PUNYASHLOK AHILYADEVI HOLKAR

SOLAPUR UNIVERSITY, SOLAPUR

NAAC Accredited-2022 'B++' Grade (CGPA 2.96)

M.Sc.- I Electronics Science

Syllabus as per NEP-2020

(w.e.f. June 2023-24)

Punyashlok Ahilyadevi Holkar Solapur University, Solapur
M.Sc.I Electronics Science

Based on NEP-2020
(w.e.f. June 2023 - 24)

1. **Title of the Course :** M.Sc.- Electronics Science

2. **Introduction:**

Master of Science (M.Sc.) in Electronics Science is a program running at Post Graduate School Of Physical Sciences, PAH Solapur University , Solapur from June 2023 and disseminating knowledge of the subject from fundamental concepts to State-of- technologies. With the view to provide exposure to the recent technologies of various sectors of the Electronics and to empower the students to make them competent for industrial needs, R & D sectors and self employment as well the curriculum is framed. Indeed, the curriculum compasses knowledge of Electronics system design, Embedded System, VLSI, Communication Electronics and IoT Programming Languages. Therefore, the student can realize the state - of art of the technological designing and development. The Choice Based Credit System (CBCS) is implemented for this course. Objectives of the course:

3. **Advantages of the Course:**

Electronics is the subject, which ensures wide application potential in diverse sectors. Along with the basic sciences, it bears the knowledge of technology as well. Therefore, it depicts the tremendous opportunities in the electronic industrial sectors. It ensures well confluence of Science and Technology. Therefore, the course helps to achieve all round development. Moreover, the students can also opt for education field for their career.

4. **Eligibility of the Course:**
   1. B.Sc. with Electronics subject at Principal / Interdisciplinary /Allied / Applied / Subsidiary Level.
   2. B.Sc. Physics ,Computer Science or Any Relevant Subject with Electronics subjectat subsidiary Level.
   3. B.C.S. or B.Sc (ECS)
   4. B.E (Electronics) & B.E(E&TC)
5. **Duration:** 2 Years– 4 Semesters

6. The Choice Based Credit System(CBCS):

A Choice based credit system (CBCS) is implemented for this course. According to this system, choice is given to the students. The Course has compulsory three Discipline Specific Course (DSC) Theory papers and three Discipline Specific Elective (DSE) Theory papers for Semester-I and Semester-II respectively. Thus Paper DSC- I, II, III, IV,V ,VI are compulsory. Moreover, choice is given to the students to select One paper from DSE at each Semester.

7. The Credit and Grading System (CGPA):

Credit is a numerical value that indicates student's work load (lectures , lab work , seminars, tutorial, field work, etc.) to complete a course unit. In most of the universities 15 contact hours constitute one credit. As per the present norms there are 4 contact hours per paper per subject per week, which works out to be 60 contact hours per paper per subject per semester or 120 contact hours in annual pattern. By converting these contact hours into credit at the rate of 15 contact hours for one credit, there will be 04 credits per paper per subject per semester and 08 credits in annual pattern. There are five papers at M.Sc. I level. The M.Sc. I student must complete minimum of 22 credits (maximum 44 credit points) in each semester.

A) Conversion of marks in to Grades :A table for the conversion of the marks obtained by a student in each paper (out of 100) to grade and grade points is given below.

Sr.No	Range of Marks	Grade	Grade Point
1.	80-100	O	10
2.	70-79	A+	9
3.	60-69	A	8
4.	55-59	B+	7
5.	50-54	B	6
6.	45-49	C+	5
7.	40-44	C	4
8.	<39	FC	0(Failed in Term Exam)
9.	<39	FR	0(Failed in Internal Assessment)

1. Grade Point Average at the end of the Semester (SGPA)

$$SGPA=\frac{(G_1xC_1)+(G_2xC_2)+\ldots\ldots}{\Sigma Ci}$$

(ΣCi-The total number of credits offered by the student during a semester Cumulative Grade Point Average (CGPA)

$$\text{...CGPA} = \frac{(G_1 x C_1)+(G_2 x C_2)+\ldots\ldots}{\Sigma Ci}$$

(ΣCi -the total number of credits offered by the student upto andincluding the semester for which CGPA is calculated.)

