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)

Master of Science (M. Sc.)

Syllabus of

M. Sc. Electronic Science (Part-I)

Implemented from

Academic year 2021 -22

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

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 credits for grades. 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 grade-based credits. The various courses of the programme are designed to include classroom teaching laboratory work, project work, viva, seminars and assignments.

In the first semester, twenty-two credits are compulsory with six Discipline Specific Core Courses (DSCC) out of which there are three theory and three practical courses. Students can opt the one theory and one practical course from Discipline Specific Elective Courses (DSCE) out of two theory and two practical courses. In addition, students have to opt for a general elective course in each semester. Students are allowed to opt the generic electives (GE) from another department other than where he/she is registered for M.Sc. Students are allowed to take all the courses/credits from the parent department. For the other semesters, the course structure is the same as the first semester. In the third semester, there is one project course of 2 credits instead of one Discipline Specific Core Course (DSCC) practical. In the fourth semester, the project course is of 4 credits instead of two Discipline Specific Core Courses (DSCC) practicals. Thirty percent of the total marks for each course will be awarded through 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.

3. Programme Structure and Course Titles:

Sr. No.	Class	Semester	Course Code	Course Title	Credits
1.	M. Sc.-I	I	MSC-ES 111 T	Advanced Communication Technologies	04
2.	M. Sc.-I	I	MSC-ES 112 T	Advanced Analog Circuit Design	04
3.	M. Sc.-I	I	MSC-ES 113 T	Advanced Digital System Design	02
4.	M. Sc.-I	I	MSC-ES 114 P	Practical Course – I	02
5.	M. Sc.-I	I	MSC-ES 115 P	Practical Course – II	02
6.	M. Sc.-I	I	MSC-ES 116 P	Practical Course – III	02
7.	M. Sc.-I	I	MSC-ES 117 T (A)	Fundamentals and Applications of PIC microcontrollers	02
			MSC-ES 117 T (B)	Fundamentals and Applications of AVR microcontrollers	
8.	M. Sc.-I	I	MSC-ES 118 P (A)	Practical Course – IV (PIC)	02
			MSC-ES 118 P (B)	Practical Course – IV (AVR)	
9.	M. Sc.-I	I	MSC-ES 119 T	Computer Organization	02
10.	M. Sc.-I	II	MSC-ES 211T	Electromagnetic Fields and Antennas	04
11.	M. Sc.-I	II	MSC-ES 212 T	Advanced Embedded System Design	04
12.	M. Sc.-I	II	MSC-ES 213 T	Optical Fiber Communication (OFC)	02
13.	M. Sc.-I	II	MSC-ES 214 P	Practical Course – V	02
14.	M. Sc.-I	II	MSC-ES 215 P	Practical Course – VI	02
15.	M. Sc.-I	II	MSC-ES 216 P	Practical Course – VII	02
16.	M. Sc.-I	II	MSC-ES 217 T (A)	Digital Image Processing (DIP)	02
			MSC-ES 217 T (B)	Artificial Intelligence (AI)	
17.	M. Sc.-I	II	MSC-ES 218 P (A)	Practical Course – VIII (DIP)	02
			MSC-ES 218 P (B)	Practical Course – VIII (AI)	
18.	M. Sc.-I	II	MSC-ES 219 T	Electronic Instrumentation	02
19.	M. Sc.-II	III	MSC-ES 311 T	Digital Signal Processing (DSP)	04
20.	M. Sc.-II	III	MSC-ES 312 T	Internet of Things (IoT)	04
21.	M. Sc.-II	III	MSC-ES 313 T	Advanced Power Electronics	02
22.	M. Sc.-II	III	MSC-ES 314 P	Practical Course – IX	02

