



**M.C.E. Society's
ABEDA INAMDAR SENIOR COLLEGE OF ARTS, SCIENCE AND
COMMERCE (AUTONOMOUS), PUNE**

AZAM CAMPUS, CAMP, PUNE – 411001

Syllabus of B.C.A. (Science)

Applicable for the Autonomous College affiliated to

Savitribai Phule Pune University

BCA (Science) Degree Course (Choice Based Credit System)

(2021 Pattern)

With effect from June 2021

Preamble:

- B.C.A. (Science) is a three year undergraduate degree programme spread over six semesters. This program is for candidates who wish to explore new emerging technologies using computer languages. The programme will be able to develop the ability and skill to have a problem solving approach towards issues related to the society and the information technology world. The programme is designed to bridge the gap between IT industries and academic institutes by incorporating the latest development into the curriculum and to give students a complete understanding within a structured framework. The structure of this program is fully computer application oriented which helps the students to build up a successful career in computer applications and to pursue higher studies.
- The B.C.A.(Science) Degree Course (2021 pattern) will be introduced in the following order:-
 - a. First Year B.C.A. Science 2021-2022
 - b. Second Year B.C.A. Science 2022-2023
 - c. Third Year B.C.A. Science 2023-2024

Programme Educational Objectives:

B.C.A. (Science) program will prepare its students as:

PEO 1: To progress their career productively in software industry, academia, research, entrepreneurial pursuit, government, consulting firms and other Information Technology enabled services.

PEO 2: To achieve peer-recognition; as an individual or in a team; by adopting ethics and professionalism and communicate effectively to excel well in cross culture and interdisciplinary teams.

PEO 3: To continue a lifelong professional development in computing that contributes in self and societal growth.

Programme Outcomes:

On completion of BCA (Science) degree, the students will be able to:

PO1: Analyze the requirements of a computing problem using appropriate algorithms and data structures.

PO2: Implement the solution of a computing problem using appropriate programming languages.

PO3: Use mathematical underpinnings of the discipline of computer science.

PO4: Recognize the ethical, legal and social implications of computing in a global society.

PO5: Use oral and written communication skills to convey technical information effectively and accurately.

PO6: Use their interpersonal skills when working in a team environment.

PO7: Recognize the need for and ability to engage in continuing professional development.

PO8: Ability to use appropriate techniques, skills, and tools necessary for computing practice

Semester -I (First Year B.C.A (Science))

Course Type	Course Code	Course / Paper Title	Credits		Evaluation		
			T	P	CIE	SEE	Total
CC – I	21SBCA111	Computer Fundamental	4	-	40	60	100
CC – II	21SBCA112	Problem Solving and C Programming	4	-	40	60	100
CC – III	21SBCA113	Applied Mathematics and Statistics	4	-	40	60	100
CC – IV	21SBCA114	Database Management System	4	-	40	60	100
Core Practical	21SBCA115	Lab I: MS Office and VBA	-	1.5	20	30	50
Core Practical	21SBCA116	Lab II: Programming in C	-	1.5	20	30	50
Core Practical	21SBCA117	Lab III: Statistics Practical using R	-	1.5	20	30	50
Core Practical	21SBCA118	Lab -IV :Database Management System	-	1.5	20	30	50
Total			16	6	240	360	600

Note: Non CGPA course to be conducted in Semester I

21SDG11M2: DEMOCRACY, ELECTIONS AND GOOD GOVERNANCE DEMOCRACY (GROUP-II, SEM-I)

Semester II (First Year B.C.A (Science))

Course Type	Course Code	Course / Paper Title	Credits		Evaluation		
			T	P	CIE	SEE	Total
CC – I	21SBCA121	Data Structures using C	4	-	40	60	100
CC – II	21SBCA122	Introduction to Web Technology	4	-	40	60	100
CC – III	21SBCA123	Advanced Database Management System	4	-	40	60	100
CC – IV	21SBCA124	Introduction to Computer Organization	4	-	40	60	100
Core Practical	21SBCA125	Lab I: Data Structures using C	-	1.5	20	30	50
Core Practical	21SBCA126	Lab II: Web Technology	-	1.5	20	30	50
Core Practical	21SBCA127	Lab III: Advanced Database Management System	-	1.5	20	30	50
Core Practical	21SBCA128	Lab IV: Computer Organization	-	1.5	20	30	50
Total			16	6	240	360	600

Note: Non CGPA course to be conducted in Semester II

21SPE12M2: PHYSICAL EDUCATION (GROUP-I, SEM-II)

Semester III (Second Year B.C.A (Science))

Course Type	Course Code	Course / Paper Title	Credits		Evaluation		
			T	P	CIE	SEE	Total
CC – I	21SBCA231	Object Oriented Programming using C++	4	-	40	60	100
CC – II	21SBCA232	Advanced Web Technology using PHP	4	-	40	60	100
CC – III	21SBCA233	Software Engineering	4	-	40	60	100
Core Practical	21SBCA234	Lab I: Object Oriented C++ Programming	-	2	20	30	50
Core Practical	21SBCA235	Lab-II Advanced Web Technology using PHP	-	2	20	30	50
Core Practical	21SBCA236	Lab III: Software Testing Tools (Testing using open source tools)	-	2	20	30	50
AECC – I	21SBHENT23	Health and Nutrition	2	-	20	30	50
AECC – II	21SBAEEL23	Language –I	2	-	20	30	50
Total			16	6	220	330	550

Note: Non CGPA course to be conducted in Semester III

21SBCM23SD: Certificate Course on Content Management System using WordPress

Semester IV (Second Year B.C.A (Science))

Course Type	Course Code	Course / Paper Title	Credits		Evaluation		
			T	P	CIE	SEE	Total
CC – I	21SBCA241	Core JAVA Programming	4	-	40	60	100
CC – II	21SBCA242	Programming in Python	4	-	40	60	100
CC – III	21SBCA243	Internet of Things	4	-	40	60	100
Core Practica l	21SBCA244	Lab I: Core JAVA	-	2	20	30	50
Core Practica l	21SBCA245	Lab II: Programming in Python	-	2	20	30	50
Core Practica l	21SBCA246	Lab-III: Internet of Things	-	2	20	30	50
AECC – I	21SBAEEV24	Environmental Science Awareness Course -II	2	-	20	30	50
AECC – II	21SBAEEL24	Language –II	2	-	20	30	50
Total			16	06	220	330	550

Semester V (Third Year B.C.A (Science))

Course Type	Course Code	Course / Paper Title	Credits		Evaluation		
			T	P	CIE	SEE	Total
DSCT1	21SBCA351	Advanced Java Programming	4	-	40	60	100
DSCT2	21SBCA352	Data Mining	4	-	40	60	100
DSCT3	21SBCA353	Computer Networks & Security	4	-	40	60	100
DSCP1	21SBCA354	Lab I: Advanced Java	-	2	20	30	50
DSCP2	21SBCA355	Lab II: Data Mining using open Source Tools	-	2	20	30	50
DSCP3	21SBCA356	Lab III: Project	-	2	20	30	50
SEC-1*	21SBCA357A	React JS	2	-	20	30	50
SEC-1*	21SBCA357B	Angular JS					
SEC-2*	21SBCA358A	C# .Net	2	-	20	30	50
SEC-2*	21SBCA358B	Objective C					
Total			16	06	220	330	550

Note: *: Choose one course from SEC1 and SEC2

Semester VI (Third Year B.C.A (Science))