2. Final Grade Point Average (FGPA) will be calculated in the similar mannerfor the total number of credits offered for completion of the said course.
   Where: Ci: Credits allocated for the course
   Gi: Grade point scored paper

B) Scheme of Evaluation: The candidate has to appear for Internal Evaluation of 20/10 marks and External Evaluation (University Exam) for 80/40 marks for each paper/practical. The nature of internal evaluation will be decided by the Post Graduate Department of Electronics. The internal evaluation comprises unit tests , tutorials ,seminars ,Group discussion, oral, etc., which ensures a process of continuousassessment.

C) Nature of Question Papers: The nature of question paper shall be as per time to time prescribed by the university authorities. The complete question paper has objective type questions, short answer type questions and long answer type questions.

D) Passing Standard: The student has to secure a minimum of 4.0 grade points (Grade C) in each paper A student who secures less than 4.0 grade point (39% or less marks, Grade FC/FR) will be declared fail in that paper (subject) and shall be required to reappear for respective paper. A student who failed in Term End Examination (Theory) & passed in Internal assessment of a paper (subject) shall be given FC Grade. Such student will have to appear for Term End Examination only. A student who fails in Internal assessment and passed in Term End examination (Theory) shall be given FR Grade. Such student will have to appear for Term End examination as well as internal assessment. In case of year down candidates from the mark scheme the candidates shall appear for the same 80 marks paper of the external examination and his performances Shall be scaled to 100 marks.

E) ATKT: A student who fails in one fourth (25%) or less papers of the total papers offered in the 1stand2ndsemester will be allowed for admission to second year (Sem. III-IV).

8) Structure of the Course:

The Course Structure of M.Sc. Electronics is as depicted in the table. It is integrated course of 2 years i.e. 4 semesters. For, M. Sc. I, semester I has Two compulsory theory papers 4 credits each , One Elective paper of 4 credits & Three Practical of DSC 2 Credits each & 4 Credits for RM Paper . For, M. Sc. I, semester II has Two compulsory theory papers , One Elective papers of 4 credits each & Three Practical of DSC 2 Credits each & 4 Credits for OJT Paper .

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Faculty of Science and Technology

Proposed structure for Two Year PG Program Degree

M.Sc. (Electronics Science)

M.Sc. I Electronics Science

Level/ Difficulty	Sem.	Major		RM	FP/RP/OJT/ Internship/ Apprenticeship	edits	Cumulative Credits
		Mandatory	Elective				
6.0/400	I	**DSC1-1 (4+2)** Electronic System Design **DSC 1-2 (4+2)** Microcontroller & Interfacing	**DSE 1-1 (4+2)** 1. Signals & Systems 2.Digital Electronics & Verilog HDL 3. Network Analysis & Synthesis	**Research Methodology (4)**	---	22	44 PG Diploma in Discipline
	II	**DSC 1-3(4+2)** Control System **DSC 1-4 (4+2)** Mechatronics	**DSE 1-2 (4+2)** 1. Digital Signal Processing **Cellular Data Communication** 2. **Advanced Microcontrollers and protocols** 3. Advanced Power Electronics	---	**OJT/In-house Project/ Internship/ Apprenticeship(4)**	22	
	Total 1 Yrs	**24**	**12**	**04**	**04**	**44**	
Exit option: Award of UG degree in Major with 132 Credits OR Continue with Major							

Abbreviations: DSC: Discipline Specific Core, DSE: Discipline Specific Elective, RM: Research Methodology, OJT: On job training internship/Apprenticeship, FP: Field project

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

M.Sc. Electronics Science

Choice Based Credit System (CBCS)

Course Structure (NEP-2020)

