



Fergusson College (Autonomous)

Pune

Learning Outcomes-Based Curriculum

For

F. Y. B. Sc. (Computer Science)

(Pattern 2019)

With effect from June 2020

Programme Outcomes for B.Sc. Programme	
<b>PO1</b>	<b>Disciplinary Knowledge:</b> Demonstrate comprehensive knowledge of the disciplines that form a part of a graduate programme. Execute strong theoretical and practical understanding generated from the specific graduate programme in the area of work.
<b>PO2</b>	<b>Critical Thinking and Problem solving:</b> Exhibit the skills of analysis, inference, interpretation and problem-solving by observing the situation closely and design the solutions.
<b>PO3</b>	<b>Social competence:</b> Display the understanding, behavioural skills needed for successful social adaptation , work in groups, exhibits thoughts and ideas effectively in writing and orally.
<b>PO4</b>	<b>Research-related skills and Scientific temper:</b> Develop the working knowledge and applications of instrumentation and laboratory techniques. Able to apply skills to design and conduct independent experiments, interpret, establish hypothesis and inquisitiveness towards research.
<b>PO5</b>	<b>Trans-disciplinary knowledge:</b> Integrate different disciplines to uplift the domains of cognitive abilities and transcend beyond discipline-specific approaches to address a common problem.
<b>PO6</b>	<b>Personal and professional competence:</b> Performing dependently and also collaboratively as a part of team to meet defined objectives and carry out work across interdisciplinary fields. Execute interpersonal relationships, self-motivation and adaptability skills and commit to professional ethics.
<b>PO7</b>	<b>Effective Citizenship and Ethics:</b> Demonstrate empathetic social concern and equity centred national development, and ability to act with an informed awareness of moral and ethical issues and commit to professional ethics and responsibility.
<b>PO8</b>	<b>Environment and Sustainability:</b> Understand the impact of the scientific solutions in societal and environmental contexts and demonstrate the knowledge of and need for sustainable development.
<b>PO9</b>	<b>Self-directed and Life-long learning:</b> Acquire the ability to engage in independent and life-long learning in the broadest context of socio-technological changes.

PSO No.	<b>Program Specific Outcomes (PSOs)</b> <b>Upon completion of this programme the student will be able to</b>
<b>PSO1</b>	<b>Academic Competence:</b> (i) Understand various concepts of Computing, Statistics, Mathematics and Electronics appropriately to the discipline. (ii) Recommend computing solutions to solve the problems in different domains
<b>PSO2</b>	<b>Personal and Professional Competence:</b> (i) Apply the fundamental knowledge for professional software development as well as to acquire new skills. (ii) Develop strong problem solving, analysing and decision-making abilities. Identify the information and apply their disciplinary knowledge and professional skills to design components , system or processes to meet required specification
<b>PSO3</b>	<b>Research Competence:</b> (i) Apply programming languages, tools and techniques to conduct research and demonstrate appropriate emerging skills to seek solutions to problems in various interdisciplinary fields. (ii) Integrate Computer Science, Electronics, Mathematical and Statistical knowledge to explore different domains' data for experimental and research purpose
<b>PSO4</b>	<b>Entrepreneurial and Social Competence:</b> (i) Use the knowledge and skills necessary to support their career in software development, web development, databases and entrepreneurship in recent trends like data analytics, artificial intelligence, Image processing, Networking, Embedded systems etc. (ii) Develop software based solutions for industry as well as research and development and develop skills required for social interaction.

