S.Y.B. Sc. Electronic Science

SYLLABUS

DISCIPLINE SPECIFIC COURSE(DSC)

UNDER NATIONAL EDUCATION POLICY 2020

CBCS NEP 2024 Pattern

TO BE IMPLEMENTED FROM

ACADEMIC YEAR 2025-26

DEPARTMENT OF ELECTRONIC SCIENCE

Maharashtra Education Society's

ABASAHEB GARWARE COLLEGE(AUTONOMOUS)

KARVE ROAD, PUNE 411 004.

Maharashtra Education Society's

Abasaheb Garware College, Pune

Credit Framework for Under Graduate (UG) to be implemented from 2024 – 25 to First Year UG

Level / Difficulty	Sem	Subject-1	Subject-2	Subject-3	GE/OE	SEC	IKS	AEC	VEC	CC	Total
4.5 / 100	I	2 (T) + 2 (P)	2(T)+2(P)	2(T)+2 (P)	2 (1T+1P)	2 (T/P)	2 (T) (Generic)	2 (T)	2	--	22
	II	2 (T) + 2 (P)	2(T)+2(P)	2(T)+2 (P)	2 (1T+1P)	2 (T/P)	--	2 (T)	2	2	22
Exit option: Award of UG Certificate in Major with 44 credits and an additional 4 credits core NSQF course/ Internship OR Continue with Major and Minor Continue option: Student will select one subject among the (subject 1, subject 2 and subject 3) as major and another as minor and third subject will be dropped.											

Level / Difficulty	Sem	Credits Related to Major				Minor		GE/OE	SEC	IKS	AEC	VEC	CC	Total
		Major Core	Major Elective	VSC	FP / OJT / CEP									
5.0 / 200	III	4 (T) + 2 (P)	--	2 (T/P)	2 (FP)	2(T)+2(P)	--	2 (1T+1P)	--	2 (T) (Major Subject Specific)	2 (T)	--	2	22
	IV	4 (T) + 2 (P)	--	2 (T/P)	2 (CEP)	2(T)+2(P)	--	2 (1T+1P)	2 (T/P)	--	2 (T)	--	2	22
Exit option: Award of UG Diploma in Major and Minor with 88 credits and an additional 4 credits core NSQF course/ Internship OR Continue with Major and Minor														
5.5 /300	V	8(T) + 4(P)	2 (T) + 2 (P)	2 (T/P)	2 (FP/CEP)	2(T)	--	--	--	--	--	--	--	22
	VI	8(T) + 4(P)	2 (T) + 2 (P)	2 (T/P)	4 (OJT)	--	--	--	--	--	--	--	--	22
Total 3 Years		44	8	8	10	18	8	8	6	4	8	4	6	132
Exit option: Award of UG Degree in Major with 132 credits OR Continue with Major and Minor														
6.0 /400	VII	6 (T) + 4 (P)	2 (T) + 2 (T/P)	--	4 (RP)	4(RM)(T)		--	--	--	--	--	--	22
	VIII	6 (T) + 4 (P)	2 (T) + 2 (T/P)	--	8 (RP)	0			0	0	0	0	0	22
Total 4 Years		64	16	8	22	22	8	8	6	4	8	4	6	176
Four Year UG Honours with Research Degree in Major and Minor with 176 credits OR														
6.0 /400	VII	10(T) + 4(P)	2 (T) + 2 (T/P)	0	0	4 (RM) (T)			0	0	0	0	0	22
	VIII	10(T) + 4(P)	2 (T) + 2 (T/P)	0	4 (OJT)	0			0	0	0	0	0	22
Total 4 Years		72	16	8	14	22	8	8	6	4	8	4	6	176
Four Year UG Honours Degree in Major and Minor with 176 credits														

M.E.S. Abasaheb Garware College Pune-4

18.4.24

Principal

MES. Abasaheb Garware College

Pune-4.

Course Codes and Course Titles

for S. Y. B. Sc. Electronic Science

Semester	Vertical Name	Course Code	Course Title	Theory/Practical	Credits
III	Major	ELS-211-MJ	Communication Systems	Theory	2
		ELS-212-MJ	Semiconductor Technology and Quantum Computing	Theory	2
		ELS-213-MJP	Electronic Sc. Practical Course III	Practical	2
	Minor	ELS-243-MN	Introduction to data and Programming Languages	Theory	2
		ELS-244-MNP	Practical Course on data and programming languages	Practical	2
	VSC	ELS-222-VSC	Introduction to Internet of Things and Python Programming	Theory+Practical	2
	IKS	ELS-200-IKS	Technology in Ancient India	Theory	2
	OE	OE-211—ELS	Introduction to Consumer Electronics	Theory	2
	FP	ELS-231-FP	Field Project	Practical	2
IV	Major	ELS-255-MJ	Digital System Design using VHDL	Theory	2
		ELS-256-MJ	Electronic Instrumentation	Theory	2
		ELS-257-MJP	Electronic Sc. Practical course IV	Practical	2
	Minor	ELS-293-MN	Fundamentals of Electric Vehicles	Theory	2
		ELS-294-MNP	Practicals Course Electric Vehicles	Practical	2
	VSC	ELS-271-VSC	IoT and applications	Theory+Practical	2
	OE	OE-261—ELS	Repairing and Maintenance of Electronic Products	Practical	2
	SEC	SEC-252-ELS	Mobile Application Development	Theory+Practical	2
	CEP	ELs-281-CEP	Community Enhancement Project	Practical	2

CREDIT FRAMEWORK IN NEP

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.

