artificial Intelligence	08
2	Problem-solving by Search and constraint satisfaction	11
3	Knowledge representation and reasoning	11
4	Expert Systems	11
5	Agents	10
6	Introduction to AI Techniques and Application Areas	09

Total Hours (Theory): 60

Total Contact Hours:60

Detail Syllabus:

Unit I: Introduction to Artificial Intelligence

Hours 08

Concepts and definitions of Artificial Intelligence (AI) – Brief history of AI – AI and related fields – The AI problems and underlying assumptions, AI approaches: Cognitive Science, Turing Test.

Unit II: Problem solving by Search and constraint satisfaction

Hours 11

Problem spaces; brute-force search; best-first search; two-player games; constraint satisfaction

Unit III: Knowledge representation and reasoning

Hours 11

Review of propositional and predicate logic; resolution and theorem proving; non-monotonic inference; probabilistic reasoning; Bayes theorem, reasoning under uncertainty.

Unit IV: Expert Systems

Hours 11

Introduction – Representing and using domain knowledge – Knowledge acquisition and representation – General structure of Expert Systems – Expert System Shell – Advantages and disadvantages of Expert Systems, Applications of Expert Systems

Unit V: Agents

Hours 10

Definition of agents; successful applications and state-of-the-art agent-based systems; software agents, personal assistants, and information access; multi-agent systems.

Unit VI: Introduction to AI Techniques and Application Areas

Hours 09

Introduction to fuzzy logic – Introduction to various application areas of AI like Natural Language Processing (NLP), Learning, Speech Recognition, Computer Vision, Game Playing, Robotics.

Core Books:

1. Norvig, Peter, Paradigms of AI Programming, Morgan Kauffman, 1992.
2. S. Russell and P. Norvig, Modern Approach to Artificial Intelligence, Prentice Hall of India Ltd., 2006.
3. Rich & Knight, Artificial Intelligence, 2nd edition, TMH, 1991.

Reference Books:

1. R.Akerker and P. S. Sajja, Knowledge-Based Systems, Jones and Bartlett, MIT, 2010.
2. George Luger, Artificial Intelligence, 5th Edition, Addison Wesley, 2004.

Web References:

1. http://www.tutorialspoint.com/artificial_intelligence/ [Basics of AI]
2. <http://intelligence.worldofcomputing.net/ai-branches/expert-systems.html> [Expert Systems]
3. <http://pages.cs.wisc.edu/~bolo/shipyard/neural/local.html> [Neural Network]

Course Outcomes: Upon successful completion of the course, students will be,

CO1 :	To understand basic problems of AI and history of AI.
CO2 :	Getting deep knowledge of searching algorithms and its applications in AI.
CO3 :	Learning Knowledge Representation and reasoning techniques.
CO4 :	To gain understanding Expert System and Agent Based Systems.
CO5 :	To explore various application areas of AI.

Course Outcomes Mapping:

Unit No.	Unit Name	Course Outcomes				
		CO1	CO2	CO3	CO4	CO5
1	Introduction to Artificial Intelligence	√				
2	Problem solving Search and constraint satisfaction		√			
3	Knowledge representation and reasoning			√		
4	Expert Systems				√	
5	Agents				√	
6	Introduction to AI Techniques and Application Areas					√

Course Articulation Matrix:

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	PSO1	PSO2
CO1	-	2	2	2	1	-	-	-	-	-	-	1	2
CO2	3	2	2	3	2	2	-	3	-	-	-	2	2
CO3	-	-	3	3	2	-	-	-	-	-	-	1	-
CO4	3	2	2	-	2	2	-	3	-	-	-	1	2
CO5	2	-	-	-	2	-	3	3	-	-	-	1	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation “-”

CAOA202: Social Media and BLOG Writing

Credit	Component	Instruction/Contact Hours(Per Week)	Instruction/Contact Hours(Per Course)	Experiential Learning Hours(Per Course)	Total Notional Hours
02	Practical	04	60	40	100
Experiential Learning Components: Lab Assignments, Practical Test, VIVA					

Prerequisites: None.

Methodology, Pedagogy & Andragogy: This course focuses on providing hands-on experience to students for understanding social media marketing strategies and BLOG writing skills.

Outline of the Course:

Week No	Practical	Description
1	Introduction to Social Media - Platforms for social media marketing - Roles of social media in digital marketing	Learn basics of Social Media
2	Optimizing for Social Media Platforms - Facebook - Instagram - X (formerly Twitter)	Learn about various social media platforms and optimizing for them.
3	Content Calendar for Social Media Creating content calendar with different focus	
4	Content creation and Management in Meta Business Suite Understanding and Managing Meta Business Suite	Understanding Search Engine Result Page, and learn about On-the-Page and Off-the-Page Optimization
5	Introduction to BLOG - What is BLOG? - Importance of BLOG	-
6	Popular Blogging Platforms - WordPress - Blogger	-
7	Using SEO in Blogging - Using AI in Blogging - Understanding SEO in Blogging	-
8	Using Blogger for Blogging	-

9	Using WordPress for Blogging	-
10	Case Study – I (Social Media)	-
11-12	Case Study – II (Blogging)	-
Total hours: 60		

Text Books:

1. Damian Ryan and Calvin Jones: Understanding Digital Marketing, Kogan Page, 2014
2. Stephanie Diamond: Digital Marketing All-in-One for Dummies, Wiley Publication, 2019
3. Amy Lupold Bair, Blogging for Dummies, 7th Edition, Wiley Publication, 2020

Reference Books:

1. Philip Kotler, Hermawan Kartajaya, and Iwan Setiawan: Marketing 4.0: Moving from Traditional to Digital, Wiley Publication, 2016
2. Jan Zimmerman and Deborah Ng: Social Media Marketing All-in-One for Dummies, Wiley Publication, 2017

Web References:

1. <https://www.simplilearn.com/tutorials/digital-marketing-tutorial>
2. https://www.tutorialspoint.com/digital_marketing/index.htm
3. <https://intellipaat.com/blog/digital-marketing-tutorial/>
4. <https://www.javatpoint.com/digital-marketing>
5. <https://www.javatpoint.com/blog>

Course Outcome: Upon successful completion of the course, student will:

CO1:	Able to understand digital marketing and its importance.
CO2:	Able to create and manage content using social media platforms
CO3:	Able to optimize social media platforms
CO4:	Able to blogging and its importance in digital marketing.
CO5:	Able to use generative AI in Digital Marketing.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	1	2	1	3	2	2	1	1	-	1	1	1	1
CO2	-	1	2	3	1	3	1	-	-	2	2	2	2
CO3	1	1	2	3	1	3	1	-	-	2	2	2	2
CO4	1	1	2	3	1	1	1	1	-	1	-	1	1
CO5	2	2	3	3	2	3	3	2	1	2	2	3	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation “-”

**TEACHING SCHEME &
DETAILED SYLLABUS**

FOR

**ONLINE BCA PROGRAMME
(5th SEMESTER)
AS PER NEP 2020**

**EFFECTIVE FROM
ACADEMIC YEAR 2025-26**

Online BCA Semester-V

Course Code	Course Name	Theory/ Practical/ Others	Marks (Theory)		Marks (Practical)		Credit	NEP - 2020 Classification
			CCE	SEE	CCE	SEE		
CAOC301	Object Oriented Programming Using JAVA	Theory and Practical	30	70	30	70	06 (04-Theory) (02-Practical)	Major Core
CAOC302	Fundamentals of Visual Programming	Theory and Practical	30	70	30	70	06 (04-Theory) (02-Practical)	Major Core
CAOE301	Software Engineering	Theory	30	70	-	-	04	Minor
CAOE302	Python Programming	Practical	-	-	30	70	02	Minor
CAOE303 CAOE304	(Select any one) 1. Introduction to Data warehousing 2. Geographical Information System	Theory	30	70	-	-	02	Minor
HSOS301	French	Practical	-	-	30	70	02	SEC
*CCE- Continuous and Comprehensive Evaluation (Assignments, Unit Tests, Sessional Test, Case Study, Attendance, Practical Test, Viva etc.) *SEE- Semester –End- Evaluation								

CAOC301: Object Oriented Programming Using JAVA

Credit	Component	Instruction/Contact Hours (Per Week)	Instruction /Contact Hours (Per Course)	Experiential Learning Hours (Per Course)	Total Notional Hours
04	Theory	04	60	50	110
02	Practical	04	60	40	100
Experiential Learning Components (Theory): Unit Tests, Assignments, Case Study etc. Experiential Learning Components (Practical): Lab Assignments, Practical Test, VIVA					

Pre-requisite: Basic Knowledge of Introduction to Programming (CAU-103)

Methodology, Pedagogy & Andragogy: Upon successful completion of the syllabus, students will get basic knowledge of object oriented programming. Concretely, students should be able to create appropriate classes using the Java Programming Language to solve problems using Object Oriented Approach. They should be able to write console based and multithreaded applications using the Java Programming Language. Students should be able to implement the interface and classed of collection framework.

