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-II)

Implemented from

Academic Year 2022 - 23

Ahmednagar Jilha Maratha Vidya Prasarak Samaj's

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

Board of Studies in Electronic Science

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

Programme Structure and Course Titles: (All academic years)

Sr. No.	Class	Semester	Course Code	Course Title	Credits
1.	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	02
			MSC-ES 118 P (B)	Practical Course – IV	
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	02
			MSC-ES 218 P (B)	Practical Course – VIII	
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	02
			MSC-ES 318 P (B)	Practical Course – XI	
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	02
			MSC-ES 417 P (B)	Practical Course – XIII	
35.	M. Sc.-II	IV	MSC-ES 418 T	Technical Writing	02

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Syllabus of M. Sc. Electronic Science (Part-II)

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Semester – III	**Paper – I**
Course Code: MSC-ES 311 T	**Title of the Course: Digital Signal Processing (DSP)**
Credits: 4	**Total Lectures: 60 Hrs.**

Course Outcomes (COs):

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

a. Understand the fundamental aspects of Digital Signal Processing (DSP).
b. Understand the mathematical techniques required for DSP.
c. Design digital filters FIR/IIR and implementation on digital Signal processor.

Detailed Syllabus:

Unit I: Signals and Systems (12)

Classification of signals: Continuous-time and discrete-time. Elementary signal types, amplitude and phase spectrum. Classification of systems and types. Real-time DSP system and interfacing A-D conversion process: sampling, quantization and encoding, oversampling and antialiasing, one-bit ADC and DAC conversion process. Advantages of digital signal processing over analog signal processing.

Unit II: Mathematical Tools for DSP (15)

Fourier series, Fourier Transform (FT), Discrete Fourier Transform (DFT) and its Inverse DFT, properties of DFT, computational complexity, decimation-in-time, Fast Fourier Transform (FFT) algorithm, Inverse FFT, implementation of FFT, DIT and DIF algorithm, z-transform. Correlation, convolution, types of convolution, deconvolution, implementation and application examples of convolution and correlation.

Unit III: Digital Filter Design (18)

Frame work of digital filter design: introduction, types – Infinite Impulse Response (IIR), Finite Impulse Response (FIR). FIR filter: features, design steps, specifications, coefficient calculation methods, window method, optimal method, frequency sampling method,

realization structure for FIR filter, finite word length effects, and implementation of FIR filters. IIR Filter: basic features, design steps, coefficient calculation, poles-zeros placement, impulse invariant method, bilinear transform, Matched z-transform, Nyquist effect, realization structure for IIR filter, finite word length effects, implementation of IIR filters. Multirate digital signal processing, sampling rate reduction/increase, conversion, software implementation and decimator and interpolator.

Unit IV: DSP Processor and Application Areas (15)

Introduction to DSP processors. Complete architecture for signal processing, fixed time digital signal processors, floating time digital signal processors. Implementation of DSP algorithm for FIR, IIR filtering, FFT and multirate processing. Application areas: speech processing, biomedical signal processing and RADAR.

Suggested Readings:

1. Digital Signal Processing: A Practical Approach - Emmanuel Ifeachor, Barrie Jervis, Prentice Hall.
2. Digital Signal Processing - S. Salivahan, A. Valuraj, C.Gnanapriya, Tata McGraw Hill, Pub. Co. Ltd.
3. Digital Signal Processing: A Hands on Approach - Charles Schuller, Mahesh Chugani, Tata McGraw Hill Pub. Co. Ltd.
4. Digital Signal Processing: - Principles, Algorithms and Applications - John G Proakis, Dimitris G Monolkis, and Pub. Person 2005.
5. Digital Signal Processing and Applications with the C6713 and C6416 DSK - Rulph Chassaing, a John Wiley and Sons, Inc.
6. The Scientist and Engineer's Guide to Digital Signal Processing - Steven W. Smith Second Edition California Technical Publishing.
7. Digital Signal Processing - R.A.Barapate.

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Semester – III	**Paper – II**
Course Code: MSC-ES 312 T	**Title of the Course: Internet of Things (IoT)**
Credits: 4	**Total Lectures: 60 Hrs.**

Course Outcomes (COs):

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

a. Understand the various concepts and terminologies of IoT systems.
b. Identify architecture, structure and security as well as privacy aspects of IoT.
c. Comprehend the concepts of cloud technology and cloud platforms used in IoT.
d. Identify hardware components used for development of IoT based application.

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 (15)

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 (15)

Arduino: Introduction, features, architecture, types, Arduino boards for IoT. Raspberry Pi: Introduction, features, architecture and types. NodeMCU: Introduction, features, architecture

and types. GPS module, RFID module. Wi-Fi module ESP8266, Bluetooth, Xbee, Z-wave, thread, GSM / GPRS and LoRa: Introduction, features, architecture and types.

Unit IV: IoT Applications (12)

Home Automation, Smart Cities, Surveillance, Retail Management, Agriculture, Health, Lifestyle and Automotive. (Discuss applications with block diagram, hardware and software components required, cloud requirements and discuss structural aspects.)

Suggested Readings:

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.

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Semester – III	**Paper – III**
Course Code: MSC-ES 313 T	**Title of the Course: Advanced Power Electronics**
Credits: 2	**Total Lectures: 30 Hrs.**

Course Outcomes (COs):

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

a. Understand the use of power devices and there I-V characteristics.
b. Use rectifiers for different power electronic applications.
c. Comprehend the working of AC voltage controllers.
d. Understand the working of invertors and compare between different types.

Detailed Syllabus:

Unit I: Introduction to Power Devices **(12)**

Comparison of Power Electronics and linear electronics, power devices, control characteristics of power devices, concept of load, applications of power devices, types of power electronic circuits and design of power electronic equipment.

