



**Progressive Education Society's  
Modern College Of Arts, Science & Commerce (Autonomous)  
Ganeshkhind, Pune – 411016**

**Three Year Degree Program in B.C.A.(Science)  
(Faculty of Science & Technology)**

**F.Y.B.C.A. (Science)**

**Choice Based Credit System Syllabus  
To be implemented from Academic Year 2022-2023**

**Title of the Course:** Bachelor of Computer Applications (Science)

### **Preamble of the syllabus**

The B.C.A. (Science) program is a combination of computer and applied courses from science stream. The computer related courses introduce techniques of programming, databases, web designing, system analysis, design tools and different computing environments. The applied courses include mathematics, statistics and electronics that provide theoretical and practical foundation for the learner.

### **Objectives:**

- To produce knowledgeable and skilled human resources that is employable in IT and ITeS.
- To impart knowledge required for planning, designing and building Complex Application Software Systems as well as to provide support for automated systems or applications.
- It helps students analyse the requirements for system development and exposes students to business software and information systems.
- This course provides students with options to specialize in legacy application software, system software or mobile applications.
- To produce entrepreneurs

### **Introduction**

The Program is of Three Years duration with six semesters. It is a Full Time Degree Program. The program will be based on Choice-based credit system comprising 132+8 (140) credit points.

### **Eligibility for Admission:**

Any candidate who has passed the XII standard Examination in Science stream from, Maharashtra State Board of Secondary and Higher Secondary Education or equivalent Board of Examination, is eligible for admission to the First Year of this program.

OR

Passed Three Year Diploma Course approved by the DTE, Maharashtra State or Equivalent authority.

### **Lateral Entry to SYBCA**

Any candidate who has passed three Year Diploma course in Computer Engineering/ Technology/ Information Technology/ Electronics Communication/ Electronics Telecommunications/ Electronics approved by the DTE, Maharashtra State or Equivalent authority is eligible for admission to direct second year (SYBCA) of this program.

Semester -I F.Y. B.C.A (Science)						
Course Code	Course Title	Credits		Evaluation		
		T	P	CIA	CE	Total
22-BCA-111	Fundamentals Of Computers	4	-	30	70	100
22- BCA-112	Problem Solving And C Programming	4	-	30	70	100
22- BCA -113	Basics Of Web Designing	4	-	30	70	100
22- BCA -114	Applied Mathematics	4	-	30	70	100
22- BCA -115	Fundamentals Of Computers Laboratory	-	1.5	15	35	50
22- BCA -116	Programming In C Laboratory	-	1.5	15	35	50
22- BCA -117	Basics Of Web Designing Laboratory	-	1.5	15	35	50
22- BCA -118	Applied Mathematics Laboratory	-	1.5	15	35	50
<b>Total</b>		<b>16</b>	<b>6</b>	<b>180</b>	<b>420</b>	<b>600</b>

**Total Credits: [16(TH) + 6 (PR)] = 22**

**TH:** Theory **PR:** Practical **CIA:** Continuous Internal Assessment **CSE:** College Semester Examination

\*Theory sessions each of 5 hours duration to be conducted for every subject per week

\*Laboratory sessions each of 3 hours duration to be conducted for each batch of 20 students in each week.

Semester -II F.Y. B.C.A (Science)						
Course Code	Course Title	Credits		Evaluation		
		T	P	CIA	CE	Total
22-BCA-121	Computer Organization	4	-	30	70	100
22-BCA-122	Advanced C Programming	4	-	30	70	100
22-BCA-123	Software Engineering	4	-	30	70	100
22-BCA-124	Database Management Systems –I	4	-	30	70	100
22-BCA-125	Computer Organization Laboratory	-	1.5	15	35	50
22-BCA-126	Advance C Programing Laboratory	-	1.5	15	35	50
22-BCA-127	Software Engineering Documentation Laboratory	-	1.5	15	35	50
22-BCA-128	Database Management Systems -I Laboratory	-	1.5	15	35	50
<b>Total</b>		<b>16</b>	<b>6</b>	<b>180</b>	<b>420</b>	<b>600</b>

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Semester -III S.Y. B.C.A (Science)						
Course Code	Course Title	Credits		Evaluation		
		T	P	CIA	CE	Total
23-BCA-231	Data Structures	4	-	30	70	100
23-BCA-232	Database Management Systems – II	4	-	30	70	100
23-BCA-233	Web Technology using PHP	4	-	30	70	100
23-BCA-234	Data Structures Laboratory	-	2	15	35	50
23-BCA-235	Database Management Systems - II Laboratory	-	2	15	35	50
23-BCA-236	Web Technology using PHP Laboratory	-	2	15	35	50
	Environmental Science I	2	-	15	35	50
	Language –I	2	-	15	35	50
<b>Total</b>		<b>16</b>	<b>6</b>	<b>165</b>	<b>385</b>	<b>550</b>