Outline of the course:

Unit Number	Title of the Unit	Minimum Number of Theory Hours
1.	Introduction to Object Oriented Programming in Java	10
2.	Fundamental programming structures in java	09
3.	Inheritance, Abstract class, and Interface	09
4.	Packages and Wrapper class	09
5.	Exception handling and Multithreading	11
6.	Basics of Collections Framework	12

Total Hours (Theory) :60
Total hours (Practical) : 60
Total Contact Hours: 120

Outline of the Course (Practical):

Week No	Practical	Description
1	Basic of Java	Fundamental concepts in Java, Class & Objects , Structure of java program.
2	Data Types & Variables	Understand and utilize arrays effectively, keywords, Identifiers.
3	Defining classes, variables and methods	Implement this keyword, static keyword, method overloading, final keyword, creating objects, accessing rules of java
4	Constructors, Basics of Inheritance & Runtime Polymorphism	Implement Default constructors, Parameterized constructors, passing object as a parameter, constructor overloading. Implement inheritance types and runtime polymorphism
5	Exception handling	Able to implements exception handling: types of exceptions, Throwable class, keywords – try, catch, throw, throws and finally, nested try statement, java built in exceptions, user defined exceptions.
6	Creating packages	Able to apply the predefined packages and the use defines package and access protection.
7	Multithreading	Implementing methods of Thread class.
8	Creating Multiple Threads	Creating Multiple Threads, Thread class and the Runnable Interface.
9	Thread Priority	Implementing Thread priority
10	Synchronization & Inter-thread communication	Implementing thread synchronization and inter-thread communication.
11	Collections Framework	Implementation of Collections Framework, Collection,.
12	Iterator interface	Accessing a collection using an Iterator, ListIterator.
13	Interfaces of Collections	List, Set, Sorted Set
14	Collection classes	Array List, Linked List, Vector, Hash Set, Tree Set, Priority Queue
15	Map interface	Map, Map Entry, SortedMap, HashMap, LinkedHashMap, TreeMap.
		Total Hours: 60

Core Books:

1. Pravin M. Jain: The class of JAVA, Pearson Education, 2011.
2. Herbert Schildt: The Complete Reference Java J2SE, 5th Edition, TMH Publishing Company Ltd, New Delhi.

Reference Books:

1. Ivor Horton: Beginning Java JDK, 5th Edition, Wiley Press, 2008.
2. Cay Horstmann and Gary Cornell: Core Java Volume 1, 8th Edition or later, Pearson Education, 2008.
3. Ken Arnold, James Gosling and David Holmes: The Java Programming Language, 4th Edition, Addison Wesley.

Web References:

1. <http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-092introductiontoprogramming-in-java-january-iap-2010/lecture-notes/> [Lecture Notes in PDF]
2. <http://www.javatpoint.com/java-tutorial> [Notes]

Course Outcomes: Upon successful completion of the course, students will be able

CO1 :	To understand basic of Object Oriented Concepts, execution environment in NetBeans
CO2 :	To understand basic syntax and semantics of Java, structure of java.
CO3 :	Learning Inheritance, Abstract class and Interface to understand how the java works ethically.
CO4 :	To introduce the implementation of Exception and Packages.
CO5 :	To introduce the concepts of multithreading & Collections framework.

Course Outcomes Mapping:

Unit No.	Unit Name	Course Outcomes				
		CO1	CO2	CO3	CO4	CO5
1	Basic Introduction of Java	√	√			
2	Variable & Data Types		√			
3	Class Objects and Methods			√		
4	Exception Handling & Packages			√	√	
5	Multithreading					√
6	Basics of Collections Framework					√

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	3	2	2	2	-	-	-	1	-	3	3
CO2	3	3	2	3	3	3	-	-	-	1	-	3	3
CO3	3	2	2	3	2	2	-	-	-	2	-	2	2
CO4	3	2	2	3	2	2	-	-	-	2	-	2	2
CO5	2	2	2	3	2	2	-	-	-	2	-	2	2
CO6	-	-	-	-	-	2	-	-	-	-	-	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation “-”

CAOC302 Fundamentals of Visual Programming

Credit	Component	Instruction/Contact Hours (Per Week)	Instruction/Contact Hours (Per Course)	Experiential Learning Hours (Per Course)	Total Notional Hours
04	Theory	04	60	50	110
02	Practical	04	60	40	100
Experiential Learning Component (Theory): Unit Tests, Assignments, Case Study etc. Experiential Learning Components (Practical): Lab Assignments, Practical Test, VIVA					

Pre-requisite: Basic knowledge of programming language.

Methodology, Pedagogy & Andragogy: During theory lectures, illustrations will be provided to emphasize the importance of advanced features of the .Net framework and their application in developing Windows and desktop-based solutions using the C#.Net. Practical sessions will focus on hands-on learning, where students will be tasked with creating desktop applications by applying the concepts discussed during the lectures. This approach ensures a comprehensive understanding of both theoretical aspects and their practical implementation, equipping students with the skills to develop robust Windows-based applications.

Outline of the course:

Unit Number	Title of the Unit	Minimum Number of Theory Hours
1	Introduction of .NET Framework	07
2	Object-Oriented Programming with C#.NET	12
3	Introduction To Windows Forms	12
4	Introduction To ADO.NET	11
5	WPF and Advanced Features of .NET	08
6	Web Applications	10

Total Hours (Theory): 60
Total Hours (Practical): 60
Total Contact Hours:120

Detail Syllabus:

Unit I: Introduction of .NET Framework

Hours 07

Introducing .NET Framework, .NET Framework Component, .NET Framework Version Compatibility, Core of .NET Framework: Application Services, Base Class Library and CLR, Types of Applications which can be developed using MS.NET, MS.NET Base Class Library, MS.NET Namespaces, Common Language Runtime (CLR), Managed Code, MS.NET Memory Management/Garbage Collection, Common Type System (CTS), Common Language Specification (CLS), Types of JIT Compilers

Unit II: Object-Oriented Programming with C#.NET

Hours 12

Overview of Object-Oriented Programming, Principles of Object Orientation programming: Encapsulation, inheritance, polymorphism, Object, Defining Properties, Using Auto-Implemented Properties, Defining Methods, Understanding Constructors, Defining and Implementing Interfaces, Understanding the Role of Interfaces in .NET. C# Datatypes & Variables Declaration, Implicit and Explicit Casting, Checked and Unchecked Blocks – Overflow Checks, Boxing and Unboxing, Operators, Control Statements, Working with Arrays, C# Application Basics: Command line and VS.NET compilation.

