**Ahmednagar Jilha Maratha Vidya Prasarak Samaj's**

# New Arts, Commerce, and Science College, Ahmednagar

# (Autonomous)

## (Affiliated to Savitribai Phule Pune University, Pune)

## National Education Policy (NEP)

## Choice Based Credit System (CBCS)

**Programme Skeleton and Syllabus of**

## M.Sc. Electronic Science

**Implemented from**

## Academic Year 2023-24

## 9.2 Distribution of credits

| Type of Courses | Total Credits | Credits / Semester |
|---|---|---|
| Discipline-Specific Core Courses (DSC) | 54 | 14 /12 |
| Discipline Specific Elective Courses (DSE) | 16 | 04 |
| Research Methodology (RM) | 04 | Semester I only |
| On-Job Training/ Internship (OJT/I | 04 | Semester II only |
| Project (PR) | 10 | Semesters III and IV only |
| Total | 88 | 22 |

## 9.3 Master of Science (M.Sc.) Course Distribution

| Class | Semester | Subjects | Courses | DSC | | DSE | | RM/OJT/ Internship etc. | | Project * | Total Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | T | P | T | P | T | P | | |
| M. Sc. I | I | 01 | 09 | 03 | 03 | 01 | 01 | 01* | | 00 | 22 |
| M. Sc. I | II | 01 | 09 | 03 | 03 | 01 | 01 | 00 | 01 | 00 | 22 |
| M. Sc. II | III | 01 | 07 | 02 | 02 | 01 | 01 | 00 | 00 | 01 | 22 |
| M. Sc. II | IV | 01 | 07 | 02 | 02 | 01 | 01 | 00 | 00 | 01 | 22 |

## 9.4 Master of Science (M. Sc.) Credit Distribution

| Class | Semester | Subjects | Courses | DSC | | DSE | | RM/OJT/ Internship etc. | | Project * | Total Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | T | P | T | P | T | P | | |
| M. Sc. I | I | 01 | 09 | 08 | 06 | 02 | 02 | 04 | | 00 | 22 |
| M. Sc. I | II | 01 | 09 | 08 | 06 | 02 | 02 | 00 | 04 | 00 | 22 |
| **Exit Option: PG Diploma** | | | | | | | | | | | |
| M. Sc. II | III | 01 | 07 | 08 | 06 | 02 | 02 | 00 | 00 | 04 | 22 |
| M. Sc. II | IV | 01 | 07 | 08 | 04 | 02 | 02 | 00 | 00 | 06 | 22 |
| | | | | **32** | **22** | **08** | **08** | **02** | **06** | **10** | **88** |

## 9.5 Master of Science (M. Sc.) Distribution of Courses

| Class | Semester | Course and their credits in the bracket | | | |
|---|---|---|---|---|---|
| | | DSC | DSE | RM/OJT/ Internship etc. | Project * |
| M. Sc. I | I | DSC -01 (03) | DSE -01 (02) | RM-01(04) | NA |
| M. Sc. I | I | DSC -02 (03) | DSE -02 (02) | | |
| M. Sc. I | I | DSC -03 (02) | | | |
| M. Sc. I | I | DSC -04 (02) | | | |
| M. Sc. I | I | DSC -05 (02) | | | |
| M. Sc. I | I | DSC -06 (02) | | | |
| M. Sc. I | II | DSC -07 (03) | DSE -03 (02) | OJT-01 (04) | NA |
| M. Sc. I | II | DSC -08 (03) | DSE -04 (02) | | |
| M. Sc. I | II | DSC -09 (02) | | | |
| M. Sc. I | II | DSC -10 (02) | | | |
| M. Sc. I | II | DSC -11 (02) | | | |
| M. Sc. I | II | DSC -12 (02) | | | |
| M. Sc. II | III | DSC -13 (04) | DSE -05 (02) | NA | PR-01(04) |
| M. Sc. II | III | DSC -14 (04) | DSE -06 (02) | | |
| M. Sc. II | III | DSC -15 (03) | | | |
| M. Sc. II | III | DSC -16 (03) | | | |
| M. Sc. II | IV | DSC -17 (04) | DSE -05 (02) | NA | PR-02(06) |
| M. Sc. II | IV | DSC -18(04) | DSE -06 (02) | | |
| M. Sc. II | IV | DSC -19 (02) | | | |
| M. Sc. II | IV | DSC -20 (02) | | | |

### Programme Framework (Courses and Credits): M. Sc. Electronic Science

| Sr. No. | Year | Semester | Level | Course Type | Course Code | Title | Credits |
|---|---|---|---|---|---|---|---|
| 1. | I | I | 6.0 | DSC-01 | MS-ES111T | Modern Communication Technologies | 03 |
| 2. | I | I | 6.0 | DSC-02 | MS-ES112T | Advanced Analog Circuit Design | 03 |
| 3. | I | I | 6.0 | DSC-03 | MS-ES113T | Programming Raspberry Pi using Python | 02 |
| 4. | I | I | 6.0 | DSC-04 | MS-ES114P | Practical Course – I | 02 |
| 5. | I | I | 6.0 | DSC-05 | MS-ES115P | Practical Course – II | 02 |
| 6. | I | I | 6.0 | DSC-06 | MS-ES116P | Practical Course – III | 02 |
| 7. | I | I | 6.0 | DSE-01 | MS-ES117T(A) | Advanced Embedded System Design | 02 |
| | | | | | MS-ES117T(B) | C++ Programming and Data Structure | |
| 8. | I | I | 6.0 | DSE-02 | MS-ES118P(A) | Practical Course – IV | 02 |
| | | | | | MS-ES118P(B) | Practical Course – IV | |
| 9. | I | I | 6.0 | RM-01 | MS-ES119T/P | Research Methodology | 04 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 10. | I | II | 6.0 | DSC-07 | MS-ES121T | Electromagnetic Fields and Antennas | 03 |
| 11. | I | II | 6.0 | DSC-08 | MS-ES122T | Internet of Things | 03 |
| 12. | I | II | 6.0 | DSC-09 | MS-ES123T | Optical Fiber Communication | 02 |
| 13. | I | II | 6.0 | DSC-10 | MS-ES124P | Practical Course – V | 02 |
| 14. | I | II | 6.0 | DSC-11 | MS-ES125P | Practical Course – VI | 02 |
| 15. | I | II | 6.0 | DSC-12 | MS-ES126P | Practical Course – VII | 02 |
| 16. | I | II | 6.0 | DSE-03 | MS-ES127T(A) | Digital Image Processing | 02 |
| | | | | | MS-ES127T(B) | Artificial Intelligence | |
| 17. | I | II | 6.0 | DSE-04 | MS-ES128P(A) | Practical Course – VIII | 02 |
| | | | | | MS-ES128P(B) | Practical Course – VIII | |
| 18. | I | II | 6.0 | OJT-01 | MS-ES129P | On Job Training | 04 |
| 19. | II | III | 6.5 | DSC-13 | MS-ES131T | Digital Signal Processing | 04 |
| 20. | II | III | 6.5 | DSC-14 | MS-ES132T | Robotics and Mechatronics | 04 |
| 21. | II | III | 6.5 | DSC-15 | MS-ES133P | Practical Course – IX | 03 |
| 22. | II | III | 6.5 | DSC-16 | MS-ES134P | Practical Course – X | 03 |
| 23. | II | III | 6.5 | DSE-05 | MS-ES135T(A) | Virtual Instrumentation | 02 |
| | | | | | MS-ES135T(B) | VLSI System Design | |
| 24. | II | III | 6.5 | DSE-06 | MS-ES136P(A) | Practical Course – XI | 02 |
| | | | | | MS-ES136P(B) | Practical Course – XI | |
| 25. | II | III | 6.5 | PR-01 | MS-ES137P | Project Course – I | 04 |
| 26. | II | IV | 6.5 | DSC-17 | MS-ES141T | Measurement techniques and Control Systems | 04 |
| 27. | II | IV | 6.5 | DSC-18 | MS-ES142T | Industrial Electronics | 04 |
| 28. | II | IV | 6.5 | DSC-19 | MS-ES143P | Practical Course – XII | 02 |
| 29. | II | IV | 6.5 | DSC-20 | MS-ES144P | Practical Course – XIII | 02 |
| 30. | II | IV | 6.5 | DSE-07 | MS-ES145T(A) | Wireless Sensor Network | 02 |
| | | | | | MS-ES145T(B) | Computational Methods for Electronics | |
| 31. | II | IV | 6.5 | DSE-08 | MS-ES146P(A) | Practical Course – XIV | 02 |
| | | | | | MS-ES146P(B) | Practical Course – XIV | |
| 32. | II | IV | 6.5 | PR-02 | MS-ES147P | Project Course – II | 06 |

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. | Dr. D. S. Shelar | Member |
| 4. | Miss. M. R. Markad | Member |
| 5. | Dr. M. A. Shaikh | Member |
| 6. | Mr. G. V. Avhale | Member |
| 7. | Miss. P. M. Gaikwad | Member |
| 8. | Dr. S. N. Helambe | Academic Council Nominee |
| 9. | Mr. S. K. Shinde | Academic Council Nominee |
| 10. | Dr. M. S. Zambare | Vice-Chancellor Nominee |
| 11. | Mr. Bipinchandra Todmal | Alumni |
| 12. | Mr. P. D. Nirmal | Industry Expert |
| 13. | Prof. A. V. Mancharkar | Member (co-opt) |
| 14. | Mrs. B. M. Danave | Member (co-opt) |

## 1. Prologue / Introduction of the programme:

The M. Sc. programme is for 2 academic years and 4 semesters. The minimum total number of credits requirements for each programme is 88 credits and 12 additional non CGPA credits. The students after successful completion of 44 credits in the first year of a two year PG program may opt to exit with PG diploma. The M.Sc. degree will be awarded to the students who complete a total of 88 credits in a minimum of two years by completing an average of 22 credits per semester and 12 additional non-CGPA credits. The various courses of the programme are designed to include classroom teaching laboratory work, project work, viva, seminars and assignments.