### Programme Structure

Semester	Course Code	Course Title	Course	No. of credits
<b>F. Y. B.Sc.</b>	<b>Semester I</b>			
	STC1101	Descriptive Statistics	TCore-1	2
	STC1102	Probability theory and discrete probability distributions	TCore-2	2
	STC1103	Statistics Practical - I	PCore-1	2
	ELC1101	Fundamentals of Logic Circuit Design	TCore-3	2
	ELC1102	Sequential Logic Circuits	TCore-4	2
	ELC1103	Electronics Practical - I	PCore-2	2
	CSC1101	Basic Programming using C	TCore-5	2
	CSC1102	Database Management System: SQL	TCore-6	2
	CSC1103	Computer Science Practical – I (Practical course based on CSC1101 and CSC1102)	PCore-3	2
	MTC1101	Discrete Mathematics	TCore-7	2
	MTC1102	Algebra	TCore-8	2
	MTC1103	Mathematics Practical - I	PCore-5	2
	<b>Semester II</b>			
	STC1201	Multiple Regression, Time Series and Simulation	TCore-1	2
	STC1202	Continuous Probability Distributions and Inference	TCore-2	2
	STC1203	Statistics Practical - II	PCore-1	2
	ELC1201	Computer Instrumentation	TCore-3	2
	ELC1202	Computer Organization	TCore-4	2
	ELC1203	Electronics Practical - II	PCore-2	2
	CSC1201	Advance Programming using C	TCore-5	2
	CSC1202	Relational Database Management System: PL / SQL	TCore-6	2
	CSC1203	Computer Science Practical – II (Practical course based on CSC1201 and sCSC1202)	PCore-3	2
	MTC1201	Graph theory	TCore-7	2
	MTC1202	Calculus	TCore-8	2
	MTC1203	Mathematics Practical - II	PCore-5	2

Year	Course Code	Course Title	Course	No. of credits
<b>S. Y. B.Sc.</b>	<b>Semester III</b>			
	ELC2301	Microcontroller	TCore-1	2
	ELC2302	Communication Principles	TCore-2	2
	ELC2303	Electronics Practical III	PCore-1	2
	CSC2301	Data Structures and Algorithms - I	TCore-3	2
	CSC2302	Software Engineering	TCore-4	2
	CSC2303	Computer Science Practical – III	PCore-2	2
	MTC2301	Applied Algebra	TCore-5	2
	MTC2302	Operations Research	TCore-6	2
	MTC2303	Mathematics Practical - III	PCore-4	2
	<b>Semester IV</b>			
	ELC2401	ARM 7 Based LPC 2148 Microcontroller	TCore-1	2
	ELC2402	Advanced Communication and Networking	TCore-2	2
	ELC2403	Electronics Practical IV	PCore-1	2
	CSC2401	Data Structures and Algorithms - II	TCore-3	2
	CSC2402	Computer Networks - I	TCore-4	2
	CSC2403	Computer Science Practical – IV	PCore-2	2
	MTC2401	Computational Geometry	TCore-5	2
	MTC2402	Multivariable Calculus	TCore-6	2
	MTC2403	Mathematics Practical - IV	PCore-4	2

Year	Paper No.	Course Code	Title of Paper	Credits
T.Y. B.Sc.	<b>Semester V</b>			
	DSE-1A	CSC3501	Operating System-I	2
	DSE-1B	CSC3502	Fundamentals of Data Science	2
	DSE-2A	CSC3503	Java Programming –I	2
	DSE-2B	CSC3504	Web Development-I	2
	DSE-3A	CSC3505	Computer Networks-II	2
	DSE-3B	CSC3506	Theoretical Computer Science	2
	DSE-1	CSC3507	Computer Science Practical-V	2
	DSE-2	CSC3508	Computer Science Practical-VI	2
	DSE-3	CSC3509	Computer Science Project-I	2
	SEC-1*	CSC3511	Software Testing and Automation Tools	2
	SEC-2*	CSC3512	Python Programming	2
	<b>Semester VI</b>			
	DSE-4A	CSC3601	Operating System-II	2
	DSE-4B	CSC3602	Data Analytics	2
	DSE-5A	CSC3603	Java Programming -II	2
	DSE-5B	CSC3604	Web Development -II	2
	DSE-6A	CSC3605	Design and Analysis of Algorithms	2
	DSE-6B	CSC3606	Artificial Intelligence	2
	DSE-4	CSC3607	Computer Science Practical-VII	2
	DSE-5	CSC3608	Computer Science Practical- VIII	2
	DSE-6	CSC3609	Computer Science Project-II	2
	SEC-4*	CSC3612	User Interface Design	2