Unit III: Introduction To Windows Forms

Hours 12

Building Windows Forms Applications, Setting Form Properties, Understanding the Life-cycle of a Form, Using the Windows Forms Designer, MessageBox Class and .config File, Working with Windows Forms Controls: TextBox, Button, Selection, List, DateTimePicker, Container, Image, Timer, ErrorProvider, TooltipProvider, Dialog box (ColorDialog, FolderBrowserDialog, OpenFileDialog, SaveFileDialog, FontDialog), MenuStrip, Handling Events: Understanding the Event-Driven Programming Model, Writing Event Handlers, Sharing Event Handlers, MDI, SDI.

Unit IV: Introduction To ADO.NET

Hours 11

Evolution of ADO.NET, Understanding the ADO.NET Object Model, Connected vs. Disconnected Access, Use of Connection, Command, DataReader, DataAdapter and Dataset class, Exceptional Handling.

Unit V: WPF and Advanced Features of .NET

Hours 08

Overview of WPF, Features of WPF, Windows Forms vs WPF, Introduction to XAML, WPF Layout: Grid Panel, Stack Panel, Dock Panel, Wrap Panel and Canvas Panel, WPF Controls: TextBlock, PasswordBox, ListBox, Slider, Popup, Menus and Expander, Animation using WPF, Introduction to MVC, Custom Controls, Introduction to Multithreading.

Unit VI: Web Applications

Hours 10

Basic of Http Request and Http Response. o Understand form Tag and Comparison between Get and Post. ASP.NET Page Life Cycle. Structure of an ASP.NET Page: ASPX Page, Code behind File, Web config and Machine config, Rich Web Control, Validation Controls. State Management Techniques o Client side: ViewState, Hidden Field, Cookie , Server Side: ApplicationState, Session.

Outline of the Course (Practical) :

Week No	Practical	Description
1	Console Environment without IDE	To set the path and environment variable to execute a console-based program without any IDE
2	Introduction to Visual Studio IDE and .NET	Familiarize with the Visual Studio IDE and the basic programming structure of C#.NET.
3	Developing Console Applications	Creating console-based applications using input and output statements, and understanding the role of the Main method.
4		
5	Object-Oriented Programming Concepts	Implementing encapsulation, inheritance, and polymorphism in C#.
6	Control Statements and Arrays	Using operators, control statements, and working with arrays in C#.
7	Building Windows Forms Applications and Events Handling	Working with TextBox, Button, and other common controls in Windows Forms. Understanding event-driven programming and writing event handlers.
8		
9		
10	Database Connectivity with ADO.NET	Connecting to a database, executing commands, and retrieving data using ADO.NET.
11		
12	A Complete Windows Forms Application	Designing and implementing a complete Windows Forms application, integrating various controls, handling events, and database connectivity.
13	Building a WPF Application	Creating a basic WPF application.
14	Basics of ASP.NET	Understanding HTTP requests and responses, and creating a simple ASP.NET page.
15		

Core Books:

1. Christian Nagel : Professionals C# and .NET 2021 Edition , Wiley – India, WROX
2. Albahani Josheph: C# 4.0 Pocket Reference, Shroff publication,2010.

Reference Books:

1. Jon Skeet, C# in Depth, Manning Publication, 2010
2. Drayton David: C# Language Pocket Reference, Shroff publication, 2005

Web References:

1. <http://csharp.net-informations.com/> [to learn C# and .NET fundamentals]
2. <http://www.wpftutorial.net/> [to learn WPF]
3. <https://dotnet.microsoft.com/en-us/learn/csharp> [tutorial and videos to learn C#]
4. <https://dotnettutorials.net/course/csharp-dot-net-tutorials/> [to learn C# and .NET fundamentals]
5. <https://www.javatpoint.com/c-sharp-tutorial> [to learn basic fundamentals of C#]

Course Outcomes: Upon successful completion of the course, the students will:

CO1 :	Understand .NET Framework core features and Components.
CO2 :	Develop modular and user-friendly desktop applications using object-oriented programming concepts in C# and Windows Forms.
CO3 :	Perform database operations using ADO.NET for seamless data integration.
CO4 :	Create rich, graphical desktop applications using WPF.
CO5:	Design and develop dynamic web applications in the .NET framework.

Course Outcomes Mapping:

Unit No.	Unit Name	Course Outcomes				
		CO1	CO2	CO3	CO4	CO5
1	Introduction of .NET Framework	✓				
2	Object-Oriented Programming with C#.NET		✓			
3	Introduction To Windows Forms		✓			
4	Introduction To ADO.Net			✓		
5	WPF and Advanced Features of .NET				✓	
6	Web Applications					✓

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	PSO1	PSO2
CO1	3	2	2	3	-	2	1	-	-	1	1	2	-
CO2	2	3	3	2	-	3	2	-	-	2	-	1	-
CO3	-	3	3	-	-	-	-	-	-	-	1	-	-
CO4	-	2	2	3	-	-	-	-	-	-	-	-	-
CO5	2	3	3	2	-	3	3	-	-	2	2	2	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation “-”

CAOE301: Software Engineering

Credit	Component	Instruction/Contact Hours (Per Week)	Instruction/Contact Hours (Per Course)	Experiential Learning Hours (Per Course)	Total Notional Hours
04	Theory	04	60	50	110
Experiential Learning Components: Unit Tests, Assignments, Case Study, Certification courses, etc.					

Pre-requisite: Fundamentals of System Analysis and Design.

Methodology, Pedagogy & Andragogy: Software engineering is an art and while learning this the students will also get familiar with the concept of project management and development of SRS document. Students will get used to entire software development process by incorporating the latest tools for designing and documenting the process.

Outline of the course:

Unit Number	Title of the Unit	Minimum Number of Theory Hours
1	Introduction to software and Software Engineering	08
2	Software Process Models	10
3	Managing Software Projects	12
4	Software Requirement analysis and specification	12
5	Software Maintenance and Risk Management	10
6	Modern methods in Software Engineering	08

Total Hours (Theory): 60
Total Contact Hours:60

Detail Syllabus:

Unit I: Introduction to software and Software Engineering

Hours 08

Definition of Software, Types of Software, Nature of Software, Software Applications, Definition of Software Engineering, Software Engineering-A Layered Technology, A process framework.

Unit II: Software Process Models

Hours 10

Definition of Software Process, Software Process Model - The Waterfall model, Incremental Process

Models: The Incremental model, The RAD model Evolutionary Process models: Prototyping, The Spiral model, The Concurrent Development model, A final comment on evolutionary Processes, Component based development, Concept of Product and Process.

Unit III: Managing Software Projects

Hours 12

The Management Spectrum, W5HH principles, Concepts of measures, metrics and indicators. Process Metrics and Project Metrics: An overview, Software Measurements: Size oriented and function oriented metrics.

Unit IV: Software Requirement analysis and specification

Hours 12

Introduction to system and software requirements, types of software requirements: Functional and non- functional requirements. Requirement Specification (SRS), Requirement Analysis and Requirement Elicitation, Requirement Engineering.

Unit V: Software Maintenance and Risk Management

Hours 10

Software risks, risk identification, risk projection, risk mitigation, monitoring and management. Introduction to software maintenance, types of maintenance. Concept of software reengineering, Business Process Reengineering(BPR), BPR life cycle, reverse engineering, Applications of Software Engineering.

Unit VI: Modern methods in Software Engineering

Hours 08

Introduction to Agile development: What is Agility? principles and values of Agile development, concept of Extreme Programming, values of XP.

Core Books:

1. Roger S.Pressman, Software Engineering- A practitioner's Approach, McGraw-Hill International Editions
2. Grady Booch, James Rumbaugh, Ivar Jacobson: The Unified Modeling Language User
3. Rajib Mall, Fundamentals of software Engineering, Prentice Hall of India.