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Semester -IV S.Y. B.C.A (Science)						
Course Code	Course Title	Credits		Evaluation		
		T	P	CIA	CE	Total
23-BCA-241	Core Java	4	-	30	70	100
23-BCA-242	Object Oriented Programming in PHP	4	-	30	70	100
23-BCA-243	Object Oriented Software Engineering	4	-	30	70	100
23-BCA-244	Core Java Laboratory	-	2	15	35	50
23BCA-245	Object Oriented Programming in PHP Laboratory	-	2	15	35	50
23-BCA-246	Python Programming Laboratory	-	2	15	35	50
	Environmental Science Awareness Course -II	2	-	15	35	50
	Language –II	2	-	15	35	50
<b>Total</b>		<b>16</b>	<b>6</b>	<b>165</b>	<b>385</b>	<b>550</b>

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Semester -V T.Y. B.C.A (Science)						
Course Code	Course Title	Credits		Evaluation		
		T	P	CIA	CE	Total
24-BCA-351	Advanced Java	4	-	30	70	100
24-BCA-352	Data Science	4	-	30	70	100
24-BCA-353	Principles of Operating Systems	4	-	30	70	100
24-BCA-354	Artificial Intelligence	2	-	15	35	50
24-BCA-355	Computer Network	2	-	15	35	50
24-BCA-356	Advanced Java Laboratory	-	2	15	35	50
24-BCA-357	Data Science Laboratory	-	2	15	35	50
24-BCA-358	Operating Systems Laboratory	-	2	15	35	50
<b>Total</b>		<b>16</b>	<b>6</b>	<b>165</b>	<b>385</b>	<b>550</b>

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Semester -VI T.Y. B.C.A (Science)						
Course Code	Course Title	Credits		Evaluation		
		T	P	CIA	CE	Total
24-BCA-361	Android Programming	4	-	30	70	100
24-BCA-362	Data Mining	4	-	30	70	100
24-BCA-363	Internet of Things (IoT)	4	-	30	70	100
24-BCA-364	Blockchain Technology	2	-	15	35	50
24-BCA-365	Cloud Computing	2	-	15	35	50
24-BCA-366	Android Programming Laboratory	-	2	15	35	50
24-BCA-367	IoT & Blockchain Technology Laboratory	-	2	15	35	50
24-BCA-367	Project Laboratory	-	2	15	35	50
<b>Total</b>		<b>16</b>	<b>6</b>	<b>165</b>	<b>385</b>	<b>550</b>

**Total Credits: [16(TH) + 6 (PR)] = 22**

**TH:** Theory **PR:** Practical **CIA:** Continuous Internal Assessment **CSE:** College Semester Examination



**F.Y.B.C.A (Science)****SEMESTER I****Subject Code: 22-BCA-111****Subject Name: Fundamentals of Computers****Course Objectives**

- To study the basics of Computer System
- To learn how to configure computer devices
- To Learn Basic Commands of Operating system and application software
- To understand Open Source Software

**Course Outcomes**

At the end of the course, students will be able to

- Define working of computers and peripherals, types of software and languages
- Troubleshoot the computer systems and use utility software
- Choose commands and features of operating systems and application software
- Use open source software

**Course Contents****Unit I Introduction to Computer System****08 Hrs**

1. Introduction– Characteristics of Computers, Basic structure and operation of a computer, functional units and their interaction,
2. Types of computers and features- Mini Computers, Micro Computers, Mainframe Computers, Super Computers, Laptops and Tablets,
3. Types of Programming Languages- Machine Languages, Assembly Languages, Highlevel Languages Translators- Assembler, Compiler,
4. interpreter Data Organization- Drives, Directories and Files Number Systems-Introduction to Binary, Octal, Hexadecimal system, Conversion, Addition, Subtraction, Multiplication, Division

**Unit II Computer Peripherals****08 Hrs**

1. Primary storage devices – RAM, ROM, PROM, EPROM
2. Secondary Storage Devices – HDD, CD, DVD, Pen drive
3. I/O Devices - Keyboards, Scanners, Digitizers, Plotters, LCD, Plasma Display,

4. Pointing Devices – Mouse, Joystick, Touch Screens
5. Introduction to Network devices – Hubs, Switches, Routers, NAS, MODEM, Access Points

**Unit III Computer Software****08 Hrs**

1. Types of software: System Software, Application Software. System Software: Operating System.
2. Types of O.S., Basic Commands in Linux – ls, pwd
3. Introduction to GUI: Desktop Icons, File and Directory structure, Menu Items, Control Panel, File and Directory Search
4. Utility programs: Anti-plagiarism software, Anti-virus, Disk Cleaning, Defragmentation, Compression/Decompression of files.
5. Application software: Examples of commercial software with brief introduction

**Unit IV Editors, Word Processors, Spreadsheets & Presentation Tools 08 Hrs**

1. Editors and Word Processors: Features and functionalities, examples of basic and advanced editors like notepad, vi and Emacs, Introduction to desktop publishing –
2. Features and functionalities Spreadsheets: Features and functionalities, Spreadsheet Applications
3. Introduction to Google Apps: Google Docs, Sheets and Forms and its applications
4. Presentation Tools : Design Slides (using Text, images, charts, clipart), Slide Animation, Template and theme creation

