Fergusson College (Autonomous)

Pune

Learning Outcomes-Based Curriculum

for

F. Y. B. Sc.

(Electronic Science)

With effect from June 2019

Program Learning Outcomes

PO1	Acquires knowledge of basic and applied sciences (Physics, Chemistry, Mathematics and Statistics) for understanding elements of Electronic Science.
PO2	Gains the knowledge of information communication systems in real world (i.e. analog) and modern world (digital).
PO3	Identifies the basic elements and systems used in real analog world and modern digital world.
PO4	Acquires knowledge and skills of handling basic and advanced tools, equipment and Instruments
PO5	Demonstrates the ability to build and test basic blocks of modern digital systems and computers
PO6	Develops skills regarding selection and understanding performance parameters through data sheets for sensors, actuators, linear and digital ICs
PO7	Acquires knowledge of applications of Electronics in various domains like Computers, consumer products, medical, transportation, agriculture and defence.
PO8	Identifies, formulates and provides creative, innovative and effective solutions to real world problems using hardware –software co-design tools for microcontroller / embedded systems.
PO9	Develops and utilizes modern tools (like PSIPICE, MATLAB, Simulink) for mathematical modelling and simulation for future ready systems.
PO10	Thinks independently, take initiative, work in team effectively, prepares project reports and develops capability to lead the team through real life projects.

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

Particulars	Course	Paper code	Title of Paper	Type of Paper	No. of Credits
F.Y. B.Sc. Semester- I	Course- 1	ELS1101	Circuit Theory and Networks	CORE-1	2
	Course- 2	ELS1102	Semiconductor devices	CORE- 2	2
	Course- 3	ELS1103	Electronic Science Practical - I	PCORE-1	2
F.Y. B.Sc. Semester- II	Course- 4	ELS1201	Electronic Circuits	CORE-3	2
	Course- 5	ELS1202	Digital Electronics	CORE-4	2
	Course- 6	ELS1203	Electronic Science Practical - II	PCORE-2	2

Mapping Program Outcomes with Course Outcomes

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10
Course-1	×	×	×							
Course-2	×		×							
Course-3	×		×					×		
Course-4	×		×							
Course-5	×	×	×		×					
Course-6	×		×		×			×		

ELS1101: Circuit Theory and Networks

[Credits-2]

Course Outcome:	**Suggested Pedagogies**
The learner should be able to 1. Explore fundamental laws and elements of electrical circuits. 2. Understand DC circuit, theorems, and networks. 3. Reduce more complicated circuits into simpler equivalent circuits 4. Understands AC circuits and related terminologies with examples. 5. Design simple DC and AC circuits and solve numerical problems.	1. Use appropriate ICT tool, wherever necessary, for effective teaching. 2. Use diagrams to discuss different AC/DC circuits. 3. Discuss different numerical problems related to course.

Unit-I	**DC Circuits and Networks** Circuits, DC and AC, Sources of Electricity, Resistors, Types, Colour Coding, Variable Resistors, Rheostat, Potentiometers, Nonlinear resistors, Power Ratings, ohms law, voltage, current, resistance, electric power ,power dissipation, series circuits, parallel circuits, series-parallel circuits, voltage and current dividers. Kirchhoff's Current Law and Voltage, Superposition Theorem, Thevenin's Theorem, Norton's Theorem, Millman's Theorem, T to π Conversions	18
Unit-II	**AC Circuits** Alternating Voltage and Current, Sine wave, Voltage and Current values, Peak values, Average, Root means square, frequency, period, wavelength, phase angle. Capacitors-Charging and Discharging, Types of Capacitors, Capacitor coding, Series and Parallel, Capacitive reactance, RC series, RC Parallel circuits Inductors, Self Inductance, Mutual Inductance, Transformer, Transformer ratings, Types of Core, Variable Inductors, Series and Parallel Inductors, Inductive Reactance, Time constants-LR and RC, RC Wave Shapers, Short and Long Time constants. Resonance, Series, Parallel, Resonant Frequency, Bandwidth, Q-factors, Filters, Transformer Coupling, Capacitor Coupling, By Pass Capacitor, Low Pass Filter, High Pass Filters.	18
Recommended book : ***Basic Electronics,*** *B. Grob, Mc Graw Hill (2007)*		
Other References: 1. Theory and problems of basic circuit analysis, Schaum's outline series, John O'malley (2004) 2. Electric Circuits, Schaum's outline series, S. A. Nasar, Tata Mc Graw Hill (2004) 3. Electric circuits, Schaum's outline series, M. Nahvi and J. Edminister, Tata McGraw Hill (2005)		

ELS1102: Semiconductor Devices

[Credits-2]

Course Outcome:	**Suggested Pedagogies**
The learner should be able to 1. Understand the basic material and properties of semiconductors 2. Explore the constructional features of basic semiconductor devices. 3. Describe the biasing principles of semiconductor devices like diode and transistors 4. Explain the I-V characteristics of semiconductor devices like diode, BJT, UJT, JFET and MOS FET	1. Use appropriate ICT tool, wherever necessary, for effective teaching. 2. Use diagrams to discuss different device structures. 3. Discuss recent technologies related to course.