Reference Books:

1. Ian Sommerville, Software engineering, Pearson education Asia
2. Pankaj Jalote, Software Engineering – A Precise Approach Wiley
3. Merlin Dorfman (Editor), Richard H. Thayer (Editor), Software Engineering
4. Robert C. "Uncle Bob" Martin, Clean Architecture: A Craftsman's Guide to Software Structure and Design
5. Deepak Gaikwad, Viral Thakkar, DevOps Tools from Practitioner's ViewPoint, Wiley

Web References:

1. https://en.wikibooks.org/wiki/Introduction_to_Software_Engineering/Process/Methodology [Introduction to Software Engineering/Process/Methodology]
2. <https://www.uml-diagrams.org/> [UMLUnits]
3. <https://nptel.ac.in/courses/106/101/106101061/> [Agile Software Development and Extreme Programming and Overview of DevOps]

Course Outcomes: Upon successful completion of the course, students will be,

CO1 :	Able to understand concept of Software and its types.
CO2 :	Get familiarize with software processes and related models.
CO3 :	Able to analyze requirements and manage project
CO4 :	Able to understand concepts of creating Software Requirement Specification
CO5 :	Able to understand risk management, software maintenance and modern Software engineering methods.

Course Outcomes Mapping:

Unit No.	Unit Name	Course Outcomes				
		CO1	CO2	CO3	CO4	CO5
1	Introduction to software and Software Engineering	√				
2	Software Process Models		√			
3	Managing Software Projects			√		
4	Software Requirement analysis and specification				√	
5	Software Maintenance and Risk Management					√
6	Modern methods in Software Engineering					√

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	1	2	3	1	3	3	3	1	1	3	1	3	3
CO2	2	2	3	2	3	3	3	1	1	3	3	2	2
CO3	2	3	3	3	3	3	3	2	1	3	3	3	3
CO4	3	2	3	2	3	3	3	3	1	2	2	3	3
CO5	2	3	3	3	2	3	3	1	1	2	1	2	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation “-”

CAOE302: Python Programming

Credit	Component	Instruction/Contact Hours(Per Week)	Instruction/Contact Hours(Per Course)	Experiential Learning Hours(Per Course)	Total Notional Hours
02	Practical	04	60	40	100
Experiential Learning Components: Lab Assignments, Practical Test, Case Study					

Prerequisites: CAOC103: Fundamentals of Object Oriented Programming

Methodology, Pedagogy & Andragogy: The practical sessions will cover the Python Programming concepts and practices that support application development using Python Programming. The practical sessions will cover Object Oriented programming using Python Programming .

Outline of the Course:

We ek No	Practical	Description
1	Downloading and Installation: Installation of Python and Python documentation.	Student will be familiarizing with downloadingand installing Python.
2	Primary and secondary prompts, basicstatements and expressions, Datatypes and Operators	Students will understand executing programs using Python. They also learn various data types supported by Python.
3	Conditional statements and Iterative statements	Students will to learn conditional and looping statements in Python.
4	Introduction to sequence types supported by Python: String, List, Tuple	Students will learn how to implement String, List, and Tuple types supported by Python.
5	Mapping and other types: Dictionary, set	Students will learn how to implement Dictionary and Set types supported by Python.
6	Exposure of python built-in Functions	Student will be familiarize with built-in functions in Python.

7	Python User-Define Functions	Students will to learn to create own function for reusability of the code.
8	Python Comprehension and filter() and map()	Students will learn to optimize the conditional and looping statements.
9	Introduction to Object Oriented Programming	Student will be familiarize with the concept of Object Oriented Programming using Python.
10	Introduction to Inheritance and concept of method overriding.	Student will be familiarize with the concept of Inheritance, method overriding using Python
11	Introduction to Polymorphism, Encapsulation, Abstraction and magic methods	Student will be familiarize with the concept of Polymorphism, Encapsulation, Abstraction and magic methods.
12	Exception Handling in python	Student will be able to understand exception handling using Python.
13	Python Module and Libraries	Student can able to learn python module and libraries to use.
14	Introduction to Web Framework: Django.	Students understand MVT based web application development using Django.
15	Creating web application based on MVT and database.	Student can apply concept of MVT and develop applications for CRUD operations.

Text Books:

1. Wesley J. Chun: Core Python Programming, 2nd edition, Pentice Hall, 2006.
2. Megnus Lie Hetland: Beginning Python from novice to professional, 2nd edition, Apress, 2009.
3. Megnus Lie Hetland: Beginning Python from novice to professional, 2nd edition, Apress, 2009.
3. Julia Elman, Mark Lavin: Lightweight Django: Using REST, WebSockets, and Backbone, 1st edition, O'Reilly Media, Inc, 2014

Reference Books:

1. Richard L. Halterman: Learning to Program with Python, Southern Adventist University 2011.
2. Mark Lutz: Programming Python, 4th Edition, O'reilly, 2011.
3. Steve Holden: Python Web Programming, 1st edition, 2002.

Web References:

1. <https://www.python.org/about/gettingstarted/> [For beginners of Python]
2. <http://ocw.mit.edu/courses/electrical-engineering-and-computerscience/6-189-agentleintroduction-to-programming-using-pythonjanuary-iap-2008/> [Python Materials]
3. http://people.cs.aau.dk/~normark/prog303/html/notes/paradigms_them.esparadigmoverview-section.html [Overview of Programming Paradigms]
4. <https://docs.python.org> [Python Documentation]
5. <https://www.tutorialspoint.com/django/index.htm> [Overview of Django Framework]

Course Outcomes: Upon successful completion of the course, students will be,

CO1 :	Able to understand scripting and the contributions of scripting languages.
CO2 :	Able to aware the built-in objects of Python and object-oriented concepts
CO3 :	Able to understand and implement functional and Object Oriented Programming
CO4 :	Able to learn exception handling
CO5	Able to grasp Python for web based programming

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO 8	PO9	PO10	PO11	PSO 1	PSO 2
CO1	3	2	-	-	-	2	-	-	-	-	-	3	1
CO2	-	3	3	-	-	-	3	1	-	-	-	3	1
CO3	2	-	2	-	3	-	1	-	-	-	-	3	1
CO4	-	-	3	3	1	-	2	-	-	-	-	3	1
CO5	1	2	3	3	1	2	2	1	1	1	1	3	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation “-”

CAOE303: Introduction to Datawarehouse

Credit	Component	Instruction/ Contact Hours (Per Week)	Instruction/ Contact Hours (Per Course)	Experiential Learning Hours (Per Course)	Total Notional Hours
02	Theory	02	30	20	50
Experiential Learning Components : Unit Tests, Assignments, Case Study etc.					

Pre-requisite: Basic concepts of DBMS

Methodology, Pedagogy & Andragogy: During the classroom sessions, the emphasis will be given on the fundamentals of data warehouse and its architectures along with the different applications. Also, the emphasizes given on using OLAP and OLTP tools for understanding the real time applications of data warehouse technologies and the broad concept of data mining techniques. Same concepts will be made concrete through assignments, case studies, and unit tests.

Outline of the course:

Unit Number	Title of the Unit	Minimum Number of Theory Hours
1	Introduction Data Warehouse	5
2	Data Warehouse Architecture	6
3	Fundamentals of OLTP and OLAP	5
4	Concepts of ETL and ELT	5
5	Applications of Data Warehouse and Business Intelligence	4
6	Overview of Data Mining	5

Total Hours (Theory): 30

Total Contact Hours:30

Detail Syllabus:

Unit I: Introduction to Data Warehouse

Hours 05

Overview of data warehousing, Types of data warehouses, Comparison of databases and data warehouses. Importance and defining characteristics of data warehousing, Classifications and key components of a data warehouse, Advantages, limitations, and future trends in data warehousing.

Unit II: Data Warehouse Architecture

Hours 06

Concepts of Data Warehouse Design and Dimensional modelling, Evolution of Data Warehouse Architecture, Understanding Data Warehouse Architecture: Explore Architecture, Concepts, and Components, Exploring Components of Data Warehouses, Data Warehouse Design Methodologies: Creating Star Schema and Snowflake Schema.

