SOLAPUR UNIVERSITY, SOLAPUR

M.Sc. Electronics

Choice Based Credit System

(CBCS)

Revised Syllabus

(w.e.f. June 2016)

Solapur University, Solapur

M.Sc. Electronics

Choice Based Credit System (CBCS)

(w.e.f. June, 2016)

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

Master of Science (M.Sc.) in Electronics is a programme running at Post Graduate Department of Electronics, Shankarrao Mohite Mahavidyalaya, Akluj Dist Solapur from June 2006 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 encompasses knowledge of Embedded System and Instrumentation, Communication Electronics and VLSI design and technologies. On collaboration with American companies, the Cypress Semiconductor USA , MicroSemi USA and ARM University London the laboratories for respective specialization are established. 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. In addition to M. Sc.-Electronics, the research programmes M.Phil. as well as Ph.D. are also going on.

3. Objectives of the course:

Following are objectives of the course.

- To provide exposure to the students to the recent technologies.
- To provide the knowledge of design and implementation of instrumentation of significant preciseness.
- To inculcate awareness among the student to perform the projects of industrial standards, which could also, ensures the interdisciplinary approach.
- To empower the students to cater the needs of industrial sectors. It is also attempted to expose the students to the research activities and to inculcate the research awareness.
- To expose the students to the industrial environment a on job training and internship may be provided
- To empower the students to achieve the success in the NET/GATE/SET etc examinations.

4) 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. The students of M. Sc.- Electronics can opt one of the three specializations for part- II.

5) Eligibility of the Course

- B. Sc. with Electronics subject at Principal / Interdisciplinary /Allied/ Applied/ Subsidiary level.
- B. Sc. Physics with Electronics subject at subsidiary Level.
- B.C.S.(ECS)

6) Duration:

2 Years – 4 Semesters

7) 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. In fact, the department offers three specializations Embedded System and Instrumentation, Communication Electronics and VLSI design. Students can opt any one out of three at Semester-III and IV. Moreover, each specialization has three papers for semester –III and IV. The choice is given to the students to select two papers out of three. Two papers for Semester –III and IV are compulsory. Thus, Papers XI, XII, XV and XVI are elective papers of respective specialization.

8) 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 four papers at PG level. The PG student must complete minimum of 16 credits (maximum 160 credit points) in each semester.

a) Conversion of marks into 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)

2. **Cumulative Grade Point Average (CGPA)**

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

Σ Ci - the total number of credits offered by the student upto and including the semester for which CGPA is calculated.)

3. **Final Grade Point Average (FGPA)** will be calculated in the similar manner for the total number of credits offered for completion of the said course.

Where: Ci: Credits allocated for the i^{th} course

Gi: Grade point scored in i^{th} paper

Conversion of average grade points into grades:

The students performance of course will be evaluated by assigning a letter grade on ten points scale as given below.

CGPA/CBCS	Letter Grade
9.5-10	O
8.5-9.4	A+
7.5-8.4	A
6.5-7.4	B+
5.5-6.4	B
4.5-5.4	C+
4.0-4.4	C
<3.9	FC
	FR

b) Scheme of evaluation:

The candidate has to appear for internal evaluation of 30 marks and external evaluation (University Exam) for 70 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 continuous assessment.

c) Nature of Question Papers

There shall be seven questions out of which the candidate has to solve five questions. Each question will carry 14 marks. Following is the nature of Question paper.

Q. NO. 1 : (Objective type) Compulsory
Q. No. 2 : (Short Answer) Compulsory
Q. No. 3 to 7 (Any three)

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 70 marks paper of the external examination and his performance 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 1st and 2nd semester will be allowed for admission to second year (Sem. III-IV)

9) 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, each semester bears four compulsory theory papers and Two practical papers. Moreover, for M.Sc.-II two papers are compulsory for each semester and two papers are elective. There are following three specializations and student has to opt one of it.