M.Sc. Part- I Electronics Science w.e.f. 2023-24

M.Sc. Electronics Science semester -I												
PaperCode	Title of the Paper	Credits	Contact hours/week			ribution of Marks forExamination					
			Th (L)	Pr	Total	Internal		External		Total	
						Th	Pr	Th	Pr	Th	Pr
DSC-1	Electronic System Design	4	4	---	4	20	---	80	---	100	---
DSC-2	Microcontroller & Interfacing	4	4	---	4	20	---	80	---	100	---
DSE-1	1. Signals & Systems 2. Digital Electronics & Verilog HDL 3. Network Analysis & Synthesis	4	4	---	4	20	---	80	---	100	---
RM	Research Methodology	4	4	---	4	20	---	80	---	100	---
Lab-1	Practical-1: (Based on DSC-1)	2	---	4	4	---	10	---	40	---	50
Lab-2	Practical-2:(Based on DSC-2)	2	---	4	4	---	10	---	40	---	50
Lab-3	Practical-3:(Based on DSE-1)	2	---	4	4	---	10	---	40	---	50
Total for Semester-I		**22**	**16**	**12**	**28**	**80**	**30**	**320**	**120**	**400**	**150**
M.Sc. Electronics Science , Semester –II												
Code	Title of the Paper	Credits	ntact hours /week			ribution of Marks forExamination					
			Th (L)	Pr	Total	Internal		External		Total	
						Th	Pr	Th	Pr	Th	Pr
DSC-3	Control System	4	4	---	4	20	---	80	---	100	---
DSC-4	Mechatronics	4	4	---	4	20	---	80	---	100	---
DSE-2	1. Digital Signal Processing 2. Advanced Microcontrollers and protocols 3. Advanced Power Electronics	4	4		4	20	---	80	---	100	---
OJT/FP	OJT/FP	4	---	8	8	---	20	---	80	---	100
Lab-1	Practical-1: (Based on DSC-3)	2	---	4	4	---	10	---	40	---	50
Lab-2	Practical-2:(Based on DSC-4)	2	---	4	4	---	10	---	40	---	50
Lab-3	Practical-3(Based on DSE-2)	2	---	4	4	--	10	---	40	---	50
Total for Semester-II		**22**	**16**	**12**	**28**	**80**	**30**	**320**	**120**	**400**	**150**

DSC: Discipline Specific Course, **DSE:** Discipline Specific Elective, **FP**: Field projects **OJT:** On Job Training: Internship/ Apprenticeship, **RM:** Research Methodology, **RP:** Research Project

DSC-1: Electronic System Design

Unit I **15**

Introduction: Units and standards of measurement, functional elements of Measurement system, static and dynamic characteristics or performance characteristics of transducer, Measurement and calibration systems- Requirement.

Working principle of Resistance type, Capacitance type, inductive, and displacement transducer.Working principle of level transducers, pressure transducers and flow transducers.

Working principle of Thermometers, Resistance temperature detector (RTD), Thermistors, Thermocouples, and Pyrometers. pH measurement, Conductivity measurement, ORP (Oxidation reduction Potential) Measurement, Humidity measurement and Intelligent Sensors.

Unit I **15**

Zener series and shunt regulators, transistors as series and shunt regulators, regulator design with discrete components and IC 741/78xx, current sources and their design with discrete components and ICs, SMPS design.Design of multivibrators, (AMV, MMV) using ICs (555, 741), schimitt trigger, triangular waveform generator, design of oscillators using 741,

Unit III **15**

CMOS-TTL and TTL-CMOS interfaces, design of counter using FF and counter ICs, Oscillator design using Schmitt trigger (7414), inverter and NAND gate, MMV using gates and ICs (74/54121, 74221), design of binary to gray code converter, design of full adder using MUX, design of 16-1 using 4 4-1 MUXs, design of parity checker.

Unit IV: **15**

Need for signal conditioning, Current and Voltage standards.

Signal conditioning for Resistive sensors: RTD, Thermister, load cell, potentiometricsensors.

Signal conditioning for capacitive sensors: Level sensor, displacement sensor,proximity detector, humidity sensor, differential pressure cell.

Signal conditioning for inductive sensors: Displacement transducer (LVDT/RVDT), Design of capacitance and inductance meter, design of DVM using 7107, design of frequency synthesizer, design of digital multimeter.