Course Type	Course Code	Course / Paper Title	Credits		Evaluation		
			T	P	CIE	SEE	Total
DSCT1	21SBCA361	Introduction to Data Science and Machine Learning	4	-	40	60	100
DSCT2	21SBCA362	Android Programming	4	-	40	60	100
DSCT3	21SBCA363	Operating System	4	-	40	60	100
DSCP1	21SBCA364	Lab I: Data Science and Machine Learning using Python	-	2	20	30	50
DSCP2	21SBCA365	Lab II: Android Programming	-	2	20	30	50
DSCP3	21SBCA366	Lab III: Project	-	2	20	30	50
SEC-1*	21SBCA367A	Node JS	2	-	20	30	50
SEC-1*	21SBCA367B	Laravel Framework					
SEC-2*	21SBCA368A	ASP .Net	2	-	20	30	50
SEC-2*	21SBCA368B	Spring Framework					
Total			16	06	220	330	550

Note: *: Choose one course from SEC1 and SEC2

SEMESTER – I



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F.Y.B.C.A (Science) Computer Fundamental

2021-22 (CBCS – Autonomy 21 Pattern)

Course/ Paper Title	Computer Fundamental
Course Code	21SBCA111
Semester	I
No. of Credits	04

Aims & Objectives of the Course

Sr. No.	Objectives
1.	To study the basics of Computer System
2.	To learn how to configure computer devices
3.	To Learn Basic Commands of Operating system and application software
4.	To understand Open Source Software

Expected Course Specific Learning Outcome

Sr. No.	Learning Outcome
1.	Define working of computers and peripherals, types of software and languages
2.	Troubleshoot the computer systems and use utility software
3.	Choose commands and features of operating systems and application software
4.	Use open source software

Unit No	Title with Contents	No. of Lectures	
Unit I	Introduction to Computer System	10	
	1. Introduction i. The basic parts of a computer	1	
	2. History of Computers i. Mini Computers ii. Micro Computers iii. Mainframe Computers iv. Supercomputers v. Laptops vi. Tablets.	2	
	3. Types of Computer i. Analog ii. Digital iii. Hybrid	1	
	4. Types of CPU i. Single Core ii. Dual Core iii. Quad Core	1	
	5. Types of Programming Languages i. Machine Languages ii. Assembly Languages iii. High Level Languages	1	
	6. Translators i. Assembler ii. Compiler iii. Interpreter	1	
	7. Introduction Number Systems i. Binary ii. Octal iii. Hexadecimal system iv. Conversion v. Addition vi. Subtraction vii. Multiplication viii. Division	3	
	Unit II	Computer Peripherals	08
		1. Hardware & Motherboard i. Introduction ii. Hardware upgrade iii. Components of Motherboard	1
		2. Register Memory	1

	<ul style="list-style-type: none"> i. Types ii. Functions of Computer Register 	
	3. Cache Memory <ul style="list-style-type: none"> i. Types of Cache Memory ii. Its working 	1
	4. Primary Memory <ul style="list-style-type: none"> i. RAM ii. ROM iii. PROM iv. EPROM 	1
	5. Secondary Storage Devices <ul style="list-style-type: none"> i. HDD ii. SSD 	1
	6. I/O Devices <ul style="list-style-type: none"> i. Scanners ii. Digitizers iii. Plotters iv. LCD v. Plasma Display 	1
	7. Pointing Devices <ul style="list-style-type: none"> i. Joystick ii. Touch Screens 	1
	8. Introduction to Network devices <ul style="list-style-type: none"> i. Hubs ii. Switches iii. Routers iv. NAS v. MODEM vi. Access Points vii. Various cables. 	1
Unit III	Computer Software	10
	1. Types of Software <ul style="list-style-type: none"> i. System Software ii. Application Software 	2
	2. Operating System <ul style="list-style-type: none"> i. Types of Operating System ii. Functions of Operating System 	2
	3. Utility Programs <ul style="list-style-type: none"> i. Anti-plagiarism software ii. Disk Cleaning iii. Defragmentation 	2
	4. Application Software <ul style="list-style-type: none"> i. Dropbox, 	2

	<ul style="list-style-type: none"> ii. Git iii. Jenkins <p>5. Linux Commands</p> <ul style="list-style-type: none"> i. sudo, ls, pwd, cat, grep, cd, chmod, chown, curl, df, diff, echo, exit, find, finger, free, groups, gzip, head, history, kill, less, man, mkdir, mv, rm, passwd, ping, ps, shutdown, ssh, tail, tar, top, uname, w, whoami and alias. 	2
Unit IV	Open Source Software	12
	<p>1. Introduction</p> <ul style="list-style-type: none"> i. Open Source ii. Free Software iii. Free Software vs. Open Source software <p>2. Open Source Operating Systems</p> <ul style="list-style-type: none"> i. GNU/Linux ii. Android <p>3. Development tools</p> <ul style="list-style-type: none"> i. IDE (Visual Studio and Eclipse) ii. LAMP <p>4. Open Source Projects</p> <ul style="list-style-type: none"> i. GNU/Linux ii. Wikipedia iii. Wordpress iv. GCC v. Github vi. Open Office. <p>5. Word Processors</p> <ul style="list-style-type: none"> i. LibreOffice <p>6. Editors</p> <ul style="list-style-type: none"> i. Notepad++ ii. Vi iii. Emacs iv. Gedit and Kate v. Difference between Word Processor/Editors and IDE. <p>7. Presentation Tools</p> <ul style="list-style-type: none"> i. LibreOffice Impress. <p>8. Introduction to Google Apps</p> <ul style="list-style-type: none"> i. Google Docs ii. Google Sheets iii. Google Forms iv. Applications 	<p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>2</p> <p>2</p> <p>2</p> <p>2</p>

Unit V	MS Office	10
	1. MS - Word Basics 2. MS - PowerPoint Basics 3. MS- Spreadsheet basics <ul style="list-style-type: none"> i. Creating, editing, saving and printing spreadsheets ii. Working with functions & formulas iii. Modifying worksheets with color & auto formats iv. Graphically representing data <ul style="list-style-type: none"> a. Charts b. Graphs v. Speeding data entry using Data Forms vi. Analyzing data <ul style="list-style-type: none"> a. Data Menu b. Subtotal c. Filtering Data vii. Formatting worksheets viii. Securing and Protecting spreadsheets 	3 3 4
Unit VI	Introduction to VBA(Advance Excel)	10
	1. VBA Overview <ul style="list-style-type: none"> i. Developer Tab ii. Macro Security iii. File Extension iv. Name Rule v. Code vi. Window 2. Insert Module, Start Code, End Code 3. Code Basic <ul style="list-style-type: none"> i. Object ii. Collection iii. Property iv. Method 	4 2 4

References:

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

Website Reference Link:

1. Open Source Initiative: <https://opensource.org/>
2. Wikipedia, the free encyclopedia : <https://en.wikipedia.org/>
3. GitHub Documentation : <https://help.github.com/>
4. libreofficehelp.com - Quick Tutorials, Solutions and to the point:
<https://www.libreofficehelp.com>
5. Tutorials point-Ubuntu : https://www.tutorialspoint.com/ubuntu/ubuntu_libreoffice.html
6. Pdfdrive-MSOOffice : <https://www.pdfdrive.com/skills-for-success-with-ms-office-2010-vol1-e175845419.html>

Best IDE Tools:

Sr.No	Name of IDE or Tools	Operating System
1	MS Office 2013, GitHub Platform, VBA 6.5 onwards	Window Operating System
2	Libre Office 6.1.3, VBA 6.5 onwards	Red Hat /Linux / Ubuntu



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F.Y.B.C.A (Science) Problem Solving and C Programming

2021-22 (CBCS – Autonomy 21 Pattern)

Course/ Paper Title	Problem Solving and C Programming
Course Code	21SBCA112
Semester	I
No. of Credits	04

Aims & Objectives of the Course

Sr. No.	Objectives
1.	To provide a broad overview of problem solving techniques.
2.	To gain a thorough understanding of the fundamentals of C programming
3.	To write a code, compile and test C programs.
4.	To develop the logical ability for solving the real world problems.