Specializations :

a. Embedded System and Instrumentation (ESI)
b. Communication Electronics (CE)
c. VLSI Design (VD)

The course structure

(M.Sc. Electronics)

Paper No.	Title of the course	Credit	Teaching (H/W)	Marking Scheme		
				University Exam.	Internal Evaluation	Total
M. Sc.-I Semester – I						
I	Numerical Methods	4	4	70	30	100
II	Instrumentation Design	4	4	70	30	100
III	Power Electronics	4	4	70	30	100
IV	Advanced Microcontrollers	4	4	70	30	100
Pr-I	Practical – I	4	12	70	30	100
Pr-II	Practical – II	4	12	70	30	100
Seminar-I	Seminar – I	1	-	-	25	25
M. Sc.-I Semester-II						
V	Control theory	4	4	70	30	100
VI	Real Time Operating System	4	4	70	30	100
VII	Opto Electronics	4	4	70	30	100
VIII	Signals and Systems	4	4	70	30	100
Pr-III	Practical – III	4	12	70	30	100
Pr-IV	Practical – IV	4	12	70	30	100
Seminar-II	Seminar – II	1	-	-	25	25
M. Sc.-II Semester-III						
IX	Digital Signal Processing	4	4	70	30	100
X	Advanced Digital Design with VHDL	4	4	70	30	100
XI	Elective – I	4	4	70	30	100
XII	Elective – II	4	4	70	30	100
Pr-V	Practical – V	4	12	70	30	100
Pr-VI	Practical – VI	4	12	70	30	100
Seminar-III	Seminar – III	1	-	-	25	25
M. Sc.-II Semester-IV						
XIII	Microwave devices, Antennas and Measurements	4	4	70	30	100
XIV	Networking and data communications	4	4	70	30	100
XV	Elective – III	4	4	70	30	100
XVI	Elective-IV	4	4	70	30	100
Pr-VII	Project	4	12	70	30	100
Pr-VIII	Project	4	12	70	30	100
Seminar-IV	Seminar - IV	1	-	-	25	25

M. Sc. Electronics

Semester – I

I : Numerical Methods
II : Instrumentation Design
III : Power Electronics
IV : Advanced Microcontrollers

Semester – II

V : Control theory
VI : Real Time Operating System
VII : Opto Electronics
VIII : Signals and Systems

Semester – III

IX : Digital Signal Processing
X : Advanced Digital Design with VHDL
XI : Elective – I
XII :Elective - II
Practical- Compulsory Laboratory.
Practical- Elective Laboratory.

Semeste- IV

XIII : Microwave devices, Antennas and Measurements
XIV : Networking and data communications
XV :Elective – III
XVI : Elective-IV
Project (Two Course Weightage)

Elective papers:

(ESI) Embedded System and Instrumentation

Sem – III

ESI-1. ARM Microcontroller and system design.
ESI-2. Medical Instrumentation.
ESI-3. Agro Instrumentation.

Sem –IV

ESI-4. Nanoelectronics
ESI-5. Virtual Instrumentation
ESI-6. Mechatronics and Industrial Automation .

(CE) Communication Electronics

Sem.–III

CE-1 ARM Microcontroller and system design.
CE-2 Digital Communication
CE-3 Cellular and mobile communication

Sem.– IV

CE-4 Optical Fiber Communication
CE-5 Wireless Sensor Network
CE-6 Satellite Communication

(VD) VLSI Design

Sem.–III

VD-1 CMOS Design Technologies
VD-2 CMOS Analog Circuit Design
VD-3 Programming with Verilog HDL

Sem.– IV

VD-1 Nanoelectronics
VD-2 Smart Fusion Technology Based System Design
VD-3 Mixed Signal Based SoC Design

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Class : M. Sc.-I
Semester : I
Subject : Electronics
Paper : I

Paper-I Numerical Methods

Unit-I System of Linear Algebraic Equations: 12

a) Formulation of system of linear algebraic equations using matrix and vector notations. Matrix transformations, adjoint and co-factors, Determinant of matrix, Inverse of matrix, Identification of square, Singular, upper-triangular(U), lower triangular(L), tri-diagonal, matrices, Fundamentals of Eigen Value Problem.

b) **Direct methods :** Forward and Backward Substitution, Gauss Jordan elimination method, Gaussian Elimination method and LU factorization method . Introduction to Iterative method**.**

c) **Case Study** : Study of R-2R ladder network using tri-diagonal system

Unit-II Laplace Transform: 10

a) Introduction to Integral transform Laplace transform and its importance to study electrical circuits.

b) Laplace transform of standard functions, properties of Laplace transform, Laplace transform of periodic functions,

c) Inverse Laplace transform, Partial fraction rule.

d) Study of RL, RC, RLC circuits using Laplace transform.