F.Y. B.Sc. Semester I		
Title of the Course and Course Code	Basic Programming using C CSC1101	Number of Credits : 02
<b>Course Outcomes (COs)</b> <b>On completion of the course, the students will be able to:</b>		
CO1	Identify and define appropriate solutions to problems in the field of computer science and other related disciplinary areas.	
CO2	Illustrate the solutions to the problems in the form of simple algorithms and flowcharts.	
CO3	Apply various computer programming language concepts and strategies to write and execute efficient and structured computer programs.	
CO4	Analyze and compile the programs to detect any errors, debug and correct the programs.	
CO5	Test and perform critical evaluation of the program outcome to validate the program logic.	
CO6	Integrate the concepts of control structures, functions and arrays to create more complex programming solutions.	
Unit No.	Title of Unit and Contents	
I	<b>Programming Languages and Tools</b> Machine language, Assembly language, High level languages, Compilers and Interpreters, Problem solving, Algorithms, Flowcharts	
II	<b>Introduction to C</b> History and C as middle level language, C as procedure-oriented programming Structure of a C program, Application Areas, C Program development life cycle, Sample programs	
III	<b>C Tokens</b> Keywords, Identifiers, Variables Constants – character, integer, float, string, escape sequences, Data types – built-in and user defined(enumerated), Operators and Expressions Operator types, (arithmetic, relational, logical, assignment, bitwise, conditional, other operators), precedence and associativity rules Input and Output – character input and output, formatted input and output	
IV	<b>Control Structures</b> Decision making structures <i>if, if-else, switch</i> , Loop Control structures <i>while, do-while</i> and <i>for</i> , Nested structures, <i>break, continue</i> and <i>goto</i>	
V	<b>Functions</b> What is a function? Advantages of Functions, Standard library functions User defined functions: Declaration, definition, function call, parameter passing (by value), return keyword, Scope of variables, storage classes, Recursion	
VI	<b>Arrays</b> What is an Array? Types – one, two and multidimensional, Array declaration, initialization and accessing array elements, Memory representation of 2D array, Passing arrays to functions	

**References:**

1. Behrouz A. Forouzan and Richard F. Gilberg, Computer Science: A Structured Programming Approach using C Third Edition, Thomson Course Technology publication
2. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language Second Edition, Prentice Hall Publication
3. Byron S Gottfried, Schaum's Outlines Programming with C, Second Edition, Tata McGraw Hill
4. Yashavant Kanetkar, Let Us C, Seventh Edition, PBP Publications
5. E Balagurusamy, Programming in ANSI C, Fourth Edition, Tata McGraw Hill

Title of the Course and Course Code	Database Management System: SQL CSC1102	Number of Credits : 02
<b>Course Outcomes (COs)</b> <b>On completion of the course, the students will be able to:</b>		
CO1	Identify the databases and relationships between them by analyzing the information.	
CO2	Discuss database concepts, applications, data models in the field of computer science along with other areas and develop the design of databases.	
CO3	Apply the knowledge of database concepts with normalization to write and execute the queries and operations in SQL.	
CO4	Integrate the concepts of queries, joins, aggregate functions in SQL.	
CO5	Test the queries and operations to detect the errors.	
CO6	Develop the strong ability to use the database concepts for writing queries and operations in SQL.	

Unit No.	Title of Unit and Contents
I	<b>Introduction to DBMS</b> File system Vs DBMS, Describing & storing data (Data models (relational, hierarchical, network)), Levels of abstraction, Data independence, Structure of DBMS, Users of DBMS, Advantages of DBMS
II	<b>Database design and ER Model:</b> Overview, ER – Model, Constraints, E-R Diagrams, ERD Issues, Weak Entity Sets, Codd's Rules, Relational database model: Logical view of data, keys, integrity rules, Relational Database design: Features of good relational database design, Atomic domain and Normalization 1NF, 2NF, 3NF, BCNF
III	<b>Structured Query Language (PostgreSQL)</b> Introduction, Basic operations, Set operations, Aggregate functions, Null values, Nested Sub-queries, Modifications to Database, DDL commands with examples, SQL mechanisms for joining relations (inner joins, outer joins and their types), Examples on SQL (case studies)
IV	<b>Relational algebra:</b> Introduction, Basic operations: Selection and projection, set operations, renaming, Joins, Division



**References:**

1. Henry F. Korth, Abraham Silberschatz, S. Sudarshan Database System Concepts, Tata McGraw-Hill Education
2. Korry Douglas, PostgreSQL, ISBN:9780672327568
3. John Worsley, Joshua Drake Practical PostgreSQL (B/CD), Shroff/O'reilly
4. Joshua D. Drake, John C Worsley, Practical Postgresql, O'Reilly Publication
5. Richard Stones, Neil Matthew, Beginning Databases with PostgreSQL From Novice to Professional, 2<sup>nd</sup> Edition Apress
6. Elmasri and Navathe, Fundamentals of Database Systems, 4<sup>th</sup> Edition
7. S. K. Singh, Database Management System: Concepts, design & applications, Pearson publication

