PUNYASHLOK AHILYADEVI HOLKAR

SOLAPUR UNIVERSITY, SOLAPUR

पुण्यश्लोक अहिल्यादेवी होळकर
सोलापूर विद्यापीठ
।। विद्यया संपन्नता ।।

NAAC Accredited-2015
'B' Grade (CGPA 2.62)

Name of the Faculty: Science & Technology

Choice Based Credit System (CBCS)

Syllabus: Electronic Science

Name of the Course: M.Sc.- I (Semester I & II)

(Syllabus to be Implemented from w.e.f. June 2020)

SCHOOL OF PHYSICAL SCIENCES
PUNYASHLOK AHILYADEVI HOLKAR SOLAPUR UNIVERSITY
M.Sc. - Electronic Science
Choice Based Credit System
w.e.f June 2020-21

Semester	Code	Title of the Paper	Semester exam			L	T	P	Credits
First		**Hard core**	**Theory**	**IA**	**Total**				
ES	**HCT1.1**	Electronics System design	80	20	100	4	1	-	4
	HCT1.2	Network Analysis and Synthesis	80	20	100	4		-	4
	HCT1.3	Signals and Systems	80	20	100	4		-	4
		Soft Core (Any one)							
	SCT1.1	Microcontrollers and Interfacing	80	20	100	4		0	4
	SCT1.2	Digital Electronics and Verilog HDL	80	20	100	4		0	
									1
		Practical							
	HCT 1.1	Practical HCP 1.1	40	10	50	-	-	2	6
	HCP1.2	Practical HCP 1.2	40	10	50	-	-	2	
	HCP1.3	Practical HCP 1.3	40	10	50	-	-	2	
		Soft core (Any one)							
	SCP1.1	Practical SCP1.1	40	10	50	-	-	2	2
	SCP1.2	Practical SCP1.2	40	10	50	-	-	2	
		Total for first semester	**480**	**120**	**600**				**25**
Second		**Hard core**							
ES	**HCT2.1**	Control Systems	80	20	100	4	1	-	4
	HCT2.2	Digital Signal Processing	80	20	100	4		-	4
		Soft core (Any one)							
	SCT2.1	Advanced Microcontrollers and Protocols	80	20	100	4		-	4

	SCT2.2	VLSI Design	80	20	100	4		-	
		Open elective (Any one)							
	OET2.1	Fundamentals of Electronics	80	20	100	4		-	4
	OET2.2	Power Supplies	80	20	100	4		-	
									1
		Practical							
	HCP 2.1	Practical HCP 2.1	40	10	50	-	-	2	4
	HCP2.2	Practical HCP 2.2	40	10	50	-	-	2	
		Soft core (Any one)							
	SCP1.1	Practical SCP2.1	40	10	50	-	-	2	
	SCP1.2	Practical SCP2.2	40	10	50	-	-	2	2
		Open elective (Any one)							
	OEP2.1	Practical OEP2.1	40	10	50	-	-	2	2
	OEP2.2	Practical OEP2.2	40	10	50	-	-	2	
		Total for second semester	**480**	**120**	**600**				**25**

Third		**Hard core**							
ES	**HCT3.1**	**Process Control**	80	20	**100**	**4**		**-**	**4**
	HCT3.2	**Microwave Devices and Applications**	80	20	**100**	**4**		**-**	**4**
		Soft core (Any one)	80	20					
	SCT3.1	**Embedded System Design**	80	20	**100**	**4**		**-**	**4**
	SCT3.2	**Introduction to Electronics Materials**	80	20	**100**	**4**	**1**	**-**	
		Open elective (Any one)	80	20					
	OET3.1	**Antenna and Wave Propogation**	80	20	**100**	**4**		**-**	**4**
	OET3.2	**Digital Electronics and Communication System**	80	20	**100**	**4**		**-**	
									1
		Practical							
	HCP	**Practical HCP 3.1**	40	10	**50**	**-**	**-**	**2**	**2**

	3.1								
	HCP3.2	**Practical HCP 3.2**	40	10	**50**	**-**	**-**	**2**	**2**
	SCP 3.1	**Practical SCP 3.1**	40	10	**50**	**-**	**-**	**2**	**2**
		Open elective (Any one)	40	10	**50**				
	OEP3.1	**Practical OEP3.1**	40	10	**50**	**-**	**-**	**2**	**2**
	OEP3.2	**Practical OEP3.2**	40	10	**50**	**-**	**-**	**2**	
		Total for third semester	**480**	**120**	**600**				**25**
Four		**Hard core**							
ES	**HCT4.1**	**Optical Fiber Communication**	80	20	**100**	**4**		**-**	**4**
	HCT4.2	**Power Electronics**	80	20	**100**	**4**		**-**	**4**
	HCT 4.3	**PLC and SCADA**	80	20	**100**	**4**		**-**	**4**
			80	20			**1**		**1**
		Soft core (Any one)	80	20					
	SCT4.1	**Internet of Things (IoT)**	80	20	**100**	**4**		**-**	**4**
	SCT4.2	**Foundation of Nano-electronics**	80	20	**100**	**4**		**-**	
	MP4.3	**Major Project**	**160**	**40**	**200**	**-**	**-**	**-**	**8**
		Total for four semester	**480**	**120**	**600**				**25**
	Total								**100**

L = Lecture T = Tutorials P = Practical
4 Credits of Theory = 4 Hours of teaching per week
2 Credit of Practical = 4 hours per week
HCT = Hard core theory
SCT = Soft core theory
HCP = Hard core practical
SCP = Soft core practical
OET = Open elective theory
OEP = Open elective practicalMP = Major project

HCT 1.1: Electronic System Design

Unit I **(15 Hrs)**

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 II

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

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 Hrs)**

Need for signal conditioning, Current and Voltage standards.

