Maharashtra Education Society's

Abasaheb Garware College

Karve Road, Pune – 411 004.

(Autonomous)

(affiliated to Savitribai Phule Pune University, Pune)

Three Year B.Sc. Degree Program in Electronic Science

(Faculty of Science and Technology)

Syllabi under Autonomy

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

Choice Based Credit System Syllabus

To be implemented from Academic Year 2022-2023

B.Sc. (Electronic Science)

Preamble

The systematic and planned curricula from first year to the third year shall motivate and encourage the students for pursuing higher studies in Electronics and for becoming an entrepreneur.

At first year of under-graduation: The basic topics related to the fundamentals of electronics are covered. Since electronics is very close to technological advancements, the practical course is intended to achieve the basic skills required for circuit building and testing.

At second year under-graduation: The level of the theory and practical courses shall be one step ahead of the first year B.Sc. Courses based on content of first year shall be introduced. Analog and digital circuit design concepts will be introduced at this stage.

At third year under-graduation: Theory papers in each semester deal with the further detailed studies of the branches of Electronics. The first two practical courses shall be based on the theory courses. Third practical course is project course in which student can independently think and carry out the project work.

Eligibility: 1 First Year B.Sc.: Higher Secondary School Certificate (10+2) Science stream or its equivalent Examinations per the Savitribai Phule Pune University eligibility norms

Program Outcomes of B.Sc. Electronic Science

The following program specific outcomes have been identified for B.Sc .Electronic Science.

PSO1	Ability to apply knowledge of mathematics and science in solving electronics related problems
PSO2	Ability to design and conduct electronics experiments, as well as to analyze and interpret data
PSO3	Ability to design and manage electronic systems or processes that conforms to a given specification within ethical and economic constraints
PSO4	Ability to identify, formulate, solve and analyze the problems in various disciplines of electronics
PSO5	Ability to function as a member of a multidisciplinary team with sense of ethics, integrity and social responsibility
PSO6	Ability to communicate effectively in term of oral and written communication skills
PSO7	Recognize the need for, and be able to engage in lifelong learning
PSO8	Ability to use techniques, skills and modern technological/scientific/engineering software/tools for professional practices

B. Sc. (Electronic Science)
Course Structure

Year	Semester	Course type	Course code	Course Title	Remark	Credits	No. of Lectures /Practical to be conducted
I	I	Core Courses	USEL-111	Paper I: Basic Circuit Theory and Network Analysis	Theory	2	36
			USEL-112	Paper II: Basics of Digital Electronics	Theory	2	36
			USELP-113	Paper III: Practical Course	Practical	1.5	08 Expts
	II	Core Courses	USEL-121	Paper 1: Semiconductor Devices	Theory	2	36
			USEL-122	Paper 2: Digital Circuits	Theory	2	36
			USELP-123	Paper 3: Practical Course	Practical	1.5	08 Expts
II	III	Core Courses	USEL-231	Paper I: Electronic Circuits	Theory	2	36
			USEL-232	Paper II: Digital System Design and VHDL	Theory	2	36
			USELP-233	Paper III: Practical Course	Practical	2	10 Expts
		Language (Science)	USLG -231	Language	Theory	2	36
		Environmental Science	UEVS-231	Environmental Science	Theory	2	36
	IV	**Core Courses**	USEL-241	Paper I: Operational Amplifiers and applications	Theory	2	36
			USEL-242	Paper II: Microcontrollers	Theory	2	36
			USELP-243	Paper III: Practical Course	Practical	2	10 Expts
		Language (Science)	USLG -241	Language	Theory	2	36
		Environmental Science	UEVS-241	Environmental Science	Theory	2	36
III	V	Discipline Specific Core Courses	USEL-351	Digital Design using Verilog	Theory	2	36
			USEL-352	Microcontroller Architecture and Programming	Theory	2	36
			USEL-353	Analog circuit Design and Applications	Theory	2	36
			USEL-354	Nanoelectronics	Theory	2	36
			USEL-355	Signals and Systems	Theory	2	36
		Discipline Specific Elective Course	USELELE-356 A	A. Optics and Fiber Optic Communication	Optional Theory	2	36
			USELELE-356 B	B. Electronic Product Design and Entrepreneurship	Optional Theory	2	36
		Discipline	USELP-357	Practical Course I	Practical	2	10 Expts