Reference Books:

1. E. O. Doebelin, ―Measurement System Application and Design‖,McGraw-hill International, 5th Edition, 2007.
2. D. Patranabis, ―Principles of Industrial Instrumentation‖, Tata McGraw-Hill, 3rd Edition, 2010.
3. R.K.Jain, ―Mechanical and Industrial Measurement‖, KhannaPublications, 9th print 2013.
4. C. D. Johnson, ―Process Control Instrumentation Technology‖, Prentice-Hall of India, 8th Edition, 2009.
5. Sawhney A. K., "A Course in Electrical And Electronics Measurementsand Instrumentation", Dhanpat Rai & Sons, 11th Edition, 2005.
6. D. V. S. Murthy, ―Transducers and Instrumentation‖, Prentice-Hall ofIndia, 2nd Edition, 2010.

DSC-2 Microcontrollers and Interfacing

UNIT I: Introduction PIC16F877A **15**

Salient Features of PIC16F877A, Internal architecture, Oscillator and clock, Reset Options, Special function registers, Introduction to Instruction set, Input/output pins, Ports, Counters, Timers, Capture-Compare Modules, On chip UART, On-chip ADCs configuration.

UNIT II: Introduction AVR32 Microcontroller **18**

Introduction, Architecture, Features, Pin configuration, General purpose Register, Memory Organization, Status register (SREG), Stack Pointer, Program Counter, Timers (timer block diagram), Interrupts, PWM, Output Compare Mode, Fast PWM Mode, CTC Mode, Analog Comparator, Instruction set.

UNIT III: Software Development Tools for PIC and AVR **12**

Introduction to MPLab-X IDE and ATMEL Studio IDE, Components of IDE, Structure of assembly language, Brief description to Editor, Debugger, Assembler, Simulator,

UNIT IV: Programming and Interfacing PIC16F877A **15**

Push-Button, LCD, LED's, Relay, 7-Segment, DC-motor, Servo-Motor, Matrix Keyboard, Opto-coupler, (Embedded C Programming expected)

LM35, Thermister, Thermocouple (with AD595), LDR, Humidity (HY-HS220), Current sensor, Tachogenerator (Embedded C Programming expected)

Reference Books:

1. Design with PIC microcontroller By J B Peatman, Pearson education
2. Intel Handbook on 8 Bit and 16 bit embedded controllers
3. PIC microchip Midrange MCU family reference manual.
4. Microcontrollers theory and Applications"-By Ajay Deshmukh-TATA McGraw Hill
5. https://ww1.microchip.com/downloads/en/devicedoc/39582b.pdf
6. https://ww1.microchip.com/downloads/en/DeviceDoc/Atmel-7810-Automotive-Microcontrollers-ATmega328P_Datasheet.pdf

DSE 1.1: Signal & Systems

Unit – 1 **15**

Introduction: Signal, system, importance of signals and system, continuous time and discrete time signals, transformation of the independent variable, exponential and sinusoidal signals, unit impulse and unit step functions, continuous time and discrete time system, basic system properties and classification of continues and discrete time signals, Mathematical operations on continues and discrete time signals (Scaling, folding, time shifting, addition, multiplication, differentiation and integration, even and odd signals)

Unit – 2 **15**

Impulse signal, Liner time Invariant system for continuous time domain signal (response of LTI continuous time system in time domain, convolution of continuous time signal), Liner time Invariant system for discrete time domain signal (response of LTI discrete time system in time domain, linear convolution)

Unit- 3 **15**

Laplace transform : Introduction, region of convergence, properties and thermos of Laplace transform, poles and zeros of rational function s, inverse Laplace, analysis of LTI continuoustime system using Laplace transform.

Unit- 4 **15**

Fourier series and Fourier Transform of discrete time signals: introduction, Fourier series ofdiscrete time signals, , Fourier transform of discrete time signals, properties of discrete time Fourier transform, discrete time Fourier transform of periodic discrete time signals , analysis of LTI discrete time signal using discrete time Fourier transform.