Expected Course Specific Learning Outcome

Sr. No.	Learning Outcome
1.	Define algorithms and explain their characteristics
2.	Formulate algorithm and draw flowchart to solve a given problem
3.	Explain use of appropriate data types, control statements
4.	Demonstrate ability to use top-down program design

[illegible]

	ii. While iii. do...while 4. break, continue, goto statements 5. Examples	2 2
Unit III	Functions	06
	1. Introduction to Functions & Function Arguments 2. Library & User defined functions 3. Methods for parameter passing 4. Recursion 5. Storage Classes <ul style="list-style-type: none"> i. Auto ii. Static iii. Global iv. Register 6. Introduction to Macros	1 1 1 1 1 1
Unit IV	Array and String	08
	1. Introduction <ul style="list-style-type: none"> i. Array Declarations ii. Bounds Checking 2. Types of Array <ul style="list-style-type: none"> i. Single dimension Arrays ii. Two dimension arrays 3. Arrays & Function 4. String Concept, Declaration, definition, initialization 5. Format specifiers, String literals/ constants & variables 6. Reading & writing from & to console 7. Array of strings 8. Predefined functions in string.h <ul style="list-style-type: none"> i. strlen ,strcpy ,strcat ,strcmp ,strcmpi , strev , strlwr etc. 	1 1 1 1 1 1 1 1
Unit V	Pointers	09
	1. Concept <ul style="list-style-type: none"> i. Reference ii. Dereference 2. Declaration, definition, initialization , Pointer Arithmetic, Multiple indirection 3. Parameter passing <ul style="list-style-type: none"> i. call by value ii. call by reference 4. Arrays & Pointers	1 1 2 1

	<ul style="list-style-type: none"> i. Pointer to array ii. Array of pointers 	
	5. Functions & pointers <ul style="list-style-type: none"> i. Passing pointer to function ii. Returning pointer from function iii. function pointer 	2
	6. Dynamic memory management, Allocation, Resizing, Releasing, Memory leak / dangling pointers	2
Unit VI	Structure and Union	07
	1. Introduction to Structure	1
	2. Defining Structure, Declaring and Initializing Structure Variable, Accessing Structure members, Copying and Comparing Structure Variable	1
	3. Array of Structure	1
	4. Nesting of Structure	1
	5. Pointers and Structure	1
	6. Passing Structure to function	1
	7. Union & Difference between Structure and Union	1
Unit VII	Command Line Argument and File Handling	08
	1. Introduction to Command Line Argument	1
	2. Introduction to File Handling	1
	3. Types of files	1
	4. Operations on text & binary files	2
	5. Random access file	1
	6. Library functions for file handling	2
	<ul style="list-style-type: none"> i. fopen ii. fclose iii. fgetc, iv. fseek v. fgets vi. fputc etc. 	

References:

1. B. W. Kerninghan & D. M. Ritchie, "The C Programming Language" (Second Edition), BPB Publication.
2. By Ajay Mittal, "Programming in C – A Practical Approach", Pearson Publications.
3. Y S Kanetkar, "Let Us C", O'Reilly Publication.
4. Cormen, Leiserson, Rivest, Stein, "Introduction to algorithms", O'Reilly Publication
5. Herbert Schildt, "C Complete Reference", McGraw Hill Education, 4th Edition
6. Behrouz Forouzan & Richard Gilberg, "A structured Programming Approach using C" O'Reilly Publication

Website Reference Link:

1. C Programming - C Tutorial - TutorialsPoint.com
: <https://www.tutorialspoint.com/cprogramming/>
2. Learn C Programming : <https://www.programiz.com/c-programming>
3. C Tutorial - Learn C : <https://www.cprogramming.com/tutorial/c-tutorial.html>
4. Head First C : <https://www.pdfdrive.com/head-first-c-e19540108.html>

Best IDE Tools:

Sr.No	Name of IDE or Tools	Operating System
1	Turbo C 3.0 onwards	Window Operating System
2	Vi Editor/GEdit 8.2 onwards & C compiler	Red Hat /Linux / Ubuntu



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F.Y.B.C.A. Mathematics

(CBCS – Autonomy 21 Pattern)

Course/ Paper Title	Applied Mathematics and Statistics
Course Code	21SBCA113
Semester	I
No. of Credits	4 (1 Unit equivalent to 1 Credit)

Aims & Objectives of the Course

Sr.No.	Objectives
1.	Learn basic terminology formal logic, sets, relations, functions and perform the operations associated with same.
2.	Use formal logic proof and logical reasoning to solve problems.
3.	To understand significance of statistical measures.
4.	To study Correlation, Probability and sampling theory.

Expected Course Specific Learning Outcomes

Sr.No.	Learning Outcome
1.	Relate and apply techniques for constructing mathematical proofs and make use of appropriate set operations, propositional logic to solve problems.
2.	Demonstrate an understanding of basic marketing mathematics by solving relevant problems, including trade discounts, cash discounting, and markup and Mark down calculations.
3.	Use function or relation models to interpret associated relationships.
4.	Apply basic counting techniques and use principles of probability. Given a data, compute various statistical measures of central tendency.

Sr. No.	Course	Semester	Continuous Internal Evaluation (Internal Marks)	End Semester Exam (External Marks)	Total Marks	Credits
1.	21SBCA113 – Applied Mathematics and Statistics	I	40	60	100	4
2.	21SBCA117- Lab-III Applied Mathematics and Statistics	I	40	60	100	1.5

Continuous Internal Evaluation (CIE): Evaluation will be done continuously. Internal assessment will be of 40 marks.

Credits :04			
Duration : 1Hr/Exam		Marks:40	
10 Marks*	10 Marks	10 Marks	10 Marks*
Offline / Online objective type examination	Two Class Tests (Average of two test)	Two Assignments (Each of 5 marks)	Mid Semester Descriptive Type Examination

Syllabus

Unit No.	Title with Contents	No. of Lectures
Unit I	Set Theory, Logic and functions	11
	1. Propositional Logic.	2
	2. Propositional Equivalences.	2
	3. Sets.	2
	4. Set Operations.	2
	5. Functions.	3
Unit II	Induction and Counting	12
	1. Mathematical Induction	2
	2. Strong Mathematical Induction.	2
	3. The Basics of counting.	2
	4. The Pigeonhole Principle.	3
	5. Permutations and Combinations.	3
Unit III	Relations and Graphs	13
	1. Relations and their properties.	2
	2. n- ary Relations and their applications.	1
	3. Representing Relations.	1
	4. Closure of Relations	1
	5. Equivalence Relations.	2
	6. Partial Orderings.	1
	7. Graphs and Graph Models.	2
	8. Graph Terminology and Special Graphs.	1
	9. Representing Graphs.	1
	10. Connectivity.	1
Unit IV	Data interpretation and aggregation	14
	1. Data types: attributes, variables, discrete and continuous variables.	3
	2. Data presentation: frequency distribution, histogram, ogive, bar plots, box-plot.	3
	3. Measures of central tendency: Arithmetic mean (AM), median, mode Weighted AM, Arithmetic mean of combined groups, Geometric mean (GM) and Harmonic mean (HM).	4
	4. Measures of dispersion: Absolute and relative measures of dispersion Range, quartile deviation (QD), standard deviation (SD), variance.	4
Unit V	Statistical computing using R	10
	1. Introduction to R and R studio.	2
	2. Data types and objects, reading and writing data.	2

	3. Control structures, functions, scoping rules, dates and times.	2
	4. Data manipulation.	2
	5. Data visualization.	2

Text books:

1. KENNETH H ROSEN (Indian Adaptation by Kamala Krithivasan),

Discrete Mathematics and Its Application with Combinatorics and Graph Theory, Seventh Edition, Special Indian Edition, McGraw Hill Education (India) Private Limited

Unit I: Chapter 1: Sec. 1.1, 1.2., Chapter 2: Sec. 2.1, 2.2, 2.3.