Objectives:

I. To provide in depth knowledge of scientific and technological aspects of electronics
II. To familiarize with current and recent technological developments
III. To enrich knowledge through programmes such as industrial visits, hobby projects, market survey, projects etc.
IV. To train students in skills related to electronics industry and market.
V. To create foundation for research and development in Electronics
VI. To develop analytical abilities towards real world problems
VII. To help students build-up a progressive and successful career in Electronics

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

Maharashtra Education Society's
ABASAHEB GARWARE COLLEGE (AUTONOMOUS)
KARVE ROAD, PUNE 411 004.
DEPARTMENT OF ELECTRONIC SCIENCE
Discipline Specific Course System: Major
(CBCS NEP 2024 Pattern)

Level: 5	**Year : Second**	**Semester: 3**
Paper: 1	**Compulsory Theory Major**	**Credits: 2**
Course code: ELS-211-MJ	**Course title: Communication Systems**	
Number of lectures: 30	**Internal assessment: 25 marks**	**Semester assessment: 25 marks**

Course Outcomes: After completion of this course student is able to

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

CO1: Understand the basics of communication systems.

CO2: Understand the basics of Analog communication Techniques.

CO3: Understand the basics of Digital communication Techniques

CO4: Design and Analyse the performance of both the communication systems.

Unit	Topics	Lectures
I	**Electronic communication**: Block diagram of an electronic communication system, electromagnetic spectrum-band designations and applications, need for modulation, concept of channels and base-band signals. Concept of Noise, Types of Noise, Signal to noise ratio, Noise Figure, Noise Temperature **Amplitude Modulation:** Amplitude Modulation, modulation index and frequency spectrum. Generation of AM, Amplitude Demodulation (diode detector), Concept of Double side band suppressed carrier, Single side band suppressed carrier, other forms of AM (Pilot Carrier Modulation, Vestigial Side Band modulation, Independent Side Band Modulation). Block diagram of AM Transmitter and Receiver **Angle modulation:** Frequency and Phase modulation, modulation index and frequency spectrum, Generation of FM (direct and indirect methods), FM detector (PLL). Block diagram of FM Transmitter and Receiver Comparison between AM, FM and PM. **Pulse Analog Modulation:** Channel capacity, Sampling theorem, PAM, PWM, PPM modulation, Multiplexing, TDM and FDM.	**20**
II	**Pulse Code Modulation:** Need for digital transmission, Quantizing, Uniform and Nonuniform Quantization, Quantization Noise, Companding, Coding, Decoding, Regeneration **Digital Carrier Modulation Techniques**: Block diagram of digital transmission and reception, Information capacity, Bit Rate, Baud Rate and M-ary coding. Amplitude Shift Keying (ASK), Frequency Shift Keying (FSK), Phase Shift Keying (PSK), Binary Phase Shift Keying (BPSK) and Quadrature Phase Shift Keying (QPSK)	**10**

Suggested Books:

1. Electronic communication systems- Kennedy, 3rd edition, McGraw international publications
2. Principles of Electronic communication systems – Frenzel, 3rd edition, McGraw Hill
3. Advanced electronic communications systems – Tomasi, 6th edition, PHI.
4. Communication Systems, S. Haykin, Wiley India (2006)

Maharashtra Education Society's
ABASAHEB GARWARE COLLEGE (AUTONOMOUS)
KARVE ROAD, PUNE 411 004.
DEPARTMENT OF ELECTRONIC SCIENCE
Discipline Specific Course System: Major
(CBCS NEP 2024 Pattern)

Level: 5	**Year : Second**	**Semester: 3**
Paper: 2	**Compulsory Theory Major**	**Credits: 2**
Course code: ELS-212-MJ	**Course title: Semiconductor Technology and Quantum Computing**	
Number of lectures: 30	**Internal assessment: 25 marks**	**Semester assessment: 25 marks**

Course Outcomes: After completion of this course student is able to

CO1: Understand basics of semiconductor technology.

CO2: Understand the concept of various terminologies used in semiconductors

CO3: know about quantum mechanics

CO4: get familiar with concepts in Quantum computing.

Unit	Topics	Lectures
I	**Semiconductor Technology** **Semiconductor Physics Overview:** Evolution of the devices, Diamond structure of Silicon, Band and Bond Model of the Intrinsic and Extrinsic semiconductor, Energy band diagram of Uniform and Non-uniform doped semiconductor **Carrier Transport:** Drift and Diffusion, Mathematical expressions governing the carrier statistics. **PN Junction:** Overview of the junctions, PN junction under equilibrium, I/V characteristics of the diode: Forward and Reverse, Junction Capacitances. Metal Semiconductor and Heterojunctions: Schottky barrier diode, Metal semiconductor Ohmic contact **Heterojunction:** Two-dimensional electron gas. Two terminal MOS Cap: Flat-band voltage, Potential balance and charge balance, Effect of Gate-substrate voltage on surface condition, Inversion, Small signal capacitance. **Three and Four Terminal MOS:** Field Effect Transistor: Three Terminal MOS, Body effect, Four Terminal MOS: Regions of inversion, Transistor regions of operation, General charge sheet model	**25**
II	**Introduction to Quantum computing** Basics of Quantum Mechanics, Birth of Quantum Computing, Concept of Qbits, Quantumn gates and circuits, Quantum Algorithms, Quantum error correction, Current challenges and future prospects	**05**

Suggested books:

1. Natansh N, Futuristic Trends in Electronics & Instrumentation Engineering e-ISBN: 978-93-6252-452-2 IIP Series, Volume 3, Book 2, Part 8, Chapter 3 INTRODUCTION TO QUANTUM MECHANICS AND QUANTUM COMPUTING,
2. Streetman, Solid state Electronic Devices