In each semester, there are some Discipline Specific Core Courses (DSC) which includes theory as well as practical courses. Also, in each semester students can opt the one theory and one practical course from Discipline Specific Elective Courses (DSE) out of two theory and two practical courses. In addition, in the first semester there is Research Methodology course of 4 credits. In second semester internship is included for 4 credits and in

third and fourth semester research project is their. Thirty percent of the total marks for each course will be awarded through continuous Internal Assessment.

Electronic Science is an important branch of science devoted to the design, implementation and analysis of electronic circuits and systems. Electronics technology has the vast majority of applications in various fields including communication, consumer appliances, medical, defense and so on. The advances in electronics technology make systems smaller, smarter and powerful. The advanced electronics technologies are included for the M.Sc. electronic science programme. 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 basic fundamental concepts, knowledge of advanced electronic technologies and specific practical skills of the students have been developed.

## 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 demonstrate aptitude in the subject of electronics by demonstrating a broad and vast knowledge base.
II. Apply the knowledge of basic and applied sciences for understanding semiconductor materials, devices and integrated circuits.
III. Design, create and test analog and digital systems for real-world issues while keeping practical limits in mind.
IV. Ability to think critically for solving various problems in electronic circuits and technologies.
V. The students will be able to develop skills in system design and its implementation.
VI. The students will be able to apply knowledge of electronics in various domains like computers, communication, consumer products, industrial automation, medical, transportation, agriculture, defense and many more.
VII. The students will be able to think independently, takes initiative, generates ideas, effectively collaborates with others, writes proposals and develops the capacity to manage a team for various real-world projects.
VIII. Using hardware-software co-design techniques for microcontrollers / embedded systems, identifies, formulates and proposes unique, inventive and effective solutions to real-world challenges.

**Ahmednagar Jilha Maratha Vidya Prasarak Samaj's**

# New Arts, Commerce and Science College, Ahmednagar
## (Autonomous)
## Syllabus
## M.Sc. Electronic Science

| **Title of the Course: Modern Communication Technologies** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Year: I** | | | | **Semester: I** | | | | |
| Course Type | Course Code | Credit Distribution | | Credits | Allotted Hours | Allotted Marks | | |
| | | Theory | Practical | | | CIE | ESE | Total |
| DSC-01 | MS-ES111T | 03 | 00 | 03 | 45 | 30 | 70 | 100 |

**Learning Objectives:**

1. To introduce basic concepts of various modulation techniques used in digital communication systems.
2. To understand multiple access techniques used in communication.
3. To impart fundamental knowledge of information theory and several source coding techniques for efficient representation.

**Course Outcomes (Cos):**

After completion of this course student will be able to,

1. Understand the basic concept of a communication system
2. Know the information coding and spread spectrum techniques.
3. Comprehend the fundamentals of digital communication techniqus.
4. Understand the basic concepts of mobile communication

**Detailed Syllabus:**

**Unit I: Digital Communication Techniques (12)**

Elements of digital communication system, the sampling theorem, aliasing error, PAM, PPM and PWM signals generation and detection, quantization, pulse code modulation (PCM), companding in PCM, differential PCM, delta modulation, adaptive delta modulation, ASK, BPSK, QPSK, FSK, MSK, QAM.

**Unit II: Information Coding and Spread Spectrum Techniques (13)**

The measure of information, entropy, Shannon's coding theorem, channel capacity, the capacity of the Gaussian channel, source coding, Huffman code,Hamming code, channel coding, syndrome decoding .

Spread spectrum communication: PN sequences, direct sequence and frequency hopping spread spectrum systems, FDMA, TDMA and CDMA.

**Unit III: Mobile Communication (10)**

Evolution of mobile radio communication,overview of 2G, 3G, 4G, 5G wireless networks. Cellular fundamentals: frequency reuse, channel assignment strategies, handoff strategies, interference and system capacity, trunking and grade of service, techniques of improving coverage and capacity of a cellular system. GSM system architecture, GSM channel types, GSM frame structure, intelligent cell concept and applications, SMS, data storage device, CDMA digital cellular standard.

**Unit IV: Data Communication (10)**

Introduction to data communication, layered network architecture (OSI and TCP/IP). LAN topologies, network topologies, LAN and MAC, data link control, bridging, switching, addressing, transmission systems. Circuit switching networks, routing, signaling and traffic management. Packet switching networks. Internetworking: repeaters, bridges, routers and gateways.

**Suggested Readings/Material:**

1. Communication Electronics Principles and applications - Louis E. Frenzel, Tata McGraw Hill.
2. Digital data communication – Miller.
3. Digital communications - J. G. Proakis.
4. Mobile Cellular Telecommunication - William C. Y. Lee.
5. Mobile communication - Jochen Schiller.

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# New Arts, Commerce and Science College, Ahmednagar
## (Autonomous)
## Syllabus
## M.Sc. Electronic Science

| **Title of the Course: Advanced Analog Circuit Design** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Year: I** | | | | **Semester: I** | | | | |
| Course Type | Course Code | Credit Distribution | | Credits | Allotted Hours | Allotted Marks | | |
| | | Theory | Practical | | | CIE | ESE | Total |
| DSC-02 | MS-ES112T | 03 | 00 | 03 | 45 | 30 | 70 | 100 |

**Learning Objectives:**

1. To learn the characteristics and working of electronic devices.
2. To study the various device models.
3. To study the wideband and narrowband amplifiers using BJT.
4. To develop skills in analysis and design of analog circuits.
5. To study the designs of opamp applications.

**Course Outcomes (Cos):**

After completion of this course, students will be able to,

1. Understand the semiconductor junctions in BJT, FET and MOSFET.
2. Comprehend the frequency response of amplifiers.
3. Distinguish the concept of a tuned amplifier and oscillators.
4. Use of operational amplifiers in different applications.

**Detailed Syllabus:**

**Unit I: Basic Semiconductor Devices (12)**

Practical diode characteristics (static and dynamic resistance), temperature effects, diode applications in wave shaping circuits. BJT construction and biasing, Operation, CC, CB and CB configurations Construction of JFET, types and its operation, parameters of JFET, JFET characteristics, comparison of BJT and JFET, JFET amplifiers MOSFET, depletion and enhancement, biasing of MOSFET, applications.

**Unit II: Frequency Response of Amplifiers (10)**

BJT models and modeling parameters, equivalent circuits for CE, CB and CC configurations, single stage amplifier, small signal analysis, distortion, Design of single stage RC-coupled

amplifier with frequency response (f1 and f2) , frequency response of multistage amplifiers, different coupling schemes and gain of multistage amplifiers.

**Unit III: Amplifier and Tuned Oscillators (10)**

Tuned amplifier design, multistage tuned amplifier, Oscillators: design and analysis of LC and RC oscillators, Hartley, Colpitt's, phase shift and Wien-bridge oscillators, crystal oscillators Bubba oscillator and applications.

**Unit IV: Operational Amplifiers and their Applications (13)**

Op-amp parameters such as dc and low frequency parameters and their significance in design of op-amp, Inverting and non-inverting amplifiers with design aspects such as input and output impedance, common mode errors and limitations, bandwidth, etc. Bridge and instrumentation amplifier, Practical design aspect of integrator and differentiators, such as offset error and stability, bandwidth considerations. Concept and applications of PLL.Active Filters: Design of active filters - LPF, HPF, BPF and BRF (first and higher orders). Butterworth filters.