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

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.

Text 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‖, Khanna Publications, 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 Measurements and Instrumentation", Dhanpat Rai & Sons, 11th Edition, 2005.
6. D. V. S. Murthy, ―Transducers and Instrumentation‖, Prentice-Hall of India, 2nd Edition, 2010.

Reference Books:

1. Introduction to system design using ICs- B.S. Sonde, Wiley Western Ltd.
2. Circuit Consultants Handbook ,Hemmnigway
3. Microprocessor and Microcontroller – BPB handbook
4. Digital Fundamentals, Floyd, USB, New Delhi
5. Designing with OP-AMP analog and digital ICs, S.Francio, McGraw Hill.
6. Application and Design with analog ICs, J.Michel Jacob, Printice Hall of India

HCT 1.2: Network Analysis and Synthesis

Unit - 1 **[12L +3T]**

Introduction:Kirchhoff's laws: Node voltage analysis and mesh voltage analysis, network solutions using firstorder 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 andfinal value theorems, convolution integral, convolution as summation.

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

Unit – 2 **[12L +3T]**

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, thehybrid parameters, inverse hybrid parameters, relationships between parameter sets, series, paralleland cascade connection of two-port networks.

Unit -3 **[12L +3T]**

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

[12L+3T]Network synthesis: Introduction, scaling network functions, positive real functions, Hurwitzpolynomials, driving point synthesis with LC elements, elementary synthesis operations, synthesisof dissipative networks- 2 terminal Rc and RL networks (Foster and Cauer forms), properties of RLand RC network functions.

References:

1. Network Analysis: Van Valkenburg, PHI, 2003

2. Network Analysis and Synthesis: Bakshi A V, Bakshi U A, Technical Publications, 2009.

3. Electric circuits: Joseph Edminister, Schaum's series-McGraw Hill.

4. Network analysis and synthesis: Franklin F Kuo, John Wiley and sons, 2nd edition.

5. Networks and systems: Roy Choudhury D, New Age International, 2004.

HCT 1.3: Signal & Systems

Unit – 1 **12L+3T**

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 **12L+3T**

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 **12L+3T**

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

Unit- 4 **12L+3T**

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

References:

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

SCT 1.1 Microcontroller and Interfacing

UNIT I: Introduction PIC16F877 **[12L +3T]**

Salient Features of PIC16F877a, Internal architecture, Oscillator and clock, Reset Options, Special function registers, Introduction to Instruction set, MPLab-X IDE. (Assembly Programming expected)

UNIT II: PIC On-chip Peripherals **[12L +3T]**

Input/output pins, Ports, Counters, Timers, Capture-Compare Modules, On chip UART, On-chip ADCs configuration (With Embedded C Programming)

UNIT III: Digital Interfacing **[12L +3T]**

Push-Button, Matrix Keyboard, Relay, Leds, Opto-coupler, 7-Segment, DC-motor(with CCP), Servo-Motor (Embedded C Programming expected)

UNIT IV: Analog Interfacing **[12L +3T]**

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. PIC16f877a Datasheet.

SCT 1.2 Digital Electronics and Verilog HDL

Unit – 1 **(15L +3T)**

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 (**5L+3T)**

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

Unit – 3 (**10L+3T)**

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 **(18L+3T)**

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

Verilog model for combination Logic: Verilog Programming Examples-basic gates, 4 - bit binary 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, Second Edition, 2003.

HCT 2.1 Control Systems

Unit 1: Introduction [12L+3T]

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 [12L+3T]

Type and Order of Control system, Time Response of first and second order systems to unit step input. Steady state errors, Time Domain Specifications of Second Order System, Concept of Stability: absolute, relative and marginal, nature of system response, stability analysis using Hurwitz'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 [12L+3T]

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

Unit 4: Control system components and controllers (only theoretical treatments) [12L+3T]

Modeling and transfer function of control system components- Potentiometer, DC and AC Servomotors, gear trains, tacho-generators. Design concepts of ON-OFF, P, PI, PD, PID controllers, 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

HCT 2.2: Digital Signal Processing

Unit 1: Discrete Time Signals and Linear Systems [12L+3T]

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 [12L+3T]

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 [12L+3T]

Discrete Fourier Transform, IDFT, Properties of the DFT, Circular shift of sequence, Circular convolution, Circular convolution methods, Linear convolution from circular convolution, 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 [12L+3T]

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, Tata McGrawHill, 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

HCT 2.1: Advanced Microcontrollers and protocols

UNIT 1: Introduction to ARM [12L +3T]

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 [12L +3T]

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 [12L +3T]

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 [12L +3T]

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 I2C Bus. **SPI** terminology, SPI pins, SPI Registers, Clocking modes. The CAN standards, Extended Can, 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; Morgan Kaufmann 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.

SCT 2.2:VLSI Circuits design

Unit 1: Basic Physics of MOS Devices (12L +3T)

MOS Device structure and physical operation, MOS I-V characteristics, Second order effects in MOS devices, MOS structure capacitances, Small signal model of MOS, Long channel and short channel devices.

Current sources and Amplifier Design

Basic and cascode current mirrors, Single stage Amplifies: Basic concepts, Common source stage, Common gate stage, Cascode stage. Differential amplifiers: Differential and common mode operations.

