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	**Fundamentals of Logic Circuit Design ELC1101**	**Number of Credits : 02**
Course Outcomes (COs) **On completion of the course, the students will be able to:**		
CO1	Identify logic gates with symbols and truth tables. State Demorgan's theorems.	
CO2	Discuss working of different logic circuits.	
CO3	Apply the various rules and laws of Boolean Algebra for designing digital circuits.	
CO4	Analyze the arithmetic and logical circuits for specific applications.	
CO5	Evaluate different logic gates using universal logic gates.	
CO6	Construct different digital circuits using K-map.	

Unit No.	Title of Unit and Contents
I	**Logic gates** Introduction to analog signals and digital signals, Positive and Negative logic, pulse waveform Logic gates: definition, symbols, truth tables, Boolean expressions, pulsed operation of NOT, OR, AND, NAND, NOR, EX-OR, EX-NOR gates Universal logic gates.
II	**Number system and codes** Decimal, binary, octal, hexadecimal number systems, Conversion of number from one number system to another including decimal / binary points, Binary addition, subtraction, multiplication, division, 1's and 2's complement method of subtraction BCD code numbers and their limitations, Addition of BCD numbers, Conversion of BCD to decimal and vice-versa, Excess-3 code, Gray code, binary to gray and gray to binary conversion, Concept of parity, Error detection using parity
III	**Boolean Algebra** Rules and laws of Boolean algebra, logic expression, De Morgan's theorems, their proof, Sum of products form (min. terms), Product of sum form (max. terms), Simplification of Boolean expressions using Boolean algebra and Karnaugh map up to 4 variables.
IV	**Arithmetic and logical circuits** Half adder, Full adder circuit and its operation, Parallel binary adder, Half Subtractor and full Subtractor, Comparator
V	**Combinational Circuits** Multiplexer(2:1 and 4:1), Demultiplexer (1:2 and 1:4), Tree Multiplexing, Tree De-Multiplexing, Encoder , Priority encoder, Decoder, Active high output and active low output BCD to seven segment decoder

References:

1. Digital Principals, Schaum's outline series, Tata McGraw Hill (2006)
2. Digital System Design, Morris Mano, Pearson Education (2014)
3. Digital Computer Electronics, Malvino
4. Fundamentals of Logic design, Charles H. Roth, Jr. and Larry L. Kinney

Title of the Course and Course Code	Sequential Logic Circuits ELC1102	Number of Credits : 02
Course Outcomes (COs) **On completion of the course, the students will be able to:**		
CO1	Describe Flip flop, Counter, Shift register and various memory parameters.	
CO2	Discuss construction, working of different sequential logic circuits and compare their advantages and disadvantages.	
CO3	Use R-S, D, T flip flops for the design of counter, register and shift register circuits.	
CO4	Analyze the elements of 4-bit shift register, counter ICs and block diagrams of memory expansion circuits.	
CO5	Test working of shift registers, counters using truth tables, timing diagrams to examine the capacity of expanded memory.	
CO6	Construct modulus counters, ring counters as per the requirement of the application.	

Unit No.	Unit title and Contents
I	**Flip flops** Difference between combinational and sequential circuits, Concept of clock and types, synchronous and asynchronous circuit, Latch, S-R-latch, D-latch, Difference between latch and flip-flop, S-R, J-K and D flip-flop their operation and truth tables, race around condition, Master slave JK flip flop, T flip flop and their operation using timing diagram and truth tables
II	**Sequential Circuits** Basic building block of counter, Ripple counter, up counter, down counter, Up-Down counter, Concept of modulus counters, Decade counter, IC 7490, Shift registers: SISO, SIPO, PISO, PIPO, Ring counter, Universal 4-bit shift register, IC 7495
III	**Memory organization** Memory Architecture, Types of memory, Memory parameters (Access time, speed, capacity, cost), Concept of Address Bus, Data Bus, Control Bus, Memory Hierarchy, Memory address map Vertical & horizontal Memory expansion (increasing the capacity, increasing word size)

References:

1. Modern Digital Electronics: Jain R.P., Tata McGraw Hill
2. Digital Principles and Applications: Malvino Leach, Tata McGraw-Hill.
3. Digital Fundamentals: Floyd T.M., Jain R.P., Pearson Education
4. Computer Architecture: Morris Mano

Title of the Course and Course Code	Electronics Practical – I ELC1103	Number of Credits : 02
Course Outcomes (COs) **On completion of the course, the students will be able to:**		
CO1	Describe the circuit diagrams using different symbols of electronic components.	
CO2	Discuss working of circuits of individual experiment.	
CO3	Apply DeMorgan's theorems, laws of Boolean algebra to construct different practical circuits.	
CO4	Analyze observations of each experiment based on the aim and objectives of an experiment.	
CO5	Evaluate observed outputs with expected theoretical outputs.	
CO6	Reconstruct the given circuit to obtain electronic gadget.	