References:

1. Signals and Systems by Alan V. Oppenhem, PHI
2. Signals and Systems by A NagoorKani, Tata McGraw Hill

DSE 1.2 : Digital Electronics and Verilog HDL

Unit – 1 **(18)**

Combinational and Sequential Logic Designs: Combinational Logic Designs: Multiplexer, Demultiplexer, Encoder, Decoder, Arithmetic and Logic circuits, adder- Half adder, Full adder, carry look ahead adder, n- bit adder, BCD adder, Full subs tractor, binary multiplication and division, floating and fixed-point arithmetic, Comparison circuits, comparator, 4 - bit comparator, parity generator/checker, ALU design (Design of all is expected).

Sequential Logic Designs: Design of ripple counter, ring counter, synchronous counter, Johnson's counter. Up - down counter, Shift registers, bi – directed shift register, Universal Shift resister.

Unit – 2 (**12)**

Synchronous Sequence Machines: State diagram, State reduction, State assignment, implementation using flip flop. Finites state machines, Control Unit design

Unit – 3 (**16)**

PLD's and Architecture of commercial devices: Detail architecture, study of PROM, Simple PLD, PAL, PLA, Digital System design using PLD's, CPLD, FPGA, Xilinx XC95xx CPLDs.

Unit – 4 **(14)**

Verilog Programming and model for combinational and sequential logic: Introduction to Verilog HDL, Lexical Conventions, Ports and Modules, Operators, Gate Level Modeling, SystemTasks & Compiler Directives, Test Bench, Data Flow Modeling, Behavioral level Modeling, Tasks & Functions.

Verilog model for combination Logic: Verilog Programming Examples-basic gates, 4 – bitbinary adder, Multiplexer, Comparator, encoders, decoders.

Verilog Model for Sequential Logic: Flip – Flops, Latches, counters, Shift Register, State Machine.

Text Books:

1. Fundamentals of Digital logic Design with Verilog HDL – Brown, Vranesic – SiE (2^{nd}edition).
   Verilog HDL: A Guide to Digital Design and Synthesis, Samir Palnitkar, Prentice Hall, SecondEdition, 2003.

DSE 1.3: Network Analysis and Synthesis

Unit - 1 **[15]**

Introduction: Kirchhoff's laws: Node voltage analysis and mesh voltage analysis, network solutions using first order differential equation, initial conditions in networks .**Analysis of networks using Laplace transformation:** Basic theorems of Laplace transformation ,examples of solutions of networks using Laplace transformation. Transforms of signal waveform : the shifted unit step function, the ramp and impulse functions. Waveform synthesis, the initial and final value theorems, convolution integral, convolution as summation.

Impedance functions and network theorems: Concept of complex frequency, transform impedance and transform circuits, series and parallel combinations of elements, superposition and reciprocity, Thevenin's, Norton's, maximum power transfer and Tellegen's theorem.

Unit – 2 **[15]**

Two–port parameters: Analysis of Networks using Laplace transformation, Relationship of two-port variable, the open circuit impedance parameters, short- circuit admittance parameters, transmission parameters, inverse transmission parameters, the hybrid parameters, inverse hybrid parameters, relationshipsbetween parameter sets, series, parallel and cascade connection of two-port networks.

Unit -3 **[15]**

Resonance: Series resonance, impedance and phase angle of series resonant circuit, voltage and current in series resonant circuit. Effect of resistance on frequency response curve, bandwidth, selectivity and quality factor. Significance of Quality factor. Parallel resonant circuit(Tank circuit), resonant frequency, variation of impedance with frequency, reactance curves, numerical problems based on above.

Unit – 4 **[15]**

Network synthesis: Introduction, scaling network functions, positive real functions, Hurwitz polynomials, driving point synthesis with LC elements, elementary synthesis operations, synthesis of dissipative networks- 2 terminal RC and RL networks (Foster and Cauer forms), properties of RL and RC network functions.

References:

1. Network Analysis: Van Valkenburg, PHI, 2003
2. Network Analysis and Synthesis: Bakshi A V, Bakshi U A, TechnicalPublications, 2009.
3. Electric circuits: Joseph Edminister, Schaum's series-McGraw Hill.
4. Network analysis and synthesis: Franklin F Kuo, John Wiley and sons, 2ndedition.
5. Networks and systems: Roy Choudhury D, New Age International, 2004.