**Unit V Open Source Software****08 Hrs**

- 1 Introduction: Open Source, Free Software, Free Software vs. Open Source software, Public Domain Software, Open Source Development Model and Licenses,
- 2 Open Source Operating Systems: GNU/Linux, Free BSD, Open Solaris. Technologies, Development tools, IDEs (Visual Studio and Eclipse)
- 3 Basics of Google Applications: Google Docs, Google Sheets, Google Forms

**Unit VI Microsoft Office****08 Hrs**

1. MS - Word Basics
  - a. Creating text documents.
  - b. Editing and Formatting the existing documents.
  - c. Making a text document interactive with different features and tools.
  - d. Graphical documents, comprising images.
  - e. Used by Authors and Researchers.
  - f. Detect grammatical errors in a text document.
2. MS - PowerPoint Basics
  - a. Presentation, Slides, Notes, Handout
  - b. Colors, Photographs and other images, tables, charts, sound & video
3. MS- Spreadsheet basics
  - a. Creating, editing, saving and printing, spreadsheets,
  - b. Working with functions & formulas, Modifying worksheets with color & auto, formats
  - c. Graphically representing data, Charts, Graphs
  - d. Speeding data entry using Data Forms, Analyzing data, Data Menu, Subtotal, Filtering Data, Formatting worksheets, Securing and Protecting spreadsheets

**Reference Books:**

1. P.K. Sinha & Priti Sinha, "Computer Fundamentals", 3rd Edition, BPB Pub.
2. John Walkenbach, Michael Alexander and Richard Kusleika, "Excel 2019 Bible", Wiley Publication
3. Steven Roman, "Writing Excel Macros with VBA", O'reilly Publication.
4. Sumitabha Das, "Unix Concepts and Applications", Tata McGraw Hill Education
5. Join Josh, "PC/HARDWARE", O'Reilly Publication

**F.Y.B.C.A (Science)****SEMESTER I****Subject Code: 22-BCA-112****Subject Name: Problem Solving and C Programming****Course Objectives:**

- To provide a broad overview of problem solving techniques
- To learn C programming to solve problems

**Course Outcomes:**

At the end of the course, students will be able to

- Define algorithms and explain their characteristics
- Formulate algorithm and draw flowchart to solve a given problem
- Explain use of appropriate data types, control statements
- Demonstrate ability to use top-down program design

**Course Contents****Unit-I Problem solving, algorithms and flowcharts****08 Hrs**

1. Types of Problems, Problem solving using computer, Difficulties with problem solving, Problem solving aspects.
2. Definition & Characteristics of algorithm, Examples of algorithms, Flow charts with examples, Top-down design
3. Problem solving using Arithmetic Statements, Conditional Statement & Iterative Statements

**Unit-II C Fundamentals****08 Hrs**

1. Introduction to C, Features of C, Structure of C Program, C Character Set, Identifiers and Keywords, Variables and constants
2. Data types- Basic data types, Enumerated types, Type casting, Declarations, Expressions
3. Operators and Expressions Unary and Binary arithmetic operators, Increment Decrement operators Relational and logical operators, Bit wise operators, Assignment operators, Comma operator, size of operator, Ternary conditional operator, Precedence and associativity

**Unit-III Input Output Statements****08 Hrs**

1. printf, scanf functions, getchar, putchar, getch functions, gets, puts functions
2. Escape sequence characters, Format specifiers

**Unit-IV Control & Iterative Structures****08 Hrs**

1. If, If- Else Statements, Nested If Statements
2. Conditional Branching – switch statement, Loop (while, do...while, for), break, continue, goto statements

**Unit-V Functions****08 Hrs**

1. Introduction to Functions, Function Arguments, Library & User defined functions,
2. Methods for parameter passing, Recursion, Storage Classes – Auto, Static, Global and Register

**Unit-VI Arrays****08 Hrs**

1. Introduction, Array Declarations, Bounds Checking,
2. Types - Single dimension Arrays, Two dimensional Arrays, Arrays & Function

**Reference Books:**

1. Cormen, Leiserson, Rivest, Stein, “Introduction to algorithms”
2. Brian W. Kernighan, Dennis M. Ritchie , “The C Programming Language”, ISBN:9788120305960, PHI Learning
3. R.G. Dromey, “How to Solve it by Computer”, ISBN: 9788131705629, Pearson Education
4. Behrouz A. Forouzan, RichardF. Gilberg, “A Structured Programming Approach Using C”, ISBN:9788131500941, Cengage Learning India
5. E. Balaguruswamy, “Programming in ANSI C”, ISBN: 9781259004612, Tata Mc-Graw Hill Publishing Co Ltd.-New Delhi
6. Maureen Spankle, “Problem Solving and Programming Concepts”, ISBN: 81-317-0711- 3
7. Y S Kanetkar, “Let Us C”, BPB Publications

## F.Y.B.C.A (Science)

## SEMESTER I

Subject Code: 22-BCA-113

Subject Name: Basics of Web Design

**Course Objectives:**

- To learn basics of web designing
- To understand and learn HTML, CSS and JavaScript

**Course Outcomes:**

On completion of the course, students will be able to–

- Develop web based application using suitable client side and server side web technologies.
- Build web pages using HTML, CSS, Java Script

**Course Contents****Unit I      Web Design Principles      10 Hrs**

Basic principles involved in developing a web site, planning process, Five Golden rules of web, designing, Designing navigation bar, Page design, Home Page Layout, Design Concept. Basics in Web Design: Brief History of Internet, What is World Wide Web, Why create a web site, Web Standards.