**Suggested Readings/Material:**

1. Electronic Devices and Circuits, S. Salivahanan, N. Suresh Kumar, 3rd Edn, McGraw Hill.
2. Electronic Devices and Circuit Theory, Robert Boylestead, Louis Nashelsky, PHI.
3. Design with Operational Amplifiers and Linear IC, Sergio Franco, 3rd Edn, TMH.
4. Electronic Principles, Malvino and Bates, McGraw Hill.
5. Operational amplifier, G.B. Clayton, Elsevier Sci. Tech.
6. Microelectronic Circuits: Analysis and Design, Mohammad H. Rashid, PWS Publishing Company.
7. Electronic devices, Allen Motershed, PHI.
8. Integrated electronics, Millman Halkies, McGraw Hill.

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# New Arts, Commerce and Science College, Ahmednagar
## (Autonomous)
## Syllabus
## M.Sc. Electronic Science

| **Title of the Course: Programming Raspberry Pi using Python** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Year: I** | | | | **Semester: I** | | | | |
| Course Type | Course Code | Credit Distribution | | Credits | Allotted Hours | Allotted Marks | | |
| | | Theory | Practical | | | CIE | ESE | Total |
| DSC-03 | MS-ES113T | 02 | 00 | 02 | 30 | 15 | 35 | 50 |

**Learning Objectives:**

1. To understand the concept of SBC.
2. To study the architecture of Raspberry Pi.
3. To study the basics of Raspberry Pi.
4. To study the Programming using python.
5. To design different application circuits using Raspberry Pi.

**Course Outcomes (Cos):**

After completion of the course student will be able to,

1. Understand the difference between general computing and the Raspberry Pi.
2. Know the fundamentals of Raspberry Pi.
3. Understand the use of Raspberry Pi for an embedded system application.
4. Understand python basics.
5. Familiar with the python programming environment to develop Raspberry Pi and their interfaces with peripheral devices.

**Detailed Syllabus:**

**Unit I: Introduction to Raspberry Pi (15)**

Introduction to single board computers, single boards computer block diagram, types, comparison of SBC models, specifications. Raspberry Pi: Pin Description of Raspberry Pi, architectural features, block diagram of BCM2835.

ARM116JZF-S: CPU overview, block diagram, coprocessor interface, debug, CPU pipeline stages, CPU cache organization, component such as integer core, LSU, prefetch unit, memory system, AMBA AXI interface, Branch prediction & folding (Concept), GPU Overview.

**Unit II: Programming using Python (15)**

Basic Python Programming (Script programming): Variable & data types, Flow Control structures, Conditional statements ( If…Then…else).

Basic Arithmetic Programs: Addition, Subtraction, Multiplication, Division.

Introduction to Python for programming Raspberry Pi: I/O functions (GPIO, Digital), Time functions, other library functions.

I/O device interfacing to Raspberry pi: LED, Switch, Camera, GSM, Ultrasonic Sensor, PIR, ADC.

**Suggested Readings/Material:**

1. Rasberry Pi CookBook: Software & Hardware problems and Solutions By Simon Monk (O'Reilly Media Inc.)
2. Raspberry Pi Hardware Reference by Warren Gay ( Apress).
3. Rasberry Pi User Guide By Eben Upton, Greath Halfacree (John Wiley & Sons, Inc.).
4. Learning Python with Rasberry Pi, by Alex Bradbury, Ben Everard, John Wiley & Sons, Inc.
5. Learn Raspberry Pi programming with Python By Wolfram Donat ( Apress).
6. Think Python, Allen Downey, O'Reilly, 2012.
7. Introduction to Computing and Problem Solving using Python - E. Balagurusamy.
8. Python 3 for Absolute Beginners - Tim Hall and J-P Stacey.
9. Hands-on Python Tutorial - Dr. Andrew N. Harrington.

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# New Arts, Commerce and Science College, Ahmednagar
## (Autonomous)
## Syllabus
## M.Sc. Electronic Science

| **Title of the Course: Practical Course - I** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Year: I** | | | | **Semester: I** | | | | |
| Course Type | Course Code | Credit Distribution | | Credits | Allotted Hours | Allotted Marks | | |
| | | Theory | Practical | | | CIE | ESE | Total |
| DSC-04 | MS-ES114P | 00 | 02 | 02 | 60 | 15 | 35 | 50 |

**Learning Objectives:**

1. To design and build different modulation circuits for FSK, ASK, BPSK, PWM, PPM, PAM etc.
2. To analyse different coding methods.
3. Simulation study of modulation and demodulation techniques using MATLAB.
4. To understand local area network setup and its configuration.

**Course Outcomes (Cos):**

After completion of this course, students will be able to,

1. Use advanced communication technologies.
2. Design modulator and demodulator for different digital communication techniques.
3. Setup local area network and perform its configuration.

**Detailed Syllabus:**

The practical course consists of **10** experiments each of **4** hours duration and **1** activity equivalent to **2** experiments.

**Practicals based on Advanced Communication Technologies (Any 5)**

1. Study of PCM.
2. Delta Modulation (DM) system.
3. Adaptive Delta Modulation (ADM) system.
4. Study of ASK / FSK.
5. Study of BPSK / QPSK.
6. Study of Time division multiplexing.
7. Pulse Amplitude Modulator and demodulator.
8. Pulse Width Modulator and demodulator.

9. Pulse Position Modulator and demodulator.
10. Study of networking devices.
11. Study of local area network setup and its configuration.
12. Study of single bit error detection and correction using hamming code.

**Practicals based on MATLAB or any simulation software for Simulation of Communication Technologies (Any 5)**

1. Study of PCM.
2. Study of Delta Modulation (DM).
3. Study of Adaptive Delta Modulation (ADM).
4. Study of a PN sequence.
5. Study of DSSS.
6. Study of FHSS.
7. Study of BPSK signal.
8. Study of QPSK signal.
9. Study of FSK.
10. Study of MSK.
11. Study of CDMA.
12. Study of FDMA.
13. Study of TDMA.
14. Study of Quadrature Amplitude modulation (QAM).
15. Huffman coding.
16. Simulation of Analog modulation.

**Activity:**

1. Perform any one of the following activity and write report (equivalent to 2 experiments).
    - Industrial / institutional / Research Center visit.
    - Market Survey / Review of any advanced technology (related to the course).
    - Participation in workshop / conference / seminar.

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# New Arts, Commerce and Science College, Ahmednagar
## (Autonomous)
## Syllabus
## M.Sc. Electronic Science

| **Title of the Course: Practical Course - II** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Year: I** | | | | **Semester: I** | | | | |
| Course Type | Course Code | Credit Distribution | | Credits | Allotted Hours | Allotted Marks | | |
| | | Theory | Practical | | | CIE | ESE | Total |
| DSC-05 | MS-ES115P | 00 | 02 | 02 | 60 | 15 | 35 | 50 |

**Learning Objectives:**

1. To study analog electronic circuit design.
2. To have hands-on experience in circuit building and testing.
3. To study simulation software for understanding the response of different analog circuits.

**Course Outcomes (Cos):**

After completion of this course, students will be able to,

1. Understand the basics of analog electronic circuit design.
2. Build and test circuit on bread board or tag-board.
3. Have hands-on experience in circuit building and testing.
4. Use simulation software for understanding the response of different analog circuits.

**Detailed Syllabus:**

The practical course consists of 10 experiments each of 4 hours duration and 1 activity equivalent to 2 experiments.

**Practical based on Analog Circuit Design (Any 5)**

1. Waveform generation:Bubba oscillator.
2. V to F and F to V.
3. Study of Schmitt trigger.
4. Instrumentation amplifier for a given gain.
5. Transistor based microphone amplifier.
6. PLL characteristics.
7. Second order Butterworth filters (BP/BR).
8. Tunned amplifier small signal/large signal for IF.
9. Design JFET based preamplifier.

10. Multistage amplifier.

**Practical based on Circuit Simulation using LTSPICE/Multisim (Any 5)**

1. Study of LTSPICE Simulation software.
2. D.C. circuit simulation.
3. Frequency response filters:All types.
4. Transient and AC analysis of rectifiers and clamper.
5. Differential amplifier.
6. Frequency response and transfer characteristics of multistage RC coupled amplifier.
7. Integrator and differentiator using op-amp.
8. Voltage follower using op-amp.
9. Astable and monostable multivibrator using op-amp.
10. Hartley oscillator.

**Activity(Any 1):**

1. Design, build and test any analog electronic application circuit (equivalent to 2 experiments).
   - Build circuit using PCB / breadboard / tag board.
   - Write short report.
2. Perform any one of the following activity and write report (equivalent to 2 experiments).
   - Industrial/institutional/Research Center visit.
   - Market Survey/Review of any advanced technology (related to course).
   - Participated in workshop/conference/seminar.