Unit II: Chapter 4: Sec. 4.1, 4.2 (Only Strong Induction and its examples),

Chapter 5: Sec. 5.1, 5.2, 5.3.

Unit III: Chapter 7: Sec. 7.1, 7.2, 7.3, 7.4, 7.5, 7.6.

Chapter 8: Sec. 8.1, 8.2, 8.3 (Only Representing Graphs), 8.4.

2. Mathematical Statistics-J.N. Kapur and H.C. Saxena S. Chand Publication 20th Edition

Unit IV: Chapter 1, Chapter 2, Chapter 3.

3. Shailaja R. Deshmukh, Sharad D. Gore, Sudha G. Purohit. Statistics using R. Alpha Science International Ltd.

Unit V: Chapter 1, 2.

Reference books:

1. Bernard Kolman, Robert C. Busy, Sharon Cutler Ross, Discrete Mathematical Structures, Sixth Edition, PHI Learning Private Limited.

2. John P. D'Angelo & Douglas B West, Mathematical Thinking–Problem Solving and Proofs. Prentice Hall, 2nd Edition.

3. D Biswas. Probability and statistics. New Central book agency, Pvt Ltd



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F.Y.B.C.A (Science) Database Management Systems

2021-22 (CBCS – Autonomy 21 Pattern)

Course/ Paper Title	Database Management Systems
Course Code	21SBCA114
Semester	I
No. of Credits	04

Aims & Objectives of the Course

Sr. No.	Objectives
1.	To understand the fundamental concepts of database management such as database design, database languages, and database-system implementation
2.	To study and understand systematic database design approaches
3.	To learn SQL – the database Query language

Expected Course Specific Learning Outcome

Sr. No.	Learning Outcome
1.	Design E-R Model for given requirements and convert the same into database tables.
2.	Formulate database queries using SQL
3.	Design a database in appropriate normal form

Unit No	Title with Contents	No. of Lectures
Unit I	File Organization	10
	1. Introduction 2. Physical / logical files 3. Record organization <ol style="list-style-type: none"> Fixed Variable length 4. Types of file organization <ol style="list-style-type: none"> Heap Sorted Indexed Hashed 	2 2 2 4
Unit II	Introduction of DBMS	10
	1. Overview 2. File system Vs. DBMS 3. Data models - relational, hierarchical, network 4. Levels of abstraction 5. Data independence 6. Structure of DBMS 7. Users of DBMS 8. Advantages and disadvantages of DBMS	1 1 2 2 2 1 1
Unit III	Conceptual Design (E-R model)	10
	1. Overview of DB design 2. ER data model <ol style="list-style-type: none"> Entities Attributes Entity sets Relations Relationship sets 3. Additional constraints <ol style="list-style-type: none"> Key constraints Participation constraints Weak entities 4. Aggregation and Generalization 5. Case studies	1 3 3 1 2
Unit IV	Structure of Relational Databases	10
	1. Concepts of a table, a row, a relation, a tuple and a key in a relational database	4

	2. Conversion of ER to Relational model 3. Integrity constraints <ol style="list-style-type: none"> Primary key Referential Integrity Null constraint Unique constraint Check constraint 	2 4
Unit V	Structured Query Language	10
	1. Introduction 2. DDL commands with examples <ol style="list-style-type: none"> Create Drop Alter 3. DML commands with examples <ol style="list-style-type: none"> Insert Update Delete 4. Basic structure of SQL query 5. Set operations & Aggregate functions 6. Nested Sub-queries 7. SQL Joins and their types 8. Examples on SQL (case studies)	1 2 2 1 1 1 1 1
Unit VI	Relational Database Design	10
	1. Pitfalls in Relational-Database 2. Functional dependencies <ol style="list-style-type: none"> Basic concepts Closure of set of functional dependencies Closure of an Attribute set 3. Concept of a Super Key and a primary key 4. Concept of Decomposition 5. Desirable Properties of Decomposition <ol style="list-style-type: none"> Lossless join Dependency preservation 6. Concept of Normalization - Normal forms (only definitions) with example <ol style="list-style-type: none"> 1NF 2NF 3NF BCNF 	1 2 2 1 2 2

References:

1. Abraham Silberschatz, Henry F. Korth and S. Sudarshan, ,“Database System Concepts”, McGraw-Hill Education
2. Atul Kahate, “Introduction to Database Management Systems”,Pearson Education
3. C. J. Date, A. Kannan and S. Swamynathan,“An Introduction to Database Systems” Pearson Education
4. Ramez Elmasri , Shamkant B. Navathe, “Fundamentals of Database Systems” Pearson Education ,7th Edition
5. BIPIN C DESAI, “An Introdcution to Database System”,Galgotia Publication

Website Reference Link:

1. Learn DBMS - Database Management System Tutorial :
<https://www.tutorialspoint.com/dbms/index.htm>
2. DBMS Tutorial | Database Management System - javatpoint
:<https://www.javatpoint.com/dbms-tutorial>
3. Computer Science and Engineering - NOC:Data Base Management System :
<https://nptel.ac.in/courses/106/105/106105175/>
4. Computer Science and Engineering - Introduction to Database Systems and Design :
<https://nptel.ac.in/courses/106/106/106106095/>

Best IDE Tools:

Sr.No	Name of IDE or Tools	Operating System
1	Postgresql 11.0 onwards	Window Operating System
2	Postgresql 11.0 onwards	Red Hat /Linux / Ubuntu



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F.Y.B.C.A (Science) Lab I: MS Office and VBA

2021-22 (CBCS – Autonomy 21 Pattern)

Course/ Paper Title	Lab I: MS Office and VBA
Course Code	21SBCA115
Semester	I
No. of Credits	1.5

Aims & Objectives of the Course

Sr. No.	Objectives
1.	To understand installation process
2.	To install operating system and applications
3.	To learn various features of application software

Expected Course Specific Learning Outcome

Sr. No.	Learning Outcome
1.	Install operating system and execute various commands
2.	Effectively use various features of application software
3.	Create and use spreadsheets effectively
4.	Able to Troubleshoot Operating System problems

Assignment No	Assignment Name	No. Of Sessions
1	Operating System Commands , Editors and IDE	01
2	Open Office	03
3	MS Office	03
4	Git, GitHub and Jenkins	01
5	Visual Basic for Application 1 (1 Program, Run Macro, Variable)	03
6	Visual Basic for Application 2 (3 Programs, Function Basic,)	03
Total Number of Sessions		14

Guidelines for Student Journal

The laboratory assignments are to be submitted by students in the form of a journal. Journal consists of Certificate, table of contents, and **handwritten write-up** of each assignment (Title, Problem Statement, Outcomes, Date of Completion, Assessment grade/marks and assessor's sign Program codes with sample output of all performed assignments are to be submitted as softcopy.

Guidelines for Assessment

Continuous assessment of laboratory work is to be done based on the overall performance of students. For each lab assignment, the instructor will assign grade/marks based on parameters with appropriate weightage. Suggested parameters include- timely completion, performance, innovation, efficient codes, punctuality and neatness.