**Unit II      Introduction to HTML      10 Hrs**

What is HTML, HTML Documents, Basic structure of an HTML document, creating an HTML document, Mark up Tags, HeadingParagraphs, Line Breaks, and HTML Tags

**Unit III      Elements of HTML      10 Hrs**

Introduction to elements of HTML, Working with Text, Working with Lists, Tables and Frames, Working with Hyperlinks, Images and Multimedia, Working with Forms and controls.

**Unit IV      CSS      08 Hrs**

CSS colors, backgrounds, borders, margins, padding, height, width, box model, outline, text, fonts, icons, links, lists, tables

**Unit V                  Java Script      10 Hrs**

JS introduction, statements, syntax, comments, variables, operators, arithmetic, assignment, data types, functions, objects

**Reference Books:**

- 1.. HTML, XHTML and CSS Bible (5th Edn.): Steven M. Schafer, Wiley India.
2. Beginning HTML, XHTML, CSS and JavaScript: John Duckett, Wiley India.
3. Java Script Pocket Reference: David Flanagan, Orielly
4. HTML and CSS the complete reference, fifth edition: Thomas Powell

**F.Y.B.C.A (Science)****SEMESTER I****Subject Code: 22-BCA-114****Subject Name: Applied Mathematics****Course Objectives:**

- Learn basic terminology formal logic, proofs, sets, relations, functions and perform the operations associated with same
- Use formal logic proof and logical reasoning to solve problems
- To understand significance of statistical measures
- To study Correlation, Probability and sampling theory

**Course Outcomes:**

On completion of the course, students will be able to–

- Relate and apply techniques for constructing mathematical proofs and make use of appropriate set operations, propositional logic to solve problems
- Use function or relation models to interpret associated relationships
- Apply basic counting techniques and use principles of probability
- Given a data, compute various statistical measures of central tendency
- Use appropriate Sampling techniques

**Course Contents****Unit-1 Set Theory and Logic****08 hrs**

Sets– Set Theory, Need for Sets, Representation of Sets, Set Operations, cardinality of set, Types of Sets – Bounded and Unbounded Sets, Countable and Uncountable Sets, Finite and Infinite Sets, Countably Infinite and Uncountably Infinite Sets, power set, Propositional Logic- logic, Propositional Equivalences, Application of Propositional Logic- Translating English Sentences, Proof by Mathematical Induction and Strong Mathematical Induction.

**Unit-2 Relations and Functions****08 hrs**

Relations: Properties, n-ary Relations and Applications, Representing Relations , Closures of Relations, Equivalence Relations, Partial Orderings, partitions, Hasse Diagram, Lattices, Transitive Closure and Warshall's Algorithm

Functions- Surjective, Injective and Bijective functions, Inverse Functions and Compositions of Function, Graph Theory :Definition, Types and examples



**Unit-3 Counting****08 hrs**

The Basics of Counting, rule of Sum and Product, Permutations and Combinations, Binomial Coefficients and Identities, Generalized Permutations and Combinations, The Pigeonhole Principle

**Unit-4 Data Presentation and Aggregation****08 hrs**

Data Types: attribute, variable, discrete and continuous variable, Data presentation: frequency distribution, histogram, ogive, box-plot, bar plots Mean, Median, Mode, and Other Measures of Central Tendency: Arithmetic Mean (AM), Weighted Arithmetic Mean, Arithmetic Mean Computed from Grouped Data, Concept of Median, Mode, Geometric Mean (GM), Harmonic Mean (HM), Quartiles, Deciles, and Percentiles

Standard Deviation and Other Measures of Dispersion: Standard Deviation, Root Mean Square, Variance, Absolute and Relative Dispersion

**Unit-5 Correlation Theory and Sampling****08 hrs**

Moments, Skewness and Kurtosis: Moments, Computation of Moments for Grouped Data, Skewness, Kurtosis, Computation of Skewness and Kurtosis.