M.Sc-I, SEM- I, Electronics Science

RM: Research Methodology in Electronics Science

4 Credits, Marks 100 (80 UA + 20 CA)

Learning / Course Objectives: At the end of this course a candidate will be able to –

1. Understand the psychology of research which includes different perspectives and necessity of research.
2. Analyze the research outcome by using suitable statistical tool.
3. Understand various research methodology for growth of nanomaterials
4. Understand various microscopy techniques

Unit-I – Introduction to Research (15)

Scientific Research- Meaning and importance of Research – Types of Research, Selection and formulation of Research Problem – Research Design Motivation and objectives.

Defining and formulating the research problem - Selecting the problem - Necessity of defining the problem.

Importance of literature review in defining a problem – Literature review – Primary and secondary sources – reviews, treatise, monographs-patents – web as a source – searching the web Critical literature review – Identifying gap areas from literature review.

Research methods vs Methodology- Types of research – Descriptive vs. Analytical, Applied vs Fundamental, Quantitative vs. Qualitative, Conceptual vs Empirical, development of working hypothesis.

Unit-II– Research Methodology in Electronics (15)

Overview of research methodology in Electronics, Scientific problem formulation & solving.

Execution of the research, Observation and Collection of data, Data interpretation and analysis, Precision and accuracy, Error analysis, Diagrammatic & graphical presentation of data, sampling methods, tools & software, Data Processing and analysis strategies, data analysis with statistical tools.

Unit-III – Research Skills (15)

Writing research paper and/or thesis, making a presentation, writing a research proposal and patents in science and technology, effective verbal communication field data collection, safety in field.

Unit-IV- Case Studies

Case study for identified research

Reference Books:

1. An introduction to Research Methodology; Garg B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., 2002., RBSA Publishers.

2. Research Methodology: Methods and Techniques, Kothari C.R., 1990. New Age International.

3. Research Methodology; Sinha S.C. and Dhiman, A.K., 2002. Ess Publications. 2 volumes.

4. Research Methods: the concise knowledge base; Trochim W.M.K., 2005. Atomic Dog Publishing. 270p.

5. Research Methodology; Panneerselvam R., PHI, Learning Pvt. Ltd., New Delhi - 2009 6. Research Methodology: Concepts and cases, Chawala D. and N. Sondhi ;Vikas Publishing House Pvt. Ltd.

6. Introduction to Nanoscience and Nanotechnology, K.K. Chattopadhyay, A.N. Banerjee, PHI, Publisher

DSC 4: Control Systems

Unit 1: Introduction [15]

Basic Concepts of Control System, Open loop and Closed loop systems, Classifications, effect of feedbacks on Control System performance, Transfer function, modeling and representation of Control system, concept of pole and zero, Linear mathematical physical systems, Electrical analogy, Block reduction techniques, Signal flow graph, Mason's gain formula

Unit 2: Time Domain Analysis and stability [15]

Type and Order of Control system, Time Response of first and second order systems to unit stepinput. Steady state errors, Time Domain Specifications of Second Order System, Concept ofStability: absolute, relative and marginal, nature of system response, stability analysis usingHurwitz's criterion, Routh's criterion, Basic properties of Root Loci, construction of Root loci.Angle and magnitude condition for stable systems, concept of inverse root locus and root contour

Unit 3: Frequency Domain and State Variable Analysis [15]

Steady state response of a system to sinusoidal input, Relation between time and frequency response for second order systems, Frequency response specifications, Stability Analysis withBode Plots, Introduction to state space analysis, State space representation for i) ElectricalNetwork ii) nth order differential equation iii) Transfer function, State model from transferfunction using: Direct, parallel, cascade, decomposition methods

Unit 4: Control system components and controllers (only theoretical treatments) [15]

Modeling and transfer function of control system components- Potentiometer, DC and ACServomotors, gear trains, tacho-generators. Design concepts of ON-OFF, P, PI, PD, PIDcontrollers, Compensator Networks-lag and lead.