Unit 2: CMOS Inverter (12L + 3T)

CMOS Inverter: Transfer characteristics, MOS transistor circuit model, latch-up in CMOS circuits. Static and Dynamic behavior of CMOS Inverter MOS circuit design fundamentals: MOS layers, stick diagrams, lambda-based rules for NMOS and CMOS process, layout diagrams, Static and dynamic power consumption in CMOS Inverter.

Unit 3: CMOS combinational and Sequential circuit Design (20L + 3T)

Static CMOS logic design: Complementary CMOS design, DCVSL, Ratioed logic, Pass Transistor logic, Transmission gate logic. Dynamic CMOS logic design: Basic Principles, Speed and power dissipation, Issues in Dynamic design, cascading in dynamic design.

Static latches and registers, Dynamic latches and registers, Alternative register styles: Pulse registers and Sense based amplifiers, Latch vs. Register- based pipelines structures, NORA-CMOS design.

Unit 4: Timing issues in Digital circuits (4L + 3T)

Classification of Digital systems, Basics of synchronous timing, clock distribution networks, Synchronizers and arbiters.

References:

1. Digital Integrated Circuits: A Design Perspective- Jan M. Rabaey, AnanthaChadrakasan, Borivoje Nikolic, 2E,PHI 2005.
2. Design of Analog CMOS Integrated Circuits-BehzadRazavi, McGraw-Hill, 2000.
3. Microelectronic circuits: Theory and applications- Adel Sedra, Kenneth Smith, Oxford University Press,6E-2013.

OET 2.1: Fundamentals of Electronics

UNIT 1: Electronic Components [12L +3T]

Circuit concept Units, Standards and Dimensions. Electric current, Electric charge, potential difference, Electric power and Energy. Circuit elements: Passive elements and active elements. Network Law's, Junction Law's (KCL), Mesh Law's (KVL) Application of Network Law's to simple dc networks theorems – Thevenin's theorem, Norton's theorem Max power transfer theorem.

UNIT 2 : Semiconductor Devices [12L +3T]

Junction Diodes, p-n junction, an unbiased p-n junction, a biased p-n junction and V-I characteristics of p-n junction. Some special P-N junction: - Photodiodes, LED and Solar Cell. Junction transistor, Transistor static characteristic Self-bias or emitter bias, Two-port representation of Transistor (hybrid parameter) JFET: Static Characteristic of FET comparison of FET with Bipolar transistor.

UNIT 3: Operational Amplifier Characteristics and Applications [12L +3T]

Introduction, Ideal Op-Amp, DC and AC Characteristics: Instrumentation Amplifier, V to I and I-V converter Precision rectifier, Differentiator and Integrator. Comparator Schmitt trigger wave generators (Square wave and Triangular wave) and first order Low pass and High pass filters.

UNIT 4: Special IC series [12L +3T]

Op-Amp regulator, Design of power supplies using voltage regulator ICs, 555 Timer as Monostable and Astable operation.

Reference books:

1. D Chattopadhyaya, P.C. Rakshit, B Saha and N NPurkait: Foundations of Electronics, New Age International Edition.
2. D. Roy Choudhary and ShailJain : Linear Integrated Circuit, New Age International (P) Ltd.
3. P-Amp and Linear Integrated Circuits : R. A. Gaikwad, PHI of India Ltd.
4. A Texbook of Electronics (Second Edition) : S. L. Kakani and K. C. Bhandari
5. Electronic Principles : A. P. Malvino, TMH Edition.

OET 2.2: Power Supplies

Unit - 1 : Transformers [12L +3T]

Basics and design considerations: Transformers rated for 230 Volts and 208 volts primary, transformer voltage, current, and turns ratios, step-up and step-down voltage transformers, VA ratings for transformers, current transformers, dimmerstats, Transformer cores – frequency response, size, shapes, copper wire current ratings, Transformer winding techniques – for single output, multiple outputs, center tap, transformers for switching power supply.

Unit – 2: Constant Voltage (CV) Power supplies [12L +3T]

Constant Voltage (CV) Power supplies: Building blocks, Design, characterization. Zener regulator, emitter follower regulator, series regulator, shunt regulator, current limiting techniques, Switching mode regulator Constant Current (CC) and CV/CC Power supplies: Building blocks, Design, characterization. CC sources – using discrete transistor, monolithic transistors, controlled sources, Series regulator type CC supply, Guarded CC supply, Adjustable VL CC supply, Typical CV/CC supply.

Unit – 3 Power supplies using ICs [12L +3T]

Power supplies using ICs: General purpose regulators, precision regulators, fixed voltage regulators, Switch mode regulators. Protection techniques: Protection against transients, RFI suppression, current limiting, voltage limiting.

Unit – 4 Heat Sinks [12L +3T]

Heat Sinks: Effect of temperature on leakage current, current gain and power dissipation of active devices, thermal runaway, operation with and without heat silks, heat sink ratings, capabilities, practical considerations and mounting, heat sinks for ICs.

Text / Reference Books:

1. Simplified design of linear Power supplies: John D. Lenk, Butterworth-Heinemann
2. Simplified design of switching power supplies: John D. Lenk, Butterworth-Heinemann
3. Regulated power supplies Irving M Gottlieb, TAB books
4. Practical Design of Power Supplies: Ron Lenk, IEEE press +McGraw hill
5. Electric Power Transformer Engineering: James H. Harlow, CRC Press

HCT 3.1: Process Control

Unit I **[12L +3T]**

Process Dynamics: Dynamic elements in a control loop, Dead time processes and smith predictor compensator. Inverse response behavior of processes and compensator. Dynamic behavior of first and second order systems. Interacting and non-interacting systems.