Unit III: Fundamentals of OLTP and OLAP

Hours 05

Understanding Data Integration: Concepts, Processes, and Techniques, Exploring OLAP Types: ROLAP, MOLAP, and HOLAP, and Their Distinctions, Introduction to Different OLAP Tools, Executing OLAP Operations on Multi-Dimensional Data Models through SQL Queries.

Unit IV: Concepts of ETL and ELT

Hours 05

Fundamental concepts of ETL and ELT terminologies, including extraction methods, transformation techniques, key differences between ETL and ELT, tools used in ETL.

Unit V: Applications of Data Warehouse and Business Intelligence

Hours 04

Overview of applications such as Financial Services, Banking services, Consumer Goods, Retail Sector; Importance of Data Warehouse in Business Intelligence.

Unit VI: Overview of Data Mining

Hours 05

Differentiate between database, data warehouse, data mining and text mining. Core data mining tasks and the process of knowledge discovery in databases, Understanding the concepts of supervised learning and unsupervised learning.

Core Books:

1. William H. Inmon: Building the Data Warehouse, 4th edition, Wiley publication, 2005
2. Paulraj Ponniah: Data Warehousing: Fundamentals for IT Professionals, 2nd edition, 2010
3. Han J, Kamber M, Pei J. Data mining concepts and techniques third edition. University of Illinois at Urbana-Champaign Micheline Kamber Jian Pei Simon Fraser University. 2012.

Reference Books:

1. Nenad Jukic: Database Systems: Introduction to Databases and Data Warehouses 1st Edition, Prospect Press, 2017

Web References:

1. <https://www.guru99.com/>
2. <https://www.ibm.com/think/topics/data-warehouse>
3. <https://aws.amazon.com/compare/the-difference-between-olap-and-oltp/>
4. <https://panoply.io/data-warehouse-guide/>

Course Outcomes: Upon successful completion of the course, students will,

CO1 :	Have a deeper understanding of database systems and their underlying theory to be able to improve the decision-making process.
CO2 :	Be Understand the technology of data warehousing.
CO3 :	Be able to develop applications of higher order database systems.
CO4 :	Have Clear understanding of implementation of huge amount of static data.
CO5 :	Understand Data Mining concept and techniques.

Course Outcomes Mapping:

Unit No.	Unit Name	Course Outcomes				
		CO1	CO2	CO3	CO4	CO5
1	Introduction Data Warehouse	√				
2	Data Warehouse Architecture		√			
3	Fundamentals of OLTP and OLAP			√		
4	Concepts of ETL and ELT			√		
5	Applications of Data Warehouse and Business Intelligence				√	
6	Overview of Data Mining					√

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	3	2	2	1	2	2	2	1	1	1	3	3
CO2	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO3	2	2	3	3	2	2	2	2	2	1	1	1	3	2
CO4	3	3	3	3	3	3	3	3	3	2	3	3	3	2
CO5	3	3	3	3	3	3	3	3	3	2	3	3	3	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation “-”

CAOE304: Geographical Information System

Credit	Component	Instruction/Contact Hours (Per Week)	Instruction/Contact Hours (Per Course)	Total Notional Hours
02	Theory	02	30	30
Experiential Learning Components : Theory Assignments, Unit Tests, Sessional Examination, Attendance etc.				

Pre-requisite: CAOS101: Mathematics for Computer Science

Methodology, Pedagogy & Andragogy: Geographical Information System integrates theoretical approaches to provide a comprehensive understanding of GIS. It includes lecture-based learning to explain core concepts such as GIS fundamentals, data models, spatial analysis, and geostatistical techniques. Case studies and examples are incorporated to help students understand the real-world implications and applications of GIS in various fields. Assessments are designed to evaluate the depth of theoretical knowledge and conceptual understanding.

Outline of the course:

Unit Number	Title of the Unit	Minimum Number of Theory Hours
1	Introduction to GIS	06
2	Types and Data Models	04
3	Spatial Data Editing	06
4	Attribute Data and Data Exploration	05
5	Spatial Analysis	04
6	Geo Statistical Analysis Techniques	05

Total Hours (Theory): 30
Total Contact Hours: 30

Detail Syllabus:

Unit I : Introduction to GIS

Hours 06

Basic concepts: Definition and history, Components of GIS, Recent trends and applications of GIS; Data structure and formats, Spatial data models – Raster and vector, Data base design- editing and topology creation in GIS, Linkage between spatial and non-spatial data, Data inputting in GIS. Rectification, Transformation Methods; Root Mean Square (RMS) Error

Unit II : Data Types and Data Models

Hours 04

Data Types; Spatial Data; Non-Spatial Data, Data Input; Existing GIS Data, Metadata; Conversion of Existing Data, Creating New Data, Data Models; Vector Data Model; Raster Data Model; Integration and Comparison of Vector and Raster Data Models

Unit III : Spatial Data Editing

Hours 06

Types of Digitizing Errors, Causes for Digitizing Errors; Topological Editing and Non-topological Editing; Other Editing Operations; Editing Using Topological Rules

Unit IV : Attribute Data and Data Exploration

Hours 05

Attribute Data in GIS, Attribute Data Entry, Manipulation of Fields and Attribute Data, Data Exploration; Attribute Data Query, Raster Data Query, Map- Based Data Manipulation.

Unit V : Spatial Analysis

Hours 04

Spatial Data: Definition, Analysis, Processes & Steps, Software and Tools, Geodatabase Model, Role of Databases in GIS, Creating, Editing and Managing, Classification scheme of Vector- Based and Raster- Based GIS Operation Raster- Based Techniques: Methods of reclassification, overlay analysis, Digital Terrain Analysis and Modeling- TIN and DEM, Surface representation and analysis, Slope and Aspect, Geographic Visualization Data Classification, Map Comparison.

Unit VI : Geo Statistical Analysis Techniques

Hours 05

Introduction to Spatial Interpolation: Control Points, Global Method- Trend surface analysis, regression model, local methods- Thiessen polygons, density estimation, Inverse Distance weighted Interpolation, Kriging- Ordinary Kriging and Universal Kriging, GIS and decision support system, Introduction to AHP, basic principal of AHP. Principal and components of multiple criteria decision Making.

Core Books:

1. kang-tsung Chang, 'Introduction to Geographic Information Systems' Tata McGraw Hill, 2007, New Delhi
2. C.P.Lo and Albert K.W. Yeung, "Concepts and Techniques of Geographic information Systems" Prentice Hall of India, 2006, New Delhi.

Reference Books:

1. Burrough, Peter A. and Rachael McDonnell, 'Principles of Geographical Information Systems' Oxford University press, 1998, New York.
2. Magwire, D.J. Goodchild, M.F. and Rhind, D.M., 'Geographical Information Systems: Principles and Applications', Longman Group, 2005, U.K.
3. Siddiqui, M.A.; Introduction to Geographical Information System, Sharda Pustak Bhavan, 2006, Allahabad

Web References:

1. <https://www.usgs.gov/faqs/what-a-geographic-information-system-gis>
2. <https://education.nationalgeographic.org/resource/geographic-information-system-gis/>

Course Outcomes: Upon successful completion of the course, students will be,

Understand the fundamental concepts of GIS, including its
CO1 : definition, history, components, data structures, and formats, as well as recent trends and applications

CO2 :	Analyze different spatial and non-spatial data types and models, including raster and vector data models, and demonstrate integration and conversion techniques.
CO3 :	Identify and rectify digitizing errors in spatial data and perform topological and non-topological editing to enhance the quality of GIS data.
CO4 :	Manipulate attribute data within GIS, perform data exploration and queries, and use map-based techniques for data analysis.
CO5 :	Apply spatial and geostatistical analysis techniques, including interpolation, reclassification, overlay analysis, and terrain modeling, to support decision-making in GIS.

