Fergusson College (Autonomous)

Pune

Learning Outcomes-Based Curriculum

For

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

With effect from June 2019

Program Outcomes (POs) for B.Sc. Programme	
PO1	**Disciplinary Knowledge:** 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.
PO2	**Critical Thinking and Problem solving:** Exhibit the skills of analysis, inference, interpretation and problem-solving by observing the situation closely and design the solutions.
PO3	**Social competence:** Display the understanding, behavioural skills needed for successful social adaptation , work in groups, exhibits thoughts and ideas effectively in writing and orally.
PO4	**Research-related skills and Scientific temper:** 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.
PO5	**Trans-disciplinary knowledge:** Integrate different disciplines to uplift the domains of cognitive abilities and transcend beyond discipline-specific approaches to address a common problem.
PO6	**Personal and professional competence:** 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.
PO7	**Effective Citizenship and Ethics:** 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.
PO8	**Environment and Sustainability:** Understand the impact of the scientific solutions in societal and environmental contexts and demonstrate the knowledge of and need for sustainable development.
PO9	**Self-directed and Life-long learning:** Acquire the ability to engage in independent and life-long learning in the broadest context of socio-technological changes.

PSO No.	Program Specific Outcomes(PSOs) Upon completion of this programme the student will be able to
PSO1	**Academic competence:** (i) Apply the knowledge, facts, and rules of basic and applied sciences (Physics, Chemistry, Mathematics and Statistics) for understanding elements of Electronic Science. (ii) Identify basic elements and systems of the real analog world and modern digital world.
PSO2	**Personal and Professional Competence:** (i) Demonstrates the ability to build and test basic blocks of modern digital systems and computers. (ii) Operate basic and advanced tools, equipment and Instruments. (iii) Discuss performance parameters for selection of sensors, actuators, linear and digital ICs.
PSO3	**Research Competence:** (i) Design and build Electronics systems in various domains like Computers, consumer products, medical, transportation, agriculture and defence. (ii) Formulate and provide creative, innovative and effective solutions to real world problems using hardware –software co-design tools for microcontroller / embedded systems and IoTs. (iii)Develop and utilizes modern tools (like PSPICE, MATLAB, Simulink) for mathematical modelling and simulation for future ready systems.
PSO4	**Entrepreneurial and Social competence:** Employ the process of thinking independently, taking initiative, working in a team effectively, preparing project reports and developing capability to lead the team through real life projects.

Programme Structure

Year	Course Code	Course Title	Course	No. of credits
F.Y. B.Sc.	**Semester I**			
	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	PCore-3	2
	CSC1104	Computer Science Practical - II	PCore-4	Grade
	MTC1101	Discrete Mathematics	TCore-7	2
	MTC1102	Algebra	TCore-8	2
	MTC1103	Mathematics Practical - I	PCore-5	2
	Semester II			
	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 - III	PCore-3	2
	CSC1204	Computer Science Practical - IV	PCore-4	Grade
	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
S.Y. B.Sc.	**Semester III**			
	ELC2301	8051 Microcontroller	TCore-1	3
	ELC2302	Communication Principles	TCore-2	3
	ELC2303	Electronics Practical III	PCore-1	2
	CSC2301	Data Structures	TCore-3	3
	CSC2302	Web Technologies	TCore-4	3
	CSC2303	Computer Science Practical – I (Lab on Data Structures)	PCore-2	2
	CSC2304	Computer Science Practical – II (Lab on Web Technologies)	PCore-3	Grade
	MTC2301	Applied Algebra	TCore-5	3
	MTC2302	Numerical Techniques	TCore-6	3
	MTC2303	Mathematics practical	PCore-4	2
	Semester IV			
	ELC2401	ARM 7 Based LPC 2148 Microcontroller	TCore-1	3
	ELC2402	Advanced Communication and Networking	TCore-2	3
	ELC2403	Electronics Practical IV	PCore-1	2
	CSC2401	Exploring OOP's using Java	TCore-3	3
	CSC2402	PHP Programming	TCore-4	3
	CSC2403	Computer Science Practical – III (Lab on Java)	PCore-2	2
	CSC2404	Computer Science Practical – IV (Lab on PHP Programming)	PCore-3	Grade
	MTC2401	Computational Geometry	TCore-5	3
	MTC2402	Operation Research	TCore-6	3
	MTC2403	Mathematics practical	PCore-4	2