Correlation: Bivariate data, scatter plots, Linear Correlation, Correlation of Attributes, Coefficient of correlation

Linear regression: Concept, The Least-Squares Method, Regression Lines

Elementary Sampling Theory: Sampling Theory, Random Samples and Random Numbers, Sampling With and Without Replacement, Stratified Sampling

**Unit-6 Probability****04 hrs**

Probability : Random experiment, sample space, events types and operations of events, Probability definition, Axioms (The four Elementary Theorems) of probability (without proof), Conditional probability, 'Bayes' theorem (without proof), Examples, Mathematical Expectations Standard Distributions: Continuous and discrete, PDF/PMF, Introduction and properties (without proof) for binomial, normal, Standard Normal, chi-square, t, F distributions

**Unit-7 Introduction to Hypothesis testing****04 hrs**

Introduction to Hypothesis testing: Concept, definition, Null hypothesis, alternative hypothesis One sided test, two sided test, type I error, type II error

**Reference Books:**

1. Kenneth H. Rosen, Discrete Mathematics And Its Applications, Tata Mcgraw-Hill, Isbn 978-0-07-288008-3, 7th Edition.
2. Trivedi, K.S., “ Probability, Statistics, Design Of Experiments And Queuing Theory, With Applications Of Computer Science”, Prentice Hall Of India, New Delhi
3. C L Liu, “Elements Of Discrete Mathematics”, Tata Mcgraw-Hill, Isbn 10:0-07-066913-9.
4. Kulkarni, M.B., Ghatpande, S.B. And Gore, S.D., “Common Statistical Tests” Satyajeet Prakashan, Pune
5. J.N. Kapur And H.C. Saxena, “Mathematical Statistics”, S. Chand Publications, 20<sup>th</sup> Ed.  
John P. D’angelo & Douglas B. West, “Mathematical Thinking–Problem Solving And Proofs”  
Prentice Hall, 2<sup>nd</sup> Ed.

## F.Y.B.C.A (Science)

## SEMESTER I

Subject Code: 22-BCA-115

Subject Name: Fundamentals of Computers Laboratory

**Course Objectives:**

To understand installation process to install operating system and applications

To learn various features of application software

**Course Outcomes:**

On completion of the course, students will be able to–

- Install operating system and execute various commands
- Effectively use various features of application software
- Create and use spreadsheets effective
- Prepare effective Presentation

Topics for Laboratory Assignments	
Sr. No	Assignment
1	Operating System Commands
2	Word Processing
3	Spreadsheet
4	Presentation Tools
5	Utility programs, anti-plagiarism software etc
6	Google Apps: Word, Excel, Sheet

**F.Y.B.C.A (Science)****SEMESTER I****Subject Code: 22-BCA-116 Subject Name: Problem Solving & C Programming Laboratory****Course Objectives:**

- To learn formulation of algorithm for a given problem
- To study various data types, arrays and functions in C
- To understand input-output and, control and iterative statements in C

**Course Outcomes:**

On completion of the course, students will be able to–

- Formulate an algorithm and draw flowchart for the given problem\
- Implement the given algorithm in C
- Write programs using appropriate data types and control structures in C

<b>Sr.No</b>	<b>Assignment</b>
1	Assignment on use of data types, simple operators (expressions)
2	Assignment on decision making statements (if and if-else, nested structures, Switch case )
3	Assignment on use of while loops, Assignment on use of for loops, Assignment on nested loops
4	Assignment on exit, go to, continue, break
5	Assignment on menu driven programs.
6	Assignment on writing C programs in modular way (use of user defined functions)
7	Assignment on call by value ,Assignment on call by reference
8	Assignment on recursive functions
9	Assignment on use of arrays (1-D array, 2-D arrays) functions
10	Assignment on Standard Library Function

## F.Y.B.C.A (Science)

## SEMESTER I

Subject Code: 22-BCA-117

Subject Name: Web Designing Laboratory

**Course Objectives:**

- To develop an ability to design and implement static and dynamic website
- Choose best technologies for solving web client/server problems
- Create conforming web pages
- Use JavaScript for dynamic effects

**Program Outcome:**

- Create web pages using HTML and Cascading Styles sheets
- Analyze a web page and identify its elements and attributes
- Create dynamic web pages using JavaScript

**Suggested List of Laboratory Assignments**

Suggested List of Laboratory Assignments	
1	Basic HTML Tags
2	List & Tables in HTML
3	Frames & Forms in HTML
4	CSS
5	Basics of JavaScript
6	Functions in JavaScript
7	Objects in JavaScript
8	Validation Using JavaScript & Event Handling

**F.Y.B.C.A (Science)****SEMESTER I****Subject Code: 22-BCA-118****Subject Name: Applied Mathematics Laboratory****Course Objectives:**

- To provide knowledge about applying theoretical concepts of applied mathematics and statistics to solve problems.
- To provide hands-on experience on statistical package

**Course Outcomes:**

On completion of the course, student will be able to

- Apply mathematical and statistical concepts to solve problems
- Use R to perform statistical operations and data visualization

<b>Suggested List of Laboratory Assignments</b>	
<b>Applied Mathematics: 2 Assignments each based on following topics</b>	
1	Set Theory
2	Logic, Mathematical Induction
3	Relations
4	Functions
5	Counting
<b>Statistics (Assignments may be performed using R)</b>	
1	Diagrammatic and Graphical representation
2	Measure of central tendency and measure of dispersion
3	Skewness and kurtosis using R- Software
4	Scatter diagram, correlation coefficient (ungrouped data), fitting of line of regression using R- Software
5	Probability graph :Binomial, Normal distribution
6	Computation of probabilities using R- Software
7	Small sample test : Mean test
8	Large sample test : Proportion test
9	Case studies

**F.Y.B.C.A (Science)****SEMESTER II****Subject Code: 22-BCA-121****Subject Name: Computer Organization****Course Objectives:**

- To study number system, logic gates
- To understand combinational and sequential circuits
- To provide a broad overview of architecture and functioning of computer systems
- To learn the basic concepts behind the architecture and organization of computers.