Course Outcomes Mapping:

Unit No.	Unit Name	Course Outcomes				
		CO1	CO2	CO3	CO4	CO5
1	Introduction to GIS	√				
2	Types and Data Models		√			
3	Spatial Data Editing			√		
4	Attribute Data and Data Exploration				√	
5	Spatial Analysis					√
6	Geo Statistical Analysis Techniques				√	

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	1	2	1	-	2	1	1	2	2	3	-	1	1
CO2	1	3	1	-	2	1	-	1	1	3	1	-	1
CO3	1	2	1	-	3	3	-	2	1	3	-	2	1
CO4	1	2	1	1	2	3	1	2	1	2	1	1	1
CO5	1	3	1	1	3	3	-	1	1	3	1	-	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation “-”

**TEACHING SCHEME &
DETAILED SYLLABUS**

FOR

**ONLINE BCA PROGRAMME
(6th SEMESTER)
AS PER NEP 2020**

**EFFECTIVE FROM
ACADEMIC YEAR 2025-26**

Online BCA Semester-VI

Course Code	Course Name	Theory/ Practical/ Others	Marks (Theory)		Marks (Practical)		Credit	NEP -2020 Classification
			CC E	SEE	CCE	SSE		
CAOC303	Project Work	VIVA	-	-	90	210	14	Major Core
CAOE305 CAOE306	(Select any one) 3. Introduction to Data Science 4. Fundaments of Digital Image Processing	Theory	30	70	-	-	04	Minor
CAOS301	Mobile Application Development	Theory and Practical	30	70	30	70	04 (02-Theory) (02-Practical)	SEC
HSOA302	Professional Communication, Soft Skills and Personality Development	Practical	-	-	30	70	02	AEC
*CCE- Continuous and Comprehensive Evaluation (Assignments, Unit Tests, Sessional Test, Case Study, Attendance, Practical Test, Viva etc.) *SEE- Semester –End- Evaluation								

CAOC303 : Project Work

Credit	Component	Instruction/Contact Hours (Per Week)	Instruction/Contact Hours(Per Course)	Experiential Learning Hours(Per Course)	Total Notional Hours
14	VIVA	14	180	50	110
Experiential Learning Components (Practical): VIVA					

Pre-requisite: None

Introduction:

The Project work constitutes a major component in most Professional Programmes. It needs to be carried out with due care, and should be executed with seriousness by the students. The project work is not only a partial fulfilment of the course requirements, but also provides a mechanism to demonstrate your skills, abilities and specialization. The Project work is one that involves practical work for understanding and solving problems in the field of computing. The objective of the project is to help the student develop the ability to apply theoretical and practical tools/techniques to solve real life problems related to industry, academic institutions and research laboratories.

Methodology, Pedagogy & Andragogy: The core objective of the course is to provide project and practical based on deep learning, concept understanding, its analysis, deriving inferences and documenting it towards productive outcome of the subject. The main objective of this mini project is to let the students apply the programming knowledge to a real-world situation/problem and exposed the students with specific programming skills and help in developing a working model in terms of application.

Objective:

Student should be able to:

- demonstrate a systematic understanding of project contents;
- understand methodologies and professional way of documentation;
- know the meaning of different project contents, and
- understand established techniques of project report development.

Importance of the project

The Project is not only a part of the coursework, but also a mechanism to demonstrate student's abilities and specialization. It provides the opportunity for them to demonstrate originality, teamwork, inspiration, planning and organization in a software project, and to

put into practice some of the techniques they have been taught throughout the previous courses. The Project is important for a number of reasons. It provides students with:

- Opportunity to specialize in specific areas of computer science;
- Future employers will most likely ask about project at interview;
- Opportunity to demonstrate a wide range of skills and knowledge learned,
- Encourages integration of knowledge gained in the previous course units.

Course Outcomes: Upon successful completion of the course, students will be,

CO1 :	Student will understand the implementation of concepts of SDLC and Software Engineering.
CO2 :	The programming concepts they learn during their academics, it will be converted in to the actual implementations.
CO3 :	Students will be exposed to understand the requirement of proposed software and implement these requirements in terms of programming logic and methods.
CO4 :	Students must understand the difference between a program and professional application/product/software.
CO5 :	Students will learn different categories of applications like Desktop application, Web applications, etc.

Guidelines:

Mini Project is in house project development. Every student is required to carry out Mini Project work under the supervision of a guide provided by the placement Coordinator. The guide shall monitor progress of the student continuously. A candidate is required to present the progress of the Mini Project work during the semester as per the schedule provided by the placement Coordinator.

Mini Project proposal should be prepared in consultation with project guide. It should clearly state the objectives and environment of proposed Mini Project to be undertaken. Project documentation must be with the respect to the project only. Project report should strictly follow the points suggested in format of project report. Placement coordinator will provide the format of project report. Student has to submit one copy of Mini Project to the institute. Each Student is required to make a copy of Mini Project and submit along with Mini Project report.

Evaluation:

The project must be evaluated in two aspects:

- a. Internal (100 Marks):
 - i. Reporting to internal project guide
 - ii. Incorporation of suggestions by project guide
 - iii. Internal Project viva examination
- b. External (200 Marks):
 - i. Project Report Preparation & Evaluation
 - ii. External Project Viva Examination

Web References:

1. <http://techwhirl.com/writing-software-requirements-specifications/> [For effective SRS]
2. http://www.ibm.com/developerworks/websphere/library/techarticles/0306_perks/perks2.html [For best practices of Software Project Development]
3. http://www.uacg.bg/filebank/acadstaff/userfiles/publ_bg_397_SDP_activities_and_steps.pdf [Requirement analysis guidelines]
4. <http://www.cs.wustl.edu/~schmidt/PDF/design-principles4.pdf> [Software Design Principles and Guidelines]
5. <http://www.cse.hcmut.edu.vn/~hiep/KiemthuPhanmem/Tailieuthamkhao/Effective%20Software%20Testing%20-%2050%20specific%20ways%20to%20improve%20your%20testing.pdf> [ForEffective Software Testing]
6. http://www.cs.uics.edu/~jbell/CourseNotes/OO_SoftwareEngineering/SE_Project_Report_Template.pdf [For guidelines to prepare software project report]

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	3	3	3	3	3	2	2	2	3	2
CO2	3	3	3	2	3	3	3	3	3	2	2	2	3	2
CO3	3	3	3	2	3	3	3	3	3	2	2	2	3	2
CO4	3	3	3	2	3	3	3	3	3	2	2	2	3	2
CO5	3	3	3	2	3	3	3	3	3	2	2	2	3	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation “-”

CAOE305 : Introduction to Data Science

Credit	Component	Instruction/Contact Hours (Per Week)	Instruction/Contact Hours (Per Course)	Experiential Learning Hours (Per Course)	Total Notional Hours
04	Theory	04	60	50	110
Experiential Learning Components: Unit Tests, Assignments, Case Study etc.					

Pre-requisite: CAOC101-Foundation of Programming, CAOC104-Database Fundamentals

Methodology, Pedagogy & Andragogy: During theory sessions topics related to Data Science will be covered with suitable examples. Students will get exposure of model building using machine learning algorithms. Student will get in-depth knowledge of Data Science based real applications using case study approach.

Outline of the course:

Unit Number	Title of the Unit	Minimum Number of Theory Hours
1	Fundamentals of Data Science	08
2	Statistics and Linear Algebra for Data Science	10
3	Data Preprocessing	12
4	Data Visualization	10
5	Machine Learning for Data Science	10
6	Data Science Applications and future trends	10

Total Hours (Theory):60
Total Contact Hours:60

Detailed Syllabus:

Unit I : Fundamentals of Data Science

Hours 08

Introduction to Data Science, Definition and description of Data Science, Need of Data Science, Pre-requisites of Data Scientists, Tools and Skills for Data Science, Data Science Process Life-cycle - Data Discovery, Preparation, Model Planning, Model Building, Communicate Results, Types of Data Analysis- Descriptive, Diagnostic, Predictive, Prescriptive.