Maharashtra Education Society's
ABASAHEB GARWARE COLLEGE (AUTONOMOUS)
KARVE ROAD, PUNE 411 004.
DEPARTMENT OF ELECTRONIC SCIENCE
Discipline Specific Course System: Major
CBCS NEP 2024 Pattern

Level: 5	**Year : Second**	**Semester: 3**
Paper: 3	**Compulsory Practical Major**	**Credits: 2**
Course code: ELS-213-MJP	**Course title: Electronic Science Practical Course III**	
Number of lectures: 30	**Internal assessment: 25 marks**	**Semester assessment: 25 marks**

Course Outcome - At the end of this course, students will be able to
CO1: Understand basic elements of a communication system.
CO2: Analyze the baseband signals in time domain and in frequency domain.
CO3: Build understanding of various analog and digital modulation and demodulation techniques.
CO4: Prepare the technical report on the experiments carried
CO6: Calculate the various device parameters from their characteristics.
CO7: Design power control circuits using semicondcutor power devices.

List of experiments (Any 15)

Group A: Communication Systems (Any 10)

1. Design ,build and test Amplitude Modulator using transistor
2. Design, build and test Frequency Modulation using IC 566/8038
3. Design ,build and test PPM/PWM /PAM
4. Design ,build and test FSK
5. Design ,build and test Time division multiplexing/Frequency division multiplexing
6. To design, build and test PCM encoder.
7. To design, build and test Delta/Adaptive Delta modulation
8. Study of Satellite communication system
9. Comparative study of GSM, CDMA. 2G, 3G and 4G methods
10. Study of architecture of mobile communication system
11. Study QAM /QPSK techniques
12. Study of BPSK MODEM

Group B: Semiconductor Technology and Quantum Computing (Any 3)
Self Learning experiments

- MOOC courses
- Literature Survey
- Seminar

Group C: Industrial Visit/Add on expt/MOOCS course **(equivalent to 2 expt)**

Maharashtra Education Society's
ABASAHEB GARWARE COLLEGE (AUTONOMOUS)
KARVE ROAD, PUNE 411 004.
DEPARTMENT OF ELECTRONIC SCIENCE
Discipline Specific Course System: Major

Level: 5	**Year : Second**	**Semester: 3**
Paper: 4	**Compulsory Theory Minor**	**Credits: 2**
Course code: ELS-243-MN	**Course title: Introduction to data and programming languages**	
Number of lectures: 30	**Internal assessment: 25 marks**	**Semester assessment: 25 marks**

Course Outcomes: After completion of this course student is able to

CO1: Identify different data types and their properties
CO2: know about basic building blocks of any programming language
CO3: use effectively C and python programming languages
CO4: solve problems in Electronics using these languages

Unit	Topics	Lectures
I	**Introduction to data and their types** Definition of data, different types of data (int, float etc), syntax, definition of variables, operators and their types, statements, control loops, files, structure Concept of object oriented programming and their features Difference between machine language, assembly language and high level language, modular programming	**08**
II	**Introduction to C programming and Python programming** **C Programming:** Syntax, data types: int, float, char and string and declarations, different operators and their types, statements:printf, scanf , if else switch, control loops: while do while and for , functions: call by value , call by reference and recursion, files: modes r, w,a and related types, structure and linked list **Python programming:** Python basics, Python variables, Python basic Operators, python blocks, Numeric data types: int, float, complex and string data type and string operations, Defining list and list slicing, Use of Tuple data type, Conditional blocks using if, else and elif, statements such as input and print Simple for loops in python, For loop using ranges, string, list and dictionaries, Use of while loops in python, Loop manipulation using pass, continue, break and else, Programming using Python conditional and loops, block Python Functions, Modules and Packages, List manipulation using in build methods, Dictionary manipulation, Programming using string, list and dictionary in built functions, tupules **Basic programs using C and python programming:** 1. Factorial of a number 2. Fibonacci series 3. Even and odd number **4.** Reverse of string	**22**

Suggested books:

1. Think Python, Allen Downey, O'Reilly, 2012
2. Introduction to Problem Solving with Python, E. Balagurusamy
3. Arduino-Based Embedded Systems: By Rajesh Singh, Anita Gehlot, Bhupendra Singh, and Sushabhan Choudhury.
4. Arduino Made Simple by Ashwin Pajankar

Maharashtra Education Society's
ABASAHEB GARWARE COLLEGE (AUTONOMOUS)
KARVE ROAD, PUNE 411 004.
DEPARTMENT OF ELECTRONIC SCIENCE
Discipline Specific Course System: Minor Practical

Level: 5	**Year : Second**	**Semester: 3**
Paper: 5	**Compulsory Practical Minor**	**Credits: 2**
Course code: ELS-244-MNP	**Course title: Practical Course on Introduction to data and programming languages**	
Number of Practical: 15	**Internal assessment: 25 marks**	**Semester assessment: 25 marks**

Group A: C & Python Programming (Any 12)

Write C Programs for following:

1. Simple C Programs (5)
2. Generate the Fibonacci series up to the given limit N and also print the number of elements in the series
3. Find minimum and maximum of N numbers.
4. Find the GCD of two integer numbers.
5. Calculate factorial of a given number.
6. Find all the roots of a quadratic equation $Ax^2 + Bx + C = 0$ for non -zero coefficients A, B and C
7. Calculate the value of sin (x) and cos (x) using the Fourier series. Also print sin (x) and cos (x) value using library function.
8. Generate and print prime numbers up to an integer N
9. Sort given N numbers in ascending order using bubble sort.
10. Find the sum & difference of two matrices of order MxN and PxQ
11. Find the product of two matrices of order MxN and PxQ