Process Control Action: Elements of process control, Controller Principle, Process Characteristics, Control system parameters, discontinuous, continuous and composite controller modes/actions (P, I,D,PI,PD and PID).

Unit II **[12L +3T]**

Process Controllers and Tuning: General features, construction and working of Pneumatic, Hydraulic and Electronic controller. Process reaction curve method, Zigler-Nichols method, Cohencoon correction for quarter amplitude, Frequency response method, Relay based tuning.

Control Schemes: Feedback, feedforward, cascade, ratio, split range, selective control, adaptive control, and model-based control.

Unit III **[12L +3T]**

Analysis of Control Loop: Steady state gain, Process gain, Valve gain, Process time constant, Variable time Constant, Transmitter gain, Linearizing equal percentage valve, Variable pressure drop. Analysis of Flow Control, Pressure Control, Liquid level Control, Temperature control, SLPC-features, faceplate, functions, MLPC- features, faceplate, functions, SLPC and MLPC comparison.

Scaling: types of scaling, examples of scaling.

Nonlinear Systems: Nonlinear Elements in Loop: Limiters, Dead Zones, Backlash, Dead Band Velocity Limiting, Negative Resistance, Improvement in nonlinear process performance through: Deterministic Control Loop Calculations, Calculations of the measured variable, final control element selection, cascade control design, Real time implementation issues.

Unit IV **[12L +3T]**

Multivariable Control: Block diagram analysis of multivariable systems, Interaction, Tuning of Multivariable controllers, relative gain analysis, Decoupler design.

Intelligent Controllers:

Step analysis method for finding first, second and multiple time constants and dead time. Model Based controllers: Internal Model control, Smith predictor, optimal controller, Model Predictive controller, Dynamic matrix controller (DMC). Self Tuning Controller. Fuzzy logic systems and Fuzzy controllers, Introduction, Basic Concepts of Fuzzy Logic, Fuzzy Sets, Fuzzy Relation,

Fuzzy Graphs, and Fuzzy Arithmetic, Fuzzy If-Then Rules, Fuzzy Logic Applications, Neuro-Fuzzy Artificial Neural networks and ANN controller,

Test Books:

1. Donald Eckman, "Automatic Process Control", Wiley Eastern Limited, 1st Edition, 1966
2. Thomas E Marlin, "Process Control- Designing processes and Control Systems for Dynamic Performance", McGraw-Hill International Editions, 1stEdition ,1995.
3. F.G.Shinskey, "Process control Systems",TATA MCGRAW HILL, 3rdEdition, 1988.
4. Krishna Kant, "Computer Based Industrial Control", Prentice hall of India, 2nd Edition, 2010.
5. B Liptek, "Instrument engineers handbook", Chilton book Co, 1st Edition, 1969.
6. P.W.Murrill, "Fundamentals of Process Control", International Society of Automation, 1st Edition, 2000.
7. Stephanopoulos George, "Chemical Process Control", Prentice hall of India, United States Edition, 1983.
8. P.W.Murrill, "Applications concepts of Process control", International Society of Automation, 3rd edition, 2012.
9. B.Waynebequette, "Process Control:Modeling, Design and Simulation", Prentice hall of india, 1st Edition, 2002.

Reference Books:

1. Considine, "Process/Industrial Instruments and Controls Handbook", McGraw-Hill Professional, 5th Edition, 1999.
2. T.J.Ross, Fuzzy Logic with Engineering Applications, Wiley, 3rd Edition, 2011.

HCT 3.2: Microwave Devices & Applications

Unit - 1 **[12L+3T]**

Microwave Solid State Devices: Microwave Transistor:

Tunnel diode and its applications. TEDs: Introduction, Gunn Diode-Principle, RWH Theory, Characteristics, Basic Modes Of Operation. Avalanche Transit Time Devices: Introduction, IMPATT and TRAPATT Diodes – Principle of Operation and Characteristics, Parametric Amplifiers.

UNIT 2: Microwave Bipolar Transistors, Heterojunction Bipolar Transistors and Tunnel diode **[12L +3T]**

Physical Structures, Configurations, Principles of operation and applicationsof :

Microwave Bipolar Transistors,Heterojunction Bipolar Transistors, Microwave tunnel diodes, Microwave Field effect Transistors, Junction Field-Effect Transistors (JFETs), Metal-Semiconductor Field-Effect Transistors (MESFETs), High Electron Mobility Transistors (HEMTs), Metal Oxide-Semiconductor Field-Effect Transistors (MOSFETs).

Unit - 3 **[12L +3T]**

Transferred Electron Devices (TEDs) :

Introduction, Characteristic, features of microwaves, Limitation of conventional solid state devices at Microwavefrequency.

Gunn – effect diodes – Gunn effect, Ridley – Watkins-Hilsum theory, Modes of operation, Limited space – Charge accumulation (LSA) mode of Gunn diode (INP and CdTe diode). Microwave generation and amplification. Structure, Operation, Power output and efficiency of IMPATT and TRAPATT diodes.

Unit – 4 **[12L +3T]**

Microwave Tubes and Circuits:

Microwave Tubes and Circuits: Klystrons: Reentrant Cavities, Velocity Modulation, Bunching Process, Output Power & Beam Loading. Multicavity Klystron Amplifiers: Output Current and Output Power Of Two – Cavity Klystron, Output Power Of four –Cavity Klystron. HELIX TWTS: Slow-Wave Structures, Amplification Process, Convection Current, Axial Electric Field, Wave Modes, Gain Consideration.

