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**

## S. Y. B. Sc. Electronic Science

**Implemented from**

## Academic Year 2022 - 23

Ahmednagar Jilha Maratha Vidya Prasarak Samaj's

# New Arts, Commerce and Science College, Ahmednagar (Autonomous)

## Board of Studies in Electronic Science

| Sr. No. | Name | Designation |
|---|---|---|
| 1. | Mr. D. K. Sonawane | Chairman |
| 2. | Mrs. S. D. Shelke | Member |
| 3. | Mr. D. S. Shelar | Member |
| 4. | Dr. S. N. Helambe | Academic Council Nominee |
| 5. | Mr. S. K. Shinde | Academic Council Nominee |
| 6. | Dr. M. S. Zambare | Vice-Chancellor Nominee |
| 7. | Mr. Bipinchandra Todmal | Alumni |
| 8. | Mr. P. D. Nirmal | Industry Expert |
| 9. | Prof. A. V. Mancharkar | Member (co-opt) |
| 10. | Mrs. B. M. Danave | Member (co-opt) |
| 11. | Mr. G. V. Avhale | Invitee |

## Programme Structure and Course Titles: (All academic years)

| 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 |

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| 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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**Syllabus of S. Y. B. Sc. Electronic Science**

**under**

**Faculty of Science and Technology**

| | |
|---|---|
| **Semester – III** | **Paper – I** |
| **Course Code: BSC-ES 301 T** | **Title of the Course: Communication Electronics** |
| **Credits: 02** | **Total Lectures: 30 Hrs.** |

## Course Outcomes (COs):

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

a. Understand different elements of communication systems.
b. Comprehend modulation and demodulation methods.
c. Identify different receivers and their performance parameters.
d. Understand the need of sampling and digital modulation techniques.

## Detailed Syllabus:

**Unit I: Introduction to Electronic Communication (06)**

Introduction to communication: means and modes. Block diagram of an electronic communication system, electromagnetic spectrum. Brief idea of frequency allocation for radio communication system in India, TRAI. Concept of Noise, Signal-to-Noise (S/N) ratio, noise figure and noise temperature. Concept of modulation and demodulation, need of modulation. Types of modulation.

**Unit II: Continuous-wave Modulation Techniques (10)**

Amplitude Modulation: AM waveform, mathematical expression, concept of sidebands, modulation index, power distribution, AM using transistor, AM receiver, demodulator circuit using diode and super-heterodyne receiver, block diagram of AM communication system.

Frequency Modulation: FM waveform, mathematical representation, frequency spectrum, bandwidth, modulation index, frequency deviation and average power. FM modulation using varactor diode, FM demodulator, Foster-Seeley discriminator, block diagram of FM communication system. Concept of PM. Comparison of AM and FM.

**Unit III: Introduction to digital communication (08)**

Digital communication system: block diagram, advantages, bit rate, baud rate and bandwidth. Serial and parallel communication. Concept of sampling, sampling theorem and PCM. Concept of keying techniques: ASK, FSK and PSK. Block diagram of MODEM.

**Unit IV: Pulse Modulation Techniques (06)**

Types, concept and generation of PAM, PWM, PPM, spectra of pulse modulation. Concept of time division multiplexing and frequency division multiplexing.

## Suggested Readings:

1. Communication Electronics: Principles and applications - Louis E Frenzel, TMH Publications.
2. Electronics Communication System - Denis Roddy, John Coolen, PHI publication.
3. Electronic Communication Systems - Kennedy, George and Devis, Bernard, TMH.
4. Communication Systems: Analog and Digital – Singh R.P. and Sapre S.D., TMH.

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| | |
|---|---|
| **Semester – III** | **Paper – II** |
| **Course Code: BSC-ES 302 T** | **Title of the Course: Digital System Design** |
| **Credits: 02** | **Total Lectures: 30 Hrs.** |

## Course Outcomes (COs):

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

a. Understand combinational logic circuits designing.
b. Design sequential logic circuits.
c. Understand different types of DAC, ADC and compare their performance parameters.
d. Analyze digital system design and their applications.

## Detailed Syllabus:

**Unit I: Combinational Logic Circuit Design (08)**

Revision of K maps. Design of BCD to seven segment decoder: common anode and common cathode configuration. Concept of adder using look ahead carry generator. Priority encoder. Error detection and correction techniques: Hamming code, CRC. Magnitude comparator: 2 - bit and 4 - bit.

**Unit II: Sequential Logic Circuit Design (08)**

State table, state diagram, excitation table and transition table. Design of counters using state machines: asynchronous, synchronous, modulus and up-down counters. Design of sequence generator, random sequence generator.

**Unit III: Data Convertors (08)**

Digital to Analog Converters: Weighted resistive network, R-2R ladder network and specifications of DAC.