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# New Arts, Commerce and Science College, Ahmednagar
## (Autonomous)
## Syllabus
## M.Sc. Electronic Science

| **Title of the Course: Practical Course - III** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Year: I** | | | | **Semester: I** | | | | |
| Course Type | Course Code | Credit Distribution | | Credits | Allotted Hours | Allotted Marks | | |
| | | Theory | Practical | | | CIE | ESE | Total |
| DSC-06 | MS-ES116P | 00 | 02 | 02 | 60 | 15 | 35 | 50 |

**Learning Objectives:**

1. To use basic concepts for building various applications of Rasberry-Pi.
2. To interface different I/O devices to Raspberry Pi.
3. To develop skills of analyzing test results of given experiments.
4. To develop basic programming skill in Python.

**Course Outcomes (Cos):**

After completion of the course students will be able to,

1. Design and develop own smart applicaiotns using Rasberry-Pi.
2. Write Python program for simple applications.
3. Acquire programming skills using python.
4. Develop practical skills for designing Raspberry Pi Applications.

**Detailed Syllabus:**

The practical course consists of 10 experiments each of 4 hours duration and 1 activity equivalent to 2 experiments.

**Practical based on Python (Any 4):**

1. Enter the number from the user and depending on whether the number is even or odd, print out an appropriate message to the user.
2. Write a program to generate the Fibonacci series.
3. Python program to swap two elements in a list.
4. Python program to print the factorial for a given number.
5. Program to find sum of array.
6. Python Program to find largest element in a list.
7. Calculate frequency of Phase Shift Oscillator.

8. Reverse words in a given String in Python.
9. Python program to print even numbers in a list.
10. Python Program to check Armstrong Number.

**Practical based on Raspberry Pi (Any 6):**

1. Programming of Raspberry Pi to control LEDs attached to the GPIO pins
2. Programming of Raspberry Pi to get feedback from a switch connected to the GPIO pins
3. Programming of Raspberry Pi to detect temperature using temperature sensor
4. Programming of Raspberry Pi to detect light intensity using photocell sensor
5. Programming of Raspberry Pi for Motion detection
6. Programming of Raspberry Pi for image detection
7. Programming of Raspberry Pi for interfacing RFID module.
8. Programming of Raspberry Pi for event counter.
9. Programming of Raspberry Pi for interfacing DHT11sensor.
10. Programming of Raspberry Pi for displaying different LED Patterns.

**Activity (Any 1):**

Perform any one of the following activity and write report (equivalent to 2 experiments).

- Industrial / institutional / Research Center visit./study tour.
- Market Survey / Review of any advanced technology (related to the course).
- Participation in workshop / conference / seminar.

**Ahmednagar Jilha Maratha Vidya Prasarak Samaj's**

# New Arts, Commerce and Science College, Ahmednagar
## (Autonomous)
## Syllabus
## M.Sc. Electronic Science

| **Title of the Course: Advanced Embedded System Design** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Year: I** | | | | **Semester: I** | | | | |
| Course Type | Course Code | Credit Distribution | | Credits | Allotted Hours | Allotted Marks | | |
| | | Theory | Practical | | | CIE | ESE | Total |
| DSE-01 | MS-ES117T(A) | 02 | 00 | 02 | 30 | 15 | 35 | 50 |

**Learning Objectives:**

1. To study advanced concepts of embedded system design.
2. To understand diffrent communication standards and wireless protocols used in embedded system design.
3. To learn use of MSP430 launchpad and STM32 platform for embedded system development.
4. To interface I/O devices to MSP430 launchpad and STM32 platform.

**Course Outcomes (Cos):**

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

1. Understand the advanced concepts of embedded system design.
2. Use the communication standards and wireless protocols for different applications.
3. Design and develop an embedded system using MSP430 launchpad and STM32 platform.
4. Write basic programs for interfacing I/O devices to MSP430 launchpad and STM32 platform.

**Detailed Syllabus:**

**Unit I: Communication Standards and Wireless Protocols for Embedded System (10)**

RS232 and RS485 standard: specifications, pin configuration and applications. I2C, SPI, USB, CAN and Mod bus: introduction, specifications, bus signals, master-slave configuration, error handling and addressing. Bluetooth and Zigbee: IEEE standard, features, specifications, protocol stack, applications and the study of hardware module.

**Unit II: Embedded system design using MSP430 Launchpad and STM32 (20)**

MSP430 Launchpad and STM32: Introduction, features, architecture, memory organization, I/O ports and peripherals. MSP430 Launchpad and STM32 programming using C: basic structure, data types, operators, library files, delay functions and I/O port programming. I/O device interfacing to MSP430 Launchpad and STM32: LED, push button, seven segment display and stepper motor. Case study: Intrusion detection system, event counter, temperature monitoring system, Bluetooth controlled device and wireless data acquisition system.

**Suggested Readings/Material:**

1. Embedded System Design: A Unified Hardware/Software. Approach - Frank Vahid and Tony Givargis.
2. Beginning Microcontrollers with the MSP430 - Gustavo Litovsky.
3. Embedded Hardware know it all - Jack Ganssle, Tammy Noergaard, Eady, Edwards.
4. ARM system on chip architecture – Steve Furber.

**Ahmednagar Jilha Maratha Vidya Prasarak Samaj's**

# New Arts, Commerce and Science College, Ahmednagar
## (Autonomous)
## Syllabus
## M.Sc. Electronic Science

| **Title of the Course:** C++ Programming and Data Structure | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Year: I** | | | | **Semester: I** | | | | |
| Course Type | Course Code | Credit Distribution | | Credits | Allotted Hours | Allotted Marks | | |
| | | Theory | Practical | | | CIE | ESE | Total |
| DSE-01 | MS-ES117T(B) | 02 | 00 | 02 | 30 | 15 | 35 | 50 |

**Learning Objectives:**

1. To learn basics of obeject oriented programming.
2. To study C++ programming language.
3. To study data structure and their use in difffrent applications.

**Course Outcomes (Cos):**

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

1. Write programs for different operations using C++ programming language.
2. Understand the characteristics of an object-oriented programming language.
3. Use data structures in different applications.

**Detailed Syllabus:**

**Unit I: Introduction to C++ Programming** **(20)**

Object oriented programming, characteristics of an object-oriented language.

C++ programming language: Tokens, keywords, identifier and constants, basic data types, user defined data types, derived data types, arithmetic operators, relational operators, logical operators, assignment operators, increment and decrement operators, conditional operators, bit wise operators, special operators, expressions and evaluation of expressions, scope resolution operator, member dereferencing operators, manipulators, type cast operator, implicit conversions, precedence of operators, new and delete operators. Arrays, pointers and structures. if, if-else, else-if, switch statement, break, continue and go to statement, for loop, while loop and do loop. Functions: Function definition, function arguments and passing, returning values from functions, referencing arguments, function overloading, virtual functions, library functions, local, static and global variables.

**Unit II: Data Structures** **(10)**

Multidimensional arrays definition implementation multidimensional arrays in control loops, pointers to multidimensional arrays. Stacks and queues array implementation: Definition of stacks and queues, Terminology, implementation using arrays, Link Lists, stacks and queues, Implementation of stacks and queues.

**Suggested Readings/Material:**

1. “Object- Oriented Programming with C++” by Balagurusamy E,TMH Pub.
2. “PROGRAMMING IN C++” by P.B.MAHAPATRA,S Chand Pub.
3. “Programming with C++” by Ravichandran,TMH Pub.
4. “Data structures using C and C++” by Yedidyah,Moshe, and Aaron, PHI Pub.
5. “Data structure, Algorithms & application in C++” by Sartaj Sahni ,McGraw HillPub.

**Ahmednagar Jilha Maratha Vidya Prasarak Samaj's**

# New Arts, Commerce and Science College, Ahmednagar
## (Autonomous)
## Syllabus
## M.Sc. Electronic Science

| **Title of the Course: Practical Course - IV** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Year: I** | | | | **Semester: I** | | | | |
| Course Type | Course Code | Credit Distribution | | Credits | Allotted Hours | Allotted Marks | | |
| | | Theory | Practical | | | CIE | ESE | Total |
| DSE-02 | MS-ES118P(A) | 00 | 02 | 02 | 60 | 15 | 35 | 50 |

**Learning Objectives:**

1. To learn programming of MSP430 Launchpad and STM32.
2. To learn use of software development tools for MSP430 Launchpad and STM32.
3. To understand and perform I/O device interfacing to MSP430 Launchpad and STM32.

**Course Outcomes (Cos):**

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

1. Use different software development tools for embedded systems.
2. Use target boards of MSP430 Launchpad and STM32.
3. Interface different I/O devices to design embedded systems.
4. Do error handling and debugging.

**Detailed Syllabus:**

Practical course consists of 10 experiments each of 4 hours duration and 1 activity equivalent to 2 experiments.

**Practical based on Embedded System Design using MSP430 Launchpad / STM32 (Any 10):**

1. LED array interfacing.
2. Get the status of the switch and display on LED.
3. Stepper motor interfacing (for clockwise and anticlockwise rotation).
4. Stepper motor interfacing to rotate motor for a specified angle.
5. Dot-matrix display interfacing.
6. Intrusion detection security system.
7. Seven segment display interfacing.
8. Event counter using opto-interruptor.