**Course Outcomes:**

On completion of the course, student will be able to–

- Design of combinational circuits
- Design of sequential circuits
- Explain block diagram of CPU, Memory and types of I/O transfers
- To understand the working principles of multiprocessor and parallel organization's as advanced computer architectures

**Course Contents****Unit 1 Data representation and Computers Arithmetic****08 Hrs**

1. Review of Decimal, Binary, Octal, Hexadecimal Number system and their interconversion BCD code, Gray code, Excess-3 code, ASCII , EBCDIC, Unicode, Concept of parity code.
2. Signed and Unsigned numbers, 1's and 2's complement of binary numbers, Binary arithmetic (Addition, subtraction and subtraction using 1's complement and 2's complement)

**Unit-2 Fundamentals of Digital Logic****10 Hrs**

1. Boolean Algebra, Logic Gates, Simplification of Logic Circuits: Algebraic Simplification, Karnaugh Maps.
2. Combinational Circuits : Adders(HA and FA), subtractor(HS and FS), Multiplexer(Upto 4:1 MUX), De multiplexer(Upto 1:4 DEMUX),Decoder,Encoder, 4 bit-ALU,
3. Sequential Circuits : Flip-Flops (SR, JK & D), Counters : synchronous and asynchronous Counter

**Unit-3 I/O Organization and Control unit****10 Hrs**

1. Input-Output Interface, Asynchronous Data Transfer, Modes Of Transfer, Priority Interrupt,DMA, Input-Output Processor (IOP),Serial communication.
2. Micro-Operations, Functional Requirements, Processor Control, Control,emory, Address sequencing, Micro program Example, design of Control Unit

**Unit-4 Memory system Organization****10 Hrs**

1. Classification and design parameters, Memory Hierarchy,
2. Internal Memory: RAM, SRAM and DRAM, Interleaved and Associative Memory.
3. Cache Memory: Design Principles, Memory mappings, Replacement Algorithms, Cache performance, Cache Coherence.
4. Virtual Memory, External Memory : Magnetic Discs, Optical Memory, Flash Memories, RAID Levels

**Unit 5 Introduction to Microprocessors and Microcontrollers****10 Hrs**

1. Block diagram of 8085, Functional units,Instruction Formats, Instruction Sets, Addressing Modes, Addressing Modes Examples with Assembly Language [8085 CPU]
2. Introduction to Microcontroller Intel 8051 – Functional block diagram
3. Block diagram of pentium processor, Functional units, Concept of pipeline and parallelism, Programmers model

**Reference Books**

1. R.P. Jain, “Modern Digital Electronics”, McGraw-Hill Publications
2. Flod and Jain, “Digital Fundamentals”, Pearson Publication.
3. Morris Mano, “Computer System Architecture” Prentice-Hall.
- 4 William Stallings: Computer Organization & Architecture, 9th Edition, Pearson, 2015.



**F.Y.B.C.A (Science)****SEMESTER II****Subject Code: 22-BCA-122****Subject Name: Advanced C Programming****Course Objectives:**

- To learn advanced features in C Programming
- To study advanced data types
- To understand built-in library functions

**Course Outcomes:**

- On completion of the course, student will be able to–
- Write programs using pointers, structures and unions
- Use Pre-processor directives
- Manipulate strings using library functions
- Write programs to perform operations on Files

**Course Contents****Unit I Preprocessor****08 Hrs**

- Concept, Format of preprocessor directives, File inclusion directives (#include)
- Macro substitution directives (#define), nested macros, parameterized macros, Macros versus functions, #error / #pragma directives
- Conditional compilation (#if/#ifdef/#else/#elif/#endif)
- Predefined macros (\_DATE\_ / \_TIME\_ / \_FILE\_ / \_LINE\_ / \_STDC\_)
- Preprocessor operators, Macro continuation (\), stringize (#), token pasting (##), defined()

**Unit II Pointers****08 Hrs**

- Concept – reference & dereference, Declaration, definition, initialization & use
- Types of pointers, Pointer Arithmetic, Multiple indirection, parameter passing – call by value and call by reference
- Arrays & Pointers - Pointer to array, Array of pointers, Functions & pointers - Passing pointer to function, Returning pointer from function, Function pointer, Pointers & const
- Dynamic memory management, Allocation, Resizing, Releasing, Memory leak / dangling pointers

**Unit III Strings****08 Hrs**

- Concept, Declaration, definition, initialization, format specifiers, String literals/ constants & variables
- reading & writing from & to console, Importance of terminating NULL character
- Strings & pointers Array of strings & array of character pointers
- User defined functions & Predefined functions
- Command line arguments – argc and argv