Write python program to solve the following problems:

1. Exchange the values of two variables
2. Finding minimum among n variables
3. Perform Simple sorting
4. Generate Students' marks statement
5. Find square root, GCD, exponentiation
6. Perform linear search, binary search
7. Perform Matrix operations using NumPy
8. Perform Dataframe operations using Pandas
9. Use Matplotlib on dataset and visualize
10. Perform Word count, copy file operations

11 and 12. Activity: Workshop/seminar/2 additional expts not in above list

13 to 15: Industry visit,/ Develop a billing system using python

Group B: ACTIVITY: Any one of the following activities (Any3)

1. Any two additional experiments than specified from any Group. - Equivalent to 2 epts.
2. Industrial /field Visit - equivalent to 1 experiment.
3. Hands on training Workshop - equivalent to 2 experiments.
4. Do it Yourself Open ended Project - equivalent to 4 experiments.

Maharashtra Education Society's
ABASAHEB GARWARE COLLEGE (AUTONOMOUS)
KARVE ROAD, PUNE 411 004.
DEPARTMENT OF ELECTRONIC SCIENCE
Discipline Specific Course System: VSC

Level: 5	**Year : Second**	**Semester: 3**
Paper: 6	**Compulsory Theory+ Practical VSC**	**Credits: 2**
Course code: ELS-222-VSC	**Course title: Internet of Things and Python Programming**	
Number of lectures: 30	**Internal assessment: 25 marks**	**Semester assessment: 25 marks**

Course Outcomes: After completion of this course student is able to

CO1: Identify basic elements and systems used in analog and digital circuits
CO2: Explain fundamental laws and elements of electrical circuits
CO3: Understand DC circuit theorems and networks
CO4: Understand AC circuits and related terminologies with examples

Unit	Topics	Lectures
I	**Introduction to Internet of Things(IoT)** Microprocessor and microcontroller, Concept of embedded systems, General Features and Architecture of microcontroller, Applications Introduction to Arduino: Microcontrollers used in Arduino, Pin configuration and architecture Concept of port: digital and analog ports. Arduino programming: variables and data types, Comparison Operators (arithmetic, logical and relational, modulo and assignment) Statements: If-Else Statement, Switch statement Control structures: While and For Loop Writing arduino programs: LED blinking and Push button, Function blocks: Analogread(), digitalread() functions,	**15**
II	**Introduction to Python** Python basics, Understanding Python variables, Python basic Operators, Understanding python blocks, Declaring and using Numeric data types: int, float, complex, Using string data type and string operations, Defining list and list slicing, Use of Tuple data type, Conditional blocks using if, else and elif, Simple for loops in python, For loop using ranges, string, list and dictionaries, Use of while loops in python, Loop manipulation using pass, continue, break and else Programming using Python conditional and loops, block Python Functions, Modules and Packages, List manipulation using in build methods, Dictionary manipulation, Programming using string, list and dictionary in built functions, tupules Python programming for IOT applications: 1. Sensor interfacing: soil moisture, temperature etc 2. Wifi module interfacing: ESP8266 with thinkspeak 3. IoT applications: smart home, smart polyhouse etc	**15**

Suggested books:

1. Think Python, Allen Downey, O'Reilly, 2012
2. Introduction to Problem Solving with Python, E. Balagurusamy
3. Arduino-Based Embedded Systems: By Rajesh Singh, Anita Gehlot, Bhupendra Singh, and Sushabhan Choudhury.
4. Arduino Made Simple by Ashwin Pajankar

Maharashtra Education Society's
ABASAHEB GARWARE COLLEGE (AUTONOMOUS)
KARVE ROAD, PUNE 411 004.
DEPARTMENT OF ELECTRONIC SCIENCE
Discipline Specific Course System: IKS

Level: 5	**Year : Second**	**Semester: 3**
Paper: 7	**Compulsory Theory IKS**	**Credits: 2**
Course code: ELS-200-IKS	**Course title: Technology in Ancient India**	
Number of lectures: 30	**Internal assessment: 25 marks**	**Semester assessment: 25 marks**

Course Outcomes: After completion of this course student is able to

CO1: Design portable IoT applications using various platforms.
CO2: Develop communication models and various protocols for IoT.
CO3: Create cloud offerings related to IoT
CO4: Develop applications of IoT in real time scenario

Unit	Topics	Lectures
I	Introduction An Overview of Ancient Indian Science Binary numbers in Ancient Antiquity Panini Backup forms in syntax of Formal Languages Planets in vedic literature The Speed of light and puranic cosmology Science of consciousness in ancient india.	**15**
II	Developments in Science and Technology in Colonial India 1. Early European Scientists in Colonial India- Surveyors, Botanists, Doctors, under the Company's Service. 81-104 2. Indian Response to new Scientific Knowledge, Science and Technology in Modern India: 105-116 3. Development of research organizations like CSIR and DRDO; Establishment of Atomic Energy Commission; Launching of the space satellites Prominent scientist of India since beginning and their achievement 1. Mathematics and Astronomy: Baudhayan, Aryabhtatta, Brahmgupta, Bhaskaracharya, Varahamihira, Nagarjuna. 142-158 2. Medical Science of Ancient India (Ayurveda & Yoga): Susruta, Charak, Yoga & Patanjali. 159-173 3. Scientists of Modern India: Srinivas Ramanujan, C.V. Raman, Jagdish Chandra Bose, Homi Jehangir Bhabha and Dr. Vikram Sarabhai.	**15**