Magnetron Oscillators – Cylindrical Magnetron, Linear Magnetron, Coaxial Magnetron, Voltage-Tunable Magnetron, Inverted Coaxial Magnetron, Frequency-Agile Coaxial Magnetron

References:

1. Liao Samuel Y, *Microwave Devices and Circuits,* Prentice-Hall of India Private Limited, New Delhi 2001
2. Pozar David M., *Microwave Engineering,* John Wiley and Sons, Inc. New York 1999.
3. Microwave Devices and Circuits, Samuel Y. Liao, PHI, 3rd Edition.
4. Microwave Engineering, David M.Pozar, Wiley India, 3rd Edition.
5. Microwave Principles-Herbert J.Reich, J.G.Skalnik, P.F.Ordung and H.L. Krauss, CBS Publishers and Distributors, New Delhi, 2004.
6. Microwave Engineering Passive Circuits-Peter A.Rizzi, PHI, 1999.
7. Electronic and Radio Engineering-F.ETerman, McGraw-Hill, 4th ed., 1955

SCT 3.1: Embedded System Design

Unit 1: Embedded system Introduction [12L + 3T]

Introduction to Embedded System, recent trends in embedded systems, embedded design concepts and definitions, memory management, hardware and software design and testing.

System Architecture: Introduction to ARM core architecture, LPC 2148, ARM extension family, instruction set, thumb instruction set, Pipeline, memory management, Bus architecture, study of on-chip peripherals like I/O ports, timers, counters, interrupts, on-chip ADC, DAC, RTC modules, WDT, PLL, PWM, USB etc.

Unit 2 : Communication protocols [12L + 3T]

SPI, SCI, SSP, I2C, CAN, USB etc.

Interfacing and Programming : Basic embedded C programs for on-chip peripherals studied in system architecture. Need of interfacing, interfacing techniques, interfacing of different displays and I/O devices.

Unit 3: Real Time Operating System Concept [12L + 3T]

Architecture of kernel, task scheduler, ISR, Semaphores, mailbox, message queues, pipes, events, timers, memory management, RTOS services in contrast with traditional OS. Introduction to µcos .

Unit 4: Case Studies [12L + 3T]

RTOS for control systems, Case study of embedded system like digital camera, Mobile phones, Mobile Internet Device (MTD)

Text books:

1. Embedded systems: a contemporary design tool, James K. Peckol- Wiley India
2. Embedded systems software primer- David Simon – Pearson
3. ARM System-on-Chip Architecture- Steve Furber - Pearson
4. Jean J Labrose - MicroC / OS-II, Indian Low Price Edition.

Reference Books:

1. DR.K.V.K.K. Prasad - Embedded / real time system – Dreamtech
2. Iyer, Gupta - Embedded real systems Programming -TMH
3. Steve Heath - Embedded System Design- Neuwans
4. Frank Vahid - Embedded Systems - Wiley India
5. Embedded Systems, Rajkamal -TMH.
6. ARM System Developer's Guide, Designing and Optimizing System Software - Andrew N. Sloss , Dominic Symes, Chris Wright - Morgan Kaufmann Publisher.
7. Datasheet of LPC 2148.

SCT 3.2: Introduction to Electronics Materials

Unit I

Fundamentals of materials science – Relative stability of Phases,Phaserule,Phase Diagram,
Phase Transformations : Elementary idea of Nucleation and Growth, methods of crystal growth.
Defects in crystals : Elementary idea of point, line and planar defects.
Materials in thin film form : Concept of thin films, preparation of thin films.

Unit II.

Special materials in Electronics:
Composite materials : Composites of glasses, polymers metals and ceramics, properties and applications.
Polymers : Mechanism of polymerination, conducting polymers, application of polymers in electronics.
Metallic Materials : Functional gradient materials, shape memory alloys, amorphous materials, IC package materials.
Liquid crystal polymers: Optical properties of cholesteric and chiral nematics liquid crystal displays, optical fibre materials.

Unit III

Introduction, Energy bands in solids, Semiconductors band gap formation
Extrinsic semiconductors, Fermi level variations, and conductivity.
Introduction to pn junctions and Metal-semiconductor junctions.
pn junctions under bias, Junction breakdown, and Heterojunctions. Problem set on Intrisic, extrinsic and pn junction.

Unit IV

Concept of organic semiconductors;
Charge carrier transport in polymeric and organic semiconductors;
Optical properties of organic semiconductors;
Charge injection from metals to organic solids;
Operating mode of the main plastic electronic devices: Organic light-emitting diodes (OLEDs), organic photovoltaic cells (OPVs) and organic field-effect transistors (OFETs).
Interfaces in plastic electronic devices

TEXTBOOKS:

- Pallab Bhattacharya “Semiconductor Opto Electronic Devices”, Prentice Hall of India Pvt., Ltd., New Delhi, 2006.
- Jasprit Singh, “Opto Electronics – As Introduction to Materials and Devices”, Mc Graw-Hill International Edition, 1998
- Ben Streetman & Sanjay Banerjee Solid State Electronic Devices,
- Murthy & Jena: Structure and properties of Engineering Materials ,TMH New Delhi

OET 3.1: Antennas& Wave propagation

UNIT 1: ANTENNA BASICS: [12L+3T]

Introduction, Radiation Mechanism, Antenna Parameters-Radiation Patterns, Patterns in Principle Planes, Main Lobe and Side Lobes, Beam widths, Beam Area, Radiation Intensity, Beam Efficiency, Directivity, Gain and Resolution, Antenna Apertures, Aperture Efficiency, Effective Height, Antenna Theorems- Applicability and Proofs for equivalence of directional characteristics.