Power diode, power BJT, power MOSFET and IGBTs: construction, working, types, I-V characteristics and switching characteristics.

Thyristors: Characteristics, two-transistor model, turn-on and turn-off methods, types, gate drive circuits, di/dt and dv/dt protection. Introduction to power integrated circuits.

Unit II: Power Circuits **(18)**

Rectifiers: single phase half-wave, full wave, bridge rectifiers and three phase bridge rectifiers, performance parameters and comparison.

Controlled rectifiers: Introduction, principle of phase controlled convertor operation, single phase and three phase – full convertor and dual converter, single phase series converters, twelve pulse converters and power factor improvement techniques.

AC voltage controllers: ON-OFF control, phase control, single phase and three phase bidirectional controller, PWM control, single phase and 3- phase cycloconverter.

Inverters: Performance parameters, single-phase bridge inverter, 3 phase inverters - 120° and 180°conduction, voltage control methods for inverters, harmonic reduction and current source inverters.

Static Switches: Single phase and three phase AC switches, AC switches for bus transfer, DC switches. Solid state and microelectronic relays.

Suggested Readings:

1. "Power Electronics: Circuits, Devices and Applications" - Mohammad Rashid, Pearson publication.
2. "Modern Power Electronics and AC drives" – B. K. Bose, Prentice Hall of India Pvt. Ltd., New Delhi.
3. "Power Electronics" - P.C. Sen TMH, New Delhi.
4. "Power Electronics" - M D Singh, K B Khanchandani, McGraw Hill, New Delhi.
5. "Power Electronics – Converters, Applications and Design" - Ned Mohan, Tore M. Undeland and William P. Robbins, John Willey and sons, Inc.

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Semester – III	**Paper – IV**
Course Code: MSC-ES 314 P	**Title of the Course: Practical Course – IX**
Credits: 2	**Total Lectures: 60 Hrs.** (12 practicals)

Course Outcomes (COs):

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

a. Use different software development tools for IoT application development.
b. Use Arduino / Raspberry Pi / NodeMCU / Any other IoT hardware platform to perform different experiments.
c. Interface different I/O devices and wireless communication modules to Arduino / Raspberry Pi / NodeMCU / Any other IoT hardware platform.
d. Use ThingSpeak IoT cloud platform.

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 IoT using Arduino / Raspberry Pi / NodeMCU / Any other IoT hardware platform (Any 10):

1. To get familiarize with Arduino and perform necessary installation procedure.
2. To interface buzzer and turn on/off using Bluetooth module.
3. To interface LDR and turn on / off LED based on light intensity.
4. To study different tasks performed using Blynk app. and to get familiarize with the procedure to use it with NodeMCU.
5. LED on/off using Blynk app.
6. To interface LM35 sensor and turn on / off buzzer based on temperature.
7. To interface DHT11 sensor and observe the output on smartphone.

8. To study different tasks performed using ThingSpeak platform and to get familiarize with the procedure to use it.
9. To interface sensor and send data to ThingSpeak cloud.
10. To study wireless data transmission using LoRa.
11. Study of RFID technology for identifying objects.
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 interface motion sensor for intruder detection and send alert on smartphone.

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.

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Semester – III	**Paper – V**
Course Code: MSC-ES 315 P	**Title of the Course: Practical Course – X**
Credits: 2	**Total Lectures: 60 Hrs.** (12 practicals)

Course Outcomes (COs):

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

a. Use MATLAB software for simulation of DSP techniques.
b. Understand the practical use of different power devices.
c. Perform simulation of different power 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 Digital Signal Processing using MATLAB (Any 7)

1. Generation of Basic Signals.
2. Verification of sampling theorem.
3. To find Dft / Idft of given DT signal.
4. Linear convolution of two given sequences.
5. Circular convolution of two given sequences.
6. Autocorrelation of a given sequence and verification of its properties.
7. Cross correlation of given sequences and verification of its properties.
8. Design of FIR filters of low pass and high pass filter.
9. Linear Convolution using Dft and Idft.
10. Sampling and effect of Aliasing.
11. Design and implementation of FIR Filter (LP/HP) to meet given specifications using rectangular window technique.
12. To perform the FFT of signal x(n).
13. To perform the DFT of signal x(n).

Practical based on Advanced Power Electronics (Any 3):

1. To design, build and test characteristics of power diode / power BJT / power MOSFET.
2. To design, build and test characteristics of IGBT / Thyristor.
3. Study of performance parameters of Static Switches.
4. To design, build and test controlled rectifier circuit.
5. To design, build and test AC voltage controllers.
6. To design, build and test Inverter.
7. Simulation of converter / inverter / rectifiers using LT-SPICE.

Activity (Any 1):

1. Perform simulation of DSP or power electronic concepts using Proteus or any other 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 – III	**Paper – VI**
Course Code: MSC-ES 316 Pr	**Title of the Course: Project Course – I**
Credits: 2	**Total Lectures: 60 Hrs.**

Course Outcomes (COs):

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

1. Understand basic methodology of selection of topic for project.
2. Understand how to do literature review for selected topic for project.
3. Apply the knowledge for design and development of the selected project.
4. Use different software and hardware for testing, validation and verification of circuits for successful outcome of project.
5. Understand documentation process in the form of project report and presentation.