Best IDE Tools:

Sr.No	Name of IDE or Tools	Operating System
1	MS Office 2013, GitHub Platform, VBA 6.5 onwards	Window Operating System
2	Libreoffice 6.1.3, VBA 6.5 onwards	Red Hat /Linux / Ubuntu



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F.Y.B.C.A (Science) Lab II: Programming in C

2021-22 (CBCS – Autonomy 21 Pattern)

Course/ Paper Title	Lab II: Programming in C
Course Code	21SBCA116
Semester	I
No. of Credits	1.5

Aims & Objectives of the Course

Sr. No.	Objectives
1.	To learn formulation of algorithm for a given problem
2.	To study various data types, arrays and functions in C
3.	To understand input-output and, control and iterative statements in C
4.	To learn advanced features in C Programming
5.	To study advanced data types
6.	To understand built-in library functions

Expected Course Specific Learning Outcome

Sr. No.	Learning Outcome
1.	Formulate an algorithm and draw flowchart for the given problem
2.	Implement the given algorithm in C
3.	Write programs using appropriate data types and control structures in C
4.	Write programs using pointers, structures and unions
5.	Use Preprocessor directives
6.	Manipulate strings using library functions
7.	Write programs to perform operations on Files

Assignment No	Assignment Name	No. Of Sessions
1	Assignment on C Fundamentals	02
2	Assignment on Control & Iterative Structures	02
3	Assignment on Functions	02
4	Assignment on Array and String	03
5	Assignment on pointers and pointers with Array	03
6	Assignment on Structures & union	02
Total Number of Sessions		14

Guidelines for Student Journal

The laboratory assignments are to be submitted by students in the form of a journal. Journal consists of Certificate, table of contents, and **handwritten write-up** of each assignment (Title, Problem Statement, Outcomes, Date of Completion, Assessment grade/marks and assessor's sign. Program codes with sample output of all performed assignments are to be submitted as softcopy.

Guidelines for Assessment

Continuous assessment of laboratory work is to be done based on the overall performance of students. For each lab assignment, the instructor will assign grade/marks based on parameters with appropriate weightage. Suggested parameters include- timely completion, performance, innovation, efficient codes, punctuality and neatness.

Best IDE Tools:

Sr.No	Name of IDE or Tools	Operating System
1	Turbo C 3.0 onwards	Window Operating System
2	Vi Editor/GEdit 8.2 onwards & C compiler	Red Hat /Linux / Ubuntu



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F.Y.B.C.A. Mathematics

(CBCS – Autonomy 21 Pattern)

Course/ Paper Title	Lab III: Statistics Practical using R
Course Code	21SBCA117
Semester	I
No. of Credits	1.5 (1 Credit equivalent to one and half hours)

Aims & Objectives of the Course

Sr.No.	Objectives
1.	To provide knowledge about applying theoretical concepts of applied mathematics and statistics to solve problems.
2.	To provide hands-on experience on statistical package.

Expected Course Specific Learning Outcomes

Sr.No.	Learning Outcome
1.	Apply mathematical and statistical concepts to solve problems.
2.	Use R to perform statistical operations and data visualization

Unit No.	Title with Contents	No. of Practical's
Unit I	Set Theory, Logic and functions	1
Unit II	Induction and counting	2
Unit III	Functions, Relation and Graphs	3
Practical's to be performed using R software		
Unit IV	Data Presentation and Aggregation	3
Unit V	Data Manipulation and Visualization	5



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F.Y.B.C.A (Science) Lab – IV Database Management System

2021-22 (CBCS – Autonomy 21 Pattern)

Course/ Paper Title	Lab – IV Database Management System
Course Code	21SBCA118
Semester	I
No. of Credits	1.5

Aims & Objectives of the Course

Sr. No.	Objectives
1.	Prepare E-R Diagram for the given problem statement
2.	Formulate appropriate SQL DDL Queries
3.	Formulate appropriate SQL DML Queries

Expected Course Specific Learning Outcome

Sr. No.	Learning Outcome
1.	Prepare E-R Diagram for the given problem statement
2.	Formulate appropriate SQL DDL Queries
3.	Formulate appropriate SQL DML Queries

Assignment No	Assignment Name	No. Of Sessions
1	To create simple tables, with only the primary key constraint	2
2	To create more than one table, with various constraints like referential integrity constraint, PK constraint, Check constraint, Unique constraint and Not null constraint	2
3	To drop a table from the database, to alter the schema of a table in the Database.	2
4	To insert, update and delete records using tables created in previous Assignments.	2
5	Queries using Aggregate function, Group by clause, Order by clause, Having clause and queries on join	3
6	Queries using set operations (union, intersect)	3
Total Number of Sessions		14

Guidelines for Student Journal

The laboratory assignments are to be submitted by students in the form of a journal. Journal consists of Certificate, table of contents, and **handwritten write-up** of each assignment (Title, Problem Statement, Outcomes, Date of Completion, Assessment grade/marks and assessor's sign Program codes with sample output of all performed assignments are to be submitted as softcopy.

Guidelines for Assessment

Continuous assessment of laboratory work is to be done based on the overall performance of students. For each lab assignment, the instructor will assign grade/marks based on parameters with appropriate weightage. Suggested parameters include- timely completion, performance, innovation, efficient codes, punctuality and neatness.

Best IDE Tools:

Sr.No	Name of IDE or Tools	Operating System
1	Postgresql 11.0 onwards	Window Operating System
2	Postgresql 11.0 onwards	Red Hat /Linux / Ubuntu

SEMESTER – II



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F.Y.B.C.A (Science) Data Structures using C

2021-22 (CBCS – Autonomy 21 Pattern)

Course/ Paper Title	Data Structures using C
Course Code	21SBCA121
Semester	II
No. of Credits	04

Aims & Objectives of the Course

Sr. No.	Objectives
1.	To provide the knowledge of basic data structures and their implementations.
2.	To develop skills to apply appropriate data structures in problem solving.
3.	To understanding about writing algorithms and step by step approach in solving problems with the help of fundamental data structures
4.	To be able to implement the abstract data type list as a linked list using the node and reference pattern.
5.	To learn static and dynamic data structures and also to understand analysis of algorithms.

Expected Course Specific Learning Outcome

Sr. No.	Learning Outcome
1.	Use the appropriate data structure in context of the solution of a given problem.
2.	Develop programming skills which require solving given problems.
3.	Develop effective software engineering practice, emphasizing such principles as decomposition, procedural abstraction, and software reuse.
4.	Know the strength and weakness of different data structures.

Unit No	Title with Contents	No. of Lectures
Unit I	Introduction to data structure	10
	1. Introduction i. Definition of Algorithm and data structures 2. Data types and data objects 3. Abstract Data Types (ADT) 4. Algorithm analysis: i. Frequency counts ii. Space and Time complexity a. Best b. Average c. Worst Case 5. Asymptotic notation i. Big O ii. Omega (Ω) 6. Matrix representation using arrays i. Row and column major ii. Basic operations on matrices 7. Sorting techniques i. Bubble sort ii. Insertion sort iii. Merge sort iv. Quick sort 8. Searching techniques i. Linear search ii. Binary search	1 1 1 1 1 1 2 2
Unit II	Linked Lists	10
	1. Linked Lists i. Introduction ii. Definition 2. Representation i. Static ii. Dynamic 3. Types of linked lists i. Singly ii. Doubly iii. Circular 4. Operations on link list	2 2 2 2

	<ul style="list-style-type: none"> i. Create ii. Display iii. Insert iv. Delete v. Reverse vi. Search vii. Sort <p>5. Applications of Linked List</p> <ul style="list-style-type: none"> i. Polynomial representation ii. Addition of two polynomials 	2
Unit III	Stack	10
	<p>1. Stack</p> <ul style="list-style-type: none"> i. Definition <p>2. Representations</p> <ul style="list-style-type: none"> i. Create ii. Display <p>3. Operations on stack</p> <ul style="list-style-type: none"> i. push (isFull()) ii. pop(isEmpty()) iii. Peek (traverse) <p>4. Applications of stack:</p> <ul style="list-style-type: none"> i. Function : Recursion ii. Polish notation: Infix to postfix, Postfix Evaluation 	<p>1</p> <p>2</p> <p>4</p> <p>3</p>
Unit IV	Queue	10
	<p>1. Queue</p> <ul style="list-style-type: none"> i. Definition <p>2. Operations</p> <ul style="list-style-type: none"> i. init() ii. enqueue() iii. dequeue() iv. isEmpty() v. isFull() vi. peek() <p>3. Implementation</p> <ul style="list-style-type: none"> i. Static ii. Dynamic <p>4. Types of Queue (with implementation)</p> <ul style="list-style-type: none"> i. Linear Queue ii. Circular Queue 	<p>1</p> <p>2</p> <p>4</p> <p>3</p>