Suggested books:

1. Computing Science in Ancient India http://ikashmir.net/subhashkak/docs/Computing%20Science%20in%20Ancient%20India.pdf
2. HISTORY OF SCIENCE AND TECHNOLOGY IN INDIA By Dr. Binod Bihari Satpathy https://margheritacollege.in/admin_portal/all_mrgclg_files/department_studymat/History%20of%20science%20and%20technology%20in%20India9577.pdf

Maharashtra Education Society's
ABASAHEB GARWARE COLLEGE (AUTONOMOUS)
KARVE ROAD, PUNE 411 004.
DEPARTMENT OF ELECTRONIC SCIENCE
Discipline Specific Course System: Open Elective (OE 1.1)

Level: 5	**Year :Second**	**Semester: 3**
Paper: 8	**Open Elective Theory Course**	**Credits: 2**
Course code: OE-211-ELS	**Course title: Introduction to Consumer Electronics**	
Number of lectures: 30	**Internal assessment: 25 marks**	**Semester assessment: 25 marks**

Units	Topics	Hours
Unit 1	Introduction to consumer Electronics Types of consumer Electronic Products: Office Equipment and Electronic Gadgets and Domestic Appliances **Introduction to Office Equipment:** Scanners, Barcode / Flat bed, Printers, Xerox, Multifunction units (Print, Scan, fax, and copy), Landline and Mobile telephony: Technology in Mobile phones: GPRS & Bluetooth. GPS Navigation system. Smart Phones	**15**
Unit 2	**Introduction to Electronic Gadgets and Domestic Appliances:** Digital clock, Digital camera, Handicam, Home security system, CCTV. Air conditioners, Refrigerators, Washing Machine/Dish Washer, Microwave oven, Vacuum cleaners **Activities:** **1.** Workshop on hands on training of various equipments /systems **2.** Market Survey of Products (at least one from each module) Industry Visit	**15**

Suggested books:

1. R. P. Bali Consumer Electronics Pearson Education (2008)
2. R. G. Gupta Audio and Video systems Tata McGraw Hill (2004)

Maharashtra Education Society's
ABASAHEB GARWARE COLLEGE (AUTONOMOUS)
KARVE ROAD, PUNE 411 004.
DEPARTMENT OF ELECTRONIC SCIENCE
Discipline Specific Course System: Open Elective (OE 1.1)

Level: 5	**Year :Second**	**Semester: 3**
Paper: 9	**FP Practical Course**	**Credits: 2**
Course code: ELS-231-FP	**Course title: Field Project**	
Number of lectures: 30	**Internal assessment: 25 marks**	**Semester assessment: 25 marks**

All Students should do on field project or training four hours a week.
Assessment will be done on their performance and final presentation.

Maharashtra Education Society's
ABASAHEB GARWARE COLLEGE (AUTONOMOUS)
KARVE ROAD, PUNE 411 004.
DEPARTMENT OF ELECTRONIC SCIENCE
Discipline Specific Course System: Major
CBCS NEP 2024 Pattern

Level: 5	**Year : Second**	**Semester: 4**
Paper: 1	**Compulsory Theory Major**	**Credits: 2**
Course code: ELS-255-MJ	**Course title: Digital System Design using VHDL**	
Number of lectures: 30	**Internal assessment: 25 marks**	**Semester assessment: 25 marks**

Course Outcomes: This course provides basic knowledge about systematic methodology of designing digital systems. After study through lectures and assignment, student will be able to

CO1: Analyze basic combinational logic circuits for simple applications
CO2: Design combinational logic circuits using K maps for identified applications
CO3: Design Sequential logic circuits using state diagram, excitation table for identified applications
CO4: Get familiar with concept of HDL and different keywords related to VHDL

Unit	Topics	Lectures
I	**Design of combinational circuits:** Design of code converters using K maps: BCD to Seven segments, Concept of adder using Look ahead carry generator, Keyboard encoder circuits: Priority encoder, Error detection technique: hamming code **Design of sequential circuits:** Sequential logic circuit design: State table, State diagram, excitation table and transition table, Design of counters using state machines: asynchronous, modulus and up-down counter, Design of sequence generator.	**15**
II	**Introduction to VHDL** A Brief History of HDL, Structure of HDL Module, Comparison of VHDL and Verilog, Introduction to Simulation and Synthesis Tools, Test Benches, Verilog Modules, Delays, data flow style, behavioral style, structural style, mixed design style, simulating design Introduction to Language Elements: Keywords, Identifiers, White Space Characters, Comments, Format, Integers, Reals and Strings, Logic Values, Data Types-net types, Undeclared nets, scalars and vector nets, Register type, Parameters, Expressions, Operands, Operators, types of Expressions Examples: Half adder, full adder, Flip Flop	**15**

Suggested books:

1. Morris Mano, Digital Design, 3 rd Edition, Prentice Hall of India.
2. R. P.Jain, Modern Digital Electronics, 4th edition, Tata MacGraw Hill Education India,
3. K. R. Botkar, Integrated Circuits, 3rd Edition, Khanna Publications
4. Thomas Floyd and Jain, Digital Fundamentals, 4th Edition, Pearson Education International

Manuals: National semiconductor, EXAR, Intersil, Signetics, Analog Devices

Maharashtra Education Society's
ABASAHEB GARWARE COLLEGE(AUTONOMOUS)
KARVE ROAD, PUNE 411 004.
DEPARTMENT OF ELECTRONIC SCIENCE
Discipline Specific Course System: Major
(CBCS NEP 2024 Pattern)

Level: 5	**Year : Second**	**Semester: 4**
Paper: 2	**Compulsory Theory Major**	**Credits: 2**
Course code: ELS-256-MJ	**Course title: Electronic Instrumentation**	
Number of lectures: 30	**Internal assessment: 25 marks**	**Semester assessment: 25 marks**

Course Outcomes: After completion of this course student is able to

CO1: Understand concepts in measurement instruments.
CO2: know about details of these instruments and instrumentation
CO3: know about working principles of various transducers
CO4: get familiar with signal conditioning circuits for these transducers.