Unit-I	**Semiconductor Basics** Introduction to Semiconductor Materials, Intrinsic Semiconductors and Extrinsic semiconductors, n type semiconductors, p type semiconductors with reference to energy levels, Donors, Acceptors, concept of Fermi Level	4
Unit-II	**PN Junction Diode** Symbol, pins, unbiased diode, depletion layer, barrier potential, working in forward bias and reverse bias, concept of break down, I-V characteristics, knee voltage, break down voltage, bulk resistance, zener diode, light emitting diode, photo diode, solar cell.	10
Unit-III	**Bipolar Junction Transistor (BJT)** Symbol, pins, basic types- PNP and NPN, unbiased transistor, Biased Transistor, transistor currents, concept of current gain, α, β of BJT, configurations CE,CB and CC, with respect to CE configuration I-V characteristics-base curve and collector curves, load line, operating point, Biasing techniques - voltage divider bias, emitter bias, collector feedback bias and base bias.	14
Unit-IV	**UJT, JFET and MOSFET** Symbol, types, construction, working principle, I-V characteristics, Specifications parameters of: Uni-Junction Transistor (UJT), Junction Field Effect Transitor (JFET), Metal Oxide Semiconductor FET (MOSFET), comparison of JFET, MOSFET and BJT.	8

Recommended Book:

Electronic Principles - Albert Malvino, David J. Bates , 7th Edition (2016)

Other Reference Books:

1. Basic Electronics - B, Grob, Mitchel E. Schultz , 11th Editio, (2007)
2. Solid state Electronic Devices, B. G. Streetman and S. Banerjee, Pearson Education (2006)

ELS1103: Electronic Science Practical - I

[Credits-2]

Course Outcome:	**Suggested Pedagogies**
The learner should be able to 1. Use simple instruments like Power supply, Analog Meters and DMM. 2. Apply Kirchhoffs laws to calculate currents, voltages and powers in DC circuits. 3. Reduce more complex circuits into Thevenin's and Norton's equivalent circuits 4. Plot I-V characteristics of various semiconductor devices. 5. Use of breadboard for building circuits.	1. Use appropriate ICT tool, wherever necessary, for effective teaching. 2. Use diagrams to discuss different device structures. 3. Use audio-visual media to demonstrate practical related concepts.

1.	Study of Series and Parallel combination of Resistors
2.	Verification of Kirchhoff's Law.
3.	Verification of Thévenin's Theorem.
4.	Verification of Norton's theorem.
5.	Verification of Superposition Theorem.
6.	Verification of the Maximum Power Transfer Theorem
7.	Measurement of Amplitude, Frequency & Phase difference using CRO.
8.	Designing of a Low Pass RC Filter and study of its Frequency Response.
9.	Designing of a High Pass RC Filter and study of its Frequency Response.
10.	Study of the I-V Characteristics of Diode – Ordinary and Zener Diode.
11.	Study of the I-V Characteristics of the CE/CB/CC configurations of BJT
12.	Study of the I-V Characteristics of JFET.
13.	Study of the I-V Characteristics of MOSFET
14.	Study of Characteristics of Solar Cell

Any 10 experiments: 8 compulsory + 1 Activity (Equivalent to Two Practical's)

ELS1201: Electronic Circuits

[Credits-2]

Course Outcome:	**Suggested Pedagogies**
1. The learner will be able to 2. Ability to apply basic concepts of P-N Junction in developing simple application circuits. 3. Understand the power supply at block level. 4. Attain knowledge of various amplifiers and their comparison. 5. Identify the applications of JFET & MOSFET. 6. Familiarization with basics of thyristor family.	1. Use appropriate ICT tool, wherever necessary, for effective teaching. 2. Use diagrams to discuss different device structures. 3. Discuss modern applications related to course.