		Specific Core Courses	USELP-358	Practical Course II	Practical	2	10 Expts
			USELP-359	Practical Course III(Project)	Project	2	
		Skill Enhancement Course	USELSEC-351	Electronic Design Automation Tools	Theory	2	36
			USELSEC-352	Internet of Things and Applications	Theory	2	36
	VI	Discipline Specific Core Courses	USEL-361	Modern Communication Systems	Theory	2	36
			USEL-362	Embedded System Design using Microcontrollers	Theory	2	36
			USEL-363	Industrial Electronics	Theory	2	36
			USEL-364	Manufacturing Processes for Electronics	Theory	2	36
			USEL-365	Fundamentals of Process Control System	Theory	2	36
		Discipline Specific Elective Course	USELELE-366 A	PLC SCADA	Optional Theory	2	36
			USELELE-366 B	Sensors and Systems	Optional Theory	2	36
		Discipline Specific Core Courses	USELP-367	Practical Course I	Practical	2	10 Expts
			USELP-368	Practical Course II	Practical	2	10 Expts
			USELP-369	Practical Course III(Project)	Project	2	
		Skill Enhancement Course	USELSEC-361	Design and Fabrication of PCB	Theory	2	36
			USELSEC-362	Mobile Application Development	Theory	2	10 Expts

Examination Pattern:

Continuous Internal Assessment marks	End Semester Marks	Total marks
15	**35**	**50**

Continuous Internal Assessment Examination includes

1. Written Examination
2. Assignment
3. Open book test
4. Problem solving
5. Survey
6. Group discussion
7. Seminars
8. Presentation
9. Any other as per the course requirement

MES ABASAHEB GARWARE COLLEGE (Autonomous)
KARVE ROAD, PUNE 411 004.
Department of Electronic Science
USEL -111: Paper I: Basic Circuit Theory and Network Analysis

Semester: I **Credits: 2** **Lectures: 36**

Course Outcomes:

At the end of this course, Students will be able to

CO1 : Study circuits in a systematic manner suitable for analysis and design.

CO2: Understand how to formulate circuit analysis problems in a mathematically tractable way with an emphasis on solving linear systems of equations.

CO3: Analyse the electric circuit using network theorems.

CO4 : Determine Sinusoidal steady state response.

CO5 : Understand the two–port network parameters with an ability to find out two-port network parameters & overall response for interconnection of two-port networks.

Syllabus contents

Unit 1: Basic Circuit Concepts (18 Lectures)

Voltage and Current Sources

Resistors: Fixed and Variable resistors, Construction and Characteristics, Color coding of resistors, resistors in series and parallel.

Capacitors: Principles of capacitance, Parallel plate capacitor, Permittivity, Definition of Dielectric Constant, Dielectric strength, charging and discharge capacitor, capacitors in series and parallel, factors governing the value of capacitors, testing of capacitors using multimeter.

Inductors: Fixed and Variable inductors, Self and mutual inductance, Energy stored in an inductor, Inductance in series and parallel, Transformers, Testing of resistance and inductance using multimeter.

Relays, Switches and Fuses (concept and symbols)

Unit 2: Network Analysis (18 Lectures)

Circuit Analysis: Kirchhoff's Current Law (KCL), Kirchhoff's Voltage Law (KVL), Thevenin's Theorem, Norton's Theorem, Superposition Theorem, Maximum Power Transfer Theorem.

Circuit analysis using network theorems (Numerical problems).

Reference books:

1. Electrical Circuits, M. Nahvi and J. Edminister, Schaum's Outline Series, Tata McGraw-Hill.(2005)
2. Robert L. Boylestad, Essentials of Circuit Analysis, Pearson Education (2004)

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Department of Electronic Science
USEL -112: Paper II: Basics of Digital Electronics

Semester: I **Credits: 2** **Lectures: 36**

Course Outcomes:

At the end of this course, students will be able to

CO1: Understand and represent numbers in powers of base and converting one from the other, carry out arithmetic operations

CO2: Understand basic logic gates, concepts of Boolean algebra and techniques to reduce/simplify Boolean expressions

CO3: Analyze and design combinatorial as well as sequential circuits

Syllabus contents

Unit-1: Basic Concepts (20 Lectures)

Number System and Codes: Decimal, Binary, Hexadecimal and Octal number systems, base conversions, Binary, octal and hexadecimal arithmetic (addition, subtraction by complement method, multiplication), representation of signed and unsigned numbers, Binary Coded Decimal code.