Unit V	Trees	10
	1. Introduction and Tree terminologies 2. Definitions <ul style="list-style-type: none"> i. Tree ii. Root iii. Child iv. Leaf v. Level vi. Height vii. depth 3. Binary Tree and its Types <ul style="list-style-type: none"> i. Rooted ii. Full iii. Complete iv. Skewed. 4. Representation of Trees <ul style="list-style-type: none"> i. Using arrays ii. Using Linked Lists 5. Types of Traversal <ul style="list-style-type: none"> i. Preorder ii. Inorder iii. Postorder 6. Applications of Binary trees 7. Binary Search Tree (BST) <ul style="list-style-type: none"> i. Introduction ii. Definition 	1 1 2 1 2 1 2
Unit VI	Graphs	10
	1. Basic concepts and Terminology of Graph 2. Representations of Graphs: <ul style="list-style-type: none"> i. Adjacency list ii. Adjacency matrix 3. Graph Traversals: <ul style="list-style-type: none"> i. BFS ii. DFS 4. Applications: <ul style="list-style-type: none"> i. Dijkstra's algorithm for shortest path 	2 3 3 2

References:

1. E. Horowitz & Sahni, "Fundamental Data Structure", Galgotia Book Source, 1983.
2. A. Tannenbaum, "Data Structure Using C", Pearson Education, 2003.
3. N. Wirth, Algorithms, "Algorithm + Data Structure = Program", Prentice Hall of India, 1979.
4. Samanta, Debasis, "Classic Data Structures", PHI Publication, 2nd Edition

Website Reference Link:

1. DATA STRUCTURES BY D SAMANTHA.pdf : <https://docs.google.com/file/d/0B-RaWa38E8KsdHd6QV8zRmw1NIE/view>
2. Download Data Structure eBooks for Free : <https://www.pdfdrive.com/data-structure-books.html>
3. Data Structure and Algorithms : https://www.tutorialspoint.com/data_structures
4. Learn Data Structures and Algorithms : <https://www.programiz.com/dsa>

Best IDE Tools:

Sr.No	Name of IDE or Tools	Operating System
1	Turbo C 3.0 onwards	Window Operating System
2	Vi Editor/GEdit 8.2 onwards & C compiler	Red Hat /Linux / Ubuntu



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F.Y.B.C.A (Science) Introduction to Web Technology

(CBCS – Autonomy 21 Pattern)

Course/ Paper Title	Introduction to Web Technology
Course Code	21SBCA122
Semester	II
No. of Credits	04

Aims & Objectives of the Course

Sr. No.	Objectives
1.	To review the current topics in Web & Internet Technologies.
2.	To learn the basic working scheme of the Internet and World Wide Web.
3.	To understand fundamental tools and technologies for web design.

Expected Course Specific Learning Outcome

Sr. No.	Learning Outcome
1.	Comprehend the technologies for Hypertext Mark-up Language (HTML).
2.	Specify design rules in constructing web pages and sites.
3.	Effectively deal with programming issues relating to CSS, JavaScript, and PHP

	8. Using Borders and Height and Width CSS Properties	1
	9. Positioning Elements	1
	10. Validating CSS and HTML.	2
Unit IV	Java Script	14
	1. Introduction to JavaScript	1
	2. Identifier & Operator	1
	3. Control Structure	2
	4. Functions	2
	5. Document Object Model (DOM)	2
	6. DOM Objects (Window, Navigator, History, Location)	2
	7. Predefined Functions	1
	8. String Functions	1
	9. Array in JavaScript	2
Unit V	Introduction to Bootstrap	12
	1. Bootstrap Overview	1
	2. Bootstrap – Environment setup	1
	3. Bootstrap – Grid system	2
	4. Bootstrap – Typography	2
	5. Bootstrap – Tables	2
	6. Bootstrap – Forms	2
	7. Bootstrap – Buttons	2
Unit VI	Advanced Bootstrap	10
	1. Bootstrap – Responsive utilities	1
	2. Bootstrap – Dropdowns	1
	3. Bootstrap – Button groups	2
	4. Bootstrap – Input groups	2
	5. Bootstrap – Navbar	1
	6. Bootstrap – Pagination	1
	7. Bootstrap – Panels	1
	8. Bootstrap – Modal	1

References:

1. Thomas A Powell, “The Complete Reference HTML and CSS”, McGraw Hill, 5th Edition
2. Jon Duckett, “HTML and CSS: Design and Build Websites”, Wiley
3. Laura Lemay, Rafe Colbum, “Mastering HTML, CSS & Javascript Web Publishing”, BPB Publications

Website Reference Link:

1. W3Schools HTML Tutorial : <https://www.w3schools.com/html/>
2. CSS Tutorial : <https://www.tutorialspoint.com/css/index.htm>
3. Learn Bootstrap Tutorial - JavaTpoint : <https://www.javatpoint.com/bootstrap-tutorial>
4. Introduction Bootstrap v4.5: <https://getbootstrap.com/docs/4.5/gettingstarted/introduction>

Best IDE Tools:

Sr.No	Name of IDE or Tools	Operating System
1	HTML 5.0, CSS 2.1, JavaScript 10.1, Bootstrap 5.0 onwards	Window Operating System
2	HTML 5.0, CSS 2.1, JavaScript 10.1, Bootstrap 5.0 onwards	Red Hat /Linux / Ubuntu



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F.Y.B.C.A (Science) Advanced Database Management Systems

2021-22 (CBCS – Autonomy 21 Pattern)

Course/ Paper Title	Advanced Database Management Systems
Course Code	21SBCA123
Semester	II
No. of Credits	04

Aims & Objectives of the Course

Sr. No.	Objectives
1.	To study fundamental concepts of RDBMS (PL/Pgsql)
2.	To study database management operations
3.	To study data security and its importance
4.	To study client server architecture

Expected Course Specific Learning Outcome

Sr. No.	Learning Outcome
1.	Formulate SQL queries using advanced SQL features.
2.	Perform Database operations using PL/PostgreSQL.
3.	Compare and contrast different concurrency control and recovery techniques.
4.	Apply mechanisms for database security.