Guidelines for Project Course - I:

This Course should be conducted using following guidelines:

a) Project topic having weightage of 60 hours should be selected for this course.

b) There should be internal continuous assessment of Project work in the form of Seminars/presentation and continuous monitoring of work.

c) After completion of project, student has to submit the Project Report in the following format.

i. Title of Project.
ii. Aim and objectives of project.
iii. Literature or Reference work.
iv. Block diagram / Circuit diagram and its explanation in brief.
v. Design and development of hardware part of the project.
vi. Design and development of software part of the project.
vii. Experimental work performed.
viii. Results, discussion and conclusion.

ix. Applications

x. Future Scope

xi. References

d) There must be observations, interpretations, conclusions, results of the project work.

e) Algorithm / flowchart, program strategy, module wise description of parts etc. be provided in case of projects related with programming.

f) Applications, usefulness, student's contribution must be clearly specified.

g) Further extension work may be suggested for better outcome of the project.

h) The presentation should be given by the student related to whatever work performed during project.

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Semester – III	**Paper – VII**
Course Code: MSC-ES 317 T (A)	**Title of the Course: Virtual Instrumentation (VI)**
Credits: 2	**Total Lectures: 30 Hrs.**

Course Outcomes (COs):

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

a. Familiarize with the concepts of Virtual Instrumentation and Graphical User Interface.
b. Use the basic programming concepts in LabVIEW.
c. Operate LabVIEW to design Virtual Instruments.

Detailed Syllabus:

Unit I: Introduction to Virtual Instrumentation and Basics of LabVIEW (15)

Review of Virtual Instrumentation: Historical perspective, need of VI, introduction to virtual instrumentation, virtual instruments versus traditional instruments**,** role of hardware in virtual instrumentation, role of software in virtual instrumentation, virtual instrumentation for test, control and design.

Components of LabVIEW, Tools and Other Palettes, Arranging Objects, Pop-Up Menus, Colour coding and code debugging. Advantages of LabVIEW, software environment, LabVIEW based system design approach: Front Panel, block diagram, Icon/Connector Pane.

Unit II: Programming Tools and Data Acquisition (15)

Programming tools: loops, tunnel, shift register, arrays, cluster and structures. Creating a VI's and sub-VI as icons. Signal Processing: waveform generation, waveform conditioning, dynamic data conversion to arrays and spectral measurements toolkit.

Basics of Data Acquisition: Classification of signals, real-world signals, analog interfacing, Connecting the Signal to the Board, Practical vs. Ideal Interfacing. Introduction of DAQ, signal conditioning, hardware configurations, block diagram, sampling and signal acquisition, measurement and VISA.

Suggested Readings:

1. Virtual Instrumentation using LabVIEW - Jovitha Jerome.
2. Virtual instrumentation using LabVIEW (Principles and Practices of Graphical Programming) - Sanjay Gupta and Joseph John.
3. LabVIEW for Everyone - J. Travis, J. King, Prentice Hall.
4. Analog electronics with LabVIEW - Kenneth L. Ashley.
5. PC interfacing and data acquisition - James K.
6. NI LabVIEW user manual.

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Semester – III	**Paper – VII**
Course Code: MSC-ES 317 T (B)	**Title of the Course: VLSI System Design**
Credits: 2	**Total Lectures: 30 Hrs.**

Course Outcomes (COs):

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

a. Understand the MOS transistor, its characteristics and MOS models.
b. Understand the various MOS technologies used for VLSI design.
c. Comprehend VLSI design and layout design rules.
d. Design layout of simple combinational and sequential digital logic circuits.

Detailed Syllabus:

Unit I: Basic Electrical Properties of MOS and CMOS Circuits (10)

MOS transistor: threshold voltage, threshold voltage equations, MOS device equations, basic DC equations, second order effects, MOS Models, small signal AC characteristics, NMOS inverter, depletion mode and enhancement mode pull ups. CMOS inverter: DC Characteristics, inverter delay, pass transistor, transmission gate, power consumption in CMOS gates, static dissipation and dynamic dissipation.

Unit II: Layout Design Rules and Digital Logic Design (20)

Layout Design Rules: Need for design rules, Mead Conway design rules for the silicon gate NMOS process, CMOS based design rules, simple layout examples, sheet resistance, area capacitance, wiring capacitance and driving large capacitive loads.

Digital logic design: Switch logic, pass transistor and transmission gate based design, gate logic, inverter, two input NAND gate, NOR gate, other forms of CMOS logic, clocked CMOS, Logic, recharged Domino CMOS logic, structured design. Simple combinational logic design examples: parity generator, multiplexers. Clocked sequential circuits: two phase clocking, charge storage, dynamic shift register, semi static register and JK flip flop circuit.

Suggested Readings:

1. Essentials of VLSI "Circuits and Systems - Kamran Eshraghian, Douglas A Puknel and Sholeh Eshraghian, prentice Hall of India, New Delhi.
2. Principles of CMOS VLSI Design: A system perspective - Neil H.E West and Kamran Eshranghian, Addison-Wesley.
3. CMOS Digital integrated circuits - Sung-Mo Kang and Yusuf Leblebici, Tata McGraw Hill New Delhi.
4. Digital Integrated Circuits - Jan M Rabaey, Chandrasekaran A and Nikolic B, Pearson Education.
5. Introduction to NMOS and CMOS VLSI System - Amar Mukharjee, Prentice Hall, USA.
6. Modern VLSI Design: System on chip design - Wayne wolf, Pearson Education.

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Semester – III	**Paper – VIII**
Course Code: MSC-ES 318 P (A)	**Title of the Course: Practical Course – XI**
Credits: 2	**Total Lectures: 60 Hrs.** (12 practicals)

Course Outcomes (COs):

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

a. Use LabVIEW software.
b. Operate LabVIEW to design Virtual instruments.
c. Develop, debug, and test LabVIEW VI's for specific applications.
d. Configure data acquisition hardware in LabVIEW.