Unit II : Statistics and Linear Algebra for Data Science

Hours 10

Descriptive Statistics- Measure of frequency, Measure of Central Tendency, Measure of Dispersion, Measure of Position. Overview of Inferential Statistics, Linear Algebra for Data Science using Vectors and Matrices- Basic Vector operations, Common Matrix operations.

Unit III : Data Preprocessing

Hours 12

Reading data using different functions, Introduction to Data Pre-processing, Data types and forms, Possible data error types, Consistent Data, Data Cleaning- Filling Missing Values, smoothing noisy data, Detecting and removing outliers, Data Integration, Data transformation- Rescaling, Normalizing data, Standardizing data Implementation Using Python.

Unit IV : Data Visualization

Hours 10

Introduction to Data Visualization, Visual encoding, Basic plots using Python, Data Visualization libraries in Python.

Unit V : Machine Learning for Data Science

Hours 10

Overview of Machine Learning- Supervised, Unsupervised, Semi-Supervised and Reinforcement Learning, Regression Methods – Simple Linear Regression, Multiple Linear Regression, Classification Methods- KNN, Logistic Regression, Naïve Bayes, SVM, Clustering Method- k-means clustering, Fuzzy c-means, Introduction of Reinforcement Learning.

Unit VI : Data Science Applications and future trends

Hours 10

Applications- Manufacturing, Personalization, Medical Image Analysis, Internet Search, Genomics, Speech Recognition, Advertising, Financial Fraud Detection, Airline Route Planning, Cyber-threats, transportation, gaming, recommendation system.

Core Books:

1. Sanjeev J, Wagh, Manisha S. Bhende, Anuradha D. Thakare : Fundamentals of Data Science: First Edition: CRC Press : 2022
2. Dr. Gypsy Nandi, Dr. Rupamkumar Sharma: Data Science Fundamentals and Practical Approaches: BPB Publications: 2020
3. Sandhya Arora, Latesh Malik: Data Science and Analytics with Python: Universities Press: 2023, ISBN: 978-93-93330-34-5

Reference Books:

1. Parikshit Narendra Mahalle, Gitanjali Rahul Shinde, Priya Dudhale Pise, Jyoti Yogesh Deshmukh: Foundation of Data Science for Engineering Problem Solving: Springer: 2022
2. K.G. Srinivasa, G.M. Siddesh, Chetan Shetty, Sowmya B. J.: Statistical Programming in R: First Edition: Oxford Press: 2017.

Web References:

1. <https://www.cs.cornell.edu/jeh/book.pdf> [Machine Learning Concepts]
2. <https://www.edureka.co/blog/math-and-statistics-for-data-science/> [Statistics for Data Science]
3. https://www.w3schools.com/datascience/ds_analyze_data.asp [Data Preparation]
4. <https://www.kdnuggets.com/2022/06/plotting-data-visualization-data-science.html> [Data Visualization for Data Science]

Course Outcomes: Upon successful completion of the course, students will be,

CO1 :	Able to understand fundamentals of Data Science.
CO2 :	Able to use statistical data analysis techniques for Data Science Applications
CO3 :	Able to apply data cleaning, visualization and exploratory data analysis techniques on data.
CO4 :	Able to build model using machine learning techniques.
CO5 :	Able to understand applications and future trends of Data Science.

Course Outcomes Mapping:

Unit No.	Unit Name	Course Outcomes				
		CO1	CO2	CO3	CO4	CO5
1	Fundamentals of Data Science	√				
2	Statistics and Linear Algebra for Data Science		√			
3	Data Preprocessing			√		
4	Data Visualization			√		
5	Machine Learning for Data Science				√	
6	Data Science Applications and future trends					√

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1	2	1	-	3	3	2	2	-	1	-
CO2	3	1	1	-	3	1	3	1	2	2	1	2	-
CO3	3	2	1	2	1	3	3	2	2	2	-	2	-
CO4	3	3	2	3	1	3	3	2	2	2	3	1	1
CO5	3	3	3	3	1	3	3	3	2	2	2	3	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation “-”

CAOE306: Fundamentals of Digital Image Processing

Credit	Component	Instruction/Contact Hours(Per Week)	Instruction/Contact Hours(Per Course)	Experiential Learning Hours(Per Course)	Total Notional Hours
04	Theory	04	60	50	110
Experiential Learning Components: Unit Tests, Assignments, Case Study etc.					

Pre-requisite: None

Methodology, Pedagogy & Andragogy: The theory sessions will emphasize fundamentals and applications of digital image processing. The classroom sessions will make students aware of various operations such as colour image processing, image enhancement, segmentation, representation, recognition, and compression, which are performed on digital images. To enhance comprehension, we will provide illustrations of digital image processing operations using a programming language. To bridge the gap between theoretical knowledge and practical application, we have to schedule industrial visits. These visits are designed to offer students a tangible correlation between their studies and real-world practices. Students shall be assigned case studies to facilitate the practical application of their acquired knowledge. These case studies aim to deepen understanding and foster the ability to apply theoretical concepts to real-world scenario of digital image processing and analysis.

Outline of the course:

Unit Number	Title of the Unit	Minimum Number of Theory Hours
1	Digital Image Fundamentals	18
2	Colour Image Processing	10
3	Image Enhancement	09
4	Image Segmentation	06
5	Image Representations and Recognition	09
6	Image Compression	08

Total Hours (Theory): 60
Total Contact Hours:60

Detail Syllabus:

Unit I : Digital Image Fundamentals

Hours 18

Introduction, History, Components of image processing system, Applications of Digital Image Processing, Human visual system, Image as a 2D data, Image representation, Gray scale and Colour images, image sampling and quantization, Basic Relationships between Pixels.

Unit II : Colour Image Processing

Hours 10

Colour fundamentals, Colour models, Colour transformation, Smoothing and Sharpening, Colour segmentation, Noise Models, Noise Reduction, Inverse Filtering.

Unit III : Image Enhancement

Hours 09

Basic gray level Transformations, Histogram Processing, Spatial Filtering, Extension to functions of two variables, Image Smoothing, Image Sharpening, Frequency domain filtering, Homomorphic filtering

Unit IV : Image Segmentation

Hours 06

Edge based segmentation, Region based segmentation, Region split and merge techniques, Region growing by pixel aggregation, optimal thresholding, Hough Transform, boundary detection.

Unit V : Image Representations and Recognition

Hours 09

Boundary representation, Chain code, Polygonal Approximation, Signature, Boundary segments, Boundary description, Regional Descriptors, Topological Feature, Texture, Pattern and Patterns classes, Recognition Based on matching

Unit VI : Image Compression

Hours 08

Introduction, Image compression model, Error free compression, Variable length coding, Bit plan coding, Lossless predictive coding, Lossy compression, Compression standards.

Core Books:

1. Rafael C. Gonzalez, Richard E. Woods: Digital Image Processing, Fourth edition, Pearson education.
2. Anil K. Jain: Fundamentals of Digital Image Processing, First Edition, Pearson Education.

Reference Books:

1. Burger, Wilhelm, Burge, Mark J: Principles of Digital Image Processing, Springer.
2. Milan Sonka, Vaclav Hlavac, Roger Boyle: Image Processing, Analysis, and Machine Vision, CL Engineering
3. Nixon, Mark, and Alberto Aguado. Feature extraction and image processing for computer vision. Academic press, 2019

Web References:

1. <https://www.tutorialspoint.com/dip/> [Basics of Image Processing]
2. <https://sisu.ut.ee/imageprocessing/book/1> [All concepts of digital image processing]
3. <https://www.cs.auckland.ac.nz/courses/compsci773s1c/lectures/ImageProcessing-html/topic3.htm> [Image segmentation]
4. <http://www.elelel.p.lodz.pl/mstrzeI/imageproc/enhancement1.PDF> [Image enhancement]

Course Outcomes: Upon successful completion of the course, students will,

CO1 :	Understand the concept of various types of images and analyze various techniques for intensity transformation and spatial filtering with applications.
CO2 :	Understand the concepts of color image processing and noise models.
CO3 :	Understand the concepts of image enhancement and its techniques.
CO4 :	Learn various image segmentation techniques.
CO5 :	Be able to represent and recognize images using various pattern recognition methods its compression techniques.