**Unit IV Structures****08 Hrs**

- Concept, Declaration, definition, initialization
- accessing structure members ( . operator)
- Array of structures, Pointers to structures, Declaring pointer to structure Accessing structure members via pointer to structure, Structures & functions
- Passing each member of structure as a separate argument, Passing structure by value / address Nested structures, typedef & structures

**Unit V Union****08 Hrs**

- Concept, Declaration, definition, accessing union members
- Difference between Structures & unions,
- Structures within union, union within structures, pointers and unions, nested unions, enumerated data types, Bit fields, Concept, need, use, multi-file programs

**Unit VI File Handling****08 Hrs**

- Concept of streams, need, Types of files
- Operations on text & binary files
- Random access file, library functions for file handling – fopen, fclose, fgetc, fseek, fgets, fputc etc

**Reference Books:**

1. The C Programming Language (Second Edition) – By B. W. Kerninghan& D. M. Ritchie
2. Programming in C – A Practical Approach – By Ajay Mittal (Pearson Publications)
3. Programming with C – By Byron S Gottfried (Schaum’s Outlines)
4. A structural Programming Approach using C – By BehrouzForouzan& Richard Gilberg
5. Y S Kanetkar, “Let Us C”, BPB Publications

**F.Y.B.C.A (Science)****SEMESTER II****Subject Code: 22-BCA-123****Subject Name: Software Engineering****Course Objectives:**

- To learn and understand the principles of System and Software Engineering
- To be acquainted with methods of capturing, specifying, visualizing and analyzing software requirements.
- To learn design processes and software quality parameters

**Course Outcomes:**

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

- Compare and contrast various Software Engineering models
- Decide on appropriate process model for a developing a software project
- Classify software applications and Identify unique features of various domains
- Prepare System Requirement Specification (SRS) for the given problem
- Design and analyze Data Flow diagrams Course Content

**Course Contents:****Unit 1: Introduction to Software Engineering****8 Hrs**

1. Definition of Software, Nature of Software Engineering, Changing nature of software
2. Software Process - The Process Framework
3. Umbrella Activities, Process Adaptation

**Unit 2: Introduction to Process Models****10 Hrs**

1. Generic Process Model, Prescriptive Process Models , The Waterfall Model
2. Incremental Process Models, Evolutionary Process Models
3. Concurrent Models, The Unified Process

**Unit 3: Agile Development****10 Hrs**

1. What is Agility, Agile Process-Agility Principles, The Politics Of Agile Development, Human Factors
2. Extreme Programming(XP) 2.3.1XP Values 2.3.2XP Process 2.3.3 Industrial XP
3. Adaptive Software Development(ASD) , Scrum
4. Dynamic System Development Model (DSDM), Agile Unified Process (AUP)

**Unit 4: Requirement Engineering**

**10 Hrs**

1. Introduction, Requirement Engineering Tasks
2. Establishing Groundwork for understanding of Software Requirement , Requirement Gathering
3. Feasibility study, Fact Finding Techniques

**Unit 5: Analysis and Design Engineering**

**10 Hrs**

1. Decision Tree and Decision Table
2. Data Flow Diagrams (DFD)
3. Data Dictionary - Elements of DD, Advantages of DD
4. Input and Output Design
5. Pseudo Code
6. Case Studies on above topics

**Reference Books:**

1. Software Engineering : A Practitioner's Approach- Roger S. Pressman, McGraw hill International Editions 2010(Seventh Edition)
2. System Analysis, Design and Introduction to Software Engineering (SADSE) - S. Parthasarthy, B.W. Khalkar
3. Analysis and Design of Information Systems(Second Edition) - James A. Senn, McGraw Hill

**F.Y.B.C.A (Science)****SEMESTER II****Subject Code: 22-BCA-124****Subject Name: Database Management Systems-I****Course Objectives:**

- To study and understand systematic database design approaches
- To explain basic database concepts, applications, data models, schemas and instances
- Describe the basics of SQL and construct queries using SQL.
- To emphasize the importance of normalization in databases.

**Course Outcomes:**

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

- Design E-R Model for given requirements and convert the same into database tables.
- Formulate database queries using SQL
- Design a database in appropriate normal form

**Course Contents****Unit 1: File Organization****8 Hrs**

1. Introduction to File Organization
2. Physical / logical files
3. Record organization (fixed, variable length)
4. Types of file organization(heap, sorted, indexed, hashed)

**Unit 2:Introduction of DBMS****8 Hrs**

1. Overview of DBMS, File system Vs. DBMS
2. Levels of abstraction, Data independence
3. Structure of DBMS, Users of DBMS, Advantages of DBMS

**Unit 3:Conceptual Design (E-R model)****8 Hrs**

1. Overview of DB design
2. ER data model (entities, attributes, entity sets, relations, relationship sets)
3. Additional constraints (key constraints, participation constraints, weak entities)  
aggregation,generalization,specialization
4. Case Studies