Detailed Syllabus:

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

Practical's based on VI using LabVIEW (Any 10):

1. Study of LabVIEW software.
2. Create a VI for performing arithmetic operations on given numbers.
3. Create a VI for performing Boolean operations.
4. Sum of 'n' numbers using for loop and while loop.
5. Factorial of a give number using for loop and while loop.
6. Write and design a program for temperature conversion.
7. Design a water tank alarm system.
8. Program to design traffic light signal.
9. Reading data from and writing data to files.
10. Sorting even numbers using while loop in an array.
11. Finding maximum and minimum number in an array.
12. Bundle and unbundle cluster.

13. Create two 2D numeric arrays and add them. Change the number of rows and number of columns of each array and see the result.
14. Build a VI that generates 1D array of random number and sort the ascending descending array and also find the max. and min. value array element.
15. Create a VI for waveform generation and manipulations.
16. Build a VI to generate two waveforms of different amplitude and frequency add the signal to find the resultant and plot it on the separate waveform graph.
17. Reading an analog signal from a signal generator and displaying in LabVIEW.
18. Sending an analog signal from the DAQ card and displaying on Oscilloscope.

Activity (Any 1):

1. Create VI for any one of the following topic and write a report (equivalent to 2 experiments):
   - Build a VI to for four pumps A, B, C, D and a water tank of height 10 meters. Pump A should be switched off if both B and C are simultaneously on, pump B should be switched off if both C and D are simultaneously on.
   - Study of data acquisition card (DAQ card) and create a VI to acquire voltage.
   - Develop VI based temperature monitoring system using LabVIEW and DAQ hardware.
   - Program to design a calculator that can perform simple mathematical operations (using case structure).
   - Design ON-OFF control system with dead zone.
   - Any other application 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 – III	**Paper – VIII**
Course Code: MSC-ES 318 P (B)	**Title of the Course: Practical Course – XI**
Credits: 2	**Total Lectures: 60 Hrs.** (12 practicals)

Course Outcomes (COs):

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

a. Use simulation software for VLSI system.
b. Reproduce the characteristics of digital circuits like inverter and other logic gates based on CMOS technology.
c. Design the digital circuit components like latches, multiplexers etc.
d. Create, select, and apply appropriate techniques, resources, and modern engineering tools.

Detailed Syllabus:

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

Practical's based on VLSI System Design (Any 10):

To design following logic, calculate W/L ratios, prepare layout in multi metal layers and Simulate. Assume suitable technology, load capacitance, free running frequency, switching timings etc.

1. CMOS Inverter.
2. CMOS NAND, NOR gate.
3. CMOS XOR gate.
4. 2:1 MUX by conventional method and by transmission gates.
5. 4:1 MUX.
6. 2 to 4 Decoder.
7. CMOS combinational logic for minimum 4 variables.
8. RS latch.

9. D latch.
10. Edge triggered D register.
11. Clock divider.
12. Synchronous Counter/ Shift register.
13. Constructing a 4-input AND gate using CMOS 2-input NAND and NOR gates.
14. Common Drain amplifier.
15. Cascade amplifier.
16. Current mirror.

Activity (Any 1):

1. Perform simulation study of any one of the following topic and write a report (equivalent to 2 experiments).
   - To study V-I characteristics of a differential amplifier.
   - To design and plot the static (VTC) and dynamic characteristics of a digital CMOS inverter.
   - To design and plot the dynamic characteristics of 2-input NAND, NOR, XOR and XNOR logic gates using CMOS technology.
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 of M. Sc. Electronic Science (Part-II)

under

Faculty of Science and Technology

Semester – III	**Paper – IX**
Course Code: MSC-ES 319 T	**Title of the Course: Technical Communication**
Credits: 2	**Total Lectures: 30 Hrs.**

Course Outcomes (COs):

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

a. Understand the nature and objective of Technical Communication relevant for the work place
b. Imbibe inputs by technical communication techniques to enhance confidence in face of diverse readers.
c. Create a vast expertise of the application of the learning to promote their technical competence.
d. Evaluate their efficiency as fluent and efficient communicators by earning the voice-dynamics.

Detailed Syllabus:

Unit I: Fundamentals of Technical Communication (15)

Technical Communication: Definition, process, features. Distinction between general and technical communication. Relevance and importance of communication in a globalized world. Types of communication: Verbal and non-verbal. Brevity and clarity in various forms of communication. Language as a tool of communication. Dimensions of communication: Reading and comprehension. The flow of communication: Downward, upward, lateral or horizontal. Barriers to communication.

Unit II: Technical Communication Techniques (15)

Technical communication techniques: Forms, clarity of substance, emotion, humor. Methods of presentation: Interpersonal, impersonal. Class room presentation: style, method. Individual conferencing. Modes of presentation. Overcoming stage fear. Confident speaking. Public

speaking modes and methods. Audience analysis and retention of audience interest. Audience participation: Quizzes and interjections.

Suggested Readings:

1. Technical Communication: Principles and Practices - Meenakshi Raman and Sangeeta Sharma, Oxford Univ. Press.
2. Practical Communication: Process and Practice - L.U.B. Pandey, A.I.T.B.S. Publications India Ltd.
3. Communication Skills for Engineers and Scientists - Sharma, Sangeeta and Mishra, Binod. PHI Learning.
4. Skills for Effective Business Communication - Michael Murphy, Harward University.
5. Business Correspondence and Report Writing - Prof. R.C. Sharma and Krishna Mohan, Tata McGraw Hill and Co. Ltd.