Reference Books:

1. I.J. Nagrath, M.Gopal "Control Systems Engineering", 5th Edition, New Age International Publication

2. Ogata Katsuhiko, "Modern Control Engineering", 4th Edition, PHI.

3. Kuo B.C. Automatic Control System, PHI, New Delhi

4. Schaum's Series book "Feedback Control Systems"

5. Les Fenical "Control Systems", 1st Edition, Cengage Learning India.

6. Norman S. Nise "Control Systems Engineering", 4th edition, Wiley

7. Samarjeet Ghosh, "Control Systems Theory & Applications", 1st edition, Pearson education.

8. S.K. Bhattacharya, "Control Systems Engineering", 1st edition, Pearson education

DSC 5 : Mechatronics

Unit I: **15**

Introduction to mechatronics, Mechatronic design process, Signal Conditioning, Digital Signals, Digital Logic, Fault diagnosis

Mechanical components – Pulley, Gears, Levers, Linkages, Screw, Fasteners.

Unit II: **15**

Automobile- Two/four stroke I C engine, Power cycle, Pneumatic and Hydraulic Actuation Systems, Mechanical Actuation Systems, Electrical Actuation Systems.

Unit III: **15**

Single phase, three phase supply Conversion of A.C. to D.C and Vice versa.

Various types of motors: A/C motors Single phase, Three phase, Variable frequency drives, D/C motor, BLDC, Stepper motor, servo motor

Unit IV: **15**

Sensors – Positional sensor, Pressure sensor, Level sensor, Rotary sensor, Infra red sensor, Measurements. Case studies : Bar code reader, Micro wave oven, Electronic printers, Digital camera, Remote control, Washing machine, Elevator, Robotics- Hydraulic, Electrical.

Reference books

1. Mechatronics with experiments: Sabri Cetinkunt. Wiley Publications.
2. Mechatronics: Bradley, Dawson, Burd and Loader Nelson Thornes
3. Industrial Electronics: Thomas Kissel Prentice Hall of India
4. Robotic Engineering: R.D. Klafter, T.A. Chmielewski, M.Negin, PHI

Dse 2.1 : Advanced Power Electronics

UNIT 1: Power semiconductor devices:
Power Diode, Power Transistor (Switching characteristics) and its Base Drive Applications, Power MOSET (Switching characteristics), IGBT, Thyristors, SCR and GTO, MOS-controlled Thyristors.
Thyristors protection: Over voltage and over current protections, dv/dt and di/dt protections and design of snubber circuits.

UNIT 2: Power Supplies
Linear Series Voltage Regulator, Linear Shunt Voltage Regulator, Current Limiting and Overload Protection, Integrated Circuit Voltage Regulators, Fixed Positive and Negative Linear Voltage Regulators, Adjustable Positive and Negative Linear Voltage Regulators, Applications of Linear IC Voltage Regulators, Switching Regulators, Single-ended Isolated Flyback Regulators, Control Circuits and Pulse-width Modulation, Uninterruptible Power Supplies, SMPS, comparison with conventional power supply

UNIT 3: Controlled Rectifiers and Inverters
Rectifiers: Single-phase Half-wave Rectifier, Single-phase Full wave Rectifier, Power Factor of the Rectifier, Three-phase Half-wave Rectifier, Three-phase Full-wave, power factor improvement
Inverters: Principles of operation, Performance parameters, Single-phase Voltage Source Inverters, Half-bridge Voltage Source Inverters, Full-bridge Voltage Source Inverters, Introduction, current source invertors, Variable DC link inverter.
UNIT 4: DC–DC Converters:
DC Choppers, Principles of step-down and step-up choppers with R and R-L loads, impulse commutated chopper, Step-down (Buck) Converter, Step-up (Boost) Converter, Buck–Boost Converter, Cuk Converter.

Reference Books:
1. Power Electronics by M.H. Rashid, PHI
2. Power Electronics – P.C.Sen
3. Power Electronics – Williams ELBS
4. Simplified design of linear Power supplies: John D. Lenk, Butterworth-Heinemann
5. Simplified design of switching power supplies: John D. Lenk, Butterworth-Heinemann
6. Regulated power supplies Irving M Gottlieb, TAB books
7. Practical Design of Power Supplies: Ron Lenk, IEEE press +McGraw hill
8. Electric Power Transformer Engineering: James H. Harlow, CRC Press

DSE 2.2 : Advanced Microcontrollers and Protocols

UNIT 1: Introduction to ARM [15]

Introduction to RISC/ARM, ARM 7 Core, Processor Functional Block Diagram Programmers Model: Data Types, Processor modes, Registers, General Purpose Registers, Program Status Register.