Year	Course Code	Course Title	Course	No. of credits
T.Y. B.Sc.	**Semester V**			
	CSC3501	System Programming Concepts	TCore-1	3
	CSC3502	Advance Java	TCore-2	3
	CSC3503	Design And Analysis of Algorithms	TCore-3	3
	CSC3504	Software Development	TCore-4	3
	CSC3505 (Elective –I) **OR** CSC3506 (Elective –II)	Data Analytics	DElect-1	3
		Digital Image Processing	DElect-2	3
	CSC3507 (Elective –I) **OR** CSC3508 (Elective – II)	Android Programming	DElect-3	3
		Artificial Intelligence	DElect-4	3
	CSC3511	Computer Science Practical – I (Lab on System Programming)	PCore-1	3
	CSC3512	Computer Science Practical – II (Lab on Advance Java)	PCore-2	3
	CSC3513	Computer Science Project – I	PCore-3	3
	Semester VI			
	CSC3601	Operating System Concepts	TCore-1	3
	CSC3602	Python Programming	TCore-2	3
	CSC3603	Theoretical Computer Science	TCore-3	3
	CSC3604	Computer Networks	TCore-4	3
	CSC3605 (Elective –I) **OR** CSC3606 (Elective – II)	Big Data Analytics	DElect-1	3
		Biometrics	DElect-2	3
	CSC3607 (Elective –I) **OR** CSC3608 (Elective –II)	e-Commerce	DElect-3	3
		Internet of Things	DElect-4	3
	CSC3611	Computer Science Practical – III (Lab on Operating System Concepts)	PCore-1	3
	CSC3612	Computer Science Practical – IV (Lab on Python)	PCore-2	3
	CSC3613	Computer Science Project – II	PCore-3	3

F.Y. B.Sc. Semester I		
Title of the Course and Course Code	**Discrete Mathematics MTC1101**	**Number of Credits : 02**
Course Outcomes (COs) **On completion of the course, the students will be able to:**		
CO1	Describe the basic concepts of sets, permutations, relations, graphs, trees and finite state machines.	
CO2	Differentiate between disjunctive normal form and conjunctive normal form.	
CO3	Apply the concepts of graphs to solve various problems in day to day life.	
CO4	Analyze the basic structures of lattice and Boolean algebra.	
CO5	Determine the concepts of various types of lattices.	
CO6	Integrate ideas to find solutions to various recurrence relations.	

Unit No.	Title of Unit and Contents
I	**Counting Principle** Cardinality of sets, Basics of Counting: Addition rule, Product rule, Inclusion and Exclusion Principle, Mathematical Induction:1st and 2nd principle of induction.
II	**Lattices and Boolean Algebra** Introduction to relation, equivalence relation, Poset, Hasse diagram, Lattices, Complemented lattice, Bounded lattice and Distributive lattice, Boolean Functions, Boolean variable, Boolean Functions of degree n, Boolean identities, Definition of Boolean Algebra. Representation of Boolean Functions. Minterm, Maxterm Disjunctive normal form, Conjunctive normal Form.
III	**Recurrence Relations** Recurrence Relation, Formation. Linear Recurrence Relations with constant coefficients. Homogeneous Solution. Particular Solution,Total Solution.(Introduction of Solving Recurrence Relation through generating Functions.
IV	**Introduction to Graphs and Operations on Graphs** Definition and examples of graph, Handshaking lemma and it's corollaries. Types of graph, Complete graph, bipartite graph, Regular graph, Null graph. Isomorphism of graphs, Adjacency and Incidence Matrix of a Graph. Vertex induced subgraph, Edge induced subgraph, Vertex deleted subgraph, Edge deleted subgraph, Union of two graphs, Intersection of two graphs, Product of two graphs, Ring Sum of two graphs, Fusion of vertices, Complement of a graph.

References:

1. Kenneth H.Rosen. Discrete Mathematics and its applications. (7th edition) McGraw-Hill Higher Education, 2017.
2. Bernard Kolman, Robert C.Busby , and Sharon cutler Ross. *Discrete Mathematical Structures* (6th edition). Prentice-Hall, Inc. Upper Saddle River, NJ, USA, 2003.
3. John Clark and Derek Holton, a first look at Graph Theory, 2013.