Analog to Digital converters: Simultaneous conversion, counter type, successive approximation method, flash, single slope, dual slope and specifications of ADC.

**Unit IV: Digital System Design and Applications (06)**

Event detection using OR gate, frequency measurement using AND gate, square wave generator using NOT gate, key debouncer circuit using NAND gate.

Case Studies: Totalizer, Digital clock, Auto-Parking, Two digit bank token display.

## Suggested Readings:

1. Digital Design - Morris Mano, Prentice Hall of India.
2. Modern Digital Electronics - R. P. Jain, Tata McGraw Hill Education India.
3. Integrated Circuits - K. R. Botkar, Khanna Publications.
4. Digital Fundamentals - Thomas Floyd and Jain, Pearson Education International.
5. Digital Fundamentals - Thomas Floyd and Jain, Pearson Education International.
6. Manuals: National semiconductor, EXAR, Intersil, Signetics, Analog Devices.
7. Practical Digital IC's - Willams (TMH).

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| **Semester – III** | **Paper – III** |
|---|---|
| **Course Code: BSC-ES 303 P** | **Title of the Course: Practical Course - I** |
| **Credits: 02** | **Total Lectures**: **60 Hrs.** (12 Practicals) |

## Course Outcomes (COs):

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

a. Understand practical aspects of designing communication systems.
b. Understand modulation and demodulation techniques.
c. Design, build and test modulator and demodulator.
d. Design and build combinational and sequential circuits using K-map.
e. Use of ADC and DAC circuits for different applications.

## Detailed Syllabus:

The practical course consists of **10** experiments and **1** activity equivalent to **2** experiments.

**Group A: Practicals based on Communication Electronics (Any 5)**

1. Design, build and test Amplitude modulator using transistor.
2. Design, build and test FM generation using VCO / IC 8038 / varactor diode.
3. Design, build and test Frequency Shift Keying (FSK).
4. Design, build and test Phase Shift Keying (PSK).
5. Design, build and test Time division multiplexing.
6. Design, build and test Frequency division multiplexing.
7. Design, build and test balance modulator and demodulator using IC 1408.
8. Design, build and test PPM / PWM.
9. Design, build and test PAM.
10. Demonstration of PCM.

**Group B: Practicals based on Digital System Design (Any 5)**

1. Design, build and test 3-bit synchronous counter using flip flops.

2. Design, build and test Priority keyboard encoder using IC 74148.
3. Design, build and test hamming code error detection circuit.
4. Design, build and test 4-bit magnitude comparator.
5. Design, build and test DAC using R-2R ladder network.
6. Design, build and test ADC using IC 0808/IC 7109/IC 741/IC 324.
7. Design, build and test event counter.
8. Design, build and test frequency counter.
9. Design, build and test square wave generator using logic gates.
10. Design, build and test random sequence generator.

**Group C**

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

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| | |
|---|---|
| **Semester – IV** | **Paper – I** |
| **Course Code: BSC-ES 401 T** | **Title of the Course: Analog Circuit Design** |
| **Credits: 02** | **Total Lectures: 30 Hrs.** |

## Course Outcomes (COs):

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

a. Design amplifier circuits.
b. Understand designing of power amplifiers.
c. Understand the concept of feedback.
d. Design op-amp based circuits.

## Detailed Syllabus:

**Unit I: Amplifiers (06)**

Small signal amplifiers: AC and DC analysis, frequency response, gain bandwidth product. Single stage amplifier: designing, effect of coupling capacitor and bypass capacitor on frequency response (qualitative approach). Different types of coupling. Design of two stage amplifier.

**Unit II: Power Amplifier (10)**

Classification of power amplifier on the basis of conduction: class-A, class-B, class-AB and class-C. Class-A amplifier: resistive load and transformer coupled load. Class-B amplifier: Push-pull amplifier, complimentary symmetry push pull amplifier. Class-AB push pull amplifier. Thermal runaway. Heat sinks.

**Unit III: Op-amp based Systems (10)**

Concept of feedback, positive and negative feedback. Types of feedback circuits: current shunt, current series, voltage shunt and voltage series. Effect of negative feedback: gain, bandwidth, input and output impedance. Op-amp circuits: Schmitt trigger, Instrumentation amplifier,

practical integrator and differentiator, first order Butterworth active filter. Oscillators: Barkhausen's criterion, Wien bridge oscillator and Phase shift oscillator, multivibrator.

**Unit IV: Application System** **(04)**

Design of liquid level detector, Audio Amplifier and function generator.

## Suggested Readings:

1. Operational amplifiers and linear Integrated Circuits - Ramakant Gaikwad, PHP.
2. Operational amplifier - G. B. Clayton, ELBS.
3. Electronic devices and circuits - Boylested, PHP.
4. Principles of Electronics - B. L. Thereja, S. Chand and Company.