Unit No	Title with Contents	No. of Lectures
Unit I	Relational Database Design	10
	1. PL/Postgre SQL: Language structure	1
	2. Controlling the program flow i. conditional statements ii. loops	1
	3. Views	1
	4. Functions	2
	5. Handling errors and exceptions	1
	6. Cursors	2
	7. Triggers	2
Unit II	Transaction Concepts	10
	1. Transaction i. Properties of transaction ii. States of transactions iii. Concurrent execution of transactions iv. conflicting operations	4
	2. Schedules i. Types of schedules,	2
	3. Concept of serializability ii. Precedence graph for serializability	4
Unit III	Concurrency Control	10
	1. Ensuring serializability by locks i. Different lock modes	2
	2. 2PL and its variations	1
	3. Multiple Granularity locking protocol	1
	4. Basic timestamp method for concurrency	1
	5. Thomas Write Rule	1
	6. Locks with multiple granularity i. Dynamic database concurrency (Phantom Problem)	1
	7. Timestamps versus locking	1
	8. Optimistic concurrency control algorithm i. Multi version concurrency control	1
	9. Deadlock handling methods – i. Detection and Recovery a. Wait for graph ii. Prevention algorithms a. Wound-wait b. Wait-die iii. Deadlock recovery techniques a. Selection of Victim, b. Starvation,	2

	c. Rollback	
Unit IV	Crash Recovery	10
	1. Transaction Failure classification 2. Recovery concepts 3. Checkpoints 4. Recovery with concurrent transactions <ul style="list-style-type: none"> ii. Rollback i. Checkpoints ii. commit 5. Log base recovery techniques <ul style="list-style-type: none"> i. Deferred and Immediate update 6. Buffer Management 7. Database backup 8. Recovery from catastrophic failures 9. Shadow paging	1 2 1 2 1 1 1 1 1
Unit V	Database Security	10
	1. Introduction to database security concepts 2. Methods for database security 3. Access Control Method <ul style="list-style-type: none"> i. Discretionary access control method ii. Mandatory access control iii. Role based access control for multilevel security 4. Use of views in security enforcement 5. Overview of encryption technique for security 6. Statistical database security	1 2 2 2 1 2
Unit VI	Database System Architectures	10
	1. Types Of Architecture <ul style="list-style-type: none"> i. Centralized Architecture ii. Client – Server Architectures iii. Server System Architectures 2. Types Of System <ul style="list-style-type: none"> i. Introduction to Parallel Systems ii. Introduction to Distributed Systems 3. Introduction to Object Based Databases	4 4 2

References:

1. Abraham Silberschatz, Henry F. Korth and S. Sudarshan , “Database System Concepts”, McGraw-Hill Education.
2. Atul Kahate, “Introduction to Database Management Systems”, Pearson Education.
3. C. J. Date, A. Kannan and S. Swamynathan, “An Introduction to Database Systems”, Pearson Education
4. Joshua D. Drake, John C Worsley, “Practical PostgreSQL”, O’Reilly Publications

Website Reference Link:

1. Learn DBMS - Database Management System Tutorial :
<https://www.tutorialspoint.com/dbms/index.htm>
2. DBMS Tutorial | Database Management System - javatpoint :
<https://www.javatpoint.com/dbms-tutorial>
3. PostgreSQL: The world's most advanced open source database :
<https://www.postgresql.org/>
4. PostgreSQL Tutorial - Learn PostgreSQL from Scratch :
<https://www.postgresqltutorial.com/>

Best IDE Tools:

Sr.No	Name of IDE or Tools	Operating System
1	Postgresql 11.0 onwards	Window Operating System
2	Postgresql 11.0 onwards	Red Hat /Linux / Ubuntu



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F.Y.B.C.A (Science) Introduction to Computer Organization

2021-22 (CBCS – Autonomy 21 Pattern)

Course/ Paper Title	Introduction to Computer Organization
Course Code	21SBCA124
Semester	II
No. of Credits	04

Aims & Objectives of the Course

Sr. No.	Objectives
1.	To study number system, logic gates
2.	To understand combinational and sequential circuits
3.	To provide a broad overview of architecture and functioning of computer systems
4.	To learn the basic concepts behind the architecture and organization of computers.

Expected Course Specific Learning Outcome

Sr. No.	Learning Outcome
1.	Design of combinational circuits
2.	Design of sequential circuits
3.	Explain block diagram of CPU, Memory and types of I/O transfers

Unit No	Title with Contents	No. of Lectures
Unit I	Data representation and Computers Arithmetic	10
	1. Introduction to Decimal, Binary and Hexadecimal Number Systems and their inter-conversions	2
	2. BCD code, Gray code, Excess-3 code and ASCII	2
	3. Concept of parity code.	2
	4. Signed and Unsigned numbers	2
	5. Binary arithmetic, 1's and 2's complement of binary numbers, Binary subtraction using 1's and 2's complement	2
Unit II	Boolean Algebra & Logic Gates	10
	1. Logic gates (With their symbols) <ul style="list-style-type: none"> i. NOT ii. AND iii. OR iv. NAND v. NOR vi. XOR vii. XNOR viii. Boolean Equation and truth table ix. Universal gates 	4
	2. Boolean theorems, Boolean Laws, De Morgan's Theorem, Reduction of Logic expression using Boolean Algebra, Deriving Boolean expression from given circuit, Implementation of other gates using universal gates	4
	3. Karnaugh Maps <ul style="list-style-type: none"> i. Introduction ii. Reduction technique using Karnaugh maps – 2/3/4 variable K-maps iii. Grouping of variables in K-maps iv. minimize Boolean expression using K-map and obtain K-map from Boolean expression 	2

Unit III	Combinational Circuits	10
	1. Introduction i. Code converters design ii. Implementations 2. Arithmetic Circuits i. Half Adder ii. Full Adder iii. Parallel Adder iv. BCD Adder v. Binary Subtractor 3. Study of Multiplexer and Demultiplexer, 4. Study of Encoder and Decoder 5. ALU, Digital Comparator	2 2 2 2 2
Unit IV	Sequential circuits	10
	1. Flip Flop i. Introduction ii. Terminologies used iii. S-R flip-flop iv. D flip-flop v. JK flip-flop vi. T flip-flop vii. Application of flip-flops 2. Counters i. Introduction ii. Asynchronous counter iii. Terms related to counters iv. IC7493 (4-bit binary counter) v. Synchronous counter vi. Type T Design vii. Type JK Design viii. Pre-settable counter 3. Concept of modulus Counters i. IC 7490 4. Shift Register i. Introduction ii. Parallel and Shift registers iii. Ring counter iv. Johnson counter	4 2 2 2 2

Unit V	CPU, Memory and I/O Organization	10
	1. Block diagram of CPU, functions of CPU, general register organization, flags, Concept of RISC and CISC, Introduction to hardwired and micro-programmed CPU.	3
	2. Memory System hierarchy, Cache Memory, Internal Memory, External Memory, Concept of Virtual Memory, Memory parameters (Access time, speed, capacity, cost)	3
	3. Input/ Output <ol style="list-style-type: none"> Need of I/O interfaces block diagram of general I/O interface Concept of DMA DMA transfer Serial communication <ol style="list-style-type: none"> Synchronous asynchronous and their data transmission formats 	4
Unit VI	Introduction to Microprocessors ,Microcontrollers and Single Board Computers	10
	1. Introduction to Microcontroller Intel 8051	3
	2. Introduction to Microprocessor, difference between microcontroller and microprocessor, Functional block diagram of Intel 8051and their function.	3
	3. Introduction to Embedded systems using single board computers (SBC) Single boards computer block diagram, types, Comparison of SBC models, Specifications	4

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1. R.P. Jain, “Modern Digital Electronics”, McGraw-Hill Publications.
2. Floyd and Jain, “ Digital Fundamentals”, Pearson Publication
3. Morris Mano , “Computer System Architecture”, Prentice-Hall.

Website Reference Link:

1. Tutorial Points
https://www.tutorialspoint.com/microprocessor/microcontrollers_overview.htm
2. Electronic Tutorials : https://www.electronics-tutorials.ws/boolean/bool_7.html



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F.Y.B.C.A (Science) Lab I: Data Structures using C

2021-22 (CBCS – Autonomy 21 Pattern)

Course/ Paper Title	Lab I: Data Structures using C
Course Code	21SBCA125
Semester	II
No. of Credits	1.5

Aims & Objectives of the Course

Sr. No.	Objectives
1.	To understand algorithms and analysis of algorithms
2.	To learn static and dynamic data structures

Expected Course Specific Learning Outcome

Sr. No.	Learning Outcome
1.	Design an efficient algorithm for the given problem and implement it using C Programming.
2.	Apply appropriate data structures for the given problem.
3.	Determine the time and space complexity of a given algorithm.