9. DC motor interfacing (clockwise and anticlockwise rotation).
10. Water level monitoring system.
11. Home appliances control using Bluetooth.
12. Monitor temperature using the LM35 sensor and manage appliances as per the temperature level.
13. Wireless data acquisition system using Zigbee.
14. Traffic light controller.
15. Device on / off based on light intensity.
16. Position control of servo motor.

**Activity (Any 1):**

1. Design and develop any small embedded system application and write a report (equivalent to 2 experiments).
2. Perform any one of the following activity and write report (equivalent to 2 experiments).
   - Industrial / institutional / Research Center visit.
   - Market Survey / Review of any advanced technology (related to the course).
   - Participation in workshop / conference / seminar.

**Ahmednagar Jilha Maratha Vidya Prasarak Samaj's**

# New Arts, Commerce and Science College, Ahmednagar
## (Autonomous)
## Syllabus
## M.Sc. Electronic Science

| **Title of the Course: Practical Course - IV** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Year: I** | | | | **Semester: I** | | | | |
| Course Type | Course Code | Credit Distribution | | Credits | Allotted Hours | Allotted Marks | | |
| | | Theory | Practical | | | CIE | ESE | Total |
| DSE-02 | MS-ES118P(B) | 00 | 02 | 02 | 60 | 15 | 35 | 50 |

**Learning Objectives:**

1. To learn software tools used for C++ programming.
2. To study use of C++ programming to perfom different operations.
3. To learn testing and debugging of C++ programs.

**Course Outcomes (Cos):**

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

1. Use software tools for C++ programming.
2. Write programs to perform different tasks using C++ programming language.
3. Compose, execute, test and debug C++ programs.

**Detailed Syllabus:**

Practical course consists of 10 experiments each of 4 hours duration and 1 activity equivalent to 2 experiments.

**Practical based on C++ Programming (Any 10):**

1. Write a program to calculate the roots of quadratic equation Ax2+Bx+C=0.
2. Write a program to calculate the average of a set of n numbers including zero and negative numbers.
3. Write a program to sort an array element in ascending order and descending order using bubble sort technique.
4. Write a program to plot a sin (X).
5. Write a program to find a row sum and column sum of a given matrix and built a new matrix with the help of row sum and column sum and previous matrix.
6. Write a program to read and print two-dimensional matrix of order n x m. Find the sum of diagonals.

7. Write a program that calculate and prints out the maximum and minimum of array.
8. Write a program for sorting names in alphabetical order.
9. Calculate frequency of i) Astable multivibrator using 555 ii) Wein bridge Oscillator.
10. Write a program to plot and exponential series.
11. Write a program for matrix addition and matrix multiplication.
12. Write a program for the operation of (a) addition (b) subtraction (c) multiplication (d) division. Using switch command.
13. Write a program to find the factorial of a given number and Fibonacci series using switch command.
14. Write a program to find the sum of natural numbers using function.
15. Generate the Fibonacci series up to the given limit N and also print the number of elements in the series.

**Activity:**

1. Perform any one of the following activity and write report (equivalent to 2 experiments).
   - Industrial / institutional / Research Center visit.
   - Market Survey / Review of any advanced technology (related to the course).
   - Participation in workshop / conference / seminar.

**Ahmednagar Jilha Maratha Vidya Prasarak Samaj's**

# New Arts, Commerce and Science College, Ahmednagar
## (Autonomous)
## Syllabus
## M.Sc. Electronic Science

| **Title of the Course: Research Methodology** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Year: I** | | | | **Semester: I** | | | | |
| Course Type | Course Code | Credit Distribution | | Credits | Allotted Hours | Allotted Marks | | |
| | | Theory | Practical | | | CIE | ESE | Total |
| RM-01 | MS-ES119T/P | 04 | 00 | 04 | 60 | 30 | 70 | 100 |

**Learning Objectives:**

1. To strengthening foundations of research methodology in the subject of Electronics.
2. To expose the Students with the theoretical concepts of Research.
3. To understand research process in order to plan a research proposal.
4. To learn methods of research set-up in order to devise and design and conclude with report writing.

**Course Outcomes (Cos):**

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

1. Plan a research proposal and design the research.
2. Understand research problem and design before initiating stage.
3. Comprehend and perform quantitative and qualitative data analysis.
4. Write research report by bearing in mind right Ethics.

**Detailed Syllabus:**

**Unit-1 Introduction to Research** **(10)**

Research: meaning, objectives, purpose, motivation, scope; Types of research: exploratory, descriptive and experimental; Significance and characteristics of research; Criteria of good research; Concept of theory: empiricism, deductive and inductive theory; Scientific method: characteristics, research and scientific method; Research process.

**Unit-2 Research Problem and Design** **(20)**

Research problem identification & formulation: definition, formulating the research problem, necessity of defining the problem; Literature review: need and importance; Hypothesis: qualities of a good hypothesis, null hypothesis & alternative hypothesis; hypothesis testing: logic & importance.

Research design: concept and importance in research, features of a good research design; Exploratory research design: concept, types and uses; Descriptive research design: concept, types and uses; Experimental design: concept of independent & dependent variables; Qualitative and quantitative research: concept of measurement, causality, generalization, replication.

**Unit-3 Data Collection and Analysis (15)**

Data collection: data, types of data, methods, sample and population, sampling techniques, characteristics of a good sample; Tools of data collection: observation method, interview, questionnaire, various rating scales, characteristics of good research tools.

Data analysis: Univariate analysis: frequency tables, bar charts, pie charts, percentages; Bivariate analysis: cross tabulations and Chi-square test.

**Unit-4 Research Writing (15)**

Research writing: Report: definition, importance, types; Research paper writing: methods & style; Seminar & conference paper writing; Synopsis writing: methods; Thesis/Project writing: structure & importance; 7 Cs of effective research writing: concreteness, completeness, clarity, conciseness, courtesy, correctness, consideration.

Research evaluation methods; Index: h-index, I-index; Plagiarism: significance and effects, citation and acknowledgement; Intellectual property right: copyright, royalty, patent law; Research ethics.

**Suggested Readings/Material:**

1. Kothari, C. R., 2004. Research Methodology: Methods and Techniques. New Age International.
2. Sinha, S. C. and Dhiman, A. K., 2002. Research Methodology, Ess Publications.
3. Garg, B. L., Karadia, R., Agarwal, F. and Agarwal, U. K., 2002. An introduction to Research Methodology, RBSA Publishers.
4. Trochim, W. M. K., 2005. Research Methods: the concise knowledge base, Atomic Dog Publishing.
5. Wadehra, B. L. 2000. Law relating to patents, trademarks, copyright designs and geographical indications. Universal Law Publishing.
6. Research Methodology: An Introduction - Stuart Melville and Wayne, 2014. 2nd ed edition, Juta Academic.
7. Practical Research Methods - Catherine Dawson, 2002. How To Books.

**Ahmednagar Jilha Maratha Vidya Prasarak Samaj's**

# New Arts, Commerce and Science College, Ahmednagar
## (Autonomous)
## Syllabus
## M.Sc. Electronic Science

| **Title of the Course: Electromagnetic Fields and Antennas** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Year: I** | | | | **Semester: II** | | | | |
| Course Type | Course Code | Credit Distribution | | Credits | Allotted Hours | Allotted Marks | | |
| | | Theory | Practical | | | CIE | ESE | Total |
| DSC-07 | MS-ES121T | 03 | 00 | 03 | 45 | 30 | 70 | 100 |

**Learning Objectives:**

1. To introduce to students the concepts of electromagnetics
2. To understand the theory of transmission lines and wave guides
3. To study various parameters of antennas
4. To study various methods of generation of microwaves

**Course Outcomes (Cos):**

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

1. Understand the basics of Electromagnetic waves and transmission lines.
2. Comprehend the concept of the waveguide and its performance.
3. Use the Smith chart to study transmission line applications for circuit elements and impedance matching.
4. Understand the basics of the antenna and their types.

**Detailed Syllabus:**

**Unit I: Electromagnetic Waves and Transmission Lines (15)**

Electromagnetic wave: the equation of continuity for time-varying fields, Maxwell's equations, EM waves in a homogeneous medium, wave propagation in conducting and non-conducting media, skin depth, Poynting's theorem, interpretation of E x H, Poynting theorem and its applications.

Transmission lines: transmission line equation in time and frequency domain, losses and dispersion, reflection from an unknown load, single stub and double stub matching. Smith chart and its applications.

**Unit II: Waveguides and Components (15)**

Concept of waveguides, frequency range, relation to transmission lines. Rectangular Waveguides: TM and TE modes, the concept of cut-off frequency, waveguide impedance, phase velocity, guide wavelength for TE and TM modes, applications to TE mode in rectangular waveguide, power losses in rectangular waveguide, different methods of excitation of TE and TM modes in waveguides cavity resonators, Q factor of cavity resonators.