Unit-III Curve Fitting 10

a) **Curve fitting :**Introduction to curve fitting. Empirical relation and actual relation.

b) **Least Squares method of curve fitting :** Straight line fitting, Second order polynomial fitting.

c) **Interpolation :** Difference between interpolation and extrapolation. Piecewise Linear interpolation, Newton's forward difference formula for interpolation, Newton's backward difference formula for interpolation, Cubic splines approximation. Divided differences for unequal intervals, Lagrangian interpolating polynomials

Unit-IV Numerical Differentiation and Integration 08

a) **Numerical Differentiation :** Introduction, Forward, central and backward formulae for differentiation,

b) Numerical Integration : Introduction, Newton-Cotes Quadrature formula, Trapezoidal rule, Simpson 1/3 rule and 3/8 rule of numerical integration

c) Case Study : Study of RC differentiator and integrator circuits

Unit-V Solution of Ordinary Differentiation Equation 05

a) Introduction, Initial value problem and boundary value problem.

b) Taylor series method, Euler`s method , Runge Kutta method.

Reference Books:

1. Circuit and Network analysis and synthesis by A. Sudhakar and S. P. Shammohan 2nd Edition, TMH,
2. Numerical Method with programming in C 2nd Edition, by T. Veerarajan and T. Ramchandran, TMH, New Delhi.
3. Applied Numerical Methods for Engineer, using MATLAB and C, Robert J Schilling and Sandra L Harries, Thompson publishers, 1999.
4. Numerical Methods for scientific and Engineering computation by M. K. Jain, S. R. K. Iyengar and R. K. Jain 5th Edn. New Age International, New Delhi.
5. A first Course in Numerical Methods by U. M. Ascher and Chen Greif, PHI, New Delhi, 2013.

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Class : M. Sc.-I
Semester : I
Subject : Electronics
Paper : II

Paper-II INSTRUMENTATION DESIGN

Unit 1: Transducer and its interfacing (10)

a) **Sensors:** Sensors and Transducers, Active and Passive sensors, characteristics of sensors, static and dynamic characteristics, Accuracy and precision, Linearity, hysteresis, loading effects, threshold and stiffness.
Thermocouples, Thermistors, RTD, PT 100, Semiconductor temperature transducers, AD590, LM35, LM135, LM235, LM335. Their types, characteristics, specifications. Designing of simple interfacing circuits.
Strain-gauge, load cell, piezo-electric, LVDT . Force, flow, level, displacement transducers, Designing of simple interfacing circuits.
Hall effect and IR transducers and their interfacing

b) **Actuators:** Electromagnetic relay, Limit switch, Proximity sensor, Inductive, Capacitive, IR proximity sensor.

Unit 2: Instrumentation: 15

a) General block diagram of instrument design for measurement. Minimum requirements, AC and DC bridges, Excitation, Grounding and electromagnetic and electrostatic shielding. Readout, Need of display system in instrumentation. Digital and Analog display, LCD (16 x 2 line), Recorders, plotters etc.

b) Signal conditioners, Designing of pre-amplifiers, Instrumentation and chopper Amplifiers, Instrumentation amplifier, Signal conditioner (2B30), Programmable Excitation device (2B35) Programmable instrumentation amplifier 2B31, AD524, AD620, AD594/595, Isolation amplifier (Model 289)

Unit 3:Signal transformation 10

Signal transmission, 4-20mA current, Characteristics of 4-20mA current loop, programmable 4-20mA current drivers. F-V & V-F, V-I & I-V converters.

Unit 4:Data acquisition system(DAS) 5

Need of DAS, Single channel data acquisition system, Multi-channel DAS, data loggers, basic Operation of data loggers, compact data loggers. Microcontroller based minimum system for data acquisition **(5)**

Unit 5:Case Studies

- Designing of instrumentation for measurement of
  a) Temperature
  b) Humidity
- Interfacing of PIR and ultrasonic sensor modules

Reference Books:

1. Transducer Interfacing Handbook- A guide to analog signal conditioning- Daniel H Sheingold, Analog Devices, Massachusetts
2. Electronic instruments –K.S.Kalsi, Tata MC-Graw Hill.
3. Instrumentation, measurements and analysis-B.S.Nakara, Chaudhari, TMH.
4. Instrumentation measurement - Moorthy, Prentice Hall of India.
5. Industrial Electronics, Circuits, Instruments and control techniques, - Terry Bartelt- Delmer - Cengage

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Class : M. Sc.-I
Semester : I
Subject : Electronics
Paper : III

Paper-III: POWER ELECTRONICS

Unit 1: Controlled Rectifier: (12)

a) Concept of uncontrolled and controller rectifiers.
b) Single phase circuits: Half & Fully controlled bridge rectifier with resistive R & R-L load with and without freewheeling diode, series & dual converter, power factor improvement.
c) Three phase circuits: Half controlled rectifier, Half controlled Bridge rectifier, Fully controlled Bridge rectifier with R & R-L load, three phase dual converter.