Title of the Course and Course Code	Algebra MTC1102	Number of Credits : 02
Course Outcomes (COs) **On completion of the course, the students will be able to:**		
CO1	Describe basic concepts of Number Theory and various theorems.	
CO2	Discuss groups and their types along with examples.	
CO3	Apply various theorems to solve complicated problems.	
CO4	Identify different types of group structure and apply them in Cryptography.	
CO5	Determine parity check and generator matrix.	
CO6	Compile the concepts, properties, aspects of Algebra and apply them in computer science.	

Unit. No.	Title of Unit and Contents
I	**Divisibility in Integers** Division Algorithm (without proof), Divisibility and its properties, prime numbers. Definition of G.C.D and L.C.M., Expressing G.C.D. of two integers as a linear combination of the two integers. Euclidean Algorithm (Without proof). Relatively prime integers, Euclid Lemma and its generalization, Congruence relations and its properties, Residue Classes: Definition, Examples, addition and multiplication modulo n and composition tables, Euler's and Fermat's Theorems (Without proof), Chinese Remainder Theorem.
II	**Binary Operations and Groups** Definition of binary operation, properties of binary operations and examples. Definition of group, examples. Subgroups, finite and infinite groups. Permutation groups. Cyclic groups, Definition and Examples of Normal Subgroups. Definition and Examples of Quotient groups.
III	**Coding Theory and RSA** Introduction to coding: Weight, Hamming distance, Encoding, Parity check matrix, Generator Matrix, Decoding and error correction, Public key cryptography.

References:

1. Burton, D. Elementary number theory. 6th ed. New York: McGraw-Hill, 2008.
2. Lidl, Rudolf. and Pilz, Gunter. Applied abstract algebra, 2nd edition, Gunter Pilz Springer New York, 2004.
3. J.B. Fraleigh, A First Course in Abstract Algebra, Seventh Ed., Pearson Education Inc., 2017.

Title of the Course and Course Code	Mathematics Practical – I MTC1103	Number of Credits : 02
Course Outcomes (COs) **On completion of the course, the students will be able to:**		
CO1	Describe basic commands of Scilab.	
CO2	Explain various methods to find roots of Algebraic and Transcendental equations using Scilab.	
CO3	Illustrate the concepts of recurrence relations.	
CO4	Analyze different concepts of discrete mathematics and graph theory.	
CO5	Determine parity check and generator matrix.	
CO6	Build the necessary skill set and analytical abilities for writing computer based solutions using mathematical concepts.	

Sr. No.	Title of Experiment / Practical
1	Scilab I: Basic Commands.
2	Scilab II: Functions, Graphs.
3	Scilab III: Introduction to Scilab Programming.
4	Recurrance Relation.
5	Divisibility.
6	Finding roots by using Regula-falsi Method (Theory + Scilab Programming).
7	Finding roots by using Newton Raphson Method (Theory + Scilab Programming).
8	Lattices and Boolean Algebra.
9	Coding Theory.
10	Student Activity.

F.Y. B.Sc. Semester II		
Title of the Course and Course Code	**Graph theory MTC1201**	**Number of Credits : 02**
Course Outcomes (COs) **On completion of the course, the students will be able to:**		
CO1	Recall the basic concepts of trees and graphs.	
CO2	Explain various tree traversal algorithms.	
CO3	Apply the concept of directed graphs to solve network flow problems.	
CO4	Analyze different concepts of connected graphs.	
CO5	Compare features of Hamiltonian and Eulerian graphs.	
CO6	Develop real world problems using graph theory.	