UNIT 2: Instruction Sets of ARM [15]

ARM instruction set, Thumb Instruction set, Processor core vs Processor, Processor vs Microcontroller, Cortex-M0-M3, Memory and memory mapped I/O, Pipeline, Exceptions, Interrupts and Vector table.

UNIT 3: Interfacing in ARM [15]

Installation of: ST-link driver, OpenST32, Cube-MX,Keil-5 pack, Project creation in Kiel for Leds, Switch, Relay, Access level programs(Embedded C program expected).

UNIT 4: Advanced Embedded Communication Protocols [15]

Introduction to **I2C**, General I2C Operation, Start, Stop Conditions, Data Validity, Byte Format,ACK, NACK, I2C Data, writing to a Slave on The I2C Bus, Reading from a Slave on The I2CBus. **SPI** terminology, SPI pins, SPI Registers, Clocking modes. The CAN standards, ExtendedCan, bit fields of CAN, CAN Message, CAN Bus.

Reference Books:

1. John Morton, "AVR: An Introductory Course", Newnes.
2. Claus Kuhnel, "AVR RISC Microcontroller Handbook", Newnes.
3. Steve Furber , "ARM System –On –Chip architecture", Addision Wesley.
4. David Seal "ARM Architecture Reference Manual", Addison Wesley, England; MorganKaufmann Publishers
5. Andrew N Sloss, Dominic Symes, Chris Wright, "ARM System Developer's Guide -Designing and Optimizing System Software", Elsevier
6. Understanding of I2C Bus, Application Report, TI.
7. Keystone Architecture SPI, User Guide, TI.
8. Introduction to Control Area Network (CAN), Application Report, TI.

DSE 2.3 : Digital Signal Processing

Unit 1: Discrete Time Signals and Linear Systems [15]

Introduction of DSP system, Advantages, Applications, Discrete time signals classifications and representation, Operations on signals, Discrete time system, Classification, Impulse response and convolution sum, Convolution methods, Solution of Difference equations, Impulse and step responses, Analog to digital conversion: Sampling theorem, Aliasing effect, Quantization, Reconstruction of analog signal.

Unit 2: Z-Transform and Analysis of Discrete Time System [15]

Z-transform and ROC, Z-transform of Finite and Infinite sequences, Properties of Z-transform, Inverse Z transform, System Function of LTI system, Inverse Z-transform, Transient and Steady state responses, Causality and Stability of System, Solution of difference Equations, Realization of Discrete time system by Direct form-I and Direct form-II, Cascade and parallel forms.

Unit 3: Z-Transform and Analysis of Discrete Time System [15]

Discrete Fourier Transform, IDFT, Properties of the DFT, Circular shift of sequence,Circular convolution, Circular convolution methods, Linear convolution from circularconvolution, DFT of long duration sequence by overlap-save and overlap-add methods,FFT Algorithms: Radix-2 DIT and DIF algorithms to compute DFT and IDFT.

Unit 4: Design and Realization of Digital Filters [15]

FIR Filter Structure and Design: Direct and cascade forms, frequency sampling and linear phase structure. Windowing method, Frequency sampling method of design, IIR Filter structure and Design: Direct form, Cascade form, Parallel form, Impulse invariance, Bilinear Transformation method of design.

Reference Books:

1. John G Prokis, Manolakis, "Digital Signal Processing-Principles, Algorithms and Application",4th Edition, Pearson Education Publication
2. Salivahanam, AVallavaraj, C. Guanapriya, "Digital Signal Processing", 1st Edition, TataMcGrawHill, New Dehli
3. .P.RameshBabu, "Digital Signal Processing", 4th Edition, Scitech Publication.
4. P. Pirsch,"Architectures for Digital Signal Processing" John Wiley publication, New Delhi
5. B.Venkataramani, M. Bhaskar, "Digital Signal Processors", Architecture programming & applications, TMH, New Dehli