Ahmednagar Jilha Maratha Vidya Prasarak Samaj's

New Arts, Commerce and Science College, Ahmednagar

(Autonomous)

(Affiliated to Savitribai Phule Pune University, Pune)

Choice Based Credit System (CBCS)

Bachelor of Science (B.Sc.)

Syllabus of

F. Y. B. Sc. Electronic Science

Implemented from

Academic Year 2021 - 22

1. Prologue/ Introduction of the Programme:

The B.Sc. programme is for 3 academic years and 6 semesters. The minimum total number of credits requirements is 132 credits and 08 additional credits. For first-year, there are 12 Discipline-Specific Core Courses (DSCC) at each semester. During the second year, there are 9 Discipline-Specific Core Courses (DSCC) at each semester and 2 Ability Enhancement Compulsory Courses (AECC). For the third-year, students will select one specialized subject having 9 Discipline-Specific Elective Courses (DSEC) and 2 Skill Enhancement Courses (SEC) at each semester. Students are allowed to opt for Skill Enhancement Courses (SEC) from any department of the college or the same department.

Electronic Science is an important branch of science devoted to the design, implementation and analysis of electronic circuits and systems. Electronics technology has revolutionized various fields including communication, consumer appliances, medical, defense and so on. The advances in electronics technology make systems smaller, smarter and powerful. The designing-based approach has been used mostly in the syllabus that trains students to apply the acquired knowledge to design and analyze circuits for specific applications.

The syllabus has been designed such that the knowledge of fundamental concepts, advanced technologies and specific practical skills will be developed among students. To understand advanced electronics technologies students should first understand the basic concepts of electronics. In the first year of the B.Sc. electronic science course, the basic concepts of analog and digital electronics with the required theoretical understanding and practical skills have been covered. During the second year, students will learn about some designing aspects of analog and digital electronics with practical based on system design. In addition, the students will learn about communication electronics and the fundamentals of embedded system which has large application areas. In the last year of the B.Sc. electronic science course, advanced concepts of the electronics field are covered. In the third year, students will get knowledge about advanced analog, digital and communication electronics. Also, the knowledge of programmable logic controllers (PLC), microcontrollers, power electronics, sensors and transducers, C – programming, python programming will be covered which has great industrial weightage. Students will also perform project work in the last year of the programme that improves their practical knowledge as well as allows them to express themselves.

2. Programme Outcomes (POs):

Students enrolled in the program complete a curriculum that exposes and trains students in a full range of essential skills and abilities. They will have the opportunity to master the following objectives.

I. To get the knowledge of technological and practical aspects of electronic science.
II. To familiarize with the concepts of electronics technologies.
III. To create the foundation for research and development in Electronics.
IV. To enhance the programming skill in Electronics.
V. To get the practical skills required for electronics industries.
VI. To develop the analytical abilities towards the use of electronics in real-world problems.
VII. To familiarize with the current and recent technological developments.
VIII. To enrich knowledge through activities such as industrial visits, seminars, projects etc.

3. Programme Structure and Course Titles:

Sr. No.	Class	Semester	Course Code	Course Title	Credits
1.	F. Y. B. Sc.	I	BSC-ES 101 T	Principles of Analog Electronics	02
2.	F. Y. B. Sc.	I	BSC-ES 102 T	Principles of Digital Electronics	02
3.	F. Y. B. Sc.	I	BSC-ES 103 P	Practical Course - I	1.5
4.	F. Y. B. Sc.	II	BSC-ES 201 T	Analog Device Applications	02
5.	F. Y. B. Sc.	II	BSC-ES 202 T	Digital Circuits and Computer Organization	02
6.	F. Y. B. Sc.	II	BSC-ES 203 P	Practical Course - II	1.5
7.	S. Y. B. Sc.	III	BSC-ES 301 T	Communication Electronics	02
8.	S. Y. B. Sc.	III	BSC-ES 302 T	Digital System Design	02
9.	S. Y. B. Sc.	III	BSC-ES 303 P	Practical Course - I	02
10.	S. Y. B. Sc.	IV	BSC-ES 401 T	Analog Circuit Design	02