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under

Faculty of Science and Technology

Semester – IV	**Paper – I**
Course Code: MSC-ES 411 T	**Title of the Course: Control Systems**
Credits: 4	**Total Lectures: 60 Hrs.**

Course Outcomes (COs):

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

a. Compare different control loop systems.
b. Analyze the control systems using different mathematical techniques.
c. Analyze and distinguish different types of controllers and control modes.
d. Identify components of control systems.

Detailed Syllabus:

Unit I: Control System Basics (12)

Open-loop control, closed loop control and its functional elements, continuous and discrete state control, control strategies such as feedback, feed forward and adaptive control, steady state optional control concept of DCS, evolution of process control, SCADA supervisory control and data acquisition systems, Fuzzy logic direct digital control.

Unit II: Control System Analysis (18)

Mathematical models of systems, concept of transfer function and its use, method of obtaining transfer function, block diagram of control system, rules of block diagram reductions and examples. Concept of stability, Routh stability criterion, Routh-Hurwitz criterion. Root locus: angle and magnitude condition, graphical method of determining 'K', rules for construction of root locus, examples and advantages. Frequency response methods of control system analysis. Bode plots: magnitude and phase angle plot, logarithmic scale, standard factors, frequency response specifications, advantages and examples. Nyquist plots: method and examples.

Unit III: Analog and Digital Controllers (18)

Classification of controllers, controller terms. Discontinuous controllers: ON-OFF controller and three position controller. Continuous controllers: Proportional, Integral and Derivative control. Composite control modes: PI, PD and PID controllers (Derivative overrun and integral windup). Design of analog controller circuits for above modes, characteristics and applications. PLC architecture, operating modes, components of ladder programming, applications: conveyer belt control and temperature control systems. DCS, DPCS, SCADA: hardware, software and applications.

Unit IV: Control System Components and System Examples (12)

Control System Components: control valves, synchro-servo motors, solenoids, actuators, annunciators, alarms, recorders, standard graphics symbols for process control and instrumentation.

Control system examples: speed control system, position control systems, temperature and level control system.

Suggested Readings:

1. Control Systems - U.A. Bakshi and V. U. Bakshi.
2. Process control: Principles and applications - Surekha Bhanot.
3. Control Engineering - Noel. M. Morris.
4. Process control instrumentation technology - C. D Johanson, PHI.
5. Control engineering theory and practice - N. M. Bandhopadhyay.

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under

Faculty of Science and Technology

Semester – IV	**Paper – II**
Course Code: MSC-ES 412 T	**Title of the Course: Robotics and Mechatronics**
Credits: 4	**Total Lectures: 60 Hrs.**

Course Outcomes (COs):

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

a. Identify different components or blocks in any mechatronic system.
b. Distinguish different mechanical and electrical actuating mechanisms.
c. Analyze mechatronic systems using different models and methods.
d. Compare different control mechanisms.

Detailed Syllabus:

Unit I: Introduction to Robotics and Mechatronics (10)

Basics of mechatronic systems: key elements, mechatronic design process, example of mechatronic systems. Robotics: brief history, types, components and structure, kinematic arrangements (configurations). Classification of robots based on various methods: control method, power source, applications and coordinate systems based. Application areas of robots. Specifications of different industrial robots.

Unit II: Mechanisms of Robotics and Mechatronics (20)

Mechanisms and transmission: end effectors and different types of grippers.

Sensors and transducers: digital sensors for distance measurement, torque and tactile, vibration.

Solid state switches: diodes, thyristors, BJTs and MOSFETs and their applications as switches and driver circuits, solenoids.

DC Motor: types, basic construction and working, brushed and brushless DC motor driver circuits and speed control.

BLDC and PMDC motor: construction, features, specifications, driver circuits.

AC and Servo motor: construction, features, specifications, driver circuits.

Stepper motor: types, construction, features, specifications, driver circuits.

Unit III: Mechanical and Electrical Actuation Systems (14)

Mechanical actuation systems: mechanisms and their role in mechatronic systems, translational and rotational motion. Degrees of freedom. Kinematic chains: examples of links, toggle linkage, slider-crank etc., cams. Gears: types, gear trains, gear ratios. Uses of rotation-to translational motion: rack and pinion, ball screw and links, Ratchet and pawl, belt and chain drives. Bearings: types and uses, consideration of moment of inertia and torque for motor selection.

Electrical Actuating System: Relays and applications with driver circuits.

Unit IV: Systems Models, Transformations and Control in Robot (16)

Basic system models: Mechanical (translational and rotational) system building blocks, electrical system building blocks, electrical and mechanical analogies and their use in analysis. Dynamic responses of systems: modeling dynamic systems, terminology of first order and second order system.

Transformations: Rigid Motions, Rotations, coordinate transformations relating to representation of a point in two different frames.

Trajectory planning and generation. Joint space schemes *via* points.

Independent Joint Control: basic structure of feedback control system, set-point tracking using PD and PID compensator.

Force control: static force / torque relationships, natural and artificial constraints, stiffness and compliance.

Suggested Readings:

1. Mechatronics - W.Bolton, Pearson.
2. Mechatronics System Design – Devdas Shetty and Richard Kolk, Cengage Learning.
3. Robotics Engineering: An integrated approach - Richard W. Klafter, Thomas A. Chmielewski and Michael Negin, PHI Learning Pvt. Ltd.
4. Robot Dynamics and Control - Spong and M. Vidyasagar, Wiley Student Edition.
5. Robotics: Fundamental Concepts and Analysis - Ashitava Ghoshal, Oxford Higher Education.
6. Robotic Engineering: An integrated approach - Richard D. Klafter, Thomas A. Chmielewski and Michael Negin, Prentice-Hall India.