Assignment No	Assignment Name	No. Of Sessions
1	1. Non-Recursive Sorting Techniques i. Bubble Sort ii. Insertion Sort 2. Recursive Sorting Techniques i. Quick Sort ii. Merge Sort 3. Searching Techniques i. Linear search ii. Binary Search	03
2	1. Linked List 2. Singly and Singly Circular Linked List 3. Doubly and Doubly Circular Linked List	03
3	1. Stack i. Static Stack Implementation ii. Dynamic Stack Implementation 2. Infix to postfix ,Postfix Evaluation	02
4	1. Queue i. Static Queue Implementation ii. Dynamic Queue Implementation	02
5	1. Tree 2. Binary Search Tree (Dynamic)	02
6	1. Graph i. Adjacency Matrix Representation ii. Adjacency List Representation 2. In-degree and Out-degree calculation	02
Total Number of Sessions		14

Guidelines for Student Journal

The laboratory assignments are to be submitted by students in the form of a journal. Journal consists of Certificate, table of contents, and **handwritten write-up** of each assignment (Title, Problem Statement, Outcomes, Date of Completion, Assessment grade/marks and assessor's sign Program codes with sample output of all performed assignments are to be submitted as softcopy.

Guidelines for Assessment

Continuous assessment of laboratory work is to be done based on overall performance of students. For each lab assignment, the instructor will assign grade/marks based on parameters with appropriate weightage. Suggested parameters include- timely completion, performance, innovation, efficient codes, punctuality and neatness.

Best IDE Tools:

Sr.No	Name of IDE or Tools	Operating System
1	Turbo C 3.0 onwards	Window Operating System
2	Vi Editor/GEdit 8.2 onwards & C compiler	Red Hat /Linux / Ubuntu



M. C. E. Society's

Abeda Inamdar Senior College

Of Arts, Science and Commerce, Camp, Pune-1

(Autonomous) Affiliated to Savitribai Phule Pune University

NAAC accredited 'A' Grade

F.Y.B.C.A (Science) Lab II: Web Technology

2021-22 (CBCS – Autonomy 21 Pattern)

Course/ Paper Title	Lab II: Web Technology
Course Code	21SBCA126
Semester	II
No. of Credits	1.5

Aims & Objectives of the Course

Sr. No.	Objectives
1.	The main objective of the course is present the basic web technology concepts that are required for developing web applications.
2.	The key technology components are descriptive languages, server side program elements and client side program elements.

Expected Course Specific Learning Outcome

Sr. No.	Learning Outcome
1.	A student will be familiar with client server architecture and able to develop a web application using java technologies.
2.	Students will gain the skills and project-based experience needed for entry into web application and development careers

Assignment No	Assignment Name	No. Of Sessions
1	HTML Tags Programs	02
2	CSS Programs	03
3	JavaScript Programs	05
4	Bootstrap	04
Total Number of Sessions		14

Guidelines for Student Journal

The laboratory assignments are to be submitted by students in the form of a journal. Journal consists of Certificate, table of contents, and **handwritten write-up** of each assignment (Title, Problem Statement, Outcomes, Date of Completion, Assessment grade/marks and assessor's sign). Program codes with sample output of all performed assignments are to be submitted as softcopy.

Guidelines for Assessment

Continuous assessment of laboratory work is to be done based on the overall performance of students. For each lab assignment, the instructor will assign grade/marks based on parameters with appropriate weightage. Suggested parameters include- timely completion, performance, innovation, efficient codes, punctuality and neatness.

Best IDE Tools:

Sr.No	Name of IDE or Tools	Operating System
1	HTML 5.0, CSS 2.1 , JavaScript 10.1, Bootstrap 5.0 onwards	Window Operating System
2	HTML 5.0, CSS 2.1 , JavaScript 10.1, Bootstrap 5.0 onwards	Red Hat /Linux / Ubuntu



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F.Y.B.C.A (Science) Lab III: Advanced Database Management System

2021-22 (CBCS – Autonomy 21 Pattern)

Course/ Paper Title	Lab III: Advanced Database Management System
Course Code	21SBCA127
Semester	II
No. of Credits	1.5

Aims & Objectives of the Course

Sr. No.	Objectives
1.	To learn advanced features in SQL such as Nested queries, Views, Functions, Triggers, Cursors
2.	To become familiar with PL/PostgreSQL

Expected Course Specific Learning Outcome

Sr. No.	Learning Outcome
1.	Formulate SQL queries using advanced features
2.	Write stored procedures, cursors and triggers using PL/PostgreSQL.
3.	Design a database using database normalization technique

Assignment No	Assignment Name	No. Of Sessions
1.	Simple and Nested Queries	2
2.	Views Creation	2
3.	Stored Functions	3
4.	Cursors i. Simple Cursor ii. Parameterized Cursor	2
5.	Designing a Database using normalization theory for the given application / database design	2
6.	Error and Exception handling i. Raise Notice ii. Raise Exception	1
7.	Triggers i. Before (Insert, Update, Delete) ii. After (Insert, Update, Delete)	2
Total Number of Sessions		14

Guidelines for Student Journal

The laboratory assignments are to be submitted by students in the form of a journal. Journal consists of Certificate, table of contents, and **handwritten write-up** of each assignment (Title, Problem Statement, Outcomes, Date of Completion, Assessment grade/marks and assessor's sign). Program codes with sample output of all performed assignments are to be submitted as softcopy.

Guidelines for Assessment

Continuous assessment of laboratory work is to be done based on the overall performance of students. For each lab assignment, the instructor will assign grade/marks based on parameters with appropriate weightage. Suggested parameters include- timely completion, performance, innovation, efficient codes, punctuality and neatness.

Best IDE Tools:

Sr.No	Name of IDE or Tools	Operating System
1	Postgresql 11.0 onwards	Window Operating System
2	Postgresql 11.0 onwards	Red Hat /Linux / Ubuntu



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F.Y.B.C.A (Science) Lab IV: Computer Organization

2021-22 (CBCS – Autonomy 21 Pattern)

Course/ Paper Title	Lab IV: Computer Organization
Course Code	21SBCA128
Semester	II
No. of Credits	1.5

Aims & Objectives of the Course

Sr. No.	Objectives
1.	To study architecture and functioning of computer systems
2.	To learn the basic concept behind the architecture and organization of computers

Expected Course Specific Learning Outcome

Sr. No.	Learning Outcome
1.	Design and implement combinational circuits
2.	Design and implement sequential circuits
3.	Translate real world problems into digital logic formulations

Assignment No	Assignment Name	No. Of Sessions
1	Study of Logic gates and their ICs	1
2	Study Of De Morgan's Theorem	1
3	Study of Half Adder and Full Adder	2
4	Study of Binary to Gray & Gray to Binary Converter using K-Map	2
5	Multiplexer and De-multiplexer	2
6	Study of Decimal to BCD Encoder	2
7	Study of flip-flops	2
8	Study of counter ICs: IC 7490 and designing Mod-N counters	2
Total Number of Sessions		14

Guidelines for Student Journal

The laboratory assignments are to be submitted by student in the form of journal. Journal consists of Certificate, table of contents, and handwritten write-up of each assignment (Title, Objectives, Problem Statement, Outcomes, software & Hardware requirements, Date of Completion, Assessment grade/marks and assessor's sign
Program codes with sample output of all performed assignments are to be submitted as softcopy. Use of DVD containing students programs maintained by lab In-charge is highly encouraged. For reference one or two journals may be maintained with program prints.

Guidelines for Assessment

Continuous assessment of laboratory work is to be done based on overall performance of student. For each lab assignment, the instructor will assign grade/marks based on parameters with appropriate weightage. Suggested parameters include- timely completion, Performance, innovation, efficient codes, punctuality and neatness.