**Unit III: Antenna** **(15)**

Potentials of electromagnetic fields, retarded potential, radiation from oscillating dipole, concept of near zone and radiation zone, radiation resistance.

Antenna Parameters: gain, directivity, power, aperture, Friis equation, radiation pattern, half-power bandwidth, radiation intensity, apertures, effective heights. Classification of antenna, a short dipole antenna, antenna arrays, broad-side and end-fire arrays, linear arrays, half wave dipole ,folded dipole, Yagi-Uda array, horn antenna, parabolic reflector antenna, loop antenna, antennas for terrestrial mobile communications, base station antennas, and microstrip antenna.

**Suggested Readings/Material:**

1. Microwave Devices and Circuits - Samuel Y. Liao, PHI.
2. Principles of Electromagnetics - N. Sadiku, Oxford University Press.
3. Electromagnetics with Applications - Kraus and Fleiseh, McGraw Hill.
4. Electromagnetics - J.D. Kraus, McGraw Hill.
5. Antenna Theory: Analysis and Design - Constantine A. Balanis.

**Ahmednagar Jilha Maratha Vidya Prasarak Samaj's**

# New Arts, Commerce and Science College, Ahmednagar
## (Autonomous)
## Syllabus
## M.Sc. Electronic Science

| **Title of the Course: Internet of Things** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Year: I** | | | | **Semester: II** | | | | |
| Course Type | Course Code | Credit Distribution | | Credits | Allotted Hours | Allotted Marks | | |
| | | Theory | Practical | | | CIE | ESE | Total |
| DSC-08 | MS-ES122T | 03 | 00 | 03 | 45 | 30 | 70 | 100 |

**Learning Objectives:**

1. To learn fundamentals of Internet of Things technology.
2. To study cloud technology and cloud platforms used in IoT.
3. To understand the use of hardware platforms in different IoT applications.
4. To study design and building IoT applications.

**Course Outcomes (Cos):**

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

1. Understand the various concepts and terminologies of IoT systems.
2. Identify architecture, structure and security as well as privacy aspects of IoT.
3. Comprehend the concepts of cloud technology and cloud platforms used in IoT.
4. Identify hardware components used for development of IoT based applications.

**Detailed Syllabus:**

**Unit I: Introduction to IoT and Its Key Technologies (18)**

History, introduction, overview and motivations, definitions, architecture, ITU-T views, IoT frameworks, basic nodal capabilities. M2M vs. IoT. Identification of IoT Objects and Services. Structural aspects of the IoT: Environment characteristics, traffic characteristics, scalability, interoperability, security and privacy, open architecture. Key IoT technologies: Device intelligence, communication capabilities, mobility support, device power, sensor technology, RFID technology and satellite technology. Concept of Industry 4.0.

**Unit II: Cloud Technology and Cloud Platforms in IoT (10)**

Virtualization concepts, cloud architecture, cloud computing, benefits. Cloud services –

SaaS, PaaS, IaaS. Cloud providers and offerings, cloud analytics and applications, study of IoT cloud platforms. Introduction to ThingSpeak, ThingSpeak API and MQTT, web services, HTTP, REST. Introduction to Blynk App., Big data problems in IoT.

**Unit III: Hardware Platforms used in IoT and IoT applications (17)**

Arduino- Introduction, features, architecture, types, Arduino boards for IoT. NodeMCU- Introduction, features, architecture and types. GPS module, RFID module. Wi-Fi module ESP8266, Bluetooth, Z-wave, thread, GSM / GPRS and LoRa: Introduction, features, architecture and types.

IoT applications - Home Automation, Surveillance, Agriculture, Health. (Discuss applications with block diagram, hardware and software components required, cloud requirements and discuss structural aspects.)

**Suggested Readings/Material:**

1. Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications - Daniel Minoli, ISBN: 978-1-118-47347-4, Willy Publications.
2. The Internet of Things: Key Applications and Protocols – Olivier Hersent, David Boswarthick, Omar Elloumi, ISBN: 978-1-119-99435-0, 2nd Edition, Willy.
3. The Internet of Things Connecting Objects to the Web – Hakima Chaouchi, ISBN: 978-1- 84821-140-7, Willy Publications.
4. “Internet of Things (A Hands-on-Approach)” - Vijay Madisetti and Arshdeep Bahga.
5. “The Internet of Things: Enabling Technologies, Platforms, and Use Cases” - Pethuru Raj and Anupama C. Raman, CRC Press.

**Ahmednagar Jilha Maratha Vidya Prasarak Samaj's**

# New Arts, Commerce and Science College, Ahmednagar
## (Autonomous)
## Syllabus
## M.Sc. Electronic Science

| **Title of the Course: Optical Fiber Communication** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Year: I** | | | | **Semester: II** | | | | |
| Course Type | Course Code | Credit Distribution | | Credits | Allotted Hours | Allotted Marks | | |
| | | Theory | Practical | | | CIE | ESE | Total |
| DSC-09 | MS-ES123T | 02 | 00 | 02 | 30 | 15 | 35 | 50 |

**Learning Objectives:**

1. To study fundamental concepts of optical fiber communication.
2. To understand different types of losses in optical fiber.
3. To learn designing of optical fiber systems.

**Course Outcomes (Cos):**

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

1. Understand the types of optical fiber, optical sources and detectors.
2. Know about different types of losses in optical fiber.
3. Comprehend parameters of optical fiber and measurement techniques.
4. Design optical fiber systems.

**Detailed Syllabus:**

**Unit I: Introduction to Optical Fiber Communication (15)**

Principles of optical communication, optical spectral bands, basic optical laws, optical fiber structure and its advantages. Single-mode and multi-mode fibers, step-index, graded index, ray model, optical fiber as a waveguide. Optical sources and detectors – LED, LASER, photodiode. Phase and group velocity, transmission characteristics. Signal degradation in optical fiber: attenuation, dispersion, fiber bend losses. Wavelength division multiplexing, applications of optical fiber.

**Unit II: Optical Fiber Systems and Measurements (15)**

Optical fiber system: Optical fiber cable, fiber joints, splices, couplers, connectors, transmission links, optical transmitters and receivers. System design considerations: power budget, line coding, system rise time, maximum bit rate, cannel width. Electro-optic effect,

acousto-optic effect, nonlinear effect and their applications. Measurement in optical fibers: attenuation measurement, dispersion measurement and refractive index profile measurement.

**Suggested Readings/Material:**

1. An introduction to fiber optics - Ajoy Ghatak, K. Thygarajan, Cambridge University Press.
2. Fiber optics and Optoelectronics - R.P. Khare, Oxford University Press.
3. Fiber optical communication Technology - Djafar Mymbaev and Lowell L, Scheiner.
4. Fiber optic Communication Systems - G. Agrawal (John Wiley and sons).
5. Optoelectronics – Kaiser.
6. Optical fiber communication: Principles and practice - J.M. Senior.

**Ahmednagar Jilha Maratha Vidya Prasarak Samaj's**

# New Arts, Commerce and Science College, Ahmednagar
## (Autonomous)
## Syllabus
## M.Sc. Electronic Science

| **Title of the Course: Practical Course - V** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Year: I** | | | | **Semester: II** | | | | |
| Course Type | Course Code | Credit Distribution | | Credits | Allotted Hours | Allotted Marks | | |
| | | Theory | Practical | | | CIE | ESE | Total |
| DSC-10 | MS-ES124P | 00 | 02 | 02 | 60 | 15 | 35 | 50 |

**Learning Objectives:**

1. To understand the concept of wave guide and transmission line.
2. To build experimental setup and test the result.
3. To develop skills of analyzing test results of given experiments.
4. Developing Trained Programmer usng MATLAB.

**Course Outcomes (Cos):**

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

1. Use different types of antenna and measure different antenna parameters.
2. Plot directivity pattern of different types of Antenna.
3. Use of the Smith chart for drawing transmission line patterns.
4. Use MATLAB software for studying different concepts of electromagnetics.

**Detailed Syllabus:**

The practical course consists of 10 experiments each of 4 hours duration and 1 activity equivalent to 2 experiments.

**Practical based on Antennas (Any 5):**

1. To plot the directivity pattern of simple dipole λ/2 antenna.
2. To plot the directivity pattern of simple dipole λ/4 antenna.
3. Study of λ/4 phase array antenna.
4. Study of Yagi-UDA 5 Element Simple dipole antenna.
5. Study of Hertz antenna.
6. Study of λ/2 Phase Array (End fire) antenna.
7. Study of horn antenna.
8. Study of Loop antenna.