11.	S. Y. B. Sc.	IV	BSC-ES 402 T	Fundamentals of Embedded System Design	02
12.	S. Y. B. Sc.	IV	BSC-ES 403 P	Practical Course – II	02
13.	T. Y. B. Sc.	V	BSC-ES 501 T	Digital System Design using Verilog	02
14.	T. Y. B. Sc.	V	BSC-ES 502 T	Microcontrollers	02
15.	T. Y. B. Sc.	V	BSC-ES 503 T	Analog Circuit Design and Applications	02
16.	T. Y. B. Sc.	V	BSC-ES 504 T	Process Automation	02
17.	T. Y. B. Sc.	V	BSC-ES 505 T	'C' programming	02
18.	T. Y. B. Sc.	V	BSC-ES 506 T	Fundamentals of Optical Fiber Communication	02
19.	T. Y. B. Sc.	V	BSC-ES 507 P	Practical Course – I	02
20.	T. Y. B. Sc.	V	BSC-ES 508 P	Practical Course – II	02
21.	T. Y. B. Sc.	V	BSC-ES 509 Pr	Project Course – I	02
22.	T. Y. B. Sc.	V	BSC-ES 510 T	Electronic Design Automation Tools	02
23.	T. Y. B. Sc.	V	BSC-ES 511 P	Practical Course – III	02
24.	T. Y. B. Sc.	VI	BSC-ES 601 T	Modern Communication Systems	02
25.	T. Y. B. Sc.	VI	BSC-ES 602 T	Embedded System Design	02
26.	T. Y. B. Sc.	VI	BSC-ES 603 T	Power Electronics	02
27.	T. Y. B. Sc.	VI	BSC-ES 604 T	Sensors and Systems	02
28.	T. Y. B. Sc.	VI	BSC-ES 605 T	Python Programming	02
29.	T. Y. B. Sc.	VI	BSC-ES 606 T	Electronic Product Design and Entrepreneurship	02
30.	T. Y. B. Sc.	VI	BSC-ES 607 P	Practical Course – IV	02
31.	T. Y. B. Sc.	VI	BSC-ES 608 P	Practical Course – V	02
32.	T. Y. B. Sc.	VI	BSC-ES 609 Pr	Project Course – II	02
33.	T. Y. B. Sc.	VI	BSC-ES 610 T	PLC and its Applications	02
34.	T. Y. B. Sc.	VI	BSC-ES 611 P	Practical Course – VI	02

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Semester – I	**Paper – I**
Course Code: BSC-ES 101 T	**Title of the Course:** Principles of Analog Electronics
Credits: 2	**Total no. of hours:** 30

Course Outcomes (COs):

After completion of the course, the students will be able to –

1. Select proper electronic components as per the need of the application.
2. Simplify different electronic circuits using network theorems.
3. Understand the concept of semiconductor diodes
4. Compare different types of BJT configurations.

Detailed Syllabus:

Unit I: Passive Components **(09)**

Introduction to electronics, applications of electronics, electronic components: resistors, capacitors, inductors, relays, transformer, batteries, switches, cables and connectors, fuses (only basic concept, working, classification, specifications and application is expected), series and parallel combination of resistors, capacitors and inductors. (qualitative analysis only).

Unit II: Network Theorems **(06)**

Ohm's law, Kirchoff's voltage law, Kirchoff's current law, Thevenin's theorem, Norton's theorem, Superposition theorem and Maximum power transfer theorem. Numerical problems based on these network theorems.

Unit III: Semiconductor Diodes **(06)**

Semiconductor, intrinsic and extrinsic semiconductor, P and N type semiconductors, formation of PN junction diode, forward and reverse bias characteristics, Zener diode, Light Emitting

Diode, Photo Diode, Solar Cell (construction, working principle, characteristics, applications), Opto-coupler concept.

Unit IV: Bipolar Junction Transistor (BJT) (09)

Bipolar Junction Transistor (BJT) types, symbol, construction, working principle, transistor configurations - CB, CC (only concept), CE configuration: input and output characteristics, the definition of α, β and Υ, the concept of biasing – fixed bias, potential divider bias, transistor as a CE amplifier, concept of gain and bandwidth, transistor as a switch.

Suggested Readings:

1. Electronic Devices and Circuit Theory - Robert L. Boylestad and Louis Nashelsky.
2. Electronic Devices and Circuits I – T.L.Floyd- PHI.
3. Integrated Electronics – Millmam and Halkias.
4. Electronic Devices and Circuits – Bogart.
5. Principals of Electronics - V.K. Mehta, S.Chand and Co.
6. A text book of electrical technology - B.L.Theraja, S.Chand.

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Semester – I	**Paper – II**
Course Code: BSC-ES 102 T	**Title of the Course:** Principles of Digital Electronics
Credits: 2	**Total no. of hours:** 30

Course Outcomes (COs):

After completion of the course, the students will be able to –

1. Solve problems based on inter-conversion of number systems.
2. Reduce the logical expression using Boolean Algebra.
3. Minimize the logical equations using K-maps.
4. Use different arithmetic circuits.

Detailed Syllabus:

Unit I: Number Systems and Digital Codes (10)

Introduction to decimal, binary, octal and hexadecimal number systems and their inter-conversions, the concept of 1's and 2's complements, binary addition, binary subtraction using 1's and 2's complements. BCD code, Excess-3 code, Gray code and ASCII code. Gray to Binary and Binary to Gray conversion.