Unit	Topics	Lectures
I	**Measurements**: Accuracy and precision. Significant figures. Error and uncertainty analysis. Shielding and grounding. Electromagnetic Interference. **Basic Measurement Instruments:** DC measurement-ammeter, voltmeter, ohm meter, AC measurement, Digital voltmeter systems Digital Multimeter; Block diagram principle of measurement of I, V, C. Instrumentation amplifier using op-amp/IC **Power supply:** Block Diagram of a Power Supply, Qualitative idea of C and L Filters. IC Regulators (78XX and 79XX), Line and load regulation, Short circuit protection. Idea of switched mode power supply (SMPS) and uninterrupted power supply (UPS).	**12**
II	**Oscilloscope:** Block Diagram, CRT, Vertical Deflection, Horizontal Deflection. Screens for CRT, Oscilloscope probes, measurement of voltage, frequency and phase by Oscilloscope. Digital Storage Oscilloscopes. LCD display for instruments. **Signal Generators:** Function generator, Pulse Generator, (Qualitative only). **Virtual Instrumentation**: Introduction, Interfacing techniques (RS 232, GPIB, USB) **Transducers:** Classification of transducers, Basic requirement/characteristics of transducers, Active and Passive transducers, Resistive (Potentiometer-Theory, temperature compensation & applications), Capacitive (variable air gap type), Inductive (LVDT) & piezoelectric transducers. Measurement of temperature (RTD, semiconductor IC sensors), Light transducers (photo resistors & photovoltaic cells). Signal conditioning circuits: Bridge amplifier, 3-opamp instrumentation amplifiers and instrumentation amplifier using ICs.	**18**

Suggested books:

1. W.D. Cooper and A. D. Helfrick, Electronic Instrumentation and Measurement Techniques, Prentice Hall (2005).
2. E.O. Doebelin, Measurement Systems: Application and Design, McGraw Hill Book - fifth Edition (2003).

3. David A. Bell, Electronic Devices and Circuits, Oxford University Press (2015). Alan S. Morris, "Measurement and Instrumentation Principles", Elsevier (Butterworth Heinmann-2008).
4. S. Rangan, G. R. Sarma and V. S. Mani, Instrumentation Devices and Systems, Tata Mcgraw Hill (1998).
5. Introduction to measurements and instrumentation, 4th Edn., Ghosh, PHI Learning

Maharashtra Education Society's
ABASAHEB GARWARE COLLEGE (AUTONOMOUS)
KARVE ROAD, PUNE 411 004.
DEPARTMENT OF ELECTRONIC SCIENCE
Discipline Specific Course System: Major

Level: 5	**Year : Second**	**Semester:**
Paper: 3	**Compulsory Practical Minor**	**Credits: 2**
Course code: ELS-257-MJP	**Course title: Electronic Science Practical Course IV**	
Number of lectures: 30	**Internal assessment: 25 marks**	**Semester assessment: 25 marks**

List of experiments (Any 15)

A) Group A: Experiments on Electronic Instrumentation **(any 4)**

1. Measurement of resistance by Wheatstone bridge and measurement of bridge sensitivity.
2. To determine the Characteristics of LVDT.
3. To determine the Characteristics of Thermistors and RTD.
4. Measurement of temperature by Thermocouples/PT100/AD590/LM 35.
5. Design a regulated power supply of given rating (5 V or 9V).
6. To design and study the Instrumentation amplifier using Opamp.
7. To plot the frequency response of a microphone...

B) Group B: Experiments on Digital Systems Design and VHDL **(any 8)**

1. Write code to realize basic and derived logic gates.
2. Half adder, Full Adder using basic and derived gates.
3. Half subtractor and Full Subtractor using basic and derived gates.
4. Clocked D FF, T FF and JK FF (with Reset inputs).
5. Multiplexer (4x1, 8x1) and Demultiplexer using logic gates.
6. Decoder (2x4, 3x8), Encoders and Priority Encoders.
7. Design and simulation of a 4 bit Adder.
8. Code converters (Binary to Gray and vice versa).
9. 2 bit Magnitude comparator.
10. 3 bit Ripple counter

Group C: ACTIVITY: Any one of the following activities **(Any 3)**

1. Any two additional experiments than specified from any Group. - equivalent to 2 experiments.
2. Circuit Design and simulation using LTSPICE/Multisim. - equivalent to 1 experiments.
3. Industrial /field Visit - equivalent to 1 experiment.
4. Hands on training Workshop - equivalent to 2 experiments.
5. Do it Yourself Open ended Project - equivalent to 4 experiments**.**

Maharashtra Education Society's
ABASAHEB GARWARE COLLEGE(AUTONOMOUS)
KARVE ROAD, PUNE 411 004.
DEPARTMENT OF ELECTRONIC SCIENCE
Discipline Specific Course System: Minor Theory Course