Logic Gates and Boolean algebra: Introduction to Boolean Algebra and Boolean operators, Truth Tables of OR, AND, NOT, Basic postulates and fundamental theorems of Boolean algebra, Truth tables, construction and symbolic representation of XOR, XNOR, Universal (NOR and NAND) gates.

Unit-2: Combinational Logic circuits (16 Lectures)

Combinational Logic Analysis and Design: Standard representation of logic functions (SOP and POS), Karnaugh map minimization(upto 4 variables) , Encoder and Decoder, Multiplexers and Demultiplexers, Implementing logic functions with multiplexer, Half adder and subtractor , full adder, parallel adder/subtractor

Reference Books:

1. M. Morris Mano Digital System Design, Pearson Education Asia,(Fourth Edition)
2. Thomas L. Flyod, Digital Fundamentals, Pearson Education Asia (1994)
3. W. H. Gothmann, Digital Electronics: An Introduction To Theory And Practice, Prentice Hall of India(2000)
4. R. L. Tokheim, Digital Principles, Schaum's Outline Series, Tata McGraw- Hill (1994)

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Department of Electronic Science
USELP -113: Paper III: Practical Course

Semester: I **Credits: 1.5** **No. of Experiments: 08**

At the end of this course, students will be able to
CO1 : Understand and design simple digital systems.
CO2: Prepare the technical report on the experiments carried

1. Introduction to electronic components and instruments
    a. Resistance in series, parallel and series-Parallel
    b. Capacitors & Inductors in series & Parallel.
    c. Multimeter – Checking of components.
    d. Voltage sources in series, parallel and series – Parallel
    e. Voltage and Current dividers
2. Measurement of Amplitude, Frequency & Phase difference using CRO.
3. To verify Thevenin's Theorem.
4. To verify Maximum Power Transfer Theorem.
5. To verify and design AND, OR, NOT and XOR gates using NAND gates.
6. To convert a Boolean expression into logic gate circuit and assemble it using logic gate IC's.
7. Design a Half and Full Adder.
8. Study of 2: 1 Multiplexer

Activity: Students can perform Project/Industrial visit/any other experiment. This will be equivalent to two experiments.
Assignment: Introduction to logic families

Reference:
National semiconductor IC manuals
Signetics manuals
Exar manuals

Special Note for Practical Courses

Practical course is of 1.5 credits means of 3 hours and 20 minutes
For proper utilization of time, one can engage the students thus following be standard operating procedure during the practicals

1. Explanation and performance of practical (purpose, theory, circuit diagram, connections, test process, observations, plot the graph, calculations, inference, conclusion)
2. Ask the students to refer the data manuals
3. Ask the students to do simulations using Pspice, multisim etc
4. Different Application circuits with reference to particular practical
5. Ask students themselves to submit the report of the particular practical he/she has performed.

MES ABASAHEB GARWARE COLLEGE (Autonomous)
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Department of Electronic Science
USEL -121: Paper I: Semiconductor Devices

Semester: II **Credits: 2** **Lectures: 36**

Course Outcomes

At the end of this course, Students will be able to

CO1: Describe the behaviour of semiconductor materials

CO2: Reproduce the I-V characteristics of diode/BJT/MOSFET devices

CO3: Apply standard device models to explain/calculate critical internal parameters of semiconductor devices

CO4: Explain the behaviour and characteristics of power devices such as SCR/UJT etc.

Syllabus Contents

Unit 1 : Diodes and Transistors (18 Lectures)

P-N Junction Diode: Symbol, construction of diode. Derivation of Diode Equation and I-V Characteristics. Types of diode: Rectifier diode, Zener Diode, Avalanche diode,

Bipolar Junction Transistors (BJT): PNP and NPN Transistors, Basic Transistor Action, Current Gain, Input and Output Characteristics of CB, CE and CC Configurations.