Unit II: Logic Gates and Boolean Algebra (12)

Logic gates – basic and derived (symbol, Boolean equation and truth table), concept of universal gates. Laws of Boolean Algebra, De-Morgan's theorems, simplification of logic equations using Boolean algebra, minterms, maxterms, Boolean expression in SOP and POS form, conversion of SOP/POS expression to its standard SOP/POS form. Introduction to Karnaugh map, problems based on SOP (up to 4 variables), digital designing using K-map for

3-bit gray to binary and binary to gray conversion. Ex-OR gate as a 4-bit Parity Checker and Generator.

Unit III: Arithmetic Circuits **(05)**

Introduction to Arithmetic Circuits, half adder, full adder, half subtractor, full subtractor, four-bit parallel adder, universal adder / subtractor, digital comparator, introduction to ALU.

Unit IV: Logic Families **(03)**

Introduction of CMOS and TTL logic families. Parameters - voltage levels, propagation delay, noise margin, fan in, fan out, power dissipation. Comparision between CMOS and TTL logic families.

Suggested Readings:

1. Digital Design - M. Morris Mano, PHI, New Delhi.
2. Digital Systems Principles and Applications - Ronald J. Tocci.
3. Digital electronics - G. K. Kharate, Oxford University Press.
4. Fundamentals of Digital Circuits - Anand Kumar.
5. Digital Principles and Applications - Malvino and Leach, TMG Hill Edition.

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Semester – I	**Paper – III**
Course Code: BSC-ES 103 P	**Title of the Course:** Practical Course - I
Credits: 1.5	**Total no. of hours:** 45 (14 practicals)

Course Outcomes (COs):

After completion of the course, the students will be able to –

1. Identify different electronic components and instruments.
2. Calculate values of different electronic components.
3. Understand the operation of different laboratory instruments and used them for measuring different parameters.
4. Use breadboard / tag-board for building small electronic circuits.
5. Use digital circuits for different applications.

Detailed Syllabus:

Preparatory Experiments (Any 2)

1. Identification of components (Passive and Active) and study of multimeter -
    a. Minimum 10 different types of components are expected.
    b. Identification based on visual inspection / data sheets.
    c. Measure the various parameters using multimeter.
2. Study of Signal Generator and CRO -
    a. Study of front panel controls.
    b. Measurement of amplitude, frequency and phase of waveform.
3. Perform survey of following topics –
    a. Study of laboratory safety and precautionary measures.
    b. Study of e-waste management.

GROUP A (Any 6)

1. To verify the Superposition theorem.
2. To verify Kirchhoff's voltage and current laws.
3. To verify Thevenin's and Norton's Theorem.
4. To verify Maximum Power Transfer Theorem.
5. To study forward and reverse characteristics of diode.
6. To study diode rectifier circuits.
7. To design Zener voltage regulator.
8. To study transistor as a switch.
9. Study of Single stage RC coupled CE transistor Amplifier (Gain/ Bandwidth).
10. Study of solar cell.

GROUP B (Any 6)

1. Verification of logic gates by using digital ICs.
2. Realization of basic gates using discrete components.
3. Realization of basic gates using universal logic gates.
4. Study of half adder and full adder using logic gates.
5. Study of half subtractor and full subtractor using logic gates.
6. 4-bit binary parallel adder and subtractor using IC7483.
7. 3-bit binary to gray and gray to binary conversion using logic gates.
8. Verification of De Morgan's theorems.
9. Study of Ex-OR gate as a 4-bit parity checker and generator.
10. Study of 2-bit digital comparator.

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Semester – II	**Paper – I**
Course Code: BSC-ES 201 T	**Title of the Course :** Analog Device Applications
Credits: 2	**Total no. of hours:** 30

Course Outcomes (COs):

After completion of the course, the students will be able to –

1. Compare different semiconductor devices like UJT, JFET and MOSFET.
2. Understand the operation of op-amp and its various parameters.
3. Understand op-amp circuits and their usefulness in different applications.
4. Understand the use of IC 555 as a multivibrator.
5. Understand the use of sensors and actuators for different applications.

Detailed Syllabus:

Unit I: UJT, FET's Basics and Applications (10)

Symbol, types, construction, working principle, I-V characteristics, specification parameters: Uni-Junction Transistor (UJT), Junction Field Effect Transistor (JFET), Metal Oxide Semiconductor FET (MOSFET). Comparison of JFET and MOSFET.

Applications: UJT as a Relaxation oscillator, JFET as voltage variable resistor, MOSFET as a switch.

Unit II: Operational Amplifier and its Applications (08)

Block diagram, symbol, characteristics of ideal and practical op-amp. The concept of virtual ground, positive feedback and negative feedback. Differential and common mode gain, CMRR.

Applications: inverting amplifier, non-inverting amplifier, voltage follower, comparator, adder, subtractor, integrator and differentiator.