9. Study of Rhombus antenna.
10. Study of Helix antenna.
11. Study of Log Periodic antenna.

**Practical based on Electromagnetics (Any 5):**

1. Use of MATLAB for potential distribution in a region bound by two conductors.
2. Use of MATLAB for directivity pattern for simple antennas.
3. Use of MATLAB to plot equipotential contours and field lines for the given charge distribution.
4. Use of Smith chart for transmission line pattern and verify using C/MATLAB.
5. To calculate phase & group velocity using MATLAB software.
6. To study impedance match using MATLAB software.
7. Measurement of primary-secondary coupling factor of a given transformer using LCR meter (calculation of transformer model parameters expected).
8. To determine a characteristics of a microstrip transmission line.
9. To determine the standing wave ratio and reflection coefficient of a given waveguide.
10. Study of matching stub.
11. SWR measurement.
12. Study of skin depth.

**Activity (Any 1):**

1. Perform simulation of any 2 practicals mentioned in the above list using simulation software and write a report (equivalent to 2 experiments).
2. Perform any one of the following activity and write report (equivalent to 2 experiment)
   - Industrial / institutional / Research Center visit./study tour
   - Market Survey / Review of any advanced technology (related to the course).
   - Participation in workshop / conference / seminar.

**Ahmednagar Jilha Maratha Vidya Prasarak Samaj's**

# New Arts, Commerce and Science College, Ahmednagar
## (Autonomous)
## Syllabus
## M.Sc. Electronic Science

| **Title of the Course: Practical Course – VI** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Year: I** | | | | **Semester: II** | | | | |
| Course Type | Course Code | Credit Distribution | | Credits | Allotted Hours | Allotted Marks | | |
| | | Theory | Practical | | | CIE | ESE | Total |
| DSC-11 | MS-ES125P | 00 | 02 | 02 | 60 | 15 | 35 | 50 |

**Learning Objectives:**

1. To learn use of software tools for different hardware platforms.
2. To study the use of different hardware platforms.
3. To use ThingSpeak IoT platform as a cloud.
4. To design and develop IoT applications.

**Course Outcomes (Cos):**

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

1. Practice different software development tools for IoT application development.
2. Use Arduino / NodeMCU / Any other IoT hardware platform to perform different experiments.
3. Interface different I/O devices and wireless communication modules to Arduino / NodeMCU / Any other IoT hardware platform.
4. Use ThingSpeak IoT cloud platform.

**Detailed Syllabus:**

Practical course consists of 10 experiments each of 4 hours duration and 1 activity equivalent to 2 experiments.

**Practical's based on IoT using Arduino / NodeMCU / Any other IoT hardware platform (Any 10):**

1. To get familiarize with Arduino and perform necessary installation procedure. To study different tasks performed using Blynk app. and to get familiarize with the procedure to use it with NodeMCU.
2. Message transimission using LoRa technology between two devices.
3. Device on/off using Blynk app.

4. To design and develop monitoring and controlling system using any one analog sensor.
5. To design and develop wireless sensor data monitoring system.
6. To study different tasks performed using ThingSpeak platform and to get familiarize with the procedure to use it.
7. To design and develop cloud based sensor data monitoring system.
8. To control devices using Bluetooth Technology.
9. To design and develop smart light system.
10. To design and develop wireless data monotoring system using LoRa.
11. Object identification using RFID technology.
12. To interface GSM module for sending / receiving SMS.
13. To use Blynk app. to vary intensity of the LED.
14. To interface GPS to get location information.
15. To design and develop smart security system.

**Activity (Any 1):**

1. Design and develop any small IoT application and write a report (equivalent to 2 experiments).
2. Perform any one of the following activity and write report (equivalent to 2 experiments).
   - Industrial / institutional / Research Center visit.
   - Market Survey / Review of any advanced technology (related to the course).
   - Participation in workshop / conference / seminar.

**Ahmednagar Jilha Maratha Vidya Prasarak Samaj's**

# New Arts, Commerce and Science College, Ahmednagar
## (Autonomous)
## Syllabus
## M.Sc. Electronic Science

| **Title of the Course: Practical Course – VII** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Year: I** | | | | **Semester: II** | | | | |
| Course Type | Course Code | Credit Distribution | | Credits | Allotted Hours | Allotted Marks | | |
| | | Theory | Practical | | | CIE | ESE | Total |
| DSC-12 | MS-ES126P | 00 | 02 | 02 | 60 | 15 | 35 | 50 |

**Learning Objectives:**

1. To practically study different optical fiber parameters.
2. To learn measurement of different losses in optical fiber.
3. To study designing of optical fiber system.

**Course Outcomes (Cos)**

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

1. Test different optical fiber parameters.
2. Plot LED and LASER profile.
3. Measure different types of losses in optical fiber.
4. Design optical fiber communication system.

**Detailed Syllabus:**

Practical course consists of 10 experiments each of 4 hours duration and 1 activity equivalent to 2 experiments.

**Practical Based on Optical Fiber Communication (Any 10)**

1. Measurement of attenuation of optical fiber.
2. Measurement of effect of bending losses in optical fiber communication.
3. Analog link using optical fiber communication.
4. Digital link using optical fiber communication.
5. Measure and plot LASER beam profile.
6. Plotting and study of LED profile.
7. Measurement of mode field diameter.
8. Study of optical instruments: optical power meter, OTDR, OSA etc. (Survey).

9. Characteristics of light detectors.
10. Measurement of numerical aperture.
11. Design of fiber optic transmitter.
12. Design of fiber optic receiver.
13. Wavelength division multiplexing (WDM).
14. Simulation of power budget calculation.
15. Setting up fiber optic voice link.
16. Measurement of mode field diameter.

**Activity:**

Perform any one of the following activity and write report (equivalent to 2 experiments).

- Industrial / institutional / Research Center visit.
- Market Survey / Review of any advanced technology (related to the course).
- Participation in workshop / conference / seminar.

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# New Arts, Commerce and Science College, Ahmednagar
## (Autonomous)
## Syllabus
## M.Sc. Electronic Science

| **Title of the Course: Digital Image Processing** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Year: I** | | | | **Semester: II** | | | | |
| Course Type | Course Code | Credit Distribution | | Credits | Allotted Hours | Allotted Marks | | |
| | | Theory | Practical | | | CIE | ESE | Total |
| DSE-03 | MS-ES127T(A) | 02 | 00 | 02 | 30 | 15 | 35 | 50 |

**Learning Objectives:**

1. To make the students aware of basic mathematics required for digital image processing.
2. To make students familiar with different image processing algorithms.
3. To provide the students with the knowledge of practically implementing the algorithms for various applications.

**Course Outcomes (Cos):**

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

1. Understand the basics of digital image processing.
2. Comprehend the theoretical approach towards digital image processing.
3. Acquaintance with different image processing techniques and algorithms used in digital image processing.
4. Impart the knowledge of students through various real-life applications using MATLAB.

**Detailed Syllabus:**

**Unit I: Fundamentals of Digital Image Processing (12)**

Introduction, application fields of DIP, image sensing and acquisition, overview of image representation and modelling techniques. The light and the electromagnetic spectrum. Elements of visual perception: luminance, brightness, contrast, hue, saturation and Mach band effect. Color image fundamentals: RGB and HIS models. Basic concepts of sampling and quantization, two-dimensional sampling theory, practical limitations in sampling (aliasing effect). Digital image representation, spatial and intensity resolution, image interpolation. The relationship between image pixels: neighbors, logical and arithmetic operation on images.

**Unit II: Digital Image Processing Techniques and its Implementation (18)**

Image Enhancement: transformation functions, histogram processing, image observation and noise models, fundamentals of spatial filtering, spatial operations like smoothing and sharpening spatial filters, false and pseudo color, example for image enhancement and spatial filtering.

Spatial and Transform features extraction: image pyramids, the Haar transform, Hough transform, examples of features extraction.

Image Segmentation: fundamentals, point, line and edge detection, segmentation using morphological watersheds, edge detection, thresholding, region representation and description, examples of image segmentation.

Classification techniques: basic rules, need, unsupervised and supervised classification, examples of classification.

Basic image processing tools in MATLAB, syntax and codes for image processing using MATLAB.

Case study:

i. Digital image enhancement using equalization methods, salt and pepper noise removal using spatial as well as frequency domain filters.
ii. Digital image segmentation for edge detection for any real-life application.
iii. Digital image classification using supervised and unsupervised classification for any real-life application.

**Suggested Readings/Material:**

1. Digital Image Processing - Rafel C. Gonzalez, Richard E. Woods, Pearson Third Edition, 2008.
2. Digital Image Processing using MATLAB - Rafel.C.Gonzalez, Richard .E.Woods and Steven L. Eddins, Second Edition, Pearson 2017.
3. Fundamentals of Digital Image Processing - Anil.K.Jain, Pearson, 2002.
4. Digital Image Processing - Keenneth R Castleman, Pearson Education, 1995.
5. Digital Image Processing - S Jayaraman, S Esakkirajan, T Veerakumar, Second Edition, McGraw Hill, 2020.

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# New Arts, Commerce and Science College, Ahmednagar
## (Autonomous)
## Syllabus
## M.Sc. Electronic Science

| **Title of the Course: Artificial Intelligence** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Year: I** | | | | **Semester: II** | | | | |
| Course Type | Course Code | Credit Distribution | | Credits | Allotted Hours | Allotted Marks | | |
| | | Theory | Practical | | | CIE | ESE | Total |
| DSE-03 | MS-ES127T(B) | 02 | 00 | 02 | 30 | 15 | 35 | 50 |

**Learning Objectives:**

1. To make the students aware of basic mathematics required for artificial intelligence.
2. To make students familiar with different artificial intelligence algorithms
3. To provide the students with the knowledge of practically implementing the various artificial intelligence algorithms.

**Course Outcomes (Cos):**

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

1. Identify and formulate appropriate AI methods for solving a problem.
2. Define and implement the concept of Artificial Intelligence and algorithms.
3. Compare different AI algorithms in terms of design issues, computational complexity and assumption.
4. Design, implement and apply novel AI techniques for emerging real-world requirements.

**Detailed Syllabus:**

**Unit I: Fundamentals of Artificial Intelligent Systems (12)**

Introduction, history. Overview of AI problems: AI problems as NP, NP-Complete and NP Hard problems. Strong and weak, neat and scruffy, symbolic and sub-symbolic, knowledge-based and data-driven AI. Search strategies: problem spaces (states, goals and operators), problem-solving by search, Heuristics and informed search, Minmax Search, Alpha-beta pruning. Constraint satisfaction (backtracking and local search methods). Knowledge representation and reasoning: propositional and predicate logic, resolution and theorem proving, temporal and spatial reasoning.

**Unit II: Reasoning, Planning and Learning to Artificial Intelligent (18)**

Probabilistic reasoning, Bayes theorem. Planning: totally-ordered and partially-ordered planning, goal stack planning, nonlinear planning and Hierarchical planning. Learning: learning from example, learning by advice, explanation-based learning, learning in problem-solving, classification, inductive learning, Naive Bayesian classifier and decision trees. Natural language processing: language models, n-grams, vector space models, bag of words, text classification. Information retrieval. Agents: definition, architectures (reactive, layered, cognitive), Multi-agent systems, collaborating agents, competitive agents, swarm systems and biologically inspired models. Intelligent systems: representing using domain knowledge, expert system shells, explanation and knowledge acquisition. Key application areas: expert system, decision support systems, speech and vision, information retrieval and semantic web.

**Suggested Readings/Material:**

1. Introduction to Artificial Intelligence and Expert Systems - Dan W. Patterson, Pearson Education.
2. Artificial Intelligence: A Modern Approach - Stuart Russell, Peter Norvig, Prentice Hall, Fourth edition.
3. Artificial Intelligence: A Modern Approach - Stuart Russell and Peter Norvig, Third edition, Pearson.
4. Artificial Intelligence: A New Synthesis - Nils J. Nilsson, Morgan-Kaufmann.
5. Artificial Intelligence - Elaine Rich, Kevin Knight and Nair, TMH.

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# New Arts, Commerce and Science College, Ahmednagar
## (Autonomous)
## Syllabus
## M.Sc. Electronic Science

| **Title of the Course: Practical Course – VIII** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Year: I** | | | | **Semester: II** | | | | |
| Course Type | Course Code | Credit Distribution | | Credits | Allotted Hours | Allotted Marks | | |
| | | Theory | Practical | | | CIE | ESE | Total |
| DSE-04 | MS-ES128P(A) | 00 | 02 | 02 | 60 | 15 | 35 | 50 |

**Learning Objectives:**

1. To make the students practice basic mathematics syntax required for digital image processing.
2. To make students familiar with different image processing techniques using MATLAB.
3. To provide the students with the knowledge of practically implementing the algorithms for various applications.

**Course Outcomes (Cos):**

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

1. Understand the basic mathematical operation used in digital image processing.
2. Implementation of syntax and tools essential for image processing in MATLAB software.
3. Familiarization with different image processing algorithms using MATLAB software.
4. Impart the knowledge of students practically by implementing the algorithms for various real-life applications using MATLAB.

**Detailed Syllabus:**

The practical course consists of 10 experiments each of 4 hour duration and 1 activity equivalent to 2 experiments.

**Practical based on Digital Image Processing (Any 10)**

1. Implementation of image enhancement techniques in MATLAB.
2. Implementation of color image enhancement techniques in MATLAB.
3. To provides the thresholding in MATLAB.
4. Evaluation of digital image using histogram equalization in MATLAB.

5. Study & implementation of different point operation techniques in MATLAB. (To differentiates amongst any three-point operation techniques on selected image).
6. Study & implementation of spatial operation filtering techniques in MATLAB.
7. Study of edge detection technique using different operator in MATLAB.
8. Study of region representation technique using different operator in MATLAB.
9. Study and implementation of a segmentation techniques in MATLAB.
10. Study and implementation of morphological watersheds algorithm in MATLAB.
11. Implementation of boundary representation in MATLAB.
12. Implementation of boundary detection in MATLAB.
13. Study image restoration application using filtering techniques in MATLAB.
14. Implementation of unsupervised classification techniques in MATLAB.
15. Implementation of supervised classification techniques in MATLAB.

**Activity (Any 1):**

1. Implement a case study on any one real life application using various image processing techniques studies in the theory (equivalent to 2 experiments).
   - Make a report of not more than 10 page with the details viz. introduction, flowchart, program, result and discussion, conclusion, references.
2. Perform any one of the following activity and write report (equivalent to 2 experiments).
   - Industrial / institutional / research centre visit.
   - Market survey / review of any advanced technology (related to the course).
   - Participation in workshop / conference / seminar.

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# New Arts, Commerce and Science College, Ahmednagar
## (Autonomous)
## Syllabus
## M.Sc. Electronic Science

| **Title of the Course: Practical Course – VIII** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Year: I** | | | | **Semester: II** | | | | |
| Course Type | Course Code | Credit Distribution | | Credits | Allotted Hours | Allotted Marks | | |
| | | Theory | Practical | | | CIE | ESE | Total |
| DSE-04 | MS-ES128P(B) | 00 | 02 | 02 | 60 | 15 | 35 | 50 |

**Learning Objectives:**

1. To make the students aware of basic mathematics syntax used for artificial intelligence.
2. To make students familiar with different artificial intelligence algorithms using MATLAB/Python.
3. To provide the students with the knowledge of practically implementing the various artificial intelligence algorithms.

**Course Outcomes (Cos):**

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

1. Understand the designing and analysing Artificial Intelligent (AI) based algorithms.
2. Implementation of various tools essential to Artificial Intelligent.
3. Familiarization with different techniques used in Artificial Intelligent.
4. Enhance the knowledge and skill towards the solution of real-life problems by using software tools MATLAB / Python etc.

**Detailed Syllabus:**

The practical course consists of **10** experiments each of **4** hour duration and **1** activity equivalent to **2** experiments.

**Practical based on AI using MATLAB / Python (Any 10)**

1. Study of data pre-processing operation on dataset.
2. To study data annotation and creation of datasets.
3. Learn existing datasets.
4. Learn existing Treebanks.
5. Implementation of Search Strategies in AI.

6. Implementation of Natural Language Processing in AI.
7. Execution of Knowledge representation schemes.
8. Use of Temporal and spatial reasoning in AI.
9. Application of Machine learning algorithms.
10. Study of different learning techniques in AI.
11. Natural language processing tool development.
12. Application of Classification and clustering problem.
13. Study of Agent architectures in AI.
14. Study of working on parallel algorithms.
15. Understand AI through key application areas.

**Activity (Any 1):**

1. Implement a case study on any one real life application using various image processing techniques studies in the theory (equivalent to 2 experiments).
   - Make a report of not more than 10 page with the details viz. introduction, flowchart, program, result and discussion, conclusion, references.
2. Perform any one of the following activity and write report (equivalent to 2 experiments).
   - Industrial / institutional / research centre visit.
   - Market survey / review of any advanced technology (related to the course).
   - Participation in workshop / conference / seminar.

**Ahmednagar Jilha Maratha Vidya Prasarak Samaj's**

# New Arts, Commerce and Science College, Ahmednagar
## (Autonomous)
## Syllabus
## M.Sc. Electronic Science

| **Title of the Course:** **On Job Training** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Year: I** | | | | **Semester: II** | | | | |
| Course Type | Course Code | Credit Distribution | | Credits | Allotted Hours | Allotted Marks | | |
| | | Theory | Practical | | | CIE | ESE | Total |
| OJT-01 | MS-ES129P | 00 | 04 | 04 | 120 | 30 | 70 | 100 |

## Guidelines:

The guidelines for On job training course will be given by the college. The student has to follow the guidelines given by the college while completing On job training course.