Radiation from Wires: Retarded Potentials, Small Electric Dipole, Quarter wave Monopole and Half wave Dipole Radiation characteristics

UNIT 2: WAVE PROPAGATION [12L +3T]

Concepts of Propagation- frequency ranges and types of propagations. Ground Wave propagation - characteristics, Parameters, Wave Tilt, Flat and Spherical Earth Considerations, Sky Wave Propagation-Formation of Ionospheric Layers and their characteristics, Mechanism of Reflection and Refraction, Critical Frequency, MUF & Skip Distance Calculations for flat and spherical earth cases, Optimum Frequency, Virtual Height, Ionospheric Abnormalities, Ionospheric Absorption, Fundamental Equation for Free-Space Propagation, Basic Transmission Loss Calculations, Space Wave Propagation - Mechanism, LOS and Radio Horizon, Tropospheric Wave Propagation- Radius of Curvature of path, Effective Earth's Radius, Effect of Earth's Curvature, Field Strength Calculations, M-Curves and Duct Propagation, Tropospheric Scattering.

UNIT 3: ANTENNA ARRAYS, HF, VHF AND UHF ANTENNAS [12L +3T]

Two element array, Principle of Pattern Multiplication, N element Uniform Linear Arrays - Broadside, End fire Arrays, EFA with Increased directivity, Binomial Arrays, Traveling wave radiators –basic concepts, Long wire antennas-field strength calculations and patterns, V-antennas, Rhombic Antennas and Design Relations, Small Loop antennas- Concept of short magnetic dipole, Helical Antennas, Yagi-Uda Arrays, Log periodic antennas.

UNIT 4: MICROWAVE ANTENNAS AND ANTENNA MEASUREMENT THEORY [12L +3T]

Reflector Antennas: Flat Sheet and Corner Reflectors, Paraboloidal Reflectors, Cassegrain Feeds. Slot antennas-Babinets principle, Microstrip antennas, Horn antennas, Lens antennas (Qualitative treatment only) Antenna Measurements-Patterns Required, Set Up, Distance Criterion, Directivity and Gain Measurements (Comparison, Absolute and 3Antenna Methods).

TEXT BOOKS:

1. G.S.N Raju, "Antennas and Wave Propagation", 1st Edition Pearson Education, 2004.
2. K.D.Prasad, Satya Prakashan, "Antennas and Wave Propagation", Tech Publications, 3rd

Edition, 2001.

REFERENCES:

1. C.A. Balanis, “Antenna Theory”, 3rd Edition, John Wiley & Sons, 2012.
2. E. C. Jordan and K. G. Balmain, “Electromagnetic Waves and Radiating Systems”, PHI, 2nd edition, 2000.
3. John D. Kraus and Ronald J. Marhefka, “Antennas and Wave propagation”, TMH, 4rd Edition, 2010.

OET - 3.2: Digital Electronics &Communication Systems

UNIT 1 **[12L+3T]**

Introduction to communication, need for modulation, modulation and demodulation techniques AM, FM and PM (Qualitative Analysis only), Block diagram of AM and FM transmitter and Receiver (Qualitative analysis) Sampling theorem, channel capacity, PAM, PPM, PWM and PCM, Digital modulation technique ASK, PSK, QPSK (Qualitative Analysis only).

UNIT 2 **[12L +3T]**

Introductory Aspects of Multiplexing and Multiple Accesses: FDM, TDM, FDMA, TDMA, CDMA and OFMDA.

Satellite Communication: Introduction, to Orbit, types of orbits, Block diagram of satellite transponder.

UNIT 3 **[12L +3T]**

Evaluation of Communication: 1 st generation, 2nd generation, 3rd generation & 4th generation mobile communication, Basics of cellular communication (GSM, CDMA)-Cell architecture, Base stations, relay stations and principles of communication, Introduction to Bluetooth, Wi-Fi, Wi-Max and LTE network.

UNIT 4. **[12L +3T]**

Binary Systems: Introduction to Digital Systems, Number systems, binary number system, Decimal to binary & binary to decimal conversion, representation of binary using hexadecimal.

Boolean Algebra and Logic Gates: Basic definitions, operators of Boolean algebra, basic theorems and properties of Boolean algebra, basic gates -AND, OR, NOT, XOR, NAND, NOR - only truth table & gate representation, Boolean functions, canonical or standard forms,

REFERENCE:

1. Floyd T L " Digital Fundamentals", 7th Edition. (Pearson Education Asia), 2002
2. M. Morris Mono, Digital Logic and Computer Design, 4 th Edition, Pearson, 2009
3. Simon Haykins, An Introduction to Analog and Digital Communication, Wiley Student Edition, 2008.
4. B. P. Lathi, Modern digital and analog Communication systems, 3rd Edition 2005 Oxford University press.
5. Harold P.E, Stern Samy and AMahmond, Communication Systems, Pearson Edition, 2004.
6.DennisRoody and John Coolen, Electronic Communication, 4th Edition, 2008.

HCT 4.1 Optical Fiber Communication

Total hours:60
Credits:4

Unit 1. Introductionand Transmission characteristics of optical fibers:[12L+3T]

The general optical communication system, Advantages and disadvantages, Ray theory of transmission, Mode theory, Types of optical Fibers

Transmission characteristics of optical fibers:

Attenuation, Material absorption, losses in fibers, Linear and Nonlinear scattering losses, fiber bend loss, Mid-infrared and Far-Infrared transmission. Dispersion: Intermodal and Intramodal dispersion, Dispersion modified Single mode fibers.