Unit III: Multivibrator **(04)**

Definition of multivibrator, types. IC 555: block diagram, pin diagram, IC 555 as an astable multivibrator, monostable multivibrator and bistable multivibrator.

Unit IV: Sensors and Actuators **(08)**

Sensors: Definition, active and passive sensors. Specifications of sensors: accuracy, range, linearity, sensitivity, resolution, reproducibility. Temperature sensor (thermistor, LM-35), optical sensor (LDR), Passive Infrared sensor (PIR), tilt sensor, ultrasonic sensor.

Actuators: Definition, DC motor, stepper motor.

Suggested Readings:

1. Sensors and Transducers - Prof A .D. Shaligram.
2. Op Amp and Linear Integrated Circuits - Ramakant Gaykwad.
3. Linear Integrated Circuits - Roy Choudary.
4. Micro Electronics - Jacob Millan, McGrawHill.
5. Sensors and Transducers - D. Patranabis, PHI publication.
6. Electronic Devices and Circuits An Introduction - Allan Mottershead, Prentice Hall.

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Semester – II	**Paper – II**
Course Code: BSC-ES 202 T	**Title of the Course:** Digital Circuits and Computer Organization
Credits: 2	**Total no. of hours:** 30

Course Outcomes (COs):

After completion of the course, the students will be able to –

1. Understand the concept and working of combinational circuits.
2. Comprehend the concept and working of sequential circuits.
3. Understand the different components of computer system.
4. Understand the I/O organization and memory architecture.

Detailed Syllabus:

Unit I: Combinational Circuits (08)

Introduction, Multiplexer (2:1, 4:1), demultiplexer (1:2, 1:4) and their applications. Concept of code converters. Encoders: decimal to binary, hexadecimal to binary, 3x4 matrix keyboard encoder and priority encoder. Decoders: BCD to decimal and BCD to seven segment decoder.

Unit II: Sequential Circuits (12)

Introduction, Flip flops: RS, clocked RS, JK, D and T. Race around condition, Master-slave JK. Counters: asynchronous and synchronous, binary counter, up, down, up-down counter, modulus counters, decade counter.

Shift registers: SISO, SIPO, PISO, PIPO shift registers, ring counter, universal 4-bit shift register.

Unit III: Basics of Computer System **(06)**

Introduction to computer organization, the concept of an address bus, data bus, control bus. CPU block diagram, I/O organization: need of interface, block diagram of general I/O interface.

Unit IV: Memory Organization **(04)**

Memory architecture, memory hierarchy, types of memories, role of cache memory, concept of virtual memory, vertical and horizontal memory expansion.

Suggested Reading:

1. Digital Systems - Principles and Applications - Ronald J. Tocci, PHI. New Delhi.
2. Digital electronics - G. K. Kharate, Oxford University Press.
3. Digital Fundamentals - Floyd T.M., Jain R.P., Pearson Education.
4. Digital Electronics - Jain R.P., Tata McGraw Hill.
5. Digital Logic and Computer Design - M. Morris Mano, Pearson Education.
6. Computer Organization and Architecture - William Stallings, Pearson.

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Semester – II	**Paper – III**
Course Code: BSC-ES 203 P	**Title of the Course:** Practical Course - II
Credits: 1.5	**Total no. of hours:** 45 (14 practicals)

Course Outcomes (COs):

After completion of the course, the students will be able to –

1. Use OPAMP for building different applications.
2. Use IC 555 for building different applications.
3. Use simulation software for analyzing different electronic circuits.
4. Use breadboard / tag-board for building small electronic circuits.

Detailed Syllabus:

GROUP A (Any 6)

1. Use of OPAMP as a comparator.
2. Build and test Inverting and non-inverting amplifiers using OPAMP.
3. Build and test adder and subtractor circuits using OPAMP.
4. Build and test integrator and differentiator using OPAMP.
5. Design and build astable multivibrator using IC 555.
6. Design and build monostable multivibrator using IC 555.
7. Study of UJT as a Relaxation oscillator.
8. To study temperature sensor LM 35.
9. Use of LDR to control light intensity.
10. Study of FET characteristics.

GROUP B (Any 6)

1. Study of RS, JK and D flip flops.
2. Study of asynchronous up and down counter.
3. Study of decade counter using IC 7490.
4. Study of 4-bit SISO and SIPO shift register.
5. Study of Priority encoder.
6. Study of read and write action of RAM (using IC 2112/4 or equivalent).
7. Study of diode matrix ROM.
8. Study of computer hardware system.
9. Study of multiplexer and demultiplexer (4:1 & 1:4).
10. Study of BCD to seven segment decoder using IC 7447.

GROUP C (Any 2)

Perform any 2 experiments from Group A or Group B using circuit simulation software LTSPICE / CircuitMod etc. (Give preference to not performed experiments).