Title of the Course and Course Code	Computer Science Practical - I CSC1103	Number of Credits : 02
<b>Course Outcomes (COs)</b> <b>On completion of the course, the students will be able to:</b>		
CO1	Define algorithms and flowcharts for given problems in C programming. Describe an information model expressed in the form of an entity-relationship diagram.	
CO2	Illustrate the use of simple data types, operators and control structures in C programming. Transform entity-relationship diagram into a relational database schema.	
CO3	Implement various standard library functions in C programming and SQL data definition in the database.	
CO4	Divide the programs into separate modules by writing user defined functions. Organize the database using constraints and schema.	
CO5	Evaluate the programs and DBMS queries using appropriate debugging methods to test and validate the output.	
CO6	Design and write programs to implement the concepts of functions, arrays in C programming and queries, aggregate functions in DBMS.	

Sr. No.	Title of Experiment / Practical
1	Use of data types, simple operators with Decision making statements (if-else and switch case)
2	Use of loops
3	Menu driven programs using Standard Library Functions
4	Use of User Defined Functions and Recursion
5	Use of Arrays and Functions
6	Using basic Linux commands and VI Editor
7	Create table, Primary key, Referential integrity and PK constraints
8	Constraints, Alter Table, Insert, Delete and Update Statement.
9	To Query the tables using aggregate functions
10	To query table, using set operations (union, intersect) and Nested Queries (use of 'Except', exists, not exists, in, not in)

F.Y. B.Sc. Semester II		
<b>Title of the Course and Course Code</b>	<b>Advance Programming using C CSC1201</b>	<b>Number of Credits : 02</b>
<b>Course Outcomes (COs)</b> <b>On completion of the course, the students will be able to:</b>		
CO1	Define the basic concepts of C Programming to design more complex programs for solving problems.	
CO2	Illustrate efficient memory handling techniques in programs with the concepts of pointers and dynamic memory management.	
CO3	Implement various string and file handling functions.	
CO4	Identify and organize data in structures and files to develop small applications.	
CO5	Test and validate the data stored in the structures and files and perform various operations on it.	
CO6	Design simple data processing applications for real-world problems. Develop the concepts for advanced programming like data structures and Object Oriented Programming.	

<b>Unit No.</b>	<b>Title of Unit and Contents</b>
I	<b>Pointers</b> Pointer declaration, initialization, Dereferencing pointers, Pointer arithmetic Pointer to pointer, Arrays and pointers, Array of Pointers, Functions and pointers – passing pointers to functions, function returning pointers, Dynamic memory allocation
II	<b>Strings</b> Declaration and initialization, string input/output, format specifiers, Standard library functions, Strings and pointers, Array of strings, Command Line Arguments
III	<b>C Preprocessor</b> Introduction of Preprocessor directive, File Inclusion directive, Macro substitution, nested macro, macro with arguments, Difference between functions and macros
IV	<b>Structures and Unions</b> Creating structures, Structure declaration and initialization, Accessing structure members (dot Operator), Array of structures, Passing structures to functions, Nested structures, Pointers and structures, Self-referential structure, 9 Unions: Declaration, Initialization and accessing, Difference between structures and unions, typedef
V	<b>File Handling</b> Introduction – streams, types of files, Modes of file opening, Operations on files, Random access to files

### References:

1. Behrouz A. Forouzan and Richard F. Gilberg: Computer Science: A Structured Programming Approach using C Third Edition, Thomson Course Technology publication
2. Brian W. Kernighan and Dennis M. Ritchie: The C Programming Language, Second Edition, Prentice Hall Publication
3. Byron S Gottfried, Schaum's Outlines Programming With C, Second Edition, Tata McGraw Hill
4. Yashavant Kanetkar: Let Us C, Seventh Edition, PBP Publications
5. E Balagurusamy: Programming in ANSI C, Fourth Edition, TMH

<b>Title of the Course and Course Code</b>	<b>Relational Database Management System: (PL / SQL) CSC1202</b>	<b>Number of Credits : 02</b>
<b>Course Outcomes (COs)</b> <b>On completion of the course, the students will be able to:</b>		
CO1	Outline the fundamental concepts of relational database management systems.	
CO2	Explain various methods of database security and access control techniques.	
CO3	Illustrate the transaction management and recovery management techniques adopted in relational database management systems.	
CO4	Differentiate between various types of databases.	
CO5	Validate the queries by implementing error and exception handling techniques.	
CO6	Write queries, functions, triggers, cursors and views using PL/SQL.	