Unit-I	**Diode Circuits** Half wave rectifier, transformer, full wave rectifier, bridge rectifier, choke input filter, capacitor input filter, peak inverse voltage and surge current, block diagram of power supply, zener regulator, clippers and limiters, clampers and voltage multipliers	12
Unit-II	**Transistor Circuits** Transistor as a switch, transistor as an amplifier, class A operation, class B operation, Emitter follower, class B push-pull emitter follower, class C operation, Single stage RC coupled CE amplifier, voltage gain, concept of frequency response and bandwidth, JFET biasing in ohmic/active region, MOSFET in digital switching	16
Unit-III	**Thyristors** Four-layer diode, SCR, DIAC, TRAIC - Symbol, types, construction, basic working, I-V characteristics, Applications	8

Recommended Book:

Electronic Principles, Albert Malvino, David J. Bates, 7th Edition (2016)

Other Reference Books:

1. Basic Electronics - B, Grob, Mitchel E. Schultz , 11th Edition, (2007)
2. Basic Electronics and Linear circuits, N. N. Bhargava, D. C. Kulshreshtha, S. C. Gupta, Tata Mc Graw Hill (2008)
3. Semiconductor devices, Kanaan Kano, Pearson Education (2004)

ELS1202: Digital Electronics

[Credits-2]

Course Outcome:	**Suggested Pedagogies**
The learner should be able to 1. Convert different type of codes and number systems in computers and communication. 2. Describe switch model used to illustrate building blocks of digital circuits. 3. Use Boolean algebra and Karnaugh maps for reduction of logic expressions and circuits. 4. Perform arithmetic operation on binary numbers and design simple arithmetic logic circuits.	1. Use appropriate ICT tool, wherever necessary, for effective teaching. 2. Use diagrams to discuss different device structures. 3. Use of simulation tools to demonstrate basic digital circuits 4. Illustrate some digital circuits.

Unit-I	**Number Systems and Codes** Binary Number System, Binary-to-decimal Conversion, Decimal-to-binary Conversion, Octal Numbers, Hexadecimal Numbers, The ASCII Code, The Excess-3 Code, The Gray Code, Error Detection and Correction	8
Unit-II	**Digital principles and logic** Definitions for Digital Signals, Digital Waveforms, Digital Logic, Digital Computers, Digital Integrated Circuits, Digital IC Signal Levels, Digital Logic**,** The Basic Gates-NOT, OR, AND, Universal Logic Gates-NOR, NAND, AND-OR-Invert Gates, Positive and Negative Logic	8
Unit-III	**Combinational Logic Circuits** Boolean Laws and Theorems, Sum-of-Products Method, Truth Table to Karnaugh Map, Pairs, Quads, and Octets , Karnaugh Simplifications , Don't-care Conditions , Product-of-sums Method, Product-of-sums Simplification, Simplification by QUINE-Mc-CLUSKY Method	12
Unit-IV	**Arithmetic Circuits** Binary Addition, Binary Subtraction, Unsigned Binary Numbers, Sign-magnitude Numbers,2's Complement epresentation, 2's Complement Arithmetic, Arithmetic Building Blocks, The Adder-subtracter, Fast-Adder, Arithmetic Logic Unit, Binary Multiplication and Division	8
Recommended Book : *Digital Principles and Applications , Donald P Leach , Albert Paul Malvino, Goutam Saha, Tata McGraw Hill (2011)*		
Other References: 1. Digital System Design, Morris Mano, Pearson Education (2014) 2. Digital Principals, Schaum's outline series, Tata Mc Graw Hill (2006) 3. Digital Fundamentals, T. L. Floyld, Pearson Education (2013)		

ELS1203: Electronic Science Practical - II

[Credits-2]

Course Outcome:	**Suggested Pedagogies**
The learner should be able to 1. Use test and measuring instruments like signal generators and DSO. 2. Build and test simple circuits using semiconductor devices and Integrated circuits. 3. Test simple transistorized amplifier and prepare frequency response 4. Design, build and test simple building blocks of digital logic circuits.	1. Use appropriate ICT tool, wherever necessary, for effective teaching. 2. Use diagrams to discuss different device structures. 3. Use audio-visual media to demonstrate practical related concepts.

1.	Study of the half wave rectifier and Full wave rectifier.
2.	Study of power supply using C filter and Zener diode.
3.	Study of clipping and clamping circuits.
4.	Study of Fixed Bias, Voltage divider and Collector-to-Base bias Feedback configuration for transistors.
5.	Study of transistor as switch / inverter
6.	Designing of a Single Stage CE amplifier
7.	Study of the frequency response of Common Source FET amplifier
8.	Study of Voltage doubler
9.	To verify and design AND, OR, NOT and XOR gates using NAND gates.
10.	To convert a Boolean expression into logic gate circuit and assemble it using logic gate IC's.
11.	Design a Half and Full Adder
12.	Design a Half and Full Subtractor.
13.	De Morgan's theorem verification
14.	Study of RS, JK and D flip flops using NAND gates
15.	Study of Flip flop ICs
16.	Study of Tri-state Buffer

Any 10 experiments: 8 compulsory + 1 Activity (Equivalent to Two Practicals)