Level: 5	**Year :Second**	**Semester: 4**
Paper: 4	**Compulsory Theory Minor**	**Credits: 2**
Course code: ELS-293-MN	**Course title: Fundamentals of Electric Vehicles**	
Number of hours: 30	**Internal assessment: 25 marks**	**Semester assessment: 25 marks**

Course Outcomes: At the end of this course, Students will be able to
CO1: Describe the operation principles of electric cars
CO2: Familiarize with charging infrastructure technologies
CO3: Understand future technology of Electrical Vehicles

Unit	Topics	Lectures
I	**Electromechanical Machines:** DC Motors, Basic understanding of field and armature, Principle of operation, EMF equation, Back EMF, Factors controlling motor speed, Thyristor based speed control of dc motors, AC motor (Induction Motor only), Rotor and stator, torque & speed of induction motor, Thyristor control of ac motors(block diagrams only)	**12**
II	**Operation principle of electric cars:** Motors and power electronics in an electric cars EV Vs gasoline car, Electric car drivetrain, Electric motor, Power electronic in an electric car, Regenerative braking, Battery technology Storage technologies for EV, Battery working principles, Battery losses, Li-ion batteries, Battery pack and battery management system Relevant charging infrastructure technologies and innovations, such as smart charging AC charging - Type 1,2, 3, DC charging – Chademo, Tesla, CCS, Fast charging and its limitations, Smart charging and applications, Vehicle to grid (V2G) technology, Future technology for EVs such as wireless charging and solar EVs, Wireless charging of EV, On-road charging of EV, Battery swap technology, Solar powered EVs, Charging EVs from renewable energy sources	**18**

Suggested Books:
1. TUDelft OpenCourseware, Course Name- Electric Car Technology
https://ocw.tudelft.nl/courses/electric-cars technology/#1544015082085-720c3675-29b9
2. Coursera, Electric Vehicle & Mobility
https://www.coursera.org/learn/electric-vehicles-mobility

Maharashtra Education Society's
ABASAHEB GARWARE COLLEGE (AUTONOMOUS)
KARVE ROAD, PUNE 411 004.
DEPARTMENT OF ELECTRONIC SCIENCE
Discipline Specific Course System: Minor

Level: 5	**Year :Second**	**Semester: 4**
Paper: 5	**Compulsory Theory Minor**	**Credits: 2**
Course code: ELS-294-MNP	**Course title: Practical course on Electric Vehicles**	
Number of Practicals: 15	**Internal assessment: 25 marks**	**Semester assessment: 25 marks**

Group A: Electric Vehicles (Any 9)

1. To study RC circuit for charging and discharging.
2. To study SoC of battery using hydrometer.
3. To study SoC of battery suing indirect methods
4. To study charging and discharge of simple battery
5. To design and build simple battery
6. To study of battery management system
7. To study different types of batteries.
8. Comparative analysis of different electric and non-electric vehicles.
9. Survey on new Electric vehicles.

Group B: ACTIVITY: Any one of the following activities **(Any 9)**

1. Any two additional experiments than specified from any Group. - equivalent to 2 experiments.
2. Circuit Design and simulation using LTSPICE/Multisim. - equivalent to 1 experiments.
3. Industrial /field Visit - equivalent to 1 experiment.
4. Hands on training Workshop - equivalent to 2 experiments.
5. Do it Yourself Open ended Project - equivalent to 4 experiments**.**

Maharashtra Education Society's
ABASAHEB GARWARE COLLEGE (AUTONOMOUS)
KARVE ROAD, PUNE 411 004.
DEPARTMENT OF ELECTRONIC SCIENCE
Discipline Specific Course System: VSC

Level: 5	**Year : Second**	**Semester: 4**
Paper: 6	**Compulsory Theory+Practical VSC**	**Credits: 2 (1T+1P)**
Course code: ELS-271-VSC	**Course title: IoT and Applications**	
Number of lectures: 30	**Internal assessment: 25 marks**	**Semester assessment: 25 marks**

Course Outcomes: After completion of this course student is able to

CO1: Design portable IoT applications using various platforms.
CO2: Develop communication models and various protocols for IoT.
CO3: Create cloud offerings related to IoT
CO4: Develop applications of IoT in real time scenario

Unit	Topics	Lectures
I	Evolution of Internet of Things – Enabling Technologies – IoT Architectures: oneM2M, IoT World Forum (IoTWF) and Alternative IoT Models – Simplified IoT Architecture and Core IoT Functional Stack – Fog, Edge and Cloud in IoT, Functional Blocks of an IoT Ecosystem – Sensors, Actuators, and Smart Objects – Control Units - Communication modules (Bluetooth, Zigbee,Wifi, GPS, GSM Modules) **IOT Protocols -** IPv6, 6LoWPAN, MQTT, CoAP - RFID, Wireless Sensor Networks, Big Data Analytics, Cloud Computing, Embedded Systems - Use of data analytics and data science for decision making	**15**
II	IOT deployment for various platforms -Architecture –Programming – Interfacing – Accessing GPIO Pins – Sending and Receiving Signals Using GPIO Pins – Connecting to the Cloud - Use of generative AI to do coding and design. Business models for the internet of things, Smart city, Smart mobility and transport, Industrial IoT, Smart health, Environment monitoring and surveillance – Home Automation – Smart Agriculture - Debug of IoT boards **Electric Vehicles** 1. Smart Shirt for health monitoring 2. Waste Management System 3. Smart Parking System 4. Air Quality Monitoring, 5. Smart Home Automation 6. Agricultural Crop Monitoring 7. Smart Energy Management 8. Disaster Early Warning System 9. Industrial Automation 10.Connected Vehicles 11.Home security Systems 12.Asset Tracking	**15**

A team of 4 students to submit at least 3 different mini IOT application boards as completion of practicals for this course.