Unit 2: AC Voltage Controllers: (08)

a) Introduction to AC Voltage controllers AC On / Off control, Effect of duty cycle.
b) Concept of Phase control, Single Phase Uni-directional and bidirectional controllers with resistive & inductive loads.
c) Three phase half & full wave controllers with resistive & inductive loads.

Unit 3: Inverters: (08)

a) Operating principle. Single phase bridge inverter, steady state analysis. Mcmurray half and full bridge inverter, McMurray-Bedford half and full bridge inverter
b) Three phase inverter, PWM inverters, single phase PWM and Multiphase PWM inverters. Reduction of harmonics.
c) Current source inverters single phase current source inverters with R load.

Unit 4: Choppers: (07)

a) Operating principle, control strategies, time ratio control, step –up and step down chopper with R load, Class A, B, C, D, E Choppers
b) Multiphase choppers and AC choppers. .

Unit 5: Cycloconverter: (10)

a) Introduction to cycloconverter, types of cycloconverter.
b) Single Phase Cycloconverter, Mid point cycloconverter, Bridge type cycloconverter, step up cycloconverter.
c) Three phase cycloconverters. Three phase to single phase, three phase to three phase. Reduction of output harmonics.
d) Microcontroller based firing schemes.

Reference Books:

1. Power Electronics – M.H. Rashid, PHI.
2. Power Electronics –Singh – Kanchandani- TMH
3. Industrial and Power Electronics – Deodatta Shingare Electrotech publication,
4. Power Electronics – P. S. Bhimra Khanna publisher, New Delhi.

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Class : M. Sc.-I
Semester : I
Subject : Electronics
Paper : IV

Paper IV: Advanced Microcontrollers

Unit – I PIC Microcontrollers 18

- **Introduction:** Advantages of PIC microcontrollers over MCS-51 series. PIC microcontroller features, Architecture of PIC microcontrollers, Pin Description, 16CXX series. Architecture of 16F877. Memory structure, Resisters, Register file structure, Register banks, program and data memory, Use of EEPROM, SFRs, W-register, Status register, Option register etc. Interrupts in PIC microcontrollers, IO ports of 16F877. Timers of PIC Microcontrollers, Compare capture mode, PWM mode, I2C bus , On Chip ADC and DAC facility. USART the serial IO, watchdog timer, Power up timer, Sleep mode, Reset, and clock circuits, types of the RESET. Interrupt vector table. Introduction of 18FXX series.
- **Instruction Set :** Instruction set, instruction format, byte oriented instruction, bit oriented instruction, literal instruction, flow control instruction. Addressing modes

Unit – II

Integrated Development Tools for PIC: Overview of MPLAB the IDE for Assembly language. Micro C the IDE for embedded C programming. Developing, compiling, and programming the microcontroller, Some programs on IO port, timer and serial IO programming.

Unit – III AVR Microcontrollers 17

- **Introduction to AVR**: General architecture of AVR microcontroller family. Salient features, AVR Series .
- **Architecture:** Architecture and hardware resources of AVR ATMega 8L, The arithmetic logic unit, program memory & data memory, Downloadable Flash program memory, SRAM data memory, General- purpose register file, SFRs, I/O register, EEPROM data memory, IO port structure, Peripherals, timer and counters, watchdog timer, Serial Peripheral interface, universal asynchronous receiver and transmitter, Analog comparator, reset and interrupt, interrupt vector table, reset sources. On chip ADC and DAC , Reset circuit and clock circuit.
- **Instruction set:** Instruction set, Memory addressing modes, Register direct addressing, I/O direct addressing, SRAM direct addressing, SRAM indirect addressing constant addressing using the LPM instruction , Arithmetic instruction, Logical and bit wise instructions, Jumps and calls, instruction set, reset and interrupt handling, watchdog handling , stack, program constructs, conditional branches, program loops , refreshing port pins and important register, polling inputs.

Unit –IV

Integrated Development Tools for AVR: Study of development tools of ATMEL AVR microcontrollers, ATMEL AVR Studio, WinAVR and Codevision

Unit – V Programming and interfacing with AVR & PIC 10

- **Interfacing with AVR and PIC mecrocontrollers:** Interfacing of IO devices to the ports. Memory interface I/O Interface Interfacing smart LCD, relay, opto-coupler, Interfacing ADC & DAC, firing of thyristor,.
- **Development of embedded system for**
    a. Temperature controlling
    b. Measurement of pH
    c. DC Motor controlling by using PWM techniques.

Reference Books:

1. PIC Microcontrollers and Embedded systems using Assembly and C for PIC18 – M.A. Mazidi, R. D. Mckinlay and D. Causey - Pearson Education, New Delhi- 2009.
2. Embedded design with PIC18F452, John B.Peatman
3. Embedded C programming and the Microchip PIC – Richard Barnet, L.O.Cull and S. Cox Delmer.-2004.
4. Microcontrollers Theory and Application – Ajay V. Deshmukh TMH New Delhi
5. Embedded C Programming and the Atmel AVR, Richard H. Banett, Sarah A. Cox, Larry D. O'Cull, Thomson.
6. Programming and customizing The AVR Microcontroller, Dhananjay Gadre, TMH.

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Class : M. Sc.-I
Semester : II
Subject : Electronics
Paper : V

Paper -V CONTROL THEORY

Unit 1: Fundamentals of Control Systems : (06)

Introduction The control system , basic definitions, close and open loop system and their comparison, block diagrams, block diagram reduction techniques. Transfer functions and signal flow graphs

Unit 2: Feedback characteristics of control system: (08)

Feedback and Non feedback system, Reduction of parameter variation using feedback, Control of system dynamics, Control of the effects of disturbance signals using feedback, Regenerative feedback

Unit 3: Time domain analysis and Stability : (10)

Standard test signals, Time domain performance of control systems, Transient response of the first, the second and the higher order systems, Steady state errors, Effect of adding zero to the system, Design specification of second order system. Concept of poles and zeros. The concept of stability, Necessary conditions for stability Routh stability criterion.

Unit 4: Root locus techniques: . (06)

The Root locus concept, construction of root loci, Root contours, system transportation lag

Unit 5: Frequency domain analysis and stability: (07)

Correlation between time and frequency response, Polar plots, Bode plots, all pass and minimum phase system, experimental determination of transfer function, log magnitude verses phase plots, Nyquist stability criteria, Assessment of sensitivity analysis in frequency domain.

Unit 6: Control actions and industrial process control: (08)

Introduction, Process control system, Roll of controllers in process industry, Concept of sequencing and modulating controllers,

Control actions, Discontinuous (ON-OFF) and Continuous control modes, Proportional (P), Derivative (D) and Integral (I) controller, Composite (PI, PD, PID) controllers, their performance and characteristics.

Reference Books

1. Control system Engineering-J.J.Nagrath, M. Gopal, 2nd Edition, Wiley Eastern Ltd.
2. Modern control Engineering-K. Ogata, Prentice Hall of India.
3. Automatic control systems-B.C. Kuo, Prentice Hall of India.
4. Control system –Smarajit Ghosh, Pearson Education (Singapore). Ltd.

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Class : M. Sc.-I
Semester : II
Subject : Electronics
Paper : VI

Paper - VI Real Time Operating System

Unit 1: Overview of Embedded system design with AVR microcontrollers: (14)

a) **Introduction:** Concept of embedded system, structure of embedded system, characteristics of embedded system, types of embedded system,
b) **Microcontroller based embedded system:** Minimum requirement. Microcontroller, Clock circuit, Reset circuit, In system programming (ISP)
c) **Embedded system design** : Designing of AVR ATmega8L microcontroller based embedded systems for Measurement of pH, Humidity, wind velocity, temperature etc.

Unit 2: Fundamentals of Real Time Operating System (10)

a) **Introduction:** Concept of Real Time, Real Time operating System, Characteristics of Real-Time operation system, Hard and Soft Real Time Systems.
b) **Structure of RTOS:** Structure of RTOS, RTOS Kernel, Kernel Objects, Services of Scheduler.
c) **Task :** Task, Task structure, Creation of task, types of task, Task Control block, context, States of task and FSM, idle task, Priority, Static and dynamic priority, Resources, Sharing of resources, ISR, Task Management.
d) **Scheduling Algorithm :** Task scheduling Algorithm, preemption, FIFO, Round Robin scheduling, priority based preemptive scheduling. Priority Inversion, Software and hardware time Ticks, context switching.
e) Simple programs based on Tiny RTOS kernel.

Unit:3 Task Synchronization and Intertask communication: (8)

a) **Synchronization of task :** Concept of Sharing of resources, Race condition, Critical condition, deadlocks, spinlocks,
b) **Semaphores and mutexes :** Concept of semaphore, Binary semaphore, Counting semaphore, Semaphore management, **Mutexes :** Concept of mutex, mutex management.
c) **Intertask communication:** Intertask Communication, Messages, Queues, Mailboxes.

Unit:4 The RTOS Kernel MicroC/OS-II : (5)

MicroC/OS-II kernel, creation of task, task management, Simple programs on creation of task.

Unit:5 The RTOS RTLinux: (8)

RTLinux Kernel, POSIX Pthreads, Processes and Threads, Thread Basics, Process management, semaphores, mutexes. Simple programs on creation of threads.

Reference Books:

1. Embedded C - Michael J Pont
2. Embedded C Programming and the Atmel AVR - R. H. Barnett, S. Cox and L. O'Cull
3. Embedded C Programming and the Microchip PIC - R. H. Barnett, S. Cox and L. O'Cull
4. *Operating Systems – A.S. Godbole*
5. Real-Time Systems – C.M. Krishna and K.G. Shin
6. Embedded / Real Time Systems – Concepts design – programming- KVVK Prasad.
7. MicroC/OS-II, The Real Time Kernel, - J.J. Labrosse, 2nd Edn. (2006) CMP Books

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Class : M. Sc.-I
Semester : II
Subject : Electronics
Paper : VII

PAPER VII- OPTOELECTRONICS

Unit 1. Optical fibers: (6)

Construction and working principle of optical fiber, Types of optical fiber, Numerical aperture, Pulse spread due to material dispersion, loss mechanism, modes in steps and grade index fiber.

Unit 2. Optical Sources: **(6)**

Optical sources, LED, He-Ne laser, working principle spectral and spatial characterization.

Unit 3. Optical detectors: **10**

Types of detectors, Thermal detectors, semiconductor detectors, Photodiodes, APD, PIN photodiodes, photo transistors, working principle and characteristics.

Unit 4. Modulation of light. **14**

Concept of Intensity Modulation, Birefringence, Quarter wave plate, linear Electro optic(EO) effect, working of pocket cell as modulator and deflector, Kerr modulators, Magneto optic devices, Faraday effect, Acoustic optic(AO) devices, AO working principles, AO modulator

Unit 5. Fiber Optics Technology (9)

Glass fiber fabrication, Introduction to cable design, coupling, splicing and connectors, splicing methods, types fiber measurements (NA, Loss measurement, connector & splice loss, dispersion)

Reference Books:

1. Optical Fiber Communication by A. Selvarajan and etal TMH, 2002.
2. Optical Fiber Communication by Gerd Keiser , MGH , 1998.
3. Optical Electronics, 4th Edition by A. Yariv, HRW publication, 1991.
4. OPTOELECTRONICS: An introduction By J.Wilson and J.F.B.Hawkes, PHI 1983

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Class : M. Sc.-I
Semester : II
Subject : Electronics
Paper : VIII

PAPER VIII- SIGNALS AND SYSTEMS

Unit 1 Introduction to Signals 12

A Signals, Typical Examples on Signals and systems, classification of signals, continuous-time/discrete-time, deterministic/non-deterministic, periodic, Non-periodic, even-odd, energy-power signals, elementary signals, exponential, sinusoidal, impulse, unit step, ramp, parabolic, Triangular, Rectangular Signals. Basic operations on signals, Time shifting, scaling, Time Reversal, signal addition and signal multiplication.

Unit 2 Introduction to system 12

A System, classification of System, continuous-time and discrete-time system, static and dynamic, linear and non-linear, time-invariant and variant, deterministic and random (stochastic), causal and non-causal, stable and unstable. Linear Time Invariant (LTI) systems, impulse response, convolution integral, convolution sum, condition for BIBO stability for CT and DT signals in terms of impulse response.

Unit 3 Fourier series 11

The Periodic signal, Fourier series Representation of periodic signals, Dirichlet Conditions, Evaluation of Fourier coefficients, symmetry conditions, Half symmetry, amplitude & phase spectrum, Exponential Fourier series, Continuous-time Fourier series (CTFS), properties of CTFS – Parserval's theorem for power signals, power spectral density.

Unit 4 Analysis of Signals and Systems 10

Basic Structure of Matlab, File types, Matlab commands,, tool boxes, Looping and conditioning commands and operators, Matlab command for signals and system problems. Steady state solution of electric circuits with non-sinusoidal periodic inputs using Fourier series – effective values of voltages and currents – power due to non-sinusoidal voltages and currents.

Reference Books:

1. Signals and systems by P. Ramesh Babu, and R Anandanatarajan, SCItech
2. Signal and systems, I J Nagarath , S. N. Shraran and Rakesh Ranjan, TMH 2010
3. Fundamentals of Signals and System, M, J, Robert TMH, 2010
4. Signals and Systems, Richard Buranik

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Class : M. Sc.-II
Semester :III
Subject : Electronics
Paper : IX (Compulsory)

Paper- IX Digital Signal Processing

Unit 1 : Continuous Time Fourier Transform: (8)

Overview of Signals and Systems, Development of FT, Existence of FT, FT of some standard signals, Properties of FT, Linearity, Time shift and time reversal, frequency shift, scaling, FT of complex function, Auto-correlation, FT of periodic signals, Inverse FT.

Unit 2 : Discrete Fourier Transform : 08

Discrete Fourier Transform, Existence of DFT, Properties of DFT, sampling of continuous signal, Analog to digital conversion, Nyquist rate & aliasing problem, anti aliasing, Pulse Sampling, Circular convolution, Fast Fourier Transform (FFT), DIT, DIF and their comparison.

Unit 3 : Z-transform : 10

Z-transform, properties of ZT, inverse ZT, Poles & Zeros, discrete time signal, properties of ZT, Difference equation using ZT, representation of discrete system difference equations.

Unit 4: Design of digital FIR filter : 10

Realization of digital linear system, Ideal filters, signal bandwidth and system bandwidth, filter categories, system function of a digital filter, combination of filter section, implantation of digital filter using system function, Methods for design of FIR Filter, realization of FIR filter, FIR filter design using Kaiser window

Unit 5: Design of digital IIR filter : 09

Methods for design of IIR Filter, Bilinear transformation IIR filter, impulse invariance method, Design of Butterworth digital filter, realization of IIR filter.

Reference Books:

1. Introduction to DSP – Proakis, Pearsons Edn.
2. Discrete Time Signal Processing – Oppenhiem & Schafer
3. D.S.P - Pallan Technova Publications
4. D.S.P. – Luedmon.

Solapur University, Solapur

Class : M. Sc.-II
Semester :III
Subject : Electronics
Paper : X (Compulsory)

Paper X- Advanced Digital Systems Design with VHDL

Unit:1 VLSI Devices : 7

Programmable Logic Devices, PLA, PAL, CPLD, and FPGA, Architecture of Programmable Logic Devices, Concepts of Macro Cells, CLBs, PSMs, Interconnect lines, IOBs, ISP, IP Cores, General block diagrams Xilinx Spartan III

Unit-2 : Introduction to Hardware description Language. 10

a) **Introduction:** Introduction to Computer-aided design tools for digital systems. Introduction to EDA tool, IO pin configuration, design implementation, synthesis, behavioral. Programming the devices.
b) **Hardware Description Languages :** Concept of Hardware description Languages. Introduction to VHDL, data objects, classes and data types, Operators, Overloading, logical operators. Types of delays Entity and Architecture declaration.

Unit-3 : VHDL Statements : 10

a) Assignment statements, sequential statements and process, conditional statements, case statement Array and loops, resolution functions, Packages and Libraries, concurrent statements. Structural Modelling, component declaration, structural layout and generics.
b) Examples on digital circuit design

Unit-4 : Combinational Circuit Design: 8

VHDL Models and Simulation of combinational circuits such as Multiplexers, Demultiplexers, encoders, decoders, code converters, comparators, implementation of Boolean functions etc.

Unit-5 : Sequential Circuit Design: 5

Models and Simulation of Sequential Circuits Shift Registers, Counters etc

Unit -6 : Prototyping and case studies: 5

a) Design with CPLDs and FPGAs : Programmable logic devices : PLAs, PALs, CPLDs and FPGA. Design implementation using CPLDs and FPGAs
b) Examples on digital circuit design

Reference Books:

1. A VHDL Synthesis Primer J. Bhaskar BS Publications Hyderabad.
2. Digital System Design using VHDL: Charles. H.Roth ; PWS (1998)
3. Fundamental of digital Logic Design with VHDL – Stephan Brown and Zvonk Vranesic – 2nd ed TMH New Delhi.
4. VHDL-Analysis & Modelling of Digital Systems: Navabi Z; McGraw Hill.
5. VHDL by Douglas L. Perry, Mc Graw Hill Publications

Solapur University, Solapur

Class : M. Sc.-II
Semester :IV
Subject : Electronics
Paper : XIII (Compulsory)

Paper XIII- Microwave Devices, Antennas and Measurements

Unit 1 Introduction **(08)**

Microwave spectrum, Microwave applications, Electric and magnetic fields, Field in Conductors and Insulators, Maxwell's Equations and Boundary Conditions, Wave propagation in perfect insulators, Wave polarization, Wave propagation in Imperfect Insulators and Conductors, Reflections at Conducting and Dielectric Boundaries

Unit 2 Microwave Transmission Lines **(08)**

Transmission-Line Equations, Solutions of Transmission-Line Equations, Reflection Coefficient, Transmission Coefficient, Standing Wave, Standing-Wave Ratio, Line Impedance, Line Admittance, Smith Chart, Single-Stub Matching, Double-Stub Matching, Microwave Coaxial Connectors

Unit 3 Microwave Tubes and Transferred Electron Devices (TEDs) **(06)**

Klystrons, Multicavity Klystron Amplifiers, Reflex Klystrons, Helix Traveling-Wave Tubes**,** Magnetron Oscillators, Gunn-Effect diodes – GaAs diode, RWH theory, LSA Diodes, InP Diodes

Unit 4 Microwave Waveguides and Components **(10)**

Rectangular waveguides, Rectangular-Cavity Resonator, Q Factor of a Cavity Resonator, Waveguide Tees, Magic Tees, Rat-Race Circuits, Corners, bends, twists, Directional Couplers, Circulators and Isolators, Terminations and Attenuators,

Unit 5 Microwave Antennas **(05)**

Slot and Microstrip Antennas, Horn Antennas, Reflector Antennas

Unit 6 Microwave Measurements **(08)**

Detection of Microwave power- Crystal rectifiers, Crystals as Low-level Detectors, Crystals as Converters, Crystal Holders, Microwave Power Measurements-Bridge Circuits, Thermistor parameters, Operation of Thermistor in a Bridge Circuit, Thermistor Mounts, Measurement of VSWR-Standing Wave Detector, Techniques in Standing-wave Detector Measurements

Reference Books:

1. Peter A. Rizzi, *Microwave Engineering: Passive Circuits.* New Delhi : PHI, 2001
2. Samuel Y. Liao, *Microwave Devices and Circuits*. New Delhi : PHI, 2001
3. Rajeswari Chatterjee, *Antenna Theory and Practice,* New Delhi : New Age International (P) Ltd. Publishers, 2000
4. Edward L. Ginzton, *Microwave Measurements,* New York : McGraw-Hill Book Company, Inc., 1957
5. Carol G. Montgomery, Ed., *Techniques of Microwave Measurement,* Vol.1. New York : Dover Publications, Inc.,1966

Solapur University, Solapur

Class : M. Sc.-II
Semester :IV
Subject : Electronics
Paper : XIV (Compulsory)

Paper XIV- Networking and Data Communication

1. Introduction to Networking **4**

Data communication. Networks- Topology & Categories of Network. Network Models- OSI & TCP/IP- Layered architecture, Functions of layers & Addressing.

2. Physical Layer **12**

Data transmission- Analog & Digital. Multiplexing & Spreading, Transmission media- Guided & Unguided. Transmission Impairment, Switching- Circuit switched, Datagram & Virtual switched. Structure of switch. Modem Standards, Digital Subscriber Line (DSL)

3. Data Link Layer **12**

Data link control- Framing, Flow & Error control, Protocols (Simplest, Stop-and-Wait ARQ, HDLC, PPP). Wired LANs- Standard Ethernet, Bridge Ethernet, Switched Ethernet, Full-Duplex Ethernet. Wireless LANs- IEEE 802.11, Bluetooth. Connecting Devices- Hubs, Repeater, Bridges, Routers, Gateway. SONET, ATM

4. Principles of Internetworking **10**

IP Address- IPv4, IPv6.

Internet Protocols- IPv4, IPv6, Dual Stacking, Tunneling, Header Translation.

Address Mapping, Error reporting, Multicasting, Delivery, Forwarding, Routing. Connection oriented & Connectionless Network