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under

Faculty of Science and Technology

Semester – IV	**Paper – III**
Course Code: MSC-ES 413 T	**Title of the Course: Semiconductor Devices and Technology**
Credits: 2	**Total Lectures: 30 Hrs.**

Course Outcomes (COs):

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

a. Understand basic idea of doping and I-V characteristics of semiconductor devices.
b. Understand basic concept of the structure of solids, charge carriers and energy level.
c. Analyze and compare different IC fabrication techniques.

Detailed Syllabus:

Unit I: Physics of semiconductors and p-n junction (12)

Revision of semiconductor basics. Carrier transport phenomena: charge, effective mass, state and carrier distributions, carrier drift, carrier diffusion, resistivity, Hall effect. Non-equilibrium excess carriers in semiconductors: Carrier generation and Recombination, Quasi-Fermi Energy levels. The p-n junction: basic structure of the p-n junction, zero applied bias, reverse applied bias, junction breakdown, p-n junction current, generation and recombination currents, metal semiconductor junctions.

Unit II: Semiconductor Devices and IC Fabrication Technology (18)

BJT: bipolar transistor action, Eber-Moll model, hybrid – pi model, non-ideal effects. FETs: JFET and MESFET concepts, characteristics and small signal equivalent circuit. MOSFETs: MOS and MOSFET structure, capacitance-voltage characteristics and small signal equivalent circuit. LEDs: internal and external quantum efficiency. LASER diodes: stimulated emission and population inversion, optical cavity, threshold current, device structure and characteristics. Optical absorption: solar cell, photodetector, photodiode, PIN photodiode, avalanche photodiode, phototransistor, photoluminescence and electroluminescence.

IC Fabrication Technology: crystal growth, epitaxy, oxidation, lithography, doping, etching, isolation methods, metallization and bonding. Thin film deposition and characterization Techniques: XRD, TEM, SEM, EDX, Thin film active and passive devices. MOS technology and VLSI.

Suggested Readings:

1. Semiconductor Device fundamentals – Robert F. Pierret, Pearson Education.
2. Semiconductor Physics and Devices Basic Principles - Donald A. Neamen. Tata McGraw -Hill Edition.
3. Solid State Electronics Devices - Streetman PHI.
4. Physics of Semiconductor Devices - John Wiley.
5. Integrated circuits - K. R. Botkar, Khanna publishers.

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Faculty of Science and Technology

Semester – IV	**Paper – IV**
Course Code: MSC-ES 414 P	**Title of the Course: Practical Course - XII**
Credits: 2	**Total Lectures: 60 Hrs.** (12 practicals)

Course Outcomes:

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

a. Design, develop and implement different controller modes.
b. Design and develop PLC based control system.
c. Set up and implement robotic and mechatronic systems.

Detailed Syllabus:

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

Practicals based on Control Systems (Any 5)

1. Signal conditioning circuits for analog controller.
2. Design and implement the ON-OFF controller.
3. Design and implement the proportional controller.
4. Design and implement the integral / derivative controller.
5. Simulation of the PI / PD / PID controller using MATLAB.
6. Stability analysis using bode plot using MATLAB.
7. Stability analysis using root locus using MATLAB.
8. Stability analysis using Nyquist plot using MATLAB.
9. Simulate the event sequence for operation of washing machine using PLC.
10. Simulate the event sequence for coffee vending machine using PLC.
11. Design and implement conveyer belt control / temperature control system using PLC.
12. Design and implement car parking system / traffic light control using PLC.

Practicals based on Robotics and Mechatronics (Any 5)

1. Study of DC Servo motor.

2. Study of PMDC motor, its speed control.
3. Study of BLDC motor, its speed control/position control.
4. Study of AC servo motor, its speed control/position control.
5. Implementation of velocity profile of servo control.
6. Study of different components of Robots
   a) Study of controller (Microcontroller/Arduino/Any other)
   b) Study of motor driver circuits
   c) Step wise movement of Servo motor
   d) Rotation of DC motor in Clockwise and Anticlockwise direction
7. Study of Gear and Gear Ratios / Gear Train.
8. Study of distance measurement using ultrasonic sensor.
9. Positioning and orientation of Robot arm.
10. Design, built and program Robot for wireless control.

Activity:

1. Perform simulation of any 1 experiment (Give preference to not performed experiments) 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 – IV	**Paper – V**
Course Code: MSC-ES 415 Pr	**Title of the Course: Project Course – II**
Credits: 4	**Total Lectures: 120 Hrs.**

Course Outcomes (COs):

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

a. Apply the knowledge for design and development of the selected project.
b. Use different software and hardware for testing, validation and verification of circuits for successful outcome of project.
c. Expose themselves to the responsibilities and ethics in industrial environment.
d. Write Technical reports / research projects.

Guidelines for Project Course - II:

This Course should be conducted using following guidelines:

a) Project topic having weightage of 120 hours should be selected for this course.
b) The project experiment should be open ended.
c) It may be based on any topics of the syllabus.
d) There should be internal continuous assessment of project work in the form of seminars / presentation and continuous monitoring of work.
e) After completion of project, student has to submit the project report in the following format.
    i. Title of Project
    ii. Aim and objectives of project.
    iii. Literature or Reference work.
    iv. Block diagram / Circuit diagram and its explanation in brief.
    v. Design and development of hardware part of the project.
    vi. Design and development of software part of the project.
    vii. Experimental work performed.

viii. Results, discussion and conclusion.
ix. Applications
x. Future Scope
xi. References

f) There must be observations, interpretations, conclusions, results of the project work.
g) Algorithm / flowchart, program strategy, module wise description of parts etc. be provided in case of projects related with programming.
h) Applications, usefulness, student's contribution must be clearly specified.
i) Further extension work may be suggested for better outcome of the project.
j) The presentation should be given by the student related to whatever work performed during project.
k) Demonstration of the model developed during project work should be included.