Suggested books:

1. Think Python, Allen Downey, O'Reilly, 2012
2. Introduction to Problem Solving with Python, E. Balagurusamy
3. Arduino-Based Embedded Systems: By Rajesh Singh, Anita Gehlot, Bhupendra Singh, and Sushabhan Choudhury.
4. Arduino Made Simple by Ashwin Pajankar

Maharashtra Education Society's
ABASAHEB GARWARE COLLEGE (AUTONOMOUS)
KARVE ROAD, PUNE 411 004.
DEPARTMENT OF ELECTRONIC SCIENCE
Discipline Specific Course System: GE/OE

Level: 5	**Year :Second**	**Semester: 4**
Paper: 7	**GE/OE Practical**	**Credits: 2 (Practical)**
Course code: OE-261-ELS	**Course title: Repairing and Maintenance of Electronic Products**	
Number of lectures: 30	**Internal assessment: 25 marks**	**Semester assessment: 25 marks**

Course Outcomes:

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

Equip the students with basic knowledge of various electronic appliances and understand the principles of operation and its care. This course also aimed at making the students to the working of electronic products used in daily life and to repair and maintenance of these products.

Unit	Topics	Lectures
I	Introduction to Hardware & materials: Diodes & Transistors, Crystal, ICs & SMD's, Identification of the different parts, Learn to understand the parts and functioning, Key pad LEDs fault finding, Checking of components & circuit board, Identify the faulty components by cold testing method i.e to use a multimeter to check the value of resistance during powered off condition, Identify the faulty components by hot testing method (to use a multimeter to check the value of voltage during powered on Condition)	**15**
Practical	**List of Experiments** 1. Introduction to Soldering tools and techniques 2. To get familiar with different types of manuals such as Service and maintenance manuals, Instruction manuals. 3. To understand the fault detection and troubleshooting, Fault location procedure, Fault finding aids 4. To know about safety and precaution in handling electronic equipment. 5. To rectify the faults in electronic gadgets (minimum 5) 6. Workshop 7. Industrial visit	**6 expts**

Maharashtra Education Society's
ABASAHEB GARWARE COLLEGE (AUTONOMOUS)
KARVE ROAD, PUNE 411 004.
DEPARTMENT OF ELECTRONIC SCIENCE
Discipline Specific Course System: SEC

Level: 5	**Year :Second**	**Semester: 4**
Paper: 8	**SEC Theory + Practical Course**	**Credits: 2 (Practical)**
Course code: SEC - 252 - ELS	**Course title: Mobile Application Development**	
Number of lectures: 30	**Internal assessment: 25 marks**	**Semester assessment: 25 marks**

Course Outcomes:
At the end of this course, student will be able to

1. Equip the students with basic knowledge of various electronic appliances
2. Understand the principles of operation and its care.
3. This course also aimed at making the students to the working of electronic products used in daily life and to repair and maintenance of these products.

Prerequisite: Android Concepts

Installation of Required tools: Android SDK, Android Development Tool (ADT) Practice Program: Basics of Android Application Development: Anatomy of an Android applications, Android terminologies, Android User Interface Design Essentials: Managing
resources: data types, colors, images, tables, layouts, animation, media, User Interface Screen elements, Designing User Interfaces with Layouts, Drawing and Working with Animation.

Group A) Mobile Application Development (Any 9)

1. Develop an Android Application to print Hello World,
2. Develop an Android Application to use view, button, bar etc.
3. Develop an Android Application to Displaying pictures with views: Gallery and Image View
4. Develop an Android Application to Displaying Menus: Helper methods, Option and Context.
5. Develop an Android Application to emulate Simple Calculator
6. Develop an Android Application for viewing analog clock and digital clock,
7. Develop an Android Application for Location based services: Display map, zoom control,
8. Develop an Android Application for view and change, Marking, Geocoding, Get location
9. Publish Android applications and Deployment
10. Develop an Android Application to display Web Page.
11. Develop an Android Application to send SMS from application,
12. Develop an Android Application to get data from Android Sensors,

Group B: ACTIVITY: Any one of the following activities (Any 8)
1. Any two additional experiments than specified from any Group. - equivalent to 2 experiments.
2. Circuit Design and simulation using LTSPICE/Multisim. - equivalent to 2 experiments.
3. Industrial /field Visit - equivalent to 2 experiments.
4. Hands on training Workshop - equivalent to 2 experiments.
5. Do it Yourself Open ended Project - equivalent to 4 experiments.

RECOMMENDED BOOKS:

1. Android Wireless Application Development, T1. Lauren Darcey and Shane Conder, Pearson Education
2. Beginning Android Application Development, WeiMeng Lee ,Wrox Publications

Maharashtra Education Society's
ABASAHEB GARWARE COLLEGE (AUTONOMOUS)
KARVE ROAD, PUNE 411 004.
DEPARTMENT OF ELECTRONIC SCIENCE
Discipline Specific Course System: CEP

Level: 5	**Year :Second**	**Semester: 4**
Paper: 9	**CEP Practical Course**	**Credits: 2 (Practical)**
Course code: ELS-281-CEP	**Course title: Community Enhancement Project**	
Number of lectures: 30	**Internal assessment: 25 marks**	**Semester assessment: 25 marks**

All Students should do on field project or training four hours a week.
Assessment will be done on their performance and final presentation.