<b>Unit No.</b>	<b>Title of Unit and Contents</b>
I	<b>Relational Database Design</b> PL/PgSQL: Datatypes, Language structure, Controlling the program flow, conditional statements, loops, Views, Stored Functions, Stored Procedures Handling errors and exceptions, Cursors, Concepts of Triggers
II	<b>Transaction Concepts and concurrency control</b> Describe a transaction, properties of transaction, state of the transaction. Executing transactions concurrently associated problem in concurrent execution. Schedules, types of schedules, concept of Serializability, precedence graph for Serializability, Ensuring Serializability by locks, different lock modes, 2PL and its variations, Basic timestamp method for concurrency, Thomas Write Rule, Locks with multiple granularity, dynamic database concurrency (Phantom Problem), Timestamps versus locking, Deadlock handling methods, Detection and Recovery (Wait for graph), Prevention algorithms (Wound-wait, Wait-die)
III	<b>Database Integrity and Security Concepts</b> Domain constraints, Referential Integrity, Introduction to database security concepts, Methods for database security, Discretionary access control method, Mandatory access control, Role based access control for multilevel security, Use of views in security enforcement, Overview of encryption technique for security, Statistical database security
IV	<b>Crash Recovery</b> Failure classification, Recovery concepts, Log base recovery techniques (Deferred and Immediate update), Checkpoints, Recovery with concurrent transactions (Rollback, checkpoints, commit), Database backup and recovery from catastrophic failure
V	<b>Other Databases</b> Introduction to Parallel and distributed Databases, Centralized Database, Introduction to Object Based Databases, NoSQL Database, Big Data Databases

**References:**

1. Henry F. Korth, Abraham Silberschatz, S. Sudarshan Database System Concepts, ISBN:9780071289597, Tata McGraw-Hill Education
2. Korry Douglas , PostgreSQL, , ISBN:9780672327568
3. John Worsley, Joshua Drake Practical PostgreSQL (B/CD), ISBN:9788173663925 Shroff/reilly
4. Joshua D. Drake, John C Worsley Practical Postgresql , O'Reilly
5. Richard Stones , Neil Matthew Beginning Databases with PostgreSQL, From Novice to Professional, 2 nd Edition Apress
6. NoSQL Distilled, Pramod J. Sadalage and Martin Fowler, Addison Wesley
7. An Introduction to Database Systems”, C J Date, Addison-Wesley
8. Database Systems : Concepts, Design and Application”, S.K.Singh, Pearson, Education
9. NoSQL Distilled A Brief Guide to the Emerging World of Polyglot Persistence : by Pramod J. Sadalage, Martin Fowler, Addison-Wesley, Pearson Education, Inc.
10. MongoDB: The Definitive Guide , Kristina Chodorow, Michael Dirolf, O'Reilly Publications

<b>Title of the Course and Course Code</b>	<b>Computer Science Practical - III CSC1203</b>	<b>Number of Credits : 02</b>
<b>Course Outcomes (COs)</b> <b>On completion of the course, the students will be able to:</b>		
CO1	Identify the concepts of programming in C language and RDBMS to design solutions for more complex problems.	
CO2	Illustrate the use of advanced concepts of C programming and PL/SQL.	
CO3	Execute the dynamic memory management techniques using the concept of pointers, string handling functions and structures in C Programming. Implement RDBMS concepts of nested queries, functions, cursors, triggers and views.	
CO4	Explain pointers, structures, file handling in C programming and cursors, triggers and functions in PL/SQL.	
CO5	Test and validate the outputs of the C programs and RDBMS queries.	
CO6	Develop programs to design applications using advanced concepts of C programming and relational database concepts.	

<b>Sr. No.</b>	<b>Title of Experiment / Practical</b>
1	Use of pointers
2	Concept of strings, array of strings and String operations using pointers
3	Command line arguments and pre-processor directives
4	Structures and Union using array, pointer and functions
5	File handling
6	Nested queries
7	Control Structures, Stored Functions and Exception Handling
8	Views
9	Cursors
10	Triggers