Any 10 Experiments from the following list

Sr. No.	Title of Experiment / Practical
1	Study of discrete Logic gates
2	Study of logic gate using ICs
3	NAND gate as universal gate
4	Conversion and verification of a Boolean expression into logic circuit using logic gate IC's
5	Design a Half Adder and Full Adder
6	Design a Half Subtractor and Full Subtractor
7	Verification of De Morgan's theorems
8	Multiplexer (4:1) and De-Multiplexer(1:4)
9	Interfacing Thumbwheel switch to seven segment display
10	Study of Flip flop ICs : IC 7474, IC 74776, IC 74279
11	Study of Modulo counter using IC 7490
12	Study of Shift register IC 7495 (SISO –right, left shift and PIPO)
13	Study of up/down counter IC 74192/93
14	Rolling display

F.Y. B.Sc. Semester II		
Title of the Course and Course Code	**Computer Instrumentation ELC1201**	**Number of Credits : 02**
Course Outcomes (COs) **On completion of the course, the students will be able to:**		
CO1	Define sensor, its parameters and its applications.	
CO2	Classify Sensors and discuss the need of signal conditioning circuits.	
CO3	Use sensors, signal conditioning circuits, ADC and DAC in computer instrumentation.	
CO4	Analyze signal conditioning circuits and different types of ADCs and DACs.	
CO5	Compare the frequency response of different types of filters and discuss the need for selecting filters.	
CO6	Construct a 3 stage instrumentation amplifier using OP-AMP. Design ADC or DAC with given specification.	

Unit No.	Unit title and Contents
I	**Sensors** Definition of sensors and transducers, Classification of sensors: Active and passive sensors, Specifications of sensor: Accuracy, range, linearity, sensitivity, resolution, reproducibility, Temperature sensors (LM-35 and AD590), piezoelectric humidity sensor, optical sensor (LDR), displacement sensor (LVDT), Passive Infrared sensor (PIR), Touch sensor, Ultrasonic sensor, Applications of Sensor.
II	**Signal Conditioning Circuits** Introduction to signal conditioning, Transistor amplifier, Operational Amplifier: Characteristics of Op-Amp, Inverting and Non inverting amplifier, Concept of virtual ground, Three OP-amp instrumentation amplifier, Filters: active and passive filters, Op-Amp based filters: Low Pass Filter, High Pass Filter, Concept of Band Pass Filter, Band reject filter, Notch Filter
III	**Data Converters:** Digital to Analog Converter (DAC): Resistive divider, R-2R ladder, Parameters of DAC: Linearity, resolution, accuracy, Analog to Digital Converter: Flash ADC, Successive approximation ADC and dual slope ADC Parameters of ADC: Linearity, resolution, conversion time, accuracy, ADC/DAC IC's (ADuC 814, IC 0808).

References:

1. Sensors & Transducers: Dr. A. D. Shaligram: CTC publications
2. Op-Amps and Linear Integrated Circuits: Ramakant Gaikwad: PHI: 4th Ed.
3. Digital Principles and applications: Malvino Leach, Saha

Title of the Course and Course Code	Computer Organization ELC1202	Number of Credits : 02
Course Outcomes (COs) **On completion of the course, the students will be able to:**		
CO1	Describe organization of Memory unit, I/O unit and register unit of digital system.	
CO2	Discuss the construction and working of different processor architectures and architecture of 8086 Microprocessor.Discuss the use of various blocks in microprocessor architecture.	
CO3	Classify the types of memory for fast and error free program execution.	
CO4	Analyze features of serial communication, standard RS- 232 and UART.	
CO5	Evaluate working of 8086 Microprocessor.	
CO6	Construct DMA controller for fast transfer of data between I/O device and main memory.	

Unit No.	Title of Unit and Contents
I	**Memory organization** Basic structure of computer system Associative Memory, Cache memory, Cache mapping techniques: direct, associative, set associative virtual memory, virtual memory mapping (paging and segmentation).
II	**Register and stack Organization** Register based CPU organization stack organization: concept of PUSH, POP, Top of Stack and Stack pointer, Ascending and Descending stack, Register stack, Memory stack
III	**Input output organization** Need of interface, Block diagram of general I/O interface, Working concepts like polling, Daisy chain, interrupt initiated data transfer. Concept of DMA, DMA transfer, DMA Controller General block diagram of UART Serial communication standards RS-232.
IV	**Microprocessor** Evolution of Microprocessor (8086 to Pentium 4) Concept of RISC & CISC, Von- Neumann & Harvard Architecture Concept of pipeline, 8086 Architecture

References:

1. Computer system Architecture: Morris Mano, Pearson Publication
2. Computer Organization and Architecture: Designing for Performance, W. Stallings, Eighth Edition, Pearson
3. Microprocessors and Interfacing: Douglas V. Hall, Mcgraw Hill Higher Education

Title of the Course and Course Code	Electronics Practical – II ELC1203	Number of Credits : 02
Course Outcomes (COs) **On completion of the course, the students will be able to:**		
CO1	Identify components of Motherboard.	
CO2	Discuss the working of ADC, DAC and Filter circuits.	
CO3	Carry out experiments by connecting power supply, input and output electronic sources.	
CO4	Analyze observations based on the aim and objectives of an experiment.	
CO5	Evaluate observed outputs with expected theoretical outputs.	
CO6	Reconstruct the given circuit to obtain an electronic gadget.	

Any Eight Experiments from the following list:

Sr. No.	Title of Experiment / Practical
1	Parallel Priority Interrupt circuit
2	Wired communication using RS-232 by Termite software
3	Study of ALU (74181).
4	Read write action of RAM
5	Diode matrix ROM
6	EPROM
7	Study of Motherboard
8	Temperature Sensor using LM-35
9	Instrumentation amplifier
10	Filters
11	Flash ADC
12	R-2R Ladder
13	Study of DC power supply