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Semester – IV	**Paper – VI**
Course Code: MSC-ES 416 T (A)	**Title of the Course: Wireless Sensor Network (WSN)**
Credits: 2	**Total Lectures: 30 Hrs.**

Course Outcomes (COs):

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

a. Understand design constraints and architecture of WSN.
b. Understand architecture of sensor node.
c. Comprehend different wireless networking protocols.
d. Compare existing platforms and simulation tools.

Detailed Syllabus:

Unit I: Overview and Architecture Considerations of WSN (16)

Definition and background, challenges and constraints, Applications of WSN: home control, industrial automation and medical applications. Radio technology primer: propagation and propagation impairments, modulation, ISM band, specifications of WSN devices. Single-Node Architecture: hardware components, energy consumption of sensor nodes, operating systems. Network Architecture: sensor network scenarios, optimization goals and figures of merit, gateway concepts.

Unit II: Networking Sensors, Existing Platforms and Tools (14)

Physical layer and transceiver design considerations, introduction to protocols, overview of communication protocols for sensor networks, wireless networking protocols (IEEE 802.11, 802.15.1, 802.15.4, 802.16, MAC). Network Layer: Routing metrics, flooding and gossiping, proactive and reactive routing. Introduction to the RF modules, architecture of the Zigbee module, Topology Control, Clustering. Hardware platforms: Berkeley motes or equivalent, programming challenges. Introduction to Simulators: NS2 and TOSSIM.

Suggested Readings:

1. Fundamentals of wireless sensor networks: theory and practice - Dargie W, Poellabauer C., John Wiley and Sons.
2. Wireless Sensor Networks - Feng Zhao, Leonidas Guibas, Elsevier publications.
3. Wireless Sensor Networks Technology: Protocols and Applications - Kazem Sohraby, Daniel Minoli and Taieb Znati, John Wiley and Sons.
4. Protocols and Architectures for Wireless Sensor Networks - Holger Karl, Andreas Willig, John Wiley and Sons, Ltd.
5. Principle of Wireless network: A unified approach - Kaveh Pahlavan and Prashant Krishnamurthy, Prentice Hall.
6. Wireless sensor networks - Akyildiz IF, Vuran MC, John Wiley and Sons.

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Semester – IV	**Paper – VI**
Course Code: MSC-ES 416 T (B)	**Title of the Course: Computational Methods for Electronics (CME)**
Credits: 2	**Total Lectures: 30 Hrs.**

Course Outcomes (COs):

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

a. Analyze different statistical parameters.
b. Apply various numerical methods and appreciate a trade off in using them.
c. Distinguish between Numerical and Analytical methods along with their merits and demerits.

Detailed Syllabus:

Unit I: Statistical Techniques and Matrices (12)

Statistical parameter: types of errors, significant figures, data types. Measures of central tendency: mean, mode, median, variance. Concept of probability. Probability distribution functions: Gaussian, Poisson and binomial. Solving linear equations AX + B = C, LU factorization, Gauss Seidal method, Gauss elimination method, inverse of a matrix. Applications of matrices in electronic circuit analysis.

Unit II: Numerical Methods (18)

Roots of an algebraic equation: bisection method, Newton-Raphson Method, secant method, applications to stability of control system, interpolation, finite differences, Newton Forward difference and backward difference formulae, Lagrange's interpolation. Curve fitting techniques: linear regression, cubic spline, exponential curve fitting, polynomial curve fitting, application to smoothen the data by reduction in noise, linearization of electrical systems. Solution of ordinary and partial differential equations, two dimensional Laplace equation, Poisson equation, application to diode, wave equation. Integration: Trapezoidal and Simpson's 1/3rd and 3/8th rules, R-K method.

Suggested Readings:

1. Computer Oriented Numerical Methods - V. Rajaraman, PHI Learning.
2. Introductory Methods of Numerical Analysis - S. S. Shastry, Prentice Hall of India.
3. Numerical Recipes in C, The art of Scientific Computing - William H.P, S.A. Teukolsky, Cambridge University Press.
4. Getting Started with MATLAB: A Quick introduction for Scientists and Engineers - Rudra Pratap, Oxford University Press.
5. MATLAB and Introduction with applications - Amos Gilat, Wiley Student edition.

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Semester – IV	**Paper – VII**
Course Code: MSC-ES 417 P (A)	**Title of the Course: Practical Course – XIII**
Credits: 2	**Total Lectures: 60 Hrs.** (12 practicals)

Course Outcomes (COs):

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

a. Understand the characteristics of different semiconductor devices.
b. Determine the properties of semiconductor.
c. Understand point to point and multipoint communication using XBee.
d. Use XCTU software for study of range test experiments.

Detailed Syllabus:

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

Practicals based on Semiconductor Devices and Technology (Any 5)

A) Group – A Practicals (Any 3):

1. To determine the energy bandgap of semiconductor material.
2. To study the characteristics of solar cell.
3. To study the Hall Effect and determine the Hall Voltage and Hall coefficients for the given sample of a semiconductor.
4. Study the characteristics of LED and LASER diode.
5. Conductivity measurement of semiconductor material.
6. To determine absorption coefficient.

B) Group – B Practicals (Any 2):

1. To determine average crystalline size using XRD data.
2. To determine average grain size by SEM.
3. To determine atomic percentile of elements using EDAX technique.
4. Determination and visualization of Fermi level.