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| **Semester – IV** | **Paper – II** |
|---|---|
| **Course Code: BSC-ES 402 T** | **Title of the Course: Fundamentals of Embedded System Design** |
| **Credits: 02** | **Total Lectures: 30 Hrs.** |

## Course Outcomes (COs):

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

a. Understand the concept of embedded systems and its applications.
b. Design simple embedded systems.
c. Understand the assembly programming of 8051 microcontroller.
d. Interface different I/O devices to 8051.

## Detailed Syllabus:

**Unit I: Introduction to Embedded System (08)**

Embedded systems: introduction, characteristics, elements and applications. Different ways to design an embedded systems. Design metrics: NRE cost, unit cost, time to market, safety, maintenance, size, cost and power dissipation. Embedded system development cycle, algorithm and flowchart. Software development tools: editor, assembler, linker, compiler, IDE, ICE, programmer and simulator.

**Unit II: Basics of 8051 Microcontrollers (08)**

Microcontroller: History, introduction, classification, applications. Differences between microcontroller and microprocessor, criteria for choosing a microcontroller. The 8051 microcontroller: introduction, family members, architecture, block diagram, internal RAM organization, SFRs (Program Counter, Data Pointer, A and B Registers, PSW, SP), pin configuration, I/O port structure and operation, oscillator and reset circuitry, programming connections.

**Unit III: Assembly Programming of 8051 (08)**

Assembly language instruction format, addressing modes. Different groups of Instructions: Data Transfer, Logical, Arithmetic, Jump and Call. Basic programs based on arithmetic, logical, code conversion, block data transfer operations.

**Unit IV: Interfacing I/O devices and Case studies (06)**

I/O device interfacing: LED, push button, buzzer, seven segment display, Thumbwheel switch, opto-interruptor, DC and stepper motor.

Case studies: Traffic Light controller and event counter.

## Suggested Readings:


1. The 8051 Microcontroller and Embedded Systems using Assembly and C - M.A.Mazidi, J.G. Mazidi, R.D. Mckinlay. Pearson Education.
2. The 8051 Microcontroller Architecture, Programming and application - Kenneth J.Ayala, Penram International.
3. Embedded System Design: A Unified Hardware/Software. Approach - Frank Vahid and Tony Givargis.
4. The 8051 Microcontroller and Embedded Systems using Assembly and C - Kenneth J. Ayala, Dhananjay V. Gadre.
5. Microcontrollers [Theory and Applications] Deshmukh - Ajay V. TMH.
6. Microcontrollers: Principles and Applications – Ajit Pal.

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| | |
|---|---|
| **Semester – IV** | **Paper – III** |
| **Course Code: BSC-ES 403 P** | **Title of the Course: Practical Course - II** |
| **Credits: 02** | **Total Lectures**: **60 Hrs.** (12 practicals) |

## Course Outcomes (COs):

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

a. Design, build and test different analog circuits.
b. Use op-amp for different applications.
c. Use the 8051 target board and different software development tools used.
d. Simulate and debug assembly programs of 8051.

## Detailed Syllabus:

The practical course consists of **11** experiments and **1** activity equivalent to **1** experiments.

**Group A: Practicals based on Analog Circuit Design (Any 5)**

1. Design, build and test integrator circuit using op-amp.
2. Design, build and test differentiator circuit using op-amp.
3. Design, build and test Wien bridge oscillator using op-amp.
4. Design, build and test Phase shift oscillator using op-amp.
5. Design, build and test Class-B Push pull amplifier.
6. Design, build and test first order Butterworth HPF / LPF.
7. Design, build and test Schmitt trigger.
8. Design, build and test two stage amplifier using transistors.
9. Design, build and test audio amplifier.
10. Design, build and test liquid level detector.

**Group B: Practicals based on Fundamentals of Embedded System Design (Any 6)**

All the practicals should be performed for 8051 microcontroller using assembly programming.

1. To get familiarize with 8051 target board, understand the use of software development tools and perform necessary installation procedure and perform basic exercises on arithmetic, logical and data transfer operation.
2. Programs on code conversion: dec-hex, hex-dec / ASCII – HEX, HEX – ASCII / BCD – seven segment.
3. LED array interfacing (display 3 different patterns on LED).
4. Seven segments display interfacing.
5. Stepper motor interfacing (Clockwise and anticlockwise rotation).
6. DC motor interfacing (Clockwise and anticlockwise rotation).
7. Event counter (use opto-interruptor or IR pair).
8. Traffic light controller.
9. Thumbwheel switch interfacing.
10. To read push-button switch and display its status on LED.

**GROUP C**

Perform any one experiments from Group A (op-amp based) using circuit simulation software LTSPICE / Proteus / any other simulation software. (Give preference to not performed experiments).