Course Outcomes Mapping:

Unit No.	Unit Name	Course Outcomes				
		CO1	CO2	CO3	CO4	CO5
1	Digital Image Fundamentals	√				
2	Colour Image Processing		√			
3	Image Enhancement			√		
4	Image Segmentation				√	
5	Image Representations and Recognition					√
6	Image Compression					√

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	1	1	3	-	1	3	1	2	3	1	3	2	1
CO2	2	2	1	1	-	2	-	-	2	-	3	3	-
CO3	2	2	1	1	-	2	-	-	2	-	3	3	-
CO4	2	2	1	1	-	2	-	-	2	-	2	2	-
CO5	2	2	1	1	-	2	-	-	2	-	3	3	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation “-”

CAOS301: Mobile Application Development

Credit	Component	Instruction/Contact Hours (Per Week)	Instruction /Contact Hours (Per Course)	Experiential Learning Hours (Per Course)	Total Notional Hours
02	Theory	02	30	30	60
02	Practical	04	60	40	100
Experiential Learning Components (Theory): Unit Tests, Quizzes, Assignments, Case Studies etc. Experiential Learning Components (Practical): Lab Assignments, Practical Test, VIVA					

Pre-requisite: Object Oriented Programming Concepts.

Methodology, Pedagogy & Andragogy: The teaching methodology integrates theoretical and practical approaches to provide a comprehensive understanding for mobile application development subject for android application development using Kotlin language. Pedagogy involves interactive lectures, real-world examples, and guided coding sessions to build foundational knowledge and problem-solving skills. Andragogic strategies focus on self-directed learning through projects, case studies, and hands-on lab sessions, enabling students to apply theoretical concepts in developing functional mobile applications. Regular assessments, collaborative group tasks, and instructor feedback ensure an engaging and practice-oriented learning environment.

Outline of the course:

Unit Number	Title of the Unit	Minimum Number of Theory Hours
1.	Introduction Android and Android Development tools	05
2.	User Interface – I	07
3.	User Interface - II	05
4.	Material Design	04
5.	Application Data Handling	06
6.	Web Services	03

Total Hours (Theory): 30

Total hours (Practical): 60
Total Contact Hours: 90

Detail Syllabus:

Unit I: Introduction Android and Android Development tools **Hours 05**

Introduction to Mobile Applications and Android, Basics of Kotlin, setting up development environment, Dalvik Virtual Machine, Android Application Structure, DDMS, Android Manifest File, Gradle, Android permissions, APK, Basic Building blocks – Activities, Services, Broadcast Receivers & Content providers.

Unit II: User Interface – I **Hours 07**

Working with Containers: LinearLayout, RelativeLayout, TableLayout, ScrollView, and FrameLayout, Fragment, Views: Toast, TextView, EditText, Button, ImageButton, CheckBox, ToggleButton, RadioButton, RadioGroup, ProgressBar, AutoComplete TextView, Components for communication Intents & Intent Filters Intents: Explicit Intents, Implicit Intents, switching between activities and passing data between activities using Intents, Logging.

Unit III: User Interface - II **Hours 05**

Calendar: Manage Date and Time, Adapters: ArrayAdapter, BaseAdapter ListView and ListActivity, GridView, Gallery Menus: Option menu, Context menu, Sub menu Tabs and TabActivity Alert Dialogs, Android Toolbar.

Unit IV: Material Design **Hours 04**

Android Design Support Library, Vector Drawables, Basics of material design components and principles, Android styles and themes, Animations and Transitions.

Unit V: Application Data Handling **Hours 06**

Basics of Storage in Android, Shared Preference: Save key-value data, Store Data in SQLite Database, store data in a firebase, save files on Device, Sharing of data.

Unit VI: Web Services **Hours 03**

Working with Web Service in Android, Deploying Web Service.

Outline of the Course (Practical):

Week No	Practical	Description
1	Kotlin, Toast	Kotlin Code Programs, Toast Messages “Hello World”
2	TextView, EditText, Activity, Intent	Use of Textview, EditText and Toast with Operations. Use of Activity and Intent for values.
3	Views, EditText, ViewBinding, findViewById, layouts	Create the calculator app and use proper controls, Handle the views without using findViewById
4	Implicit, Explicit Intent, Activity Life Cycle	Manage Student Information using Intent and also create the App to learn the activity life cycle.
5	Different Activities, UI, toggle button, progress bar	Splash Screen, Login and user creation as well as create the application for addition operation of two variables.
6	EditText, Button	Create an app to perform the arithmetic operations using 4 buttons.
7	Implicate Intent, Explicit Intent, UI with functions	Open CHARUSAT website using Implicit Intent. Create an application to share data with native mobile apps for browser, calling app with optimized code.
8	Shared Preference and UI with complete application, Material design	Use shared Preferences for the session management and also create application for one college event using radio button, check boxes and spinners.
9	Images, Alert Dialog box	Display Toast message by clicking on Image Button and open CHARUSAT website. Use alert dialog for the messages in the application
10	AutoCompleteTextView	Create the application using AutocompleteTextView for Countries list.
11	Adapters, Array Adapter, Base Adapter, ListView	Use the Spinner using Array Adapter. Create the app with student photos using base adapter
12	Alert Dialog, Back Press	Manage the back press event using alert dialog.
13	Menu	Create an application with different types of menus. Context Menu Popup Menu Option Menu
14	Recyclerview, SQLite	Create app with Photos and names using recyclerview. Also create the app for CRUD operations using SQLite.
15	Firebase	Create the app for authentication using firebase. Also create the app for data management in Firestore.

Core Books:

1. Wei-Meng Lee: Beginning Android 4 Application Development, Wiley India Pvt Ltd.
2. Reto Meier: Professional Android 2 Application Development, Wrox publication
3. Mark L. Murphy: The Busy Coder's Guide to Android Development.

Reference Books:

1. Dawn Griffiths, David Griffiths: Head First Android Development, O'REILLY publication
2. Mark L. Murphy: Beginning Android 2, APRESS publication
3. Mark L. Murphy: The Busy Coder's Guide to Advanced Android Development, Commons Ware, LLC.

Web References:

1. <https://kotlinlang.org/> [Kotlin Tutorials]
2. <https://developer.android.com/guide/> [Android Tutorials]
3. www.vogella.com/tutorials/android.html [Android Practical Tutorials]
4. [https://www.androidhive.info/](http://www.androidhive.info/) [Android Practical Tutorials]

Course Outcomes: Upon successful completion of the course, students will be,

CO1 :	Be acquainted with Android OS
CO2 :	Be aware with Android Development Tools
CO3 :	Be aware with Android Development Tools
CO4 :	Be capable to create interactive mobile application that handle data
CO5 :	Be able to create mobile application that works web service

Course Outcomes Mapping:

Unit No.	Unit Name	Course Outcomes				
		CO1	CO2	CO3	CO4	CO5
1	Introduction Android and Android Development tools	√				
2	User Interface – I		√			
3	User Interface - II			√		
4	Material Design				√	
5	Application Data Handling				√	
6	Web Services					√

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	1	3	-	2	1	-	-	2	-	-
CO2	2	-	3	-	2	1	-	-	2	2	3	2	1
CO3	-	3	-	2	-	1	3	2	-	-	-	3	3
CO4	2	1	2	2	2	1	2	-	2	-	2	2	3
CO5	-	2	2	3	1	-	2	2	2	2	-	-	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation “-”