Unit No.	Title of Unit and Contents
I	**Connected Graphs** Walk, Trail, Path, Cycle: Definitions and elementary properties. Connected Graphs: definition and properties, Distance between two vertices, eccentricity, centre, radius and diameter of a graph. Isthmus, Cut vertex: Definition and properties. Cutset, edge connectivity, vertex connectivity. Weighted Graph and Dijkstra's Algorithm.
II	**Eulerian and Hamiltonian Graphs** Eulerian graph: Definition and examples, necessary and sufficient conditions, Fleury's Algorithm. Hamiltonian Graphs: Definition and examples, necessary condition .Introduction to Chinese Postman Problem and Travelling Salesman Problem.
III	**Trees** Definition, Properties of trees. Centre of a tree. Binary Tree: Definition and properties. Tree Traversal. Spanning Tree: Definition, Properties, Shortest Spanning Tree, Kruskal's Algorithm.
IV	**Directed Graphs** Definition, Examples, Elementary Terminologies and properties. Special Types of Digraphs. Connectedness of digraphs. Network and Flows: definition and examples, Topological Sorting.
V	**Coloring of Graphs** Chromatic Number. Chromatic Partitioning. Chromatic Polynomial. Matching.

References:

1. Kenneth Rosen, Discrete Mathematics and It's Applications (Tata McGraw Hill) ,7th edition,2007.
2. John Clark and Derek Holton, A First Look at Graph Theory (Allied Publishers), 2013.
3. Narsingh Deo, Graph Theory with Applications to Computer Science and Engineering, (Prentice), 1974.

Title of the Course and Course Code	Calculus MTC1202	Number of Credits : 02
Course Outcomes (COs) **On completion of the course, the students will be able to:**		
CO1	Recall limits, continuity, derivatives of functions of a single variable and state mean value theorems.	
CO2	Discuss the applications of various mean value theorems geometrically.	
CO3	Apply Leibnitz theorem to find nth derivatives of product function and Taylor's theorem to find different power series.	
CO4	Categorize different types of Indeterminate forms and find their solution.	
CO5	Evaluate limits in indeterminate forms with the help of various methods.	
CO6	Compile the concepts, properties, aspects of Calculus and apply them in computer science.	

Unit. No.	Title of Unit and Contents
I	**Continuity and Differentiability** Continuity and Properties of continuous functions defined on [a, b] (Without proof) and examples, Differentiability, Theorem – Differentiability implies continuity but not conversely, Intermediate value theorem (without proof), Rolle's theorem (Geometric interpretation), Lagrange's Mean Value Theorem (with proof and geometric interpretation), Cauchy's Mean Value Theorem (with proof), Verification and applications, L'Hospital's Rule (without proof).
II	**Successive Differentiation** The nth derivatives of standard functions, Leibnitz's Theorem (with proof), Examples.
III	**Taylor's and Maclaurin's Theorems** Taylor's and Maclaurin's Theorems with Lagrange's and Cauchy's form of remainders (without proof), aylor's and Maclaurin's Series.
IV	**Ordinary differential equations** [Lectures 11] Basic Concepts: Introduction, Definition, Direction Fields, First Order Differential Equations: Linear Differential Equations, Separable Differential Equations, Exact differential Equations, Bernoulli Differential Equations, Substitutions, Euler's method, Second Order Differential Equations: Basic concepts, Real, distinct roots, complex roots, repeated roots, Reduction of order.

References:

1. George F. Simmons, Differential equations with application and historical notes, McGraw Hill Education, 2nd edition, 2009.
2. Serge Lang, A First Course in Calculus, Springer publication, 5th edition, 2011.

Title of the Course and Course Code	Mathematics Practical - II MTC1203	Number of Credits : 02
Course Outcomes (COs) **On completion of the course, the students will be able to:**		
CO1	Recall the basics of mathematical concepts.	
CO2	Extend the mathematical conceptual knowledge to programming.	
CO3	Implement different mathematical concepts.	
CO4	Integrate the mathematical conceptual knowledge to write better programs.	
CO5	Evaluate problems using various tools.	
CO6	Write basic programs using Scilab.	

Sr. No.	Title of Experiment/ Practical
1	Geogebra: Introduction, Graphs of basic functions.
2	Numerical Integration Technique by using Scilab: Trapeziodal rule.
3	Numerical Integration Techniques by using Scilab: Simpson's $(1/3)^{rd}$ and Simpson's $(3/8)^{th}$ rule.
4	Continuity and Mean value Theorem.
5	Connected Graphs.
6	Successive Differentiation.
7	Trees.
8	Taylor's and Maclaurin's Theorems.
9	Directed Graphs.
10	Solution to ODE by Euler's Method (By Scilab). Runge-kutta of 2^{nd} and 4^{th} order (By Scilab).