Unit 2. Optical fibers and cables, Joints and Couplers:[12L +3T]

Preparation of optical fibers, Liquid phase and vapor phase deposition techniques, Fluoride glass fibers. Cables: Fiber strength, durability and stability of fiber transmission characteristics, cable design Optical Fiber Joints and Couplers: Fibers alignment and joint loss. Fiber splices, connectors, Fiber couplers

Unit 3. Optical sources and Optical detectors: [12L+3T]

Optical sources: LASERS basic concept, optical emission from semiconductors. Semiconductor Injection Laser, Injection laser structures and characteristics, Laser fiber coupling, Non-semiconductor Lasers, Laser Modulation. LED) LED power and efficiency, LED structures, characteristic and Modulation techniques

Optical detectors: Introduction, device, types, optical detection principals, absorption, quantum efficiency Responsivity, Long wavelength Cutoff. Semiconductor photo diodes with and without internal gain. Mid-infrared and photoconductive detectors, PN, PIN, Avalanche Photo diodes, Phototransistors.

Unit 4: Optical fiber Measurements, Receiver performance considerations and Applications: [12L+3T]

Optical fiber Measurements: Attenuation, Dispersion, Refractive index profile, cutoff wavelength, Numerical aperture, fiber diameter and field measurements.

Receiver performance considerations: Noise, Receiver noise, Receiver structures, FET preamplifiers, High performance amplifiers.

Applications: Public Network, Military, Civil, Consumer, Industrial and Computer applications.

Reference:

1. Optical fiber communications – principles and practice. John. M. Senior
2 .Optical communications By David Gover
3 Optical communications By KEISER

HCT 4.2: Power Electronics

UNIT 1:

Forced communication, Thyristor protection and Thyristor choppers ckts. [12L +3T]

Forced communication: SCRs with DC supply, forced commutations; class A, B, C, D, E and F circuits and analysis

Thyristor protection: Over voltage and over current protections, dv/dt and di/dt protections, design of snubber circuits, RFI protection, gate resistance

Thyristor choppers circuits

Principles of step-down and step-up choppers with R and R-L loads, impulse commutated chopper, impulse commutated three thyristor choppers, resonant pulse choppers/supplies

UNIT 2:

Switched mode power supply [12L +3T]

SMPS, comparison with conventional power supply, buck regulator, boost regulator, Buck-Boost regulator, Cuk regulator

UNIT 3: Controlled Rectifiers [12L +3T]

Single phase circuits, Half and Full controlled bridge rectifier with resistive R and R-L load with and without freewheeling diode, series and dual converter, power factor improvement.

Three phase circuits: Half wave-controlled rectifier, Half controlled rectifier, Half controlled bridge rectifier, Fully controlled bridge rectifier with R and R-L load, three phase dual converter

UNIT 4 : A-C power control [12L +3T]

A-C On/off and phase controls, uni and bidirectional controllers with R and R-L loads, three phase half and full wave controllers with R and R-L loads.

Text / 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

HCT 4.3: PLC and SCADA

Unit I: **[12L +3T]**

Introduction: Overview, OSI reference model, Transmission media : Copper cable, Coaxial cables, Twisted-pair cable, Connector standards, Earthing/grounding, Fiber-optic cable components, Fiber-optic cable parameters

Open control network: RS-232 overview, RS-232 interface standard, RS-232 troubleshooting, Typical RS-232 problems, RS-485 overview, The RS-485 interface standard, RS-485 troubleshooting Current loop and RS-485 converters overview, TCP/IP overview, Internet layer protocols (packet transport), Modbus overview, Modbus protocol structure, Modbus troubleshooting

Unit II: **[12L +3T]**

Network at different level: AS-I, CAN, Devicenet, Industrial Ethernet overview, Profibus PA/DP/FMS overview, Foundation Fieldbus overview, The physical layer and wiring rules, HART overview, Introduction to HART and smart instrumentation. **Safety Instrumented System (SIS)**: Need for safety instrumentation- risk and risk reduction methods, hazards analysis. Process control systems and SIS. Safety Integrity Levels (SIL) and availability. Introduction to the international functional safety standard IEC61508

Unit III: **[12L +3T]**

Automation Fundamentals: Automation and its importance, automation applications, expectations of automation. Process and factory automation. Types of plant and control – categories in industry, open loop and close loop control functions, continuous processes, discrete processes, and mixed processes. Automation hierarchy – large control system hierarchy, data quantity & quality and hierarchical control. Control system architecture – evolution and current trends, comparison of different architectures.

Programmable Logic Controller Hardware: Evolution of PLC, Definition, functions of PLC, Advantages, Architecture, working of PLC, Scan time, Types & Specifications. DIDO- AI-AO examples and ratings, I/O modules, local and remote I/O expansion, special purpose modules, wiring diagrams of different I/O modules, communication modules, Memory & addressing- memory organization (system memory and application memory), I/O addressing, hardware to software interface. Software Development of

Relay Logic Ladder Diagram, introduction to PLC Programming, programming devices, IEC standard PLC programming languages, LD programming- basic LD instructions, PLC Timers and Counters: Types and examples, data transfer & program control instructions, advanced PLC instructions, PID Control using PLC. Case study: PLC selection and configuration for any one process applications.

Unit IV: [12L +3T]

Distributed Control System (DCS): Introduction to DCS. Evolution of DCS, DCS flow sheet symbols, architecture of DCS. Controller, Input and output modules, Communication module, data highway, local I/O bus, Workstations, Specifications of DCS. Introduction of Hierarchical control of memory: Task listing, Higher and Lower computer level task. Supervisory computer tasks DCS configuration. Supervisory computer functions, Control techniques, Supervisory Control Algorithm. DCS & Supervisory computer displays, advanced control Strategies, computer interface with DCS. DCS. System integration with
PLCs computer: HMI, Man machine interface sequencing, Supervisory control, and integration with PLC, personal computers and direct I/O, serial linkages, network linkages, link between networks. Introduction to DCS Programming, Function Block Diagram method for DCS programming.

Supervisory Control and Data Acquisition (SCADA): SCADA introduction, brief history of SCADA, elements of SCADA. Features of SCADA , MTU- functions of MTU, RTU- Functions of RTU, Protocol Detail SCADA as a real time system Communications in SCADA- types & methods used, components, Protocol structure and Mediums used for communications SCADA Development for any one typical application Programming for GUI development using SCADA software.

Text Books:

1 Samuel M. Herb, ―Understanding Distributed Processor Systems for Control‖, International Society of Automation Publication, 1st Edition, 1999.
2. Thomas Hughes, ―Programmable Logic Controller‖, International Society of Automation Publication, 4th Edition, 2004
3. Stuart A. Boyer, ―SCADA supervisory control and data acquisition‖, International Society of Automation Publication, 4th Edtion, 2009.
4. Gruhn and Cheddie, ―Safety Shutdown Systems‖, International Society of Automation,
2nd Edition, 2006.

Reference Books:

1. PoppovikBhatkar, ―Distributed Computer Control in Industrial Automation‖, CRCpress, 2nd edition, 1990.
2. S.K.Singh, ―Computer Aided Process Control‖, Prentice Hall of India, 1st Edition, 2004.
3. Krishna Kant, ―Computer Based Process Control‖, Prentice Hall of India, 2nd edition,2010.

4. N.E. Battikha, ―The Management of Control System: Justification and TechnicalAuditing‖, International Society of Automation, 1st Edition, 1992.
5. Gary Dunning, ―Introduction to Programmable Logic controller‖, Thomas Learning, Pckedition, 2001.
6. John. W. Webb, Ronald A Reis, ―Programmable Logic Controllers – Principles andApplications‖, Prentice Hall Inc, 5th Edition, 2002.
7. Bela G. Liptak, ―Instrument engineers handbook- Process control‖, Chilton bookcompany, 3rd edition, 1969.
8. D.J. Smith , K.G.L. Simpson, ―Functional Safety: A Straightforward Guide to IEC61508and Related Standards‖, Butterworth-Heinemann Publications, 2nd Edition, 2004.

SCT 4.1: Internet of Things

UNIT 1: Introduction to IoT [12L +3T]

IoT, origin of terminology, characteristics, market share, evolution of connected devices, modern day IoT applications, IoT enablers(supportive companies), connectivity layers, IoT vs. M2M, Technology interdependence.

UNIT 2: Basics of IoT Networking [12L +3T]

Sensing(need, definition, classification, applications), Actuation (need, definition, classification, applications), IoT components, IoT categories, Challenges, Fundamentals of IoT networking(MQTT, CoeP, SmQTT,XmPP), Connectivity technology(CSMA,WSN, bluetooth, Xbee,WiFi, LoWPAN etc.), sensor network terminology and fundamentals.

UNIT 3: Sensor Networks [12L +3T]

Sensor networks, Sensor node, Applications of WSN, coverage, area coverage, Barrier coverage, UAV features, Key issues, UAV networks, machine to machine communication, interoperability of IoT.

UNIT 4 : Software defined networking [12L +3T]

Introduction to software defined networks, software defined IoT networking, cloud computing, definition, fundamentals, service model, Service management, Service security, sensor cloud, introduction to fog computing, smart city, smart homes, connected vehicles, smart grids, introduction to industrial IoT.

References:

1. Sudip Mishra, Transcripts of Introduction Internet of things, IIT Kharagpur.
2. Rajkumarbuyya, Internet of things, Nov-2014.
3. Jaffrey, Internet of things-IoT European research clusters, 2013.
4. Ronald Y Yager, New advances in Internet of Things, Springer 2018.

SCT 4.2 Foundation of Nanoelectronics

UNIT 1 **[12L +3T]**

Region of nanostructures, scaling of devices in silicon technology, estimation of technology limits, Uncertainty principle, Experiments on duality, Schrodinger's equation and its applications to square well potential, square potential barrier (1D).

UNIT 2 **[12L +3T]**

Infinite array of potential wells, Barrier penetration, applications to tunnel diode, Josephson effect, Perturbation theory and its applications, Scattering. Binomial and related distributions, Phase space, Statistical ensembles, applications of classical statistical mechanics, Quantum statistics, Brownian motion, Random walk problem. Concept of Chemical potential, partition function and its applications in computing thermodynamic quantities.

UNIT 3 **[12L +3T]**

Quantum electronic devices, electrons in mesoscopic structures, short channel MOSFET, split-gate transistor, electron wave transistor, electron spin transistor, quantum cellular automata, Bioelectronics, molecular processor, DNA analyzer as biochip, Molecular electronics, Fullerenes, nanotubes, switches based on Fullerenes and nanotubes.

UNIT 4 **[12L + 3T]**

Nanoelectronics with tunneling devices, resonant tunneling diode(RTD), three terminal RTDS, RTD based memory, basic logic gates and dynamic logic gates,
Principle of single electron transistor, Coulomb blockade.

Text / Reference Books:

1.Nanoelectronics and Nanosystems: K.Goser, P. Glosekotter, J. Dienstuhl, Springer (2005).
2.Quantum Mechanics: Schiff L.I. , “”
3. Fundamentals of Statistical Mechanics and Thermal Physics: Reif