5. Evaluation of drift diffusion equation.

Practical's based on Wireless Sensor Network (WSN) (Any 5):

1. Range test experiment using XBee.
2. Study of Wireless Propagation.
3. Home automation- related experiments.
4. Health care- related experiments.
5. Study of effect of various low power modes of Microcontrollers on battery life.
6. Sensor Data Acquisition.
7. Simulation study of WSN to plan a network for given area and given range with various deployment strategies (Random, Cartesian, Radial, Hexagonal).
8. Simulate a three nodes network with duplex links between them. Set the queue size and vary the bandwidth and find the number of packets dropped.
9. Simulation study of point to point communication using NS-2.
10. Simulation study of Network Topologies - Star, Bus, Ring using NS-2.
11. Evaluate the performance of Wireless Sensor Network.
12. Evaluate the performance of AODV and DSDV Routing protocols.

Activity (Any 1):

1. Perform simulation of any 1 experiment (Give preference to not performed experiments) mentioned in the above list using any simulation software and write a report (equivalent to 2 experiments).
2. Perform any one of the following activity and write report.
   - 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 – IV	**Paper – VII**
Course Code: MSC-ES 417 P (B)	**Title of the Course: Practical Course – XIII**
Credits: 2	**Total Lectures: 60 Hrs.** (12 practicals)

Course Outcomes (COs):

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

a. Understand the characteristics of different semiconductor devices.
b. Determine the properties of semiconductor.
c. Apply various numerical methods to solve linear equations.
d. Able to write program to solve different mathematical problems in electronics.

Detailed Syllabus:

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

Practicals based on Semiconductor Devices and Technology (Any 5)

A) Group – A Practicals (Any 3):

1. To determine the energy bandgap of semiconductor material.
2. To study the characteristics of solar cell.
3. To study the Hall Effect and determine the Hall Voltage and Hall coefficients for the given sample of a semiconductor.
4. Study the characteristics of LED and LASER diode.
5. Conductivity measurement of semiconductor material.
6. To determine absorption coefficient.

B) Group – B Practicals (Any 2):

1. To determine average crystalline size using XRD data.
2. To determine average grain size by SEM.
3. To determine atomic percentile of elements using EDAX technique.
4. Determination and visualization of Fermi level.
5. Evaluation of drift diffusion equation.

Practical's based on Computational Methods for Electronics (CME) (Any 5):

Use of C/MATLAB/Mathematica/ Maple/Maxima/Scilab or any other Software for developing the programs for following:

1. Study of basic matrix operations
2. Program to solve linear equation
3. Program for finding roots of f(x)=0 by newton Raphson method
4. Program for finding roots of f(x)=0 by bisection method
5. Program to solve the system of linear equations using gauss - elimination method.
6. Program to solve the system of linear equations using gauss-seidal iteration method.
7. Program for solving numerical integration by Simpson's 1/3 rule
8. Program for solving numerical integration by Simpson's 3/8 rule
9. Program for solving ordinary differential equation by Runge Kutta method
10. Find the lagrange's polynomial.
11. Curve Fitting by Least – Square Approximations
12. To Find the Numerical Solution of Laplace Equation
13. To Integrate Numerically using Trapezoidal Rule.
14. Program to solve non-linear equation.
15. To implement Newton's Backward Interpolation formula.

Activity (Any 1):

1. Perform simulation of any 1 experiment (Give preference to not performed experiments) mentioned in the above list using any simulation software and write a report (equivalent to 2 experiments).
2. Perform any one of the following activity and write report.
   - 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 – IV	**Paper – VIII**
Course Code: MSC-ES 418 T	**Title of the Course: Technical Writing**
Credits: 2	**Total Lectures: 30 Hrs.**

Course Outcomes (COs):

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

a. Write documents that are accessible and reader-centered.
b. Produce professional caliber technical documents.
c. Utilize the technical writing for the purposes of technical communication and its exposure in various dimension.
d. Prepare documents for in-depth understanding of applications and promote their technical skill.

Unit I: Forms of Technical Writing **(15)**

Technical writing: definition, sentences, paragraph. Technical style: types, methods. Technical report: definition and importance. Seminar and conference paper writing. Key-Note speech: introduction and summarization. Expert technical lecture: theme clarity, analysis and findings. Synopsis writing: structure and methods. Technical research paper writing: style, format, methods. Review of research paper/book. Technical research publications: impact factor, citation, h-index, i10-index, Scopus index, plagiarism. Thesis/Project writing: structure and importance. Business writing. 7 Cs of effective business writing: concreteness, completeness, clarity, conciseness, courtesy, correctness and consideration.

Unit II: Technical Communication Skills **(15)**

Interview skills. Group discussion: objective and method. Speaking skills: audience-awareness, voice, combating nervousness. Seminar/Conferences presentation skills: focus, content style, oral and poster presentation. Argumentation skills: critical thinking, exposition narration and description. Effective business communication skill. Discourse competence:

combination of expression and conclusion. Socio-linguistic competence. Strategic competence: solution of communication problems with verbal and non-verbal means.

Suggested Readings:

1. A Text Book of Scientific and Technical Writing - S.D. Sharma; Vikas Publication, Delhi.
2. Modern Technical Writing - Sherman, Theodore A (et.al); Apprentice Hall; New Jersey; U.S.
3. Business Correspondence and Report Writing - Prof. R. C. Sharma and Krishna Mohan, Tata McGraw Hill and Co. Ltd.
4. Research Methodology: Methods and Techniques - C.R. Kothari, Gaurav Garg, New Age International Publishers.
5. Technical Communication – Principles and Practices - Meenakshi Raman and Sangeeta Sharma, Oxford Univ. Press.