Types of Transistor biasing technique: Voltage divider bias

Unit 2: MOSFETS and Power Devices (18 Lectures)

MOSFET: types of MOSFETs, Circuit symbols, Working and Characteristic curves of Depletion type MOSFET (both N channel and P Channel) and Enhancement type MOSFET (both N channel and P channel).

Power Devices: SCR, DIAC and TRIAC: Symbols, construction and working, characteristics, UJT: Symbol, characteristic and application as relaxation oscillator

Reference Books:

1) Ben G Streetman and S. Banerjee, Solid State Electronic Devices, Pearson Education
2) Dennis Le Croissette, Transistors, Pearson Education (1989)
3) Jasprit Singh, Semiconductor Devices: Basic Principles, John Wiley and Sons (2001)
4) Kanaan Kano, Semiconductor Devices, Pearson Education (2004)
5) Robert F. Pierret, Semiconductor Device Fundamentals, Pearson Education (2006)

MES ABASAHEB GARWARE COLLEGE (Autonomous)
KARVE ROAD, PUNE 411 004.
Department of Electronic Science
USEL -122: Paper II: Digital Circuits

Semester: II **Credits: 2** **Lectures: 36**

Course Outcomes:

At the end of this course, students will be able to

CO1: Understand and represent numbers in powers of base and converting one from the other, carry out arithmetic operations

CO2: Understand basic logic gates, concepts of Boolean algebra and techniques to reduce/simplify Boolean expressions

CO3: Analyze and design combinatorial as well as sequential circuits

CO4: Explain the concepts related to PLD's

Syllabus Contents

Unit 1: Sequential logic Circuits **(18 Lectures)**

Flip flops: S-R, J-K, T and D type Flip flop, concept of level triggered and edge triggered flip flips, master slave flip flop and their truth tables

Shift Registers: SISO, SIPO, PISO and PIPO registers

Counters (synchronous and asynchronous and modulo-10), Up and Down counters Ring counter and Johnson counter. Programmable counter

Logic Devices: Basic concepts- ROM, PLA, PAL, CPLD, FPGA (Only definition)

Unit 2: Data Converters **(18 Lectures)**

A-D and D-A Conversion:

D-A conversion: Characteristics, 4 bit binary weighted resistor type, circuit and working.

A-D conversion characteristics, successive approximation ADC. (Mention the relevant ICs for all). Effect of quantization

Reference Books:

1. M. Morris Mano Digital System Design, Pearson Education Asia,(Fourth Edition)
2. Thomas L. Flyod, Digital Fundamentals, Pearson Education Asia (1994)
3. W. H. Gothmann, Digital Electronics: An Introduction To Theory And Practice, Prentice Hall of India(2000)
4. R. L. Tokheim, Digital Principles, Schaum's Outline Series, Tata McGraw- Hill (1994)

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USELP -123: Paper III: Practical Course

Semester: II **Credits: 1.5** **No. of Experiments: 08**

At the end of this course, students will be able to
CO1 : Understand and design simple digital systems.
CO2: Prepare the technical report on the experiments carried

1. Forward and reverse characteristics of Diode.
2. Output characteristics of the CE configuration of BJT and obtain ri, ro, β.
3. Output characteristics of UJT and its application as relaxation oscillator.
4. Output characteristics of SCR/DIAC/TRIAC/MOSFET.
5. Design and build modulo 2/5 counter using K maps.
6. Design and build magnitude comparator
7. Design a shift register and study Serial and parallel shifting of data.
8. Design and build 4 bit binary weighted DAC/flash ADC

Activity: Students can perform Project/Industrial visit. This will be equivalent to two experiments

Assignment: Study of different types of ADC/DAC

References:
National Semiconductor Manuals
Signetics Manuals
Exar manuals

Special Note for Practical Courses

Practical course is of 1.5 credits means of 3 hours and 20 minutes

For proper utilization of time, one can engage the students thus following be standard operating procedure during the practicals

1. Explanation and performance of practical (purpose, theory, circuit diagram, connections, test process, observations, plot the graph, calculations, inference, conclusion)
2. Ask the students to refer the data manuals
3. Ask the students to do simulations using Pspice, multisim etc
4. Different Application circuits with reference to particular practical
5. Ask students themselves to submit the report of the particular practical he/she has performed.