**Unit 4: Structure of Relational Databases****08 Hrs**

1. Concepts of a table(a row, a relation, a tuple and a key in a relational database)
2. Conversion of ER to Relational model
3. Integrity constraints (primary key, referential integrity, Null constraint, unique constraint, check constraint)
4. Examples of Conversion of ER to Relational model

**Unit 5: SQL****08 Hrs**

1. Introduction to SQL
2. DDL commands (create, drop, alter) with examples
3. Basic structure of SQL query
4. Set operations, Aggregate functions, Null values
5. Nested Sub-queries
6. Modifications of Database (insert, delete, update)
7. SQL mechanisms for joining relations (inner joins, outer joins and their types)
8. Examples on SQL (case studies)

**Unit 6: Relational Database Design****08 Hrs**

1. Pitfalls in Relational-Database Design (undesirable properties of a RDB design like repetition, inability to represent certain information)
2. Functional dependencies (Basic concepts, Closure of set of functional dependencies, Closure of an Attribute set)
3. Concept of a Super Key and a primary key (Algorithm to derive a Primary Key for a relation)
4. Concept of Decomposition, Desirable Properties of Decomposition (Lossless join and Dependency preservation)
5. Concept of Normalization - Normal forms (only definitions) 1NF, 2NF, 3NF, BCNF  
Examples on Normalization

**Reference Books:**

1. Henry F. Korth, Abraham Silberschatz, S. Sudarshan, "Database System Concepts", Tata McGraw-Hill Education
2. Raghu Ramakrishnan and Johannes Gehrke, "Database Management Systems", McGraw-Hill Science/Engin

**F.Y.B.C.A (Science)****SEMESTER II****Subject Code: 22-BCA-125****Subject Name: Computer Organization Laboratory****Course Objectives:**

- To study architecture and functioning of computer systems
- To learn the basic concept behind the architecture and organization of computers

**Course Outcomes:**

On completion of the course, student will be able to–

- Design and implement combinational circuits
- Design and implement sequential circuits
- Translate real world problems into digital logic formulations

<b>Suggested Topics for Laboratory Assignments</b>	
1	Study of Logic gates and their ICs and universal gates
2	Implement code converters
3	Implement Adder and Subtractor Arithmetic circuits
4	Design and implement combinational circuit based on the problem given and minimizing using K-map
5	Implement Encoder and Decoder and Multiplexer and De-multiplexers
6	Study of flip-flops and counters Memory Organization
7	Study of counter ICs and designing Mod-N counters

## F.Y.B.C.A (Science)

## SEMESTER II

Subject Code: 22-BCA-126

Subject Name: Advanced C Programming Laboratory

**Course Objectives:**

- To learn advanced features in C Programming
- To study advanced data types
- To understand built-in library functions

**Course Outcomes:**

On completion of the course, student will be able to–

- Write programs using pointers, structures and unions
- Use Preprocessor directives
- Manipulate strings using library functions
- Write programs to perform operations on Files

Sr. No	Assignment
1	To demonstrate use of preprocessor directives
2	To demonstrate use of pointers
3	To demonstrate advanced use of pointers
4	To demonstrate concept of strings, array of string
5	To demonstrate string operations using pointers
6	To demonstrate command line arguments
7	To demonstrate structures (using array and functions )
8	To demonstrate nested structures and Unions
9	To demonstrate use of bitwise operators
10	To demonstrate file handling



**F.Y.B.C.A (Science)****SEMESTER II****Subject Code: 22-BCA-127****Subject Name: Software Engineering Laboratory****Course Objectives:**

- To have hands on experience in developing a software project by using various software engineering principles and methods in each of the phases of software development.

**Course Outcomes:**

- Ability to translate end-user requirements into system and software requirements
- Ability to generate a high-level design of the system from the software requirements
- Will have experience and/or awareness of testing problems and will be able to develop a SRS report.

<b>Sr. No.</b>	<b>Assignment</b>
1.	Write down the problem statement for a suggested system of relevance.
2.	Design Decision tree and Decision Table
3	Design Context Level DFD and First Level DFD and Second Level DFD
4	Design Data Dictionary
5	Develop requirements specification for a given problem
6	Do requirement analysis and develop Software Requirement Specification Sheet (SRS) for suggested system

## F.Y.B.C.A (Science)

## SEMESTER II

Subject Code: 22-BCA-128

Subject Name: Database Management Systems Laboratory

**Course Objectives:**

- To learn design of E-R diagrams
- To prepare and execute database queries

**Course Outcomes:**

On completion of the course, student will be able to–

- Prepare E-R Diagram for the given problem statement
- Formulate appropriate SQL DDL Queries
- Formulate appropriate SQL DML Queries

Sr. No.	Assignment
1	Case study – ER diagram , with generalization
2	Case study – ER diagram (with aggregation)
3	Using PostgreSQL (demo of PostgrSQL)
4	Data Definition queries (Create)
5	Data Definition queries (Alter , Drop)
6	SQL DML Select queries
7	Queries using joins
8	Aggregate Functions and Group by and Having Clauses
9	Nested Queries
10	Data Manipulation queries(Insert, Update & Delete)