23.	M. Sc.-II	III	MSC-ES 315 P	Practical Course – X	02
24.	M. Sc.-II	III	MSC-ES 316 Pr	Project Course – I	02
25.	M. Sc.-II	III	MSC-ES 317 T (A)	Virtual Instrumentation (VI)	02
			MSC-ES 317 T (B)	VLSI System Design	
26.	M. Sc.-II	III	MSC-ES 318 P (A)	Practical Course – XI (VI)	02
			MSC-ES 318 P (B)	Practical Course – XI (VLSI)	
27.	M. Sc.-II	III	MSC-ES 319 T	Technical Communication	02
28.	M. Sc.-II	IV	MSC-ES 411 T	Control Systems	04
29.	M. Sc.-II	IV	MSC-ES 412 T	Robotics and Mechatronics	04
30.	M. Sc.-II	IV	MSC-ES 413 T	Semiconductor Devices and Technology	02
31.	M. Sc.-II	IV	MSC-ES 414 P	Practical Course – XII	02
32.	M. Sc.-II	IV	MSC-ES 415 Pr	Project Course – II	04
33.	M. Sc.-II	IV	MSC-ES 416 T (A)	Wireless Sensor Network (WSN)	02
			MSC-ES 416 T (B)	Computational Methods for Electronics (CME)	
34.	M. Sc.-II	IV	MSC-ES 417 P (A)	Practical Course – XIII (WSN)	02
			MSC-ES 417 P (B)	Practical Course – XIII (CME)	
35.	M. Sc.-II	IV	MSC-ES 418 T	Technical Writing	02

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Semester – I	**Paper – I**
Course Code: MSC-ES 111 T	**Title of the Course:** Advanced Communication Technologies
Credits: 4	**Total Lectures:** 60 Hours

Course Outcomes (COs):

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

1. Comprehend the fundamentals of digital communication techniques.
2. Understand the basic concepts of mobile communication.
3. Know the information coding and spread spectrum techniques.
4. Familiarize the basics of data communication.

Detailed Syllabus:

Unit I: Digital Communication Techniques (15)

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, channel coding, block codes, syndrome decoding and convolutional coding.

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

Unit III: Mobile Communication (20)

Evolution of mobile radio communication, examples of the mobile radio system, 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. Frequency and time diversity techniques, channel coding, service and features, GSM system architecture, GSM channel types, GSM frame structure, intelligent cell concept and applications. Features of the handset, SMS, security, application of mobile handset as modem, data storage device, multimedia device, measurement of signal strength. Introduction to CDMA digital cellular standard.

Unit IV: Data Communication **(12)**

Introduction to data communication, layered network architecture (OSI and TCP/IP), data communication codes, error detection and error control, modems. 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:

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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Semester – I	**Paper – II**
Course Code: MSC-ES 112 T	**Title of the Course:** Advanced Analog Circuit Design
Credits: 4	**Total Lectures:** 60 Hours

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 (15)

Practical diode characteristics (static and dynamic resistance), temperature effects, switching characteristics, diode breakdown, 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 as an amplifiers. MOSFET, depletion and enhancement mode, biasing of MOSFET and applications.

Unit II: Frequency Response of Amplifiers (15)

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, low and high-frequency equivalent circuit, Miller effect.

Different coupling schemes, the frequency response of multistage amplifiers and gain of multistage amplifiers.

Unit III: Tuned Amplifiers and Oscillators (15)

Tuned amplifier design, multistage tuned amplifiers: synchronous and stagger tuning cascade configuration, large-signal tuned amplifier. Oscillators: design and analysis of LC and RC oscillators, Hartley oscillator, Colpitt's oscillator, Miller oscillator, phase shift oscillator, Wien-bridge oscillator, crystal oscillator, bubba oscillator and their applications.

Unit IV: Operational Amplifiers and their Applications (15)

Practical consideration in op-amp based circuit design, op-amp parameters: DC and low-frequency parameters, their significance in the design of op-amp, closed-loop stability analysis and frequency compensation.

Applications: Inverting and non-inverting amplifiers with design aspects, bridge and instrumentation amplifier, integrator, differentiator, V to F, F to V and Phase Locked Loop (PLL). Active filters: LPF, HPF, BPF and BRF, Butterworth filters (design of first and higher orders).

Suggested Readings:

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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Semester – I	**Paper – III**
Course Code: MSC-ES 113 T	**Title of the Course:** Advanced Digital System Design
Credits: 2	**Total Lectures:** 30 Hours

Course Outcomes (COs):

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

1. Design different combinational and sequential circuits.
2. Use advanced techniques for digital system design.
3. Understand the use of different programmable logic devices for digital system design.
4. Use verilog programming for designing complex digital systems.

Detailed Syllabus:

Unit I: Digital System Design Process and Programmable Logic Devices (15)

Revision of combinational circuits and sequential circuits, logic families, top-down approach to design, finite state machine (FSM), Mealy and Moore machines, FSM issues: starting state, Power-on Reset, state diagram optimization, state assignment, asynchronous inputs and outputs, fault tolerance. Design with synchronous FSM using any flip flops, static timing of sequential circuits, metastability and clock issues.

Introduction to programmable logic devices and evolution: PROM, PLA, PAL. Architectures: ROM, PLA, PAL, CPLD (Xilinx / Altera), FPGA (Xilinx / Altera), programming PLD's. Design flow, logic blocks, routing architecture, programmable interconnections and applications.

Unit II: Verilog Programming **(15)**

HDL fundamentals, design flow, EDA tools, simulation and test-bench design. Examples of verilog codes for combinational and sequential logic. Verilog modelling with programming examples – gate level, data flow and behavioral. Case studies: stepper motor controller, traffic light control, washing machine control, parking controller and LCD controller.

Suggested Readings:

1. Digital Design Principles Practices - Wakerly, PHI.
2. Modern Digital Electronics - R.P Jain McGraw Hill.
3. Digital Systems Principles and Applications - Tocci, Pearson Education.
4. Digital Logic and Computer Design - Morris Mano, PHI.
5. Verilog HDL Synthesis a Practical Primer - J. Bhasker, Star Galaxy Publishing.
6. Verilog HDL; A Guide to Digital Design and Synthesis - Samir Palnitkar, Pearson Education.
7. Verilog HDL synthesis; A Practical Primer - J. Bhaskar, Star Galaxy Publishing.
8. Digital System Design with VERILOG Design - Stephen Brown, ZvonkoVranesic, TMH.

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Semester – I	**Paper – IV**
Course Code: MSC-ES 114 P	**Title of the Course:** Practical Course – I
Credits: 2	**Total Lectures:** 60 Hours (12 practicals)

Course Outcomes (COs):

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

1. Design different communication systems.
2. Use advanced communication technologies.
3. Design modulator and demodulator for different digital communication techniques.
4. Understand the concept of mobile communication.
5. 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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Semester – I	**Paper – V**
Course Code: MSC-ES 115 P	**Title of the Course:** Practical Course – II
Credits: 2	**Total Lectures:** 60 Hours (12 practicals)

Course Outcomes (COs):

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

1. Understand the basics of analog electronic circuits 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 responses 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. Tuned amplifier small signal / large signal for IF.
9. Design JFET based preamplifier.

10. Multistage amplifier.

Practical based on Circuit Simulation using LTSPICE (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 the course).
   - Participation in workshop / conference / seminar.

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Semester – I	**Paper – VI**
Course Code: MSC-ES 116 P	**Title of the Course:** Practical Course – III
Credits: 2	**Total Lectures:** 60 Hours (12 practicals)

Course Outcomes (COs):

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

1. Design, build and test different combinational as well as sequential digital circuits.
2. Perform Verilog programming using Xilinx software.
3. Use different modellings for designing digital systems using Verilog.
4. Understand the use of programmable logic devices.

Detailed Syllabus:

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

Practical based on Digital System Design (Any 3)

1. Two digits combinational lock.
2. Object counter.
3. Bidirectional stepper motor control (Sequence Generator).
4. 8-bit adder / subtractor.
5. Random sequence generator.
6. Traffic light controller.

Practical based on VERILOG Programming (Any 7)

1. Parity generator and checker.
2. Hamming code generator.

3. Up-down 4 - bit binary counter.
4. Universal shift register.
5. Four bit ALU design.
6. Keyboard scanning.
7. Traffic light controller.
8. 8-bit multiplexer.
9. LCD controller.
10. BCD to seven Segment decoder.
11. Code converter (Binary to Gray and vice a versa).
12. Magnitude Comparator.

Activity (Any 1):

1. Perform simulation of any 2 practicals mentioned in the above list using Proteus or CircuitMod or Virtual lab or any other equivalent simulation software 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.

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Semester – I	**Paper – VII**
Course Code: MSC-ES 117 T (A)	**Title of the Course:** Fundamentals and Applications of PIC Microcontroller
Credits: 2	**Total Lectures:** 30 Hours

Course Outcomes (COs):

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

1. Understand the basics of the PIC microcontroller.
2. Write PIC C programs for programming PIC microcontroller.
3. Design the embedded systems using PIC microcontroller.
4. Write PIC C programs for timer programming, serial port programming and interrupt programming of PIC microcontroller.

Detailed Syllabus:

Unit I: Fundamentals of PIC and its Programming using C (12)

Harvard and Von-Neumann architecture, introduction to PIC microcontroller, PIC families, features of PIC18F4520, architecture, memory organization, CPU registers, I/O ports, peripherals in PIC. Software development tools used for PIC programming, PIC target board design. Programming PIC using C: basic programming structure, data types, operators, library files, delay functions, bitwise operation syntax and configuration bits in PIC. Simple C programs: Data transfer operation, arithmetic operation, decision making and code conversion.

Unit II: Programming PIC Peripherals and I/O Device Interfacing (18)

Timer programming: introduction, timer operation, SFR used, C programs for delay generation, counter, compare and capture mode. Serial Communication programming: introduction, USART operation, SFR used, C programs for data transmission and reception. Interrupt Programming: introduction, interrupt handling, interrupt structure, interrupt vector table, interrupt service routine and SFR used. I/O device interfacing and programming using C: LEDs, push-button, seven-segment display, LCD, dc and stepper motor.

Suggested Readings:

1. PIC Microcontroller and Embedded Systems - Mazidi, Mckinlay and Causey, Pearson Education.
2. Embedded System Design: A Unified Hardware/Software. Approach - Frank Vahid and Tony Givargis.
3. C Programming for Embedded Systems - Kirk Zurell, Pearson Education.
4. Programming and Customizing the PIC Microcontroller – Myke Predko.
5. Designing Embedded Systems with PIC Microcontrollers – Tim Wilmshurst.

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Semester – I	Paper – VII
Course Code: MSC-ES 117 T (B)	**Title of the Course:** Fundamentals and Applications of AVR Microcontroller
Credits: 2	**Total Lectures:** 30 Hours

Course Outcomes (COs):

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

1. Understand the basics of the AVR microcontroller.
2. Write AVR C programs for programming the AVR microcontroller.
3. Write AVR C programs for timer and serial port programming.
4. Design the embedded system using an AVR microcontroller.

Detailed Syllabus:

Unit I: Fundamentals of AVR Microcontroller and its Programming using C (12)

Overview of AVR, classification of AVR family, AVR (ATmega16) architecture, Memory organization, CPU registers, I/O ports, peripherals in AVR. Software development tools used for AVR programming, AVR target board design. Programming of AVR in C: basic structure, data types, operators, library files, delay functions and bitwise operation syntax. Simple C programs: Data transfer operation, arithmetic operation, decision making and code conversion.

Unit II: Programming of AVR Peripherals (18)

Timer programming: introduction, timer operation, SFR used, C programs for delay generation, counter, compare and capture mode. Serial Communication programming: introduction, USART operation, SFR used, C programs for data transmission and reception. Interrupt Programming: introduction, interrupt handling, interrupt structure, interrupt vector table, interrupt service routine and SFR used. On-chip ADC programming: introduction, timer operation, SFR used and analog to digital conversion program using C. I/O device interfacing: dot matrix display, servo motor and analog sensor interfacing.

Suggested Readings:

1. AVR Microcontroller and Embedded Systems using Assembly and C - Mazidi and Naimi, Pearson education.
2. Programming and Customizing the AVR Microcontroller - Dhananjay Gadre.
3. Embedded Systems: Architecture, Programming and Design - Raj Kamal.
4. Programming and Interfacing ATMEL's AVRs - Thomas Grace.
5. C Programming for Embedded Systems - Kirk Zurell, Pearson Education.

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Semester – I	**Paper – VIII**
Course Code: MSC-ES 118 P (A)	**Title of the Course:** Practical Course – IV (PIC)
Credits: 2	**Total Lectures:** 60 Hours (12 practicals)

Course Outcomes (COs):

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

1. Use different software development tools for PIC.
2. Use PIC target board to perform different experiments.
3. Interface different I/O devices to PIC.
4. Do error handling and debugging of PIC programs.

Detailed Syllabus:

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

Practical's based on PIC Interfacing (Any 10):

1. To get familiarize with PIC target board, understand the use of software development tools and perform necessary installation procedure.
2. LED array interfacing (display 5 different patterns on LED).
3. Seven segments display interfacing (Single-digit).
4. Seven segments display interfacing (Two digits).
5. 16*2 LCD display interfacing (display message on both lines).
6. Use of LCD to display two digit second counter.
7. Stepper motor interfacing (for clockwise and anticlockwise rotation).
8. Stepper motor interfacing to rotate motor for a specified angle.

9. DC motor interfacing (Clockwise and anticlockwise rotation).
10. Speed variation of DC motor using PWM facility of the PIC.
11. Zigbee interfacing (for point to point communication).
12. LDR sensor interfacing and display data on LCD (for dark or illuminated condition).
13. DAC interfacing (generate at least 3 different waveforms).
14. Event counter display on SSD or LCD (use opto-interruptor or IR pair).
15. Dot-matrix display interfacing (for a single character).
16. Delay generation using PIC timer.

Activity (Any 1):

1. Perform simulation of any 2 practicals mentioned in the above list using Proteus or any other equivalent simulation software 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.

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Semester – I	**Paper – VIII**
Course Code: MSC-ES 118 P (B)	**Title of the Course:** Practical Course – IV (AVR)
Credits: 2	**Total Lectures:** 60 Hours (12 practicals)

Course Outcomes (COs):

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

1. Use different software development tools for AVR.
2. Use AVR target board to perform different experiments.
3. Interface different I/O devices to AVR.
4. Do error handling and debugging of AVR programs.

Detailed Syllabus:

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

Practical's based on AVR Interfacing (Any 10):

1. To get familiarize with AVR target board, understand the use of software development tools and perform necessary installation procedure.
2. LED and push button interfacing (Get button status and display on LED).
3. Seven segments display interfacing (Single-digit).
4. Seven segments display interfacing (Two digits).
5. 16*2 LCD display interfacing (display message on both lines).
6. Use of LCD to display two digit second counter.
7. Servo motor interfacing (for stepwise rotation).
8. DC motor interfacing (clockwise and anticlockwise rotation).
9. Bluetooth module interfacing (for point to point communication).

10. LDR Sensor interfacing and display data on LCD (for dark or illuminated condition).
11. DAC interfacing (generate at least 3 different waveforms).
12. Event counter display on SSD or LCD (use opto-interruptor or IR pair).
13. Dot-matrix display interfacing (for a single character).
14. Delay generation using timer.
15. Stepper motor interfacing (for clockwise and anticlockwise rotation).
16. Stepper motor interfacing to rotate motor for a specified angle.

Activity (Any 1):

1. Perform simulation of any 2 practicals mentioned in the above list using Proteus or any other equivalent simulation software 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.

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Semester – I	**Paper – IX**
Course Code: MSC-ES 119 T	**Title of the Course:** Computer Organization
Credits: 2	**Total Lectures:** 30 Hours

Course Outcomes (COs):

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

1. Understand the basic computer organization system.
2. Comprehend the CPU architecture and its element.
3. Understand the memory organization of the computer.
4. Understand the I/O organization of the computer.

Detailed Syllabus:

Unit I: Basics of Computer Organization System (18)

Architecture, computer function and interconnection of the general computer system, CISC and RISC architecture, comparison of CISC and RISC, pipelining concepts, organization of pipelining, an overview of super-scalar and super-pipelined organizations. Control unit operation, inside the CPU, system buses, multi-bus organization. Block diagram of CPU, functions of CPU, general register organization, ALU, stack organization: operation of stack, types of stack, register stack and memory stack.

Unit II: Memory and I/O Organization (12)

Memory organization: system memory, classification of memories, memory organization, types and organization of cache memory, virtual memory and its implementation, memory management unit, magnetic hard disks, SSD and optical disks.

I/O organization: Accessing I/O devices, Direct Memory Access and DMA controller, interrupts and interrupt controllers, multilevel bus architecture, features of PCI and PCI express bus.

Suggested Readings:

1. Computer Organization and Architecture - William Stallings, Pearson Education, New Delhi.
2. Computer organization - V. Carl, Zvonko G., Safwat G.Zaky, McGraw-Hill, International Edition.
3. Computer organization - William Stalling, PHI, Fourth Edition.
4. PC based Instrumentation: Concepts and Practice - N. Mathivanan, PHI, New Delhi.

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Semester – II	Paper – I
Course Code: MSC-ES 211 T	**Title of the Course:** Electromagnetic Fields and Antennas
Credits: 4	**Total Lectures:** 60 Hours

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 (18)

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, quarter wavelength, 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 Basics (12)

Basic radiation equation, radiation resistance, antenna patterns, half-power bandwidth, radiation intensity, directivity and gain, resolution, apertures, effective heights, Frii's transmission formula, field zones, linear, elliptical and circular polarization, the duality of antenna, twin line antenna, center-fed dipole antenna, antenna field zone, ground wave, space wave and ionospheric propagation.

Unit IV: Antenna Types (15)

The antenna family, a short dipole antenna, antenna arrays, broad-side and end-fire arrays, linear arrays, folded dipole, Yagi-Uda array, helical beam antenna, horn antenna, rhombic antenna, Hertz antenna, parabolic reflector antenna, loop antenna, antennas for terrestrial mobile communications, base station antennas, switched beam and beamforming antennas, antennas on cellular handsets and microstrip antenna.

Suggested Readings:

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.

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Semester – II	Paper – II
Course Code: MSC-ES 212 T	**Title of the Course:** Advanced Embedded System Design
Credits: 4	**Total Lectures:** 60 Hours

Course Outcomes (COs):

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

1. Understand the advanced concepts of embedded systems.
2. Know the architecture and C programming of different microcontrollers.
3. Use the communication standards and wireless protocols for different applications.
4. Write programs for interfacing of advanced I/O devices.
5. Design and develop an embedded system using microcontrollers.

Detailed Syllabus:

Unit I: Embedded System Development Process (10)

Embedded Systems: components, applications, design metrics, ways to design an embedded system, challenges in embedded system design and embedded product development life cycle. Software development process: algorithm, flow chart, assembler, compiler, linker, loader, simulator, programmer, IDE, debugging techniques. Elements of target board design. Introduction to embedded firmware: RTOS, drivers and application programs.

Unit II: Communication Standards and Wireless Protocols for Embedded System (18)

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, Zigbee and Wi-Fi: IEEE standard, features, specifications, protocol stack, applications and the study of hardware module.

Unit III: PIC Advanced Peripheral Programming and I/O Device Interfacing (20)

I2C and SPI: block diagram, operation, SFR used, PIC C programs to transfer and receive information, On-chip ADC: block diagram, operation, SFR used, PIC C programs to convert the analog signal to digital. Case study: DS1307 RTC chip interfacing, temperature monitoring system, water level monitoring system, Bluetooth controlled device and wireless data acquisition system.

Unit IV: Basics of MSP430 Microcontroller (12)

Introduction, features, architecture, memory organization, CPU registers, I/O ports and peripherals. Programming using C: basic structure, data types, operators, library files, delay functions and I/O port programming. I/O device interfacing: LED, push button, seven segment display, stepper motor and DC motor.

Suggested Readings:

1. Embedded System Design: A Unified Hardware/Software. Approach - Frank Vahid and Tony Givargis.
2. PIC Microcontroller and Embedded Systems - Mazidi, Mckinlay and Causey, Pearson Education.
3. C Programming for Embedded Systems - Kirk Zurell, Pearson Education.
4. Beginning Microcontrollers with the MSP430 - Gustavo Litovsky.
5. Embedded Hardware know it all - Jack Ganssle, Tammy Noergaard, Eady, Edwards.
6. ARM system on chip architecture – Steve Furber.

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Semester – II	**Paper – III**
Course Code: MSC-ES 213 T	**Title of the Course:** Optical Fiber Communication
Credits: 2	**Total Lectures:** 30 Hours

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:

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.

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Semester – II	**Paper – IV**
Course Code: MSC-ES 214 P	**Title of the Course:** Practical Course – V
Credits: 2	**Total Lectures:** 60 Hours (12 practicals)

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 $\lambda/2$ antenna.
2. To plot the directivity pattern of simple dipole $\lambda/4$ antenna.
3. Study of $\lambda/4$ phase array antenna.
4. Study of Yagi-UDA 5 Element Simple dipole antenna.
5. Study of Hertz antenna.
6. Study of $\lambda/2$ 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 verification.
5. Measurement of primary-secondary coupling factor of a given transformer using LCR meter (calculation of transformer model parameters expected).
6. To determine a characteristics of a microstrip transmission line.
7. To determine the standing wave ratio and reflection coefficient of a given waveguide.
8. Study of matching stub.
9. SWR measurement.

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 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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Semester – II	**Paper – V**
Course Code: MSC-ES 215 P	**Title of the Course:** Practical Course – VI
Credits: 2	**Total Lectures:** 60 Hours (12 practicals)

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 different microcontrollers to perform different experiments.
3. Interface different I/O devices to design embedded systems.
4. Do error handling and debugging.
5. Perform programming of advanced peripherals in PIC.

Detailed Syllabus:

The 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 PIC18 (Any 5):

1. Water level monitoring system.
2. Home appliances control using Bluetooth.
3. Monitor temperature using the LM35 sensor and manage appliances as per the temperature level.
4. Wireless data acquisition system using Zigbee.
5. RTC 1307 interfacing and display clock on LCD.
6. Study of security system based on interrupt facility.
7. Position control of servo motor using PWM feature.
8. Serial EEPROM / Programmable gain amplifier interface using SPI protocol.

Practical based on Embedded System Design using MSP430 (Any 5):

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

Activity (Any 1):

1. Perform simulation of any one embedded system application using Proteus or any other equivalent simulation software 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.

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Semester – II	**Paper – VI**
Course Code: MSC-ES 216 P	**Title of the Course:** Practical Course – VII
Credits: 2	**Total Lectures:** 60 Hours (12 practicals)

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:

The 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 fiber trainer kit.

9. Study of optical instruments: optical power meter, OTDR, OSA etc. (Survey).
10. Characteristics of light detectors.
11. Measurement of numerical aperture.
12. Design of fiber optic transmitter.
13. Design of fiber optic receiver.
14. Wavelength division multiplexing (WDM).
15. Simulation of power budget calculation.
16. Setting up fiber optic voice link.
17. Measurement of mode field diameter.

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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Semester – II	**Paper – VII**
Course Code: MSC-ES 217 T (A)	**Title of the Course:** Digital Image Processing (DIP)
Credits: 2	**Total Lectures:** 30 Hours

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, companding in imaging, 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: image enhancement using equalization methods, salt and pepper noise removal using spatial as well as frequency domain filters, image segmentation for edge detection for any real-life application, image classification using supervised and unsupervised classification for any real-life application.

Suggested Readings:

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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Semester – II	**Paper – VII**
Course Code: MSC-ES 217 T (B)	**Title of the Course:** Artificial Intelligent (AI)
Credits: 2	**Total Lectures:** 30 Hours

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:

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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Semester – II	**Paper – VIII**
Course Code: MSC-ES 218 P (A)	**Title of the Course:** Practical Course – VIII (DIP)
Credits: 2	**Total Lectures:** 60 Hours (12 practicals)

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

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Semester – II	**Paper – VIII**
Course Code: MSC-ES 218 P (B)	**Title of the Course:** Practical Course – VIII (AI)
Credits: 2	**Total Lectures:** 60 Hours (12 practicals)

Course Outcomes (COs):

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

1. Understand the designing and analyzing 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** hours 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 the solution of real-life problems using Artificial Intelligent (AI) (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 Center visit.
   - Market Survey / Review of any advanced technology (related to the course).
   - Participation in workshop / conference / seminar.

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Syllabus of M. Sc. Electronic Science (Part-I) under Faculty of Science and Technology

Semester – II	**Paper – IX**
Course Code: MSC-ES 219 T	**Title of the Course:** Electronic Instrumentation
Credits: 2	**Total Lectures:** 30 Hours

Course Outcomes (COs):

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

1. Know working principles of measurement system.
2. Understand the basics of measurement systems.
3. Use different measuring techniques.
4. Explore different measuring instruments and signal sources.

Detailed Syllabus:

Unit I: Basics of Electronic Measurement (15)

Measurement terminologies: accuracy, precision, sensitivity and resolution. The significance of measurements, functions of instruments and measurement systems, generalized performance characteristics of instruments, examples – Burdon tube and Thermometer. Types of errors and their minimization, statistical conditioning of data, regression analysis, the importance of calibration, static characteristics, static calibration and instrument calibration standards.

Unit II: Measuring Instruments and Signal Sources (15)

Measurement techniques for R, L, C, voltage, current, power, energy, frequency and phase. Digital multimeter, CRO. Digital storage oscilloscope: specifications, performance parameters and applications. Review of signal sources, synthesized signal source and arbitrary waveform generator. Review of instrumentation for signal analysis - digital frequency meter and spectrum analyzer.

Suggested Readings:

1. Electrical instrumentation and process control - A.V. Bakshi.
2. A Course in Electrical and Electronic Measurements and Instrumentation - A.K. Sawhney, Dhanpat Rai and Co.
3. Electronic Instrumentation - Kalsi, TMH.
4. Electronic Measurement - Oliver Cage, Mc_Graw Hill Inc.
5. Modern Electronic Instrumentation and Measurements Techniques - Cooper and Helfrick, PHI.