Tripura University

(A Central University)
Suryamaninagar
West Tripura

Syllabus for

Four Years Undergraduate Programme

Subject: Bachelor in Computer Applications

(As per NEP-2020)

Year - 2023

Tripura University

(A Central University)

Course Structure of BCA (UG Programme)
As per NEP-2020 under Tripura University

Bachelor in Computer Applications (BCA) MAJOR

Year	Semester	Paper	Credit	Mark	
1st	**1st Semester** **CA1101C** Fundamentals of Computer Application	Paper-1A Theory	2	50 (IA=20 + ESE=30)	
		Paper-1B Practical	2	50 (IA=20 + ESE=30)	Based on Theory paper 1A
	1st Semester **CA1102C** Programming Methodology using C	Paper-2A Theory	2	50 (IA=20 + ESE=30)	
		Paper-2B Practical	2	50 (IA=20 + ESE=30)	Based on Theory paper 2A
	2nd Semester **CA1201C** Basic Electronics	Paper-3A Theory	2	50 (IA=20 + ESE=30)	
		Paper-3B Practical	2	50 (IA=20 + ESE=30)	Based on Theory paper 3A
	2nd Semester CA1202C Operating System	Paper-4A Theory	2	50 (IA=20 + ESE=30)	
		Paper-4B Practical	2	50 (IA=20 + ESE=30)	Based on Theory paper 4A
2nd	**3rd Semester** **CA2301C** Data Structure & Algorithm	Paper-5A Theory	2	50 (IA=20 + ESE=30)	
		Paper-5B Practical	2	50 (IA=20 + ESE=30)	Based on theory paper 5A
	3rd Semester **CA2302C** Computer Organization	Paper 6 Theory	4	100 (IA=40 + ESE=60)	
	4th Semester **CA2401C** Computer Network	Paper-7A Theory	2	50 (IA=20 + ESE=30)	
		Paper-7B Practical	2	50 (IA=20 + ESE=30)	Based on theory paper 7A
	4th Semester **CA2402C** Database Management System	Paper-8A Theory	2	50 (IA=20 + ESE=30)	
		Paper-8B Practical	2	50 (IA=20 + ESE=30)	Based on theory paper 8A
3rd	**5th Semester** **CA3501C** Object Oriented Programming	Paper-9A Theory	2	50 (IA=20 + ESE=30)	
		Paper-9B Practical	2	50 (IA=20 + ESE=30)	Based on theory paper 9A
	5th Semester **CA3502C** Software Engineering	Paper-10A Theory	2	50 (IA=20 + ESE=30)	
		Paper-10B Practical	2	50 (IA=20 + ESE=30)	Based on theory paper 10A
	5th Semester **CA3503C** Minor Project & Technical Writing	Paper-11 Practical	4	100 (IA=40 + ESE=60)	Based on minor Project works

5th Semester **CA30XXE** Departmental Optional Paper-I	Paper-12 Theory	4	100 (IA=40 + ESE=60)	
6th Semester **CA3601C** Computer Graphics	Paper-13A Theory	2	50 (IA=20 + ESE=30)	
	Paper-13B Practical	2	50 (IA=20 + ESE=30)	Based on theory paper 13A
6th Semester **CA3602C** Web Technology	Paper-14A Theory	2	50 (IA=20 + ESE=30)	
	Paper-14B Practical	2	50 (IA=20 + ESE=30)	Based on theory paper 14A
6th Semester **CA3603C** Major Project	Paper-15 Practical	4	100 (IA=40 + ESE=60)	Based on project works
6th Semester **CA30XXE** Departmental Optional Paper-II	Paper-16 Theory	4	100 (IA=40 + ESE=60)	
7th Semester **CA4701C** Introduction to AI & Machine Learning	Paper-17A Theory	2	50 (IA=20 + ESE=30)	
	Paper-17B Practical	2	50 (IA=20 + ESE=30)	Based on theory paper 17A
7th Semester **CA4702C** Discrete Mathematical Science	Paper-18 Theory	4	100 (IA=40 + ESE=60)	
7th Semester **CA4703C** Research Project/Dissertation Phase-I	Paper-19 Practical	4	100 (IA=40 + ESE=60)	Based on Project/Dissertation works
7th Semester **CA40XXE** Departmental Optional Paper-III	Paper-20 Theory	4	100 (IA=40 + ESE=60)	
8th Semester **CA4801C** Software Project Management	Paper-21A Theory	2	50 (IA=20 + ESE=30)	
	Paper-21B Practical	2	50 (IA=20 + ESE=30)	Based on theory papers 21A
8th Semester **CA4802C** Research Project Phase-II	Paper-22 Practical	4	100 (IA=40 + ESE=60)	Based on Research Project works
8th Semester **CA4803C** Dissertation & Presentation	Paper-23 Practical	4	100 (IA=40 + ESE=60)	Based on Dissertation and Presentation works
8th Semester **CA40XXE** Departmental Optional Paper-IV	Paper-20 Theory	4	100 (IA=40 + ESE=60)	

*to be finalised later on…

Bachelor of Computer Application (BCA) Program 1st Year

Yr	Sem	Course Code	Course Title	Credits	Type
I	I	CA1101C	Fundamentals of Computer Application	4(2+2)	Major-1
		CA1102C	Programming Methodology using C	4(2+2)	Major-2
			Minor/Elective-I	4	Minor/Elective-1
			Prerequisite Allied/MOOC-I	3	Interdisciplinary Course -I
			Prescribed Courses-I	3	Skill Enhancement/ Vocational-I
			Prescribed VAC Project/ Internship/ Survey-I	2*	Common Value-Added Courses
		Total Credits of Semester I		**18+2***	
	II	CA1201C	Basic Electronics	4(2+2)	Major-3
		CA1202C	Operating System	4(2+2)	Major-4
			Minor/Elective-II	4	Minor/Elective-2
			Prescribed Courses-II	3	Skill Enhancement/ Vocational-II
			Qualifying Prescribed Course-I	3	Ability Enhancement Courses (language)
			Prescribed VAC Project/ Internship/ Survey-II	2*	Common Value-Added Courses
		Total Credits of Semester II		**18+2***	

Total Credits after completion of 1st Year=36+4* =40 Credits

- **16 credits Major**
- **8 Credits Minor**
- **3 Credits Interdisciplinary Course (**Prerequisite Allied/MOOC)
- **6 Credits Skill Enhancement/ Vocational**
- **3 Credits Ability Enhancement Courses (language)**
- **4* Credits Common Value-Added Courses (**VAC Project/ Internship/ Survey)

Students Exiting the program after securing 40 Credits will be awarded UG CERTIFICATE IN COMPUTER APPLICATIONS provided they secure 4* credits in skill based vocational courses offered during the 1st year summer term semester (exiting students need to undertake an internship of 4 credits additionally)

BACHELOR IN COMPUTER APPLICATIONS (BCA)

Bachelor of Computer Application (BCA) Program 2ⁿᵈ Year

Yr	Sem	Course Code	Course Title	Credits	Type
II	III	CA2301C	Data Structure & Algorithm	4(2+2)	Major-5
		CA2302C	Computer Organization	4(4+0)	Major-6
			Minor/Elective-III	4	Minor/Elective-3
			Prerequisite Allied/MOOC-II	3	Interdisciplinary Course –II
			Prescribed Courses-III	3	Skill Enhancement/ Vocational-III
			Prescribed VAC Project/ Internship/ Survey-III	2*	Common Value-Added Courses
		Total Credits of Semester III		**18+2***	
	IV	CA2401C	Computer Network	4(2+2)	Major-7
		CA2402C	Database Management System	4(2+2)	Major-8
			Minor/Elective-IV	4	Minor/Elective-4
			Prerequisite Allied/MOOC-III	3	Interdisciplinary Course –III
			Qualifying Prescribed Course-II	3	Ability Enhancement Courses (language)
			Prescribed VAC Project/ Internship/ Survey-IV	2*	Common Value-Added Courses
		Total Credits of Semester IV		**18+2***	

Total Cumulative Credits after completion of 2ⁿᵈ Year=72+8* =80 Credits

- **32 credits Major**
- **16 Credits Minor**
- **9 Credits Interdisciplinary Course (**Prerequisite Allied/MOOC)
- **9 Credits Skill Enhancement/ Vocational**
- **6 Credits Ability Enhancement Courses (language)**
- **8* Credits Common Value-Added Courses (**VAC Project/ Internship/ Survey)

Students Exiting the program after securing 80 Credits will be awarded **DIPLOMA CERTIFICATE IN COMPUTER APPLICATIONS** provided, they secure 8* credits in skill based vocational courses offered during the 1ˢᵗ year and 2ⁿᵈ year summer term semester (exiting students need to undertake an internship of 4 credits additionally in each year)

BACHELOR IN COMPUTER APPLICATIONS (BCA)

Bachelor of Computer Application (BCA) Program 3rd Year

Yr	Sem	Course Code	Course Title	Credits	Type
III	V	CA3501C	Object Oriented Programming	4(2+2)	Major-9
		CA3502C	Software Engineering	4(2+2)	Major-10
		CA3503C	Minor Project & Technical Writing	4(0+4)	Major-11
		CA30XXE	Departmental Optional Paper-I	4(4+0)	Major-12
			Minor/Elective-V	4	Minor/Elective-5
			Qualifying Prescribed Course-III	2	Ability Enhancement Courses (language)
		Total Credits of Semester V		**22**	
	VI	CA3601C	Computer Graphics	4(2+2)	Major-13
		CA3602C	Web Technology	4(2+2)	Major-14
		CA3603C	Major Project	4(0+4)	Major-15
		CA30XXE	Departmental Optional Paper-II	4(4+0)	Major-16
			Minor/Elective-VI	4	Minor/Elective-6
		Total Credits of Semester VI		**20**	

Departmental Optional Papers I/II (Select any two)

Course Code	Course Title	Course Code	Course Title
CA3001E	Cloud Computing	CA3005E	Distributed Computing
CA3002E	Cyber Security & Cyber Law	CA3006E	E-Commerce
CA3003E	Data Science	CA3007E	Formal Languages & Automata Theory
CA3004E	Digital Marketing	CA3008E	Internet of Things

Total Cumulative Credits after completion of 3rd Year=114+8* =122 Credits

- **64 credits Major**
- **24 Credits Minor**
- **9 Credits Interdisciplinary Course (**Prerequisite Allied/MOOC)
- **9 Credits Skill Enhancement/ Vocational**
- **8 Credits Ability Enhancement Courses (language)**
- **8* Credits Common Value-Added Courses (**VAC Project/ Internship/ Survey)

Students Exiting the program after securing above Credits will be awarded BACHELOR IN COMPUTER APPLICATIONS(BCA)

N.B. 50% courses of minor stream must be from the relevant subject/discipline and remaining 50% from any discipline.

BACHELOR IN COMPUTER APPLICATIONS (BCA)

Bachelor of Computer Application (BCA) Program 4th Year

Yr	Sem	Course Code	Course Title	Credits	Type
IV	VII	CA4701C	Introduction to AI & Machine Learning	4(2+2)	Major-17
		CA4702C	Discrete Mathematical Science	4(4+0)	Major-18
		CA4703C	Research Project/Dissertation Phase-I	4(0+4)	Major-19
		CA40XXE	Departmental Optional Paper-III	4(4+0)	Major-20
			Minor/Elective-VII	4	Minor/Elective-7
		Total Credits of Semester VII		**20**	
	VIII	CA4801C	Software Project Management	4(2+2)	Major-21
		CA4802C	Research Project Phase-II	4(0+4)	Major-22
		CA4803C	Dissertation & Presentation	4(0+4)	Major-23
		CA40XXE	Departmental Optional Paper-IV	4(4+0)	Major-24
			Minor/Elective-VIII	4	Minor/Elective-8
		Total Credits of Semester VIII		**20**	

Departmental Optional Papers III/IV (Select any two)

Course Code	Course Title	Course Code	Course Title
CA4001E	Adhoc & Sensor Network	CA4005E	Information & System Security
CA4002E	Advanced DBMS	CA4006E	Numerical Methods
CA4003E	Deep Learning	CA4007E	Mobile Computing
CA4004E	Digital Signal Processing	CA4008E	Soft Computing

Total Cumulative Credits after completion of 4th Year=154+8* =162 Credits

- **96 credits Major**
- **32 Credits Minor**
- **9 Credits Interdisciplinary Course (**Prerequisite Allied/MOOC)
- **9 Credits Skill Enhancement/ Vocational**
- **8 Credits Ability Enhancement Courses (language)**
- **8* Credits Common Value-Added Courses (**VAC Project/ Internship/ Survey)

Students Exiting the program after securing above Credits will be awarded BACHELOR IN COMPUTER APPLICATIONS (BCA) WITH RESEARCH

N.B. 50% courses of minor stream must be from the relevant subject/discipline and remaining 50% from any discipline.

BACHELOR IN COMPUTER APPLICATIONS (BCA)

PRE-REQUISITE COURSES FOR STUDENTS who are MIGRATING to Bachelor of Computer Application (BCA) Program in 2nd Year for Admission

Yr	Sem	Course Code	Course Title	Credits	Type
I	I	CA1100A	Introduction to Computer Systems	4(3+1)	Pre-Requisite-I
	II	CA1200A	Introduction to Programming Methodology using C	4(3+1)	Pre-Requisite-II

PRE-REQUISITE COURSES FOR STUDENTS who are MIGRATING to Bachelor of Computer Application (BCA) Program in 3rd Year for Admission

Yr	Sem	Course Code	Course Title	Credits	Type
II	III	CA2300A	Basics of Computer Organization	4(4+0)	Pre-Requisite-III
	IV	CA2400A	Basics of Computer Network	4(3+1)	Pre-Requisite-IV

Students admitted in 2nd year/ 3rd year from other Program are required to complete the respective pre-requisite courses for admission.

BACHELOR IN COMPUTER APPLICATIONS (BCA)

Bachelor of Computer Application (BCA) Program 1ˢᵗ Year

Yr	Sem	Course Code	Course Title	Credits	Type
I	I	CA1101C	Fundamentals of Computer Application	4(2+2)	Major-1
		CA1102C	Programming Methodology using C	4(2+2)	Major-2
			Minor/Elective-I	4	Minor/Elective-1
			Prerequisite Allied/MOOC-I	3	Interdisciplinary Course -I
			Prescribed Courses-I	3	Skill Enhancement/ Vocational-I
			Prescribed VAC Project/ Internship/ Survey-I	2*	Common Value Added Courses
		Total Credits of Semester I		**18+2***	
	II	CA1201C	Basic Electronics	4(2+2)	Major-3
		CA1202C	Operating System	4(2+2)	Major-4
			Minor/Elective-II	4	Minor/Elective-2
			Prescribed Courses-II	3	Skill Enhancement/ Vocational-II
			Qualifying Prescribed Course-I	3	Ability Enhancement Courses (language)
			Prescribed VAC Project/ Internship/ Survey-II	2*	Common Value Added Courses
		Total Credits of Semester II		**18+2***	

Total Credits after completion of 1ˢᵗ Year=36+4* =40 Credits

- **16 credits Major**
- **8 Credits Minor**
- **3 Credits Interdisciplinary Course (**Prerequisite Allied/MOOC)
- **6 Credits Skill Enhancement/ Vocational**
- **3 Credits Ability Enhancement Courses (language)**
- **4* Credits Common Value Added Courses (**VAC Project/ Internship/ Survey)

Students Exiting the program after securing 40 Credits will be awarded <u>**UG CERTIFICATE IN COMPUTER APPLICATIONS**</u> **provided they secure 4* credits in skill based vocational courses offered during the 1ˢᵗ year summer term semester (exiting students need to undertake an internship of 4 credits additionally)**

BACHELOR IN COMPUTER APPLICATIONS (BCA)

Fundamentals of Computer Application	CA1101C
3- 0 - 2 : 4 Credits	Prerequisites: *None*

PART A (Theory)

UNIT I

Introduction: Characteristics of Computer, Generation of computer, Application of computer;

Software: Definition, Relationship between Software and Hardware, Software Categories, System Software, Application Software and other software's with example;

Number Systems: Types of Number systems, Conversion between number bases, Binary arithmetic including 1's complement and 2's complement;

UNIT II

Block diagram of digital computer and function of each block; Introduction to computer memory, Types of computer memory; Input & Output Devices. Data & Information, Different data processing methods,

UNIT III

Introduction to Computer Languages. Introduction to Operating System: Types of Operating, System, Functions of Operating System, Processing function of an Operating System with example.

UNIT IV

Data Communication and Computer Network: Introduction, Data Transmission mode, Transmission Media, Types of Computer Network, Network Topologies, Communication Protocols, Network devices;

Internet Basics: Introduction, Basic Internet Terms (Website, Webpage, URL, Web Browser etc.), Internet Applications, Electronic Mail: Working principle, Search Engines, Intranet, Extranet, Data Security: Need of security, Basic principle of security.

PART B (Laboratory Works)

1. Assembling and De-Assembling of Computer, Installation of Operating System.
2. Installation of different software, Licensing of software.
3. Introduction to MS-DOS, System files, Internal and External Commands, Batch processing.
4. WINDOWS: File System, Start button and menus, Hide and Unhide properties of files and folders. Utilities of icons, Recycle bin, Task bar, Desktop background, Screen saver, working with control panel.
5. Word Processor: Utilities of Menu bar, Toolbar, Text, Font, Styles and background, Watermark, Table, Page border, Indentation, Page orientation, Equation Editor, Mail merge, Protection of the documents.
6. Spreadsheet: Formulas, Validations, Basic functions and Chart.
7. Presentation: Animation, Custom Animation, Slide Transaction, Mouse click presentation, Automatic presentation.
8. Study of IP and MAC Addresses and basic network utility commands.

BACHELOR IN COMPUTER APPLICATIONS (BCA)

Programming Methodology using C	CA1102C
2- 0 - 4 : 4 Credits	Prerequisites: *None*

PART A (Theory)

UNIT-I Introduction, Classification of Computer Languages, Characteristics of a good programming Language, Algorithm, Flowchart, Pseudocode, Testing and Debugging

UNIT-II
Introduction of C program, Basic structure, Character set, Types of Tokens, Keywords, Identifiers, Constants, Variables, Rules of declaring variables. Data types, program structure; Operators and Expressions, Precedence and Association.

UNIT-III
Control statements: IF, Nested IF, IF-Else, For, nested for, Switch, While, Do-While, Goto, Continue, Return and Break, multiple loop variables, specifying test condition for selection and iteration, simple programming.

UNIT-IV
Arrays: Array notation and representation, manipulating array elements, arrays of unknown or varying size, One-dimensional and two-dimensional arrays; Strings and standard functions.**Pointers:** Declaration and Initialization, accessing variables through pointer arithmetic, Pointers and arrays.

UNIT-V
Basic of a function, Recursion and Structures: Introduction to function**,** Types of function: Call by value and call by reference, Types of recursion, Rules for recursion function, Recursion vs Iteration. Storage class, Structure and Union, Features of structures, Declaration and initialization of structures, Arrays of structures, Pointers to structures, Structure and functions.

PART B (Laboratory Works)

1: Basic programs usingprintf and scanf Statement.
2: Programs with various operators.
3: Programs with Decision statement.
4: Programs with Switch Case.
5: Various Programs with Loop Statements and nested loop.
6: Programs with Arrays.
7: Programs with Strings.
8: Programs with functions.
9: Programs with Structures.
10: Programs with pointers.

BACHELOR IN COMPUTER APPLICATIONS (BCA)

Basic Electronics	CA1201C
3 - 0 - 2 : 4 Credits	Prerequisites: *None*

PART A (Theory)

UNIT I

Basic Electronic Components: Resistors, Capacitors, Inductors, Diodes, Transistors, Voltage Source, Current Source, Transformers. Introduction to AC and DC signals, Periodic & Non- Periodic Signals. **Various Network Laws:** Ohms' Law, Joule's Law of Electric Heating, Current Division Law, Voltage Division Law, Kirchhoff's Voltage and Current Law. **Connection Types:** Series and Parallel connection. Star- Delta transformation – Simple Problems on all mentioned topics.

UNIT II

Semiconductors: Definition, Intrinsic and Extrinsic Semiconductor, Structure of Silicon and Germanium, Energy Band Diagram of Conductor, Semiconductor and Insulator.

Diode and its Applications: P-N Junction Diodes, Forward and Reverse Biased Condition, V-I Characteristics of P-N Junction Diodes, Rectifier Circuits: Half Wave and Full Wave Rectifier (Construction and Working Principle), Ripple Factor, Filter Circuits. Clipping and Clamping Circuits, Zener Diode, V-I Characteristics of Zener Diode and Photo Diodes

UNIT III

Transistors: Symbolic Representation, Diode Analogy, Construction, Working Principle, Transistor as Amplifier, Transistor Configurations (CE, CB, CC), Transistors Regions of Operation, Transistor Load Line Analysis, Types of Transistor, JFET & MOSFET (Type, Operation & V-I Characteristics).

UNIT IV

Introduction to the Digital Signals, Digital Operations and Logic Levels.

Logic Gates: Definition, Symbol, Truth Table, Classification.

Boolean Algebra: Laws, Simplification of Boolean identities, Realization of Boolean identities
using basic and universal gates; SSOP, SPOS, K-map (up to 4 variables): Simplification (min SOP/min POS) of Boolean expression and Realization of resultant output by Basic and Universal
gates

Digital Circuits: Different types of Digital Circuits, Idea of Combinational Circuits and Sequential circuits. Overview of Different Types of Combinational and Sequential Circuits.

PART B (Laboratory Works)

1. Identify various passive components in the given circuit
2. Identify various active components in the given circuit
3. Determine the value of given resistor using digital multi-meter to confirm with color code.
4. Connect resistors in series combination on bread board and measure its value using multi-meter.
5. Connect resistors in parallel combination on bread board and measure its value using multi-meter
6. Study the V-I Characteristics of P-N Junction Diode in Both Forward and Reverse Biased Mode.
7. Study the V-I Characteristics of Zener Diode in Both Forward and Reverse Biased Mode.
8. Study the Characteristics of BJT in Common Emitter Configuration.
9. Study the Characteristics of BJT in Common Base Configuration.
10. Study the Characteristics of BJT in Common Collector Configuration.
11. Verify the truth table of different Logic gates (Basic, Universal and Exclusive gates)
12. Realize Boolean Expressions with Different Logic Gates.

BACHELOR IN COMPUTER APPLICATIONS (BCA)

Operating System	CA1202C
3 - 0 - 2 : 4 Credits	Prerequisites: *None*

PART A (Theory)

UNIT I

Introduction: System Software, Resource Abstraction, OS strategies. Definition of OS, Purpose, Early Batch Systems, Buffering and spooling Batch Systems.

Types of operating systems: Multiprogramming, Batch, Time Sharing, Single user and Multiuser, Process Control & Real Time Systems.

Operating System Organization: Factors in operating system design, basic OS functions, implementation consideration; process modes, methods of requesting system services – system calls and system programs. System Structure.

UNIT II

Process: Process Concepts, Process Model, Process state and process control block, Threads, Threads in Linux.

Scheduling: Process scheduling, Different process scheduling algorithms.

Process Synchronization: Mutual Exclusion, Semaphores, Critical Section Problems. Case study on Dining Philosopher Problem.

UNIT III

Deadlocks: examples of deadlock, resource concepts, necessary conditions for deadlock, deadlock solution, deadlock prevention, deadlock avoidance with Bankers algorithms, deadlock detection, deadlock recovery.

Device Management: Disk Scheduling Strategies, Rotational Optimization, System Consideration, Caching and Buffering.

UNIT IV

Memory Management: Logical versus physical address space, Swapping, memory allocation strategies, External and Internal Fragmentation, Paging and Segmentation, Semaphore, Virtual memory.

File System: Introduction, File Organization, Logical File System, Physical File System, File Allocation strategy, Free Space Management, File Access Control, Data Access Techniques, Data Integrity Protection.

PART B (Laboratory Works)

1. Basic commands of LINUX
2. Editing Files with Vi editor, Viewing Files, Combining Files and Using Wildcards, and Moving Around in Directories.
3. Linking Files, Removing and restoring Files, and Permissions.
4. Simple Shell-Programming.

BACHELOR IN COMPUTER APPLICATIONS (BCA)

PRE-REQUISITE COURSES FOR STUDENTS who are MIGRATING to Bachelor of Computer Application (BCA) Program in 2nd Year for Admission

Yr	Sem	Course Code	Course Title	Credits	Type
I	I	CA1100A	Introduction to Computer Systems	4(3+1)	Pre-Requisite-I
	II	CA1200A	Introduction to Programming Methodology using C	4(3+1)	Pre-Requisite-II

Introduction to Computer Systems	**CA1100A**
3- 0 - 2 : 4 Credits	Prerequisites: *None*

PART A (Theory)

UNIT I

Introduction: Characteristics of Computer, Generation of computer, Application of computer;

Software: Definition, Relationship between Software and Hardware, Software Categories, System Software, Application Software and other software's with example;

Number Systems: Types of Number systems, Conversion between number bases, Binary arithmetic including 1's complement and 2's complement;

UNIT II

Block diagram of digital computer and function of each block; Introduction to computer memory, Types of computer memory; Input & Output Devices. Data & Information, Different data processing methods,

UNIT III

Introduction to Computer Languages. Introduction to Operating System: Types of Operating, System, Functions of Operating System, Processing function of an Operating System with example.

UNIT IV

Data Communication and Computer Network: Introduction, Data Transmission mode, Transmission Media, Types of Computer Network, Network Topologies, Communication Protocols, Network devices;

Internet Basics: Introduction, Basic Internet Terms (Website, Webpage, URL, Web Browser etc.), Internet Applications, Electronic Mail: Working principle, Search Engines, Intranet, Extranet, Data Security: Need of security, Basic principle of security.

PART B (Laboratory Works)

1. Assembling and De-Assembling of Computer, Installation of Operating System.
2. Installation of different software, Licensing of software.
3. Introduction to MS-DOS, System files, Internal and External Commands, Batch processing.
4. WINDOWS: File System, Start button and menus, Hide and Unhide properties of files and folders. Utilities of icons, Recycle bin, Task bar, Desktop background, Screen saver, working with control panel.
5. Word Processor: Utilities of Menu bar, Toolbar, Text, Font, Styles and background, Watermark, Table, Page border, Indentation, Page orientation, Equation Editor, Mail merge, Protection of the documents.
6. Spreadsheet: Formulas, Validations, Basic functions and Chart.
7. Presentation: Animation, Custom Animation, Slide Transaction, Mouse click presentation, Automatic presentation.
8. Study of IP and MAC Addresses and basic network utility commands.

BACHELOR IN COMPUTER APPLICATIONS (BCA)

Introduction to Programming Methodology using C	CA1200A
3- 0 - 2 : 4 Credits	Prerequisites: *None*

PART A (Theory)

UNIT-I Introduction, Classification of Computer Languages, Characteristics of a good programming Language, Algorithm, Flowchart, Pseudocode, Testing and Debugging

UNIT-II

Introduction of C program, Basic structure, Character set, Types of Tokens, Keywords, Identifiers, Constants, Variables, Rules of declaring variables. Data types, program structure; Operators and Expressions, Precedence and Association.

UNIT-III

Control statements: IF, Nested IF, IF-Else, For, nested For, Switch, While, Do-While, Goto, Continue, Return and Break, multiple loop variables, specifying test condition for selection and iteration, simple programming.

UNIT-IV

Arrays: Array notation and representation, manipulating array elements, arrays of unknown or varying size, One-dimensional and two-dimensional arrays; Strings and standard functions. **Pointers:** Declaration and Initialization, accessing variables through pointer arithmetic, Pointers and arrays.

UNIT-V

Basic of a function, Recursion and Structures: Introduction to function**,** Types of function: Call by value and call by reference, Types of recursion, Rules for recursion function, Recursion vs Iteration. Storage class, Structure and Union, Features of structures, Declaration and initialization of structures, Arrays of structures, Pointers to structures, Structure and functions.

PART B (Laboratory Works)

1: Basic programs using printf and scanf Statement.

2: Programs with various operators.

3: Programs with Decision statement.

4: Programs with Switch Case.

5: Various Programs with Loop Statements and nested loop.

6: Programs with Arrays.

7: Programs with Strings.

8: Programs with functions.

9: Programs with Structures.

10: Programs with pointers.

BACHELOR IN COMPUTER APPLICATIONS (BCA)

Bachelor of Computer Application (BCA) Program 2nd Year

Yr	Sem	Course Code	Course Title	Credits	Type
II	III	CA2301C	Data Structure & Algorithm	4(2+2)	Major-5
		CA2302C	Computer Organization	4(4+0)	Major-6
			Minor/Elective-III	4	Minor/Elective-3
			Prerequisite Allied/MOOC-II	3	Interdisciplinary Course –II
			Prescribed Courses-III	3	Skill Enhancement/ Vocational-III
			Prescribed VAC Project/ Internship/ Survey-III	2*	Common Value Added Courses
		Total Credits of Semester III		**18+2***	
	IV	CA2401C	Computer Network	4(2+2)	Major-7
		CA2402C	Database Management System	4(2+2)	Major-8
			Minor/Elective-IV	4	Minor/Elective-4
			Prerequisite Allied/MOOC-III	3	Interdisciplinary Course –III
			Qualifying Prescribed Course-II	3	Ability Enhancement Courses (language)
			Prescribed VAC Project/ Internship/ Survey-IV	2*	Common Value Added Courses
		Total Credits of Semester IV		**18+2***	

Total Cumulative Credits after completion of 2nd Year=72+8* =80 Credits

- **32 credits Major**
- **16 Credits Minor**
- **9 Credits Interdisciplinary Course (**Prerequisite Allied/MOOC)
- **9 Credits Skill Enhancement/ Vocational**
- **6 Credits Ability Enhancement Courses (language)**
- **8* Credits Common Value Added Courses (**VAC Project/ Internship/ Survey)

Students Exiting the program after securing 80 Credits will be awarded <u>DIPLOMA CERTIFICATE IN COMPUTER APPLICATIONS</u> provided they secure 8* credits in skill based vocational courses offered during the 1st year and 2nd year summer term semester (exiting students need to undertake an internship of 4 credits additionally in each year)

BACHELOR IN COMPUTER APPLICATIONS (BCA)

Data Structure & Algorithm	CA2301C
3-0-2: 4 Credits	Prerequisites: *None*

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PART A (Theory)

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UNIT-I
Introduction: Concepts of data Structures-, Data Structure Operations, Abstract data Types. Algorithms – Complexity.

UNIT-II
Linear Data Structures: Sequential Representations:
Arrays: Terminology, Single and Multi-Dimensional Arrays, Operations on Arrays, Sparse Matrices.
Linked List: Linear Linked List, Circular Linked List, Doubly Linked List and their Applications.

UNIT-III
Stacks: Implementing Stack using Array and Linked List, Prefix, Infix and Postfix expressions, Utility and conversion of these expressions from one to another;
Queues: Introduction, Array and Linked Representation of Queue, Types of Queue.
Recursion: Developing Recursive Definition of Simple Problems and their implementation; Advantages and Limitations of Recursion.

UNIT-IV
Nonlinear Data structures: Trees: Basic Terminologies; Binary trees: Properties, Traversals, Types of binary tree, AVL tree, B-tree.

UNIT-V
Graphs: Terminologies, Representation of Graphs, Shortest Path Problem –Dijkstra's Algorithm, Graph Traversals – BFS, DFS, Minimum Spanning Trees, Euler's and Hamiltonian Circuits.

UNIT-VI
Searching and Sorting: Sequential Search and Binary Search with Complexity Analysis, Different types of sorting with complexity analysis.
Insertion Sort, Bubble Sort, Quick Sort, Selection Sort, Heap Sort, Merge Sort, Bucket Sort.
Sequential Search, Ordered Sequential Search, Binary Search, Interpolation Search.

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PART B (Laboratory Works)

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Laboratory works are based on the syllabus of **PART A**.

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BACHELOR IN COMPUTER APPLICATIONS (BCA)

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Computer Organization	CA2302C
3-1-0: 4 Credits	Prerequisites: *None*

UNIT I
Concepts and Terminologies: Digital Computer Components, Hardware and Software and their Dual Nature, Special Purpose and General Purpose Machine, Concepts of Bus Structures.

ALU Organization, Arithmetical Function, Logical Function, Data Representation: Fixed point and Floating point arithmetic.

UNIT II
General Register Organization; Hardwired & Micro Programmed Control Unit; Organization of Central Processing Unit; Stack Organization; Instruction, Instruction Format, Concept on Zero Address System, One Address System, Two Address System, Three Address System; Micro operation.

UNIT III
Memory Organization: Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Virtual Memory, Memory Management Hardware, hit/miss ratio, Concepts of Memory Mapping.

UNIT IV
Input-output Organization: Alphanumeric Codes, Error Detection Codes, Input–Output Interface, Asynchronous Data Transfer-Handshaking, Asynchronous Serial Transfer, Interrupt Initiated I/O, DMA Transfer, Interfacing Peripherals with CPU; Introduction to RISC & CISC Architectures and their Comparison.

BACHELOR IN COMPUTER APPLICATIONS (BCA)

Computer Network	**CA2401C**
3-0-2: 4 Credits	Prerequisites: *None*

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PART-A (Theory)
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UNIT- I
Introduction to Computer Networks: Definition of Network; Network Topologies; Classifications of Network; Layered Network Architecture; Overview of OSI Reference Model; Overview of TCP/IP Protocol Suite; Network Protocol.

UNIT-II
Networks Switching Techniques and Access Mechanisms: Switching; Classifications of Switched Networks.

Data Link Layer Functions and Protocol: Error Detection and Correction-Types of Errors; Types of Error Detection Techniques; Error Correction-Hamming Code Generation; Framing, Flow and Error Control – Protocols; Point to Point Protocol on Internet.

UNIT-III
Multiple Access Protocol and Networks: CSMA/CD and CSMA/CA protocols; Ethernet; Connecting LANs and Back-Bone Networks- Repeaters, Hubs, Switches, Bridges, Routers and Gateways;
Networks Layer Functions and Protocols: Routing; Routing Table; Routing Algorithms; Network Layer Protocols-IP, ICMP, IGMP, ARP, RARP.

UNIT-IV
Transport Layer Functions and Protocols: Transport Services-Error and Flow Control, Connection Establishment and Release- Three Way Handshake;
Overview of Application layer protocol: Overview of DNS Protocol; Overview of WWW &HTTP protocol; E-mail Protocols; Overview of File Transfer Service.

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PART B (Laboratory Works)
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Laboratory works are based on the syllabus of **PART A**.

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BACHELOR IN COMPUTER APPLICATIONS (BCA)
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Database Management System	CA2402C
3-0-2: 4 Credits	Prerequisites: *None*

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PART A (Theory)

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UNIT I

Introduction to Database, Application of DBMS, Characteristics of Data in Database. Data Dictionary, Types of Database languages.
Database Management System (DBMS). Characteristics, Advantage and Disadvantage of DBMS. 3-level Architecture of DBMS: External, Conceptual & Internal Levels.
DBA: Role, Functionality and Importance. Relational DBMS, Domains, Attributes, Tuples, Entities &Entity set.

UNIT II

Concepts of Keys: Database Contraints, Different types of keys
Fundamental Integrity Rules: Entity integrity, Referential integrity.
Entity-Relationship Diagram (E-R Diagram). Strong & Weak entities, Generalization, Specialization, Aggregation.
Introduction to Relational Algebra, Relational Algebraic Operations: Select, Project, Cross product.
Structured Query Language(SQL), Implementing Query, SQL Functions, View.
Different types of joins.

UNIT III

Relational Calculus, Tuple Relational calculus, Domain Relational calculus.
Concept of Database Normalization: 1NF, 2NF, 3NF, BCNF, 4NF 5NF. Functional dependencies, Multivalued dependencies.

UNIT IV

Transaction State, Implementation of Atomicity and Durability, Concurrent Executions, Serializability.

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PART B (Laboratory Works)

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Laboratory works are based on the syllabus of **PART A.**

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BACHELOR IN COMPUTER APPLICATIONS (BCA)

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PRE-REQUISITE COURSES FOR STUDENTS who are MIGRATING to Bachelor of Computer Application (BCA) Program in 3rd Year for Admission

Yr	Sem	Course Code	Course Title	Credits	Type
II	III	CA2300A	Basics of Computer Organization	4(4+0)	Pre-Requisite-III
	IV	CA2400A	Basics of Computer Network	4(2+2)	Pre-Requisite-IV

Basics of Computer Organization	CA2300A
3 - 1 - 0 : 4 Credits	Prerequisites: *None*

UNIT I

Concepts and Terminologies: Digital Computer Components, Hardware and Software and their Dual Nature, Special Purpose and General Purpose Machine, Concepts of Bus Structures.

ALU Organization, Arithmetical Function, Logical Function, Data Representation: Fixed point and Floating point arithmetic.

UNIT II

General Register Organization; Hardwired & Micro Programmed Control Unit; Organization of Central Processing Unit; Stack Organization; Instruction, Instruction Format, Concept on Zero Address System, One Address System, Two Address System, Three Address System; Micro operation.

UNIT III

Memory Organization: Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Virtual Memory, Memory Management Hardware, hit/miss ratio, Concepts of Memory Mapping.

UNIT IV

Input-output Organization: Alphanumeric Codes, Error Detection Codes, Input–Output Interface, Asynchronous Data Transfer-Handshaking, Asynchronous Serial Transfer, Interrupt Initiated I/O, DMA Transfer, Interfacing Peripherals with CPU; Introduction to RISC & CISC Architectures and their Comparison.

BACHELOR IN COMPUTER APPLICATIONS (BCA)

Basics of Computer Network	CA2400A
2 - 0 - 4 : 4 Credits	Prerequisites: *None*

PART-A(Theory)

UNIT- I

Introduction to Computer Networks: Definition of Network; Network Topologies; Classifications of Network; Layered Network Architecture; Overview of OSI Reference Model; Overview of TCP/IP Protocol Suite; Network Protocol.

UNIT-II

Networks Switching Techniques and Access Mechanisms: Switching; Classifications of Switched Networks.

Data Link Layer Functions and Protocol: Error Detection and Correction-Types of Errors; Types of Error Detection Techniques; Error Correction-Hamming Code Generation; Framing, Flow and Error Control – Protocols; Point to Point Protocol on Internet.

UNIT-II

Multiple Access Protocol and Networks: CSMA/CD and CSMA/CA protocols; Ethernet; Connecting LANs and Back-Bone Networks- Repeaters, Hubs, Switches, Bridges, Routers and Gateways;

Networks Layer Functions and Protocols: Routing; Routing Table; Routing Algorithms; Network Layer Protocols-IP, ICMP, IGMP, ARP, RARP.

UNIT-IV

Transport Layer Functions and Protocols: Transport Services-Error and Flow Control, Connection Establishment and Release- Three Way Handshake;

Overview of Application layer protocol: Overview of DNS Protocol; Overview of WWW &HTTP protocol; E-mail Protocols; Overview of File Transfer Service.

PART B(Laboratory Works)

Laboratory works are based on the syllabus of **PART A**.

BACHELOR IN COMPUTER APPLICATIONS (BCA)

Bachelor of Computer Application (BCA) Program 3rd Year

Yr	Sem	Course Code	Course Title	Credits	Type
III	V	CA3501C	Object Oriented Programming	4(2+2)	Major-9
		CA3502C	Software Engineering	4(2+2)	Major-10
		CA3503C	Minor Project & Technical Writing	4(0+4)	Major-11
		CA30XXE	Departmental Optional Paper-I	4(4+0)	Major-12
			Minor/Elective-V	4	Minor/Elective-5
			Qualifying Prescribed Course-III	2	Ability Enhancement Courses (language)
		Total Credits of Semester V		**22**	
	VI	CA3601C	Computer Graphics	4(2+2)	Major-13
		CA3602C	Web Technology	4(2+2)	Major-14
		CA3603C	Major Project	4(0+4)	Major-15
		CA30XXE	Departmental Optional Paper-II	4(4+0)	Major-16
			Minor/Elective-VI	4	Minor/Elective-6
		Total Credits of Semester VI		**20**	

Departmental Optional Papers I/II (Select any two)

Course Code	Course Title	Course Code	Course Title
CA3001E	Cloud Computing	CA3005E	Distributed Computing
CA3002E	Cyber Security & Cyber Law	CA3006E	E-Commerce
CA3003E	Data Science	CA3007E	Formal Languages & Automata Theory
CA3004E	Digital Marketing	CA3008E	Internet of Things

Total Cumulative Credits after completion of 3rd Year=114+8* =122 Credits

- **64 credits Major**
- **24 Credits Minor**
- **9 Credits Interdisciplinary Course (**Prerequisite Allied/MOOC)
- **9 Credits Skill Enhancement/ Vocational**
- **8 Credits Ability Enhancement Courses (language)**
- **8* Credits Common Value Added Courses (**VAC Project/ Internship/ Survey)

Students Exiting the program after securing above Credits will be awarded <u>BACHELOR IN COMPUTER APPLICATIONS(BCA)</u>

N.B. 50% courses of minor stream must be from the relevant subject/discipline and remaining 50% from any discipline.

BACHELOR IN COMPUTER APPLICATIONS (BCA)

Object Oriented Programming	CA3501C
2- 0 - 4 : 4 Credits	Prerequisites: *None*

PART A (Theory)

UNIT – I

Object Oriented Programming: Object-Oriented programming features and benefits. Object-Oriented features of C++, Class and Objects, Data Hiding & Encapsulation, Structures, Data members and Member functions, Scope resolution operator and its significance, Static Data Members, Static member functions, Nested and Local Class, Accessing Members of Class and Structure.

UNIT – II

Constructor, Initialization using constructor, types of constructor– Default, Parameterized & Copy Constructors, Constructor overloading, Default Values to Parameters, Destructors, Console I/O: Hierarchy of Console Stream Classes, Unformatted and Formatted I/O Operations.

UNIT – III

Manipulators, Friend Function, Friend Class, Arrays, Array of Objects, Passing and Returning Objects to Functions, String Handling in C++, Dynamic Memory Management: Pointers, new and delete Operator, Array of Pointers to Objects, this Pointer, Passing Parameters to Functions by Reference & pointers.

Operators in C++, Precedence and Associativity Rules, Operator Overloading, Unary & Binary Operators Overloading, Function Overloading, Inline Functions

UNIT – IV

Inheritance: Benefit of Inheritance. Overloading and overriding. Different types of Inheritance: Single Inheritance, Multilevel Inheritance, Multiple Inheritance, Hierarchical Inheritance, Hybrid Inheritance, Virtual Base Classes, Abstract Classes. Visibility modifiers in Inheritance.

Pointer, Virtual Functions and Polymorphism

Pointers to Objects, this Pointer, Pointers to Derived Classes, Virtual Functions.

PART B (Laboratory Works)

Laboratory works based on the syllabus of **PART A**

BACHELOR IN COMPUTER APPLICATIONS (BCA)

Software Engineering	CA3502C
3- 0 - 2 : 4 Credits	Prerequisites: *None*

PART A (Theory)

UNIT I

Software and Software Engineering, Need of Software Engineering, Software Evolution, Software Evolution Laws, E-Type software evolution, Software Paradigms, Features of good software.

Software Lifecycle models: Classical and Iterative Water-fall model, Prototyping, Spiral Model, Rad model, V-model. Comparison of different lifecycle models.

UNIT II

Software Project Management: Software projects, Need of Software Project Management, Role of Software Project Manager, Software Management Activities: Project Planning, Scope Management, Project Estimation, Project Estimation Techniques: Decomposition Technique, Empirical Estimation Technique, Software project planning and Estimation Models, Project Scheduling, Risk Analysis and Management, Configuration Management, Project Management Tools: Gantt Chart, PERT Chart, Critical Path Analysis.

Software Requirements: Requirement Process: Feasibility Study, Requirement Gathering, SRS, Software Requirement Validation, Types of Software Requirements, Software System Analyst.

Software Design Basics: Software Design Levels, Modularity, Concurrency, Coupling and Cohesion

Design Modeling: Data Modeling, Functional Modeling, Behavioral Modeling.

Data Flow Diagram: Types of DFD, DFD components, Levels of DFD, Decisio Tables, Entity Relationship Model, Data Dictionary

Software Design Strategies: Function Oriented Design and Object Oriented Design, Design Approaches

UNIT III

Software Testing: Importance of Testing, Validation and Verification, Testing Approaches: Black Box and White Box Testing, Levels of Testing: Unit Testing, Integration Testing, System Testing, Acceptance Testing, Regression Testing. Test-Cases, Testing

UNIT IV

Software Maintenance: Need of maintenance. Types of Software maintenance.

Software Re-Engineering: Source Code Translation, Program Restructuring, Data Re-Engineering, Reverse Engineering.

PART B (Laboratory Works)

Laboratory works of Software Development using Python.

BACHELOR IN COMPUTER APPLICATIONS (BCA)

Computer Graphics	**CA3601C**
3- 0 - 2 : 4 Credits	Prerequisites: *None*

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PART A (Theory)

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UNIT I

Computer-Aided Design, Presentation Graphics, Computer Art, Visualization.

Video Display Devices, Color CRT Monitors, Three-Dimensional Viewing Devices, Stereoscopic and Virtual-Reality Systems, Raster-Scan Systems, Video Controller, Raster-Scan Display Processor, Random-Scan Systems, Graphics Monitors and Workstations, Input Devices, Hard-Copy Devices, Graphics Software.

UNIT II

Points and Lines, Line Function, Circle-Generating Algorithms, Filled-Area Primitives, Fill-Area

Functions, Cell Array.

UNIT III

Line Attributes, Curve Attributes, Area-Fill Attributes, Character Attributes, Bundled Attributes,

Antialiasing, Pixel Phasing.

UNIT IV

Basic Transformations: Translation, Rotation, Scaling. Other Transformations: Reflection, Shear.

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PART B (Laboratory Works)

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Laboratory works based on the syllabus of **PART A**.

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BACHELOR IN COMPUTER APPLICATIONS (BCA)

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Web Technology	CA3602C
3- 0 - 2 : 4 Credits	Prerequisites: *None*

PART A (Theory)

UNIT I

The internet: history of the world wide web, hardware and software trend, Client/Server Computing: Middleware, Fat client VS Fat Servers, N-tiered Software Architecture and Web Browser: Browser Architecture.

UNIT II

Introduction of HTML: introduction, markup language, editing HTML: common tags, headers, text styles, linking, images, formatting text, horizontal rules and more line breaks, lists,:ordered and unordered lists, nested lists, basic HTML tables : intermediate HTML tables and formatting : basic HTML forms, more complex HTML forms, internal linking, creating and using image maps.

UNIT III

Java script – introduction to scripting: introduction- memory concepts- arithmetic- decision making. Java script control structures, Java script functions: introduction – program modules in java script - function definitions, duration of identifiers, scope rules, recursion, java script global functions. Java script arrays: introduction, array-declaring and allocating arrays, references and reference parameters – passing arrays to functions, multiple subscripted arrays. Java script objects: introduction, math, string, data, Boolean and number objects.

UNIT IV

Dynamic HTML : CSS : introduction – inline styles, creating style sheets with the style element, conflicting styles, linking external style sheets, positioning elements, backgrounds, element dimensions, text flow and the box model, user style sheets. Dynamic HTML: object model and collections: introduction, object referencing, collections all and children, dynamic style, dynamic positioning, using the frames collection, navigator object. Dynamic HTML: event model : introduction, event ON CLICK, event ON LOAD – error handling with ON ERROR, tracking the mouse with event.

PART B (Laboratory Works)

Laboratory works based on the syllabus of **PART A**.

Departmental Optional Papers I/II (Select any two)

Course Code	Course Title
CA3001E	Cloud Computing
CA3002E	Cyber Security & Cyber Law
CA3003E	Data Science
CA3004E	Digital Marketing
CA3005E	Distributed Computing
CA3006E	E-Commerce
CA3007E	Formal Languages & Automata Theory
CA3008E	Internet of Things

Cloud Computing	CA3001E
4- 0 - 0 : 4 Credits	Prerequisites: *None*

UNIT I: Introduction to Cloud Computing

Evolution of cloud, Essentials, Cloud Computing definition, Benefits and Challenges, Limitations, Usage and Applications, Business Models around Cloud Computing, Characteristics, Cloud Adoption, Cloud models: Introduction, Collaboration to cloud, Cloud Models, Cloud Applications and Architecture, Cloud Computing Architecture, Cloud Infrastructure Models, Cloud Infrastructure Self Service, Scaling a cloud infrastructure

UNIT II: Cloud Service

Introduction to Services, Storage as a Service, Database as a Service, Information as Service, Process as a Service, Application as a Service, Management/Governance as Service, Platform as a Service, Security as a Service, Testing as Service, Integration as Service, Infrastructure as Service

UNIT III: Software and Service

Introduction, Mobile Device Integration, Providers, Microsoft Online Intuit Quick base Cast Iron Cloud, Bungee Connect, Introduction to Map Reduce, Google File System, Hadoop framework, Hadoop Distributed File System

UNIT IV: Virtualization for Cloud

Introduction, Pros and Cons of Virtualization, Virtualization Architecture, Virtualization Machine, Virtualization in Clusters/Grid Context, Virtual Network, Types of Virtualization, Virtual Machine Monitor, Virtual Desktop Infrastructure

UNIT V: Visualization for Cloud

Cloud Computing: Introduction, Types of clouds, Cloud Comparing Approaches, Aneka Integration of private and public cloud, Aneka Cloud Platform, Introduction, Resource Provisioning Service, Aneka Hybrid Cloud Implementation, Comet Cloud Architecture, Autonomic Behaviour, Comet Cloud

BACHELOR IN COMPUTER APPLICATIONS (BCA)

Cyber Security and Cyber Law	CA3002E
4- 0 - 0 : 4 Credits	Prerequisites: *None*

UNIT I: Introduction to Cyber Security

History of Internet, Cyber Crime, Information Security, Computer Ethics and Security Policies, Guidelines to choose web browsers, Securing web browser,Antivirus,Email security.

UNIT II: Guidelines for social media and different security

Guidelines for social media security , Tips and best practices for safer Social Networking , Basic Security for Windows, User Account Password, Guidelines for setting up a Secure password , Two-steps authentication , Password Manager, Wi-Fi Security.

UNIT III:Smartphone security and Cyber Security Initiatives in India

Introduction to mobile phones, Smartphone Security, Android Security, IOS Security, Counter Cyber Security Initiatives in India, Cyber Security Exercise, Cyber Security Incident Handling ,Cyber Security Assurance.

UNIT IV: Online Banking, Credit Card and UPI , Micro ATM, e-wallet and POS Security

Online Banking Security, Mobile Banking Security,Security of Debit and Credit Card, UPI Security, Security of Micro ATMs, e-wallet Security Guidelines, Security Guidelines for Point of Sales(POS)

UNIT V: Social Engineering and Cyber Security Threat Landscape and Techniques

Social Engineering, Types of Social Engineering, How Cyber Criminal Works, How to prevent for being a victim of Cyber Crime, Cyber Security Threat Landscape, Emerging Cyber Security Threats , Cyber Security Techniques. Firewall.

UNIT VI : IT Security Act and Misc. Topics

IT Act, Hackers-Attacker-Countermeasures, Web Application Security, Digital Infrastructure Security, Defensive Programming.

Data Science	CA3003E
4- 0 - 0: 4 Credits	Prerequisites: *None*

UNIT I

Introduction Motivation, Importance, Definitions, Kind of Data, Data Mining Functionalities, Kinds of Patterns, Classification of Data Mining Systems, Data Mining Task Primitives, Integration of a Data Mining System with A Database or Data Warehouse System, Major Issues in Data Mining, Types of Data Sets and Attribute Values, PREPROCESSING: Data Quality, Major Tasks in Data Pre-processing, Data Reduction, Data Transformation and Data Discretization, Data Cleaning and Data Integration

UNIT II

Data Warehousing and on-line Analytical Processing Data Warehouse basic concepts, Data Warehouse Modeling - Data Cube and OLAP, Data Warehouse Design and Usage, Data Warehouse Implementation, Data Generalization by Attribute-Oriented Induction, Data Cube Computation

BACHELOR IN COMPUTER APPLICATIONS (BCA)

UNIT III

Patterns, Associations and Correlations Mining Frequent Patterns, Associations and Correlations: Basic Concepts, Efficient and Scalable Frequent Itemset, Mining Methods, Pattern Evaluation Methods, Applications of frequent pattern and associations, Frequent Patterns and Association Mining: A Road Map, Mining Various Kinds of Association Rules, Constraint-Based Frequent Pattern Mining, Extended Applications of Frequent Patterns

UNIT IV

Classification Basic Concepts, Decision Tree Induction, Bayesian Classification Methods, Rule-Based Classification, Model Evaluation and Selection, Techniques to Improve Classification Accuracy: Ensemble Methods, Handling Different Kinds of Cases in Classification, Classification by Neural Networks, Support Vector Machines, Pattern-Based Classification, Lazy Learners (or Learning from Your Neighbors)

UNIT V

Cluster Analysis Basic Concepts of Cluster Analysis, Clustering Structures, Major Clustering Approaches, Partitioning Methods, Hierarchical Methods, Density-Based Methods, Model-Based Clustering, Why outlier analysis, Identifying and handling of outliers, Outlier Detection Techniques, WEB MINING: Basic concepts of web mining, different types of web mining, PAGE RANK Algorithm, HITS Algorithm

Digital Marketing	CA3004E
4- 0 - 0 : 4 Credits	Prerequisites: *None*

UNIT I

Introduction to Digital Marketing and its Significance, Traditional Marketing Vs Digital Marketing, Digital Marketing Process, Website Planning and Developmen: Types of websites, Understanding Domain and Webhosting, Building Website/Blog using CMS WordPress, Using WordPress Plug-ins

UNIT II

Introduction to Search Engine Optimization, Keyword, P lanner Tools, On Page SEO Techniques- Indexing and Key Word Placement, Content Optimization, On Page SEO : Yoast SEO Plug-in, Off –Page SEO Techniques, Email Marketing- Introduction and Significance, Designing e-mail marketing campaigns using Mail Chimp, Building E-mail List and Signup Forms, Email Marketing Strategy and Monitoring, Email –Automization.

UNIT III

Pay Per Click Advertising: Introduction, Pay Per Click Advertising: Google Adword, Type s of Bidding strategies, Designing and Monitoring search campaigns, Designin g and Monitoring Display campaigns, Designing and Monitoring Video campaigns, Designing and Monitoring Universal App Campaigns, Google Analytics: Introduction and Significance, Google Analytics Interface and Setup, Understanding Goals and Conversions, Monitoring Traffic Behavior and preparing Reports, Social Media Marketing : Introduction and Significance, Facebook Marketing: Introduction Types of Various Ad Formats

UNIT IV

Setting up Facebook Advertising Account, Understanding Facebook Audience and its Types, Designing Facebook Advertising Campaigns, Working with Facebook Pixel, Twitter Marketing: Basics, Twitter Marketing: Basics, Introduction to LinkedIn Marketing, Developing digital marketing strategy in Integration form.

BACHELOR IN COMPUTER APPLICATIONS (BCA)

Distributed Computing	CA3005E
4- 0 - 0 : 4 Credits	Prerequisites: *None*

UNIT I

Characterization of Distributed Systems: Introduction, Examples of Distributed systems, Resource sharing and web, challenges.

System Models: Introduction, Architectural and Fundamental models

UNIT II

Time and Global States: Introduction, Clocks, Events and Process states, Synchronizing physical clocks, Logical time and Logical clocks, Global states, Distributed Debugging

Coordination and Agreement: Introduction, Distributed mutual exclusion, Elections, Multicast Communication, Consensus and Related problems

UNIT III

Inter Process Communication: Introduction, The API for the internet protocols, External Data Representation and Marshalling, Client-Server Communication, Group Communication, Case Study: IPC in UNIX.

Distributed Objects and Remote Invocation: Introduction, Communication between Distributed Objects, Remote Procedure Call, Events and Notifications, Case study-Java RMI

UNIT IV

Distributed File Systems: Introduction, File service Architecture, Case Study1: Sun Network File System, Case Study 2: The Andrew File System

Name Services: Introduction, Name Services and the Domain Name System, Directory Services, Case study of the Global Name Service

Distributed Shared Memory: Introduction Design and Implementation issues, Sequential consistency and Ivy case study, Release consistency and Munin case study, other consistency models

UNIT V

Transactions and Concurrency Control: Introduction, Transactions, Nested Transactions, Locks, Optimistic concurrency control, Timestamp ordering, Comparison of methods for concurrency control

Distributed Transactions: Introduction, Flat and Nested Distributed Transactions, Atomic commit protocols, Concurrency control in distributed transactions, Distributed deadlocks, Transaction recovery.

E-Commerce	CA3006E
4- 0 - 0 : 4 Credits	Prerequisites: *None*

UNIT-I

Electronic Commerce: Overview, Definitions, Advantages & Disadvantages of E–Commerce, Threats of E–Commerce, Managerial Prospective, Rules & Regulations For Controlling E–Commerce, Cyber Laws.

BACHELOR IN COMPUTER APPLICATIONS (BCA)

UNIT-II

Technologies: Relationship Between E–Commerce & Networking, Different Types of Networking For E–Commerce, Internet, Intranet & Extranet, EDI Systems Wireless Application Protocol: Definition, Hand Held Devices, Mobility & Commerce, Mobile Computing, Wireless Web, Web Security, Infrastructure Requirement For E–Commerce.

UNIT-III

Business Models of e–commerce: Model-Based On Transaction Type, Model Based On Transaction Party - B2B, B2C, C2B, C2C, E–Governance.

UNIT-IV

Content Management: Definition of content, Authoring Tools & Content Management, Content – partnership, repositories, convergence, providers, Web Traffic &Traffic Management; Content Marketing.

UNIT-V

Call Center: Definition, Need, Tasks Handled, Mode of Operation, Equipment, Strength & Weaknesses of Call Center, Customer Premises Equipment (CPE).

UNIT-VI

E – Payment Mechanism: Payment through a card system, E – Cheque, E–Cash, E – Payment Threats & Protections.

UNIT-VII

Electronic Data Interchange (EDI): Meaning, Benefits, Concepts, Application, EDI Model, Protocols (UN EDI FACT Data Encryption (DES / RSA).

UNIT-VIII

Risk of E–Commerce: Overview, Security for E–Commerce, Security Standards, Firewall, Cryptography, Key Management, Password Systems, Digital certificates, Digital signatures.

Formal Languages & Automata Theory	CA3007E
4- 0 - 0 : 4 Credits	Prerequisites: *None*

UNIT-I

Mathematical Preliminaries : Sets, Relations and Functions (Brief Discussion), Graphs, Trees,Strings and their properties: Definition, operation on strings, palindrome, prefix & suffix of a string, Levi theorem (Statement only), Terminal & Non-terminal symbols. The Theory of Automata.

UNIT-II

Definition of an Automaton: Definition of finite Automaton, Block diagram of finite Automaton, Transition system, Properties of Transition Functions, Acceptability of a Page 26 of 46 string by Finite Automaton. Definition of DFA and NDFA, The equivalence of DFA and NDFA. Mealy and Moore machine.

UNIT-III

Formal Language: Concept of a language**,** Definition of a grammar, Language generated by a grammar (definition with application). Chomsky classification of languages (definition), Relation between the classified languages. Recursive and recursively enumerable set (definitions).

BACHELOR IN COMPUTER APPLICATIONS (BCA)

UNIT-IV

Regular Sets & Regular Grammar: Definition of Regular expression and regular set, Identities of regular expressions Relation between regular expression and finite automata, Transition system containing /\- moves (application), Conversion of Non-deterministic systems to deterministic system (application), Construction of finite automata equivalent to a regular expression (with application).

UNIT-V

Context-Free LANGUAGES & Pushdown Automata: Introduction – Definition – Derivation trees (Definitions & application) – Ambiguity in CFG, Basic definition of PDA .

Internet of Things	CA3008E
4- 0 - 0 : 4 Credits	Prerequisites: *None*

UNIT I

Introduction to IOT, Sensing,Actuation, Basics of IoT Networking, Communication Protocols,Sensor networks, Machine-to-Machine Communications.

UNIT II

Interoperability in IoT,Introduction to Arduino programming. Integration of Sensors/Actuators to Arduino.

UNIT III

Introduction to Python programming, Introduction to Raspberry Pi,Implementation of IoT with Raspberry Pi, Introduction to SDN, SDN for IoT, Data Handling and Analytics.

UNIT IV

Cloud Computing, Sensor-Cloud, Fog Computing, Smart Cities and Smart Homes, Connected Vehicles, Smart Grid, Industrial IoT, Case Study: Agriculture, Healthcare, Activity Monitoring, Understand the ethical issues in IoT (K3), Analyze the implementational environment and identify probable ethical solution to address any issue. (K4).

Bachelor of Computer Application (BCA) Program 4ᵗʰ Year

Yr	Sem	Course Code	Course Title	Credits	Type
IV	VII	CA4701C	Introduction to AI & Machine Learning	4(2+2)	Major-17
		CA4702C	Discrete Mathematical Science	4(4+0)	Major-18
		CA4703C	Research Project/Dissertation Phase-I	4(0+4)	Major-19
		CA40XXE	Departmental Optional Paper-III	4(4+0)	Major-20
			Minor/Elective-VII	4	Minor/Elective-7
		Total Credits of Semester VII		**20**	
	VIII	CA4801C	Software Project Management	4(2+2)	Major-21
		CA4802C	Research Project Phase-II	4(0+4)	Major-22
		CA4803C	Dissertation & Presentation	4(0+4)	Major-23
		CA40XXE	Departmental Optional Paper-IV	4(4+0)	Major-24
			Minor/Elective-VIII	4	Minor/Elective-8
		Total Credits of Semester VIII		**20**	

Departmental Optional Papers III/IV (Select any two)

Course Code	Course Title	Course Code	Course Title
CA4001E	Adhoc & Sensor Network	CA4005E	Information & System Security
CA4002E	Advanced DBMS	CA4006E	Numerical Methods
CA4003E	Deep Learning	CA4007E	Mobile Computing
CA4004E	Digital Signal Processing	CA4008E	Soft Computing

Total Cumulative Credits after completion of 4ᵗʰ Year=154+8* =162 Credits

- **96 credits Major**
- **32 Credits Minor**
- **9 Credits Interdisciplinary Course (**Prerequisite Allied/MOOC)
- **9 Credits Skill Enhancement/ Vocational**
- **8 Credits Ability Enhancement Courses (language)**
- **8* Credits Common Value-Added Courses (**VAC Project/ Internship/ Survey)

Students Exiting the program after securing above Credits will be awarded <u>BACHELOR IN COMPUTER APPLICATIONS (BCA) WITH RESEARCH</u>

N.B. 50% courses of minor stream must be from the relevant subject/discipline and remaining 50% from any discipline.

BACHELOR IN COMPUTER APPLICATIONS (BCA)

Introduction to AI & Machine Learning	CA4701C
4- 0 - 0 : 4 Credits	Prerequisites: *Probablity*

UNIT I

Introduction: Philosophy of AI, Definitions, Probability Theory, Linear Algebra, Convex Optimization Introduction to Statistical Decision Theory - Regression, Classification, Bias Variance, Linear Regression, Multivariate Regression, Subset Selection, Shrinkage Methods, Principal Component Regression, Partial Least squares Linear Classification, Logistic Regression, Linear Discriminant Analysis

UNIT II

Perceptron, Support Vector Machines, Neural Networks - Introduction, Early Models, Perceptron Learning, Backpropagation, Initialization, Training & Validation, Parameter Estimation - MLE, MAP, Bayesian Estimation, Decision Trees, Regression Trees, Stopping Criterion & Pruning loss functions, Categorical Attributes, Multiway Splits, Missing Values, Decision Trees - Instability Evaluation Measures, Bootstrapping & Cross Validation, Class Evaluation Measures, ROC curve, MDL, Ensemble Methods - Bagging, Committee Machines and Stacking, Boosting

UNIT III

Gradient Boosting, Random Forests, Multi-class Classification, Naive Bayes, Bayesian Networks, Undirected Graphical Models, HMM, Variable Elimination, Belief Propagation, Partitional Clustering, Hierarchical Clustering, Birch Algorithm, CURE Algorithm, Density-based Clustering, Gaussian Mixture Models, Expectation Maximization, Learning Theory,

UNIT IV

Modeling a Problem as Search Problem, Uninformed Search, Heuristic Search, Domain Relaxations, Local Search, Genetic Algorithms, Adversarial Search, Constraint Satisfaction, Propositional Logic & Satisfiability, Uncertainty in AI, Bayesian Networks

UNIT V

Bayesian Networks Learning & Inference, Decision Theory, Markov Decision Processes, Introduction to Reinforcement Learning, Optional videos (RL framework, TD learning, Solution Methods, Applications), Introduction to Deep Learning & Deep RL

Discrete Mathematical Science	CA4702C
4- 0 - 0 : 4 Credits	Prerequisites: *None*

UNIT I

Sets, Proof Templates, and Induction, Describing Sets Mathematically , Set Membership , Equality of Sets, Finite and Infinite Sets , Relations Between Sets , Venn Diagrams , Operations on Sets , Union and Intersection , Set Difference, Complements, and DeMorgan's Laws , Power Sets and Products , Lattices and Boolean Algebras ,The Principle of Inclusion-Exclusion , Finite Cardinality , Principle of Inclusion-Exclusion for Two Sets , Three Sets ,Finitely Many Sets , Mathematical Induction, Algorithm to Generate Perfect Squares Two Algorithms for Computing Square Roots Strong Form of Mathematical Induction

UNIT II

Formal Logic, Introduction to Propositional Logic , Expression Trees for Formulas , Abbreviated Notation for Formulas , Using Gates to Represent Formulas , Truth and Logical Truth , Tautologies , Substitutions into Tautologies , Logically Valid Inferences , Combinatorial Networks ,Substituting Equivalent Subformulas , Simplifying Negations , Normal Forms , Disjunctive Normal Form, Application: DNF and Combinatorial Networks , Conjunctive Normal Form , CNF and Combinatorial Networks ,Testing Satisfiability and Validity , Predicates and Quantification , Restricted Quantification , Nested Quantifiers , Negation and , Quantification with Conjunction and Disjunction

UNIT III

Relations: Binary Relations, n-ary Relations , Operations on Binary Relations , Inverses , Composition ,Special Types of Relations , Reflexive and Irreflexive Relations , Symmetric and Antisymmetric Relations , Transitive Relations , Reflexive, Symmetric, and Transitive Closures , Equivalence Relations , Partitions , Comparing Equivalence Relations , Ordering Relations. Functions , Operations on Functions , Sequences and Subsequences , The Pigeon-Hole Principle , Countable and Uncountable Sets, Analysis of Algorithms , Complexity of Programs ,Uncomputability

UNIT IV

Graph Theory: Introduction to Graph , The Handshaking Problem , Paths and Cycles ,Graph Isomorphism , Representation of Graphs , Connected Graphs ,The Konigsberg Bridge Problem ,Trees ,Spanning Trees , Rooted Trees , Directed Graphs , Finding a Cycle in a Directed Graph ,Priority in Scheduling , Connectivity in Directed Graphs , Eulerian Circuits in Directed Graphs

BACHELOR IN COMPUTER APPLICATIONS (BCA)

Software Project Management	CA4801C
4- 0 - 0 : 4 Credits	Prerequisites: *None*

UNIT I

Defining of Software Development Process - Process - Tailoring the Process - Improving the process discipline - Need for implementing discipline. Software Production Process - Identify the Software Model - Software Process Models : Waterfall Model, Prototyping Model, RAD Model, Incremental Model, Spiral Model, Component Assembly Model - Software Life Cycle.

UNIT II

Software Development Team - Three Vital Aspects of Software Project Management - The Team - Meaning of Leadership - Communicating in Harmony - Personality traits - Project Organizations. Project Planning: Top-Down and Bottom-Up Planning - Types of Activity - Project Duration : Schedule Monitoring Tools - Gantt Chart, PERT Chart, Critical Path.

UNIT III

Tracking Meetings - Recovery plans - Schedule Work & Escalation Meetings. Project Engineering: Product Requirements - Understanding the Customer Problem to solve - Initial Investigation, Strategies for determining information requirements, Information gathering Tools - Product Objectives.

UNIT IV

Product Specifications - Defining the Final Product - Data Flow Diagram, Data Dictionary, Structured English, Decision Trees, Decision Tables - Feasibility Study. Software Testing : Test Plan - Development Testing : Verification and Validation - General Testing Methods : White Box and Black Box Testing - Unit Testing - System Integration Testing - Validation Testing - System testing.

UNIT IV

Software Quality - Quality Measures - FURPS - Software Quality Assurance - Software Reviews - Format Technical Review (FTR) Formal Approaches to SQA - Software Reliability - Introduction to SQA - The Software Quality Assurance Plan - Formal approaches to SQA - Clean room Methodology.

Departmental Optional Papers III/IV (Select any two)

Course Code	Course Title
CA4001E	Adhoc & Sensor Network
CA4002E	Advanced DBMS
CA4003E	Deep Learning
CA4004E	Digital Signal Processing
CA4005E	Information & System Security
CA4006E	Numerical Methods
CA4007E	Mobile Computing
CA4008E	Soft Computing

Adhoc & Sensor Network	CA4001E
4- 0 - 0 : 4 Credits	Prerequisites: *None*

UNIT I

Defining of

BACHELOR IN COMPUTER APPLICATIONS (BCA)

Adhoc & Sensor Network	CA4001E
4- 0 - 0 : 4 Credits	Prerequisites: *None*

UNIT I

Defining of

Adhoc & Sensor Network	CA4001E
4- 0 - 0 : 4 Credits	Prerequisites: *None*

UNIT I

Defining of

Adhoc & Sensor Network	CA4001E
4- 0 - 0 : 4 Credits	Prerequisites: *None*

UNIT I

Defining of

Adhoc & Sensor Network	CA4001E
4- 0 - 0 : 4 Credits	Prerequisites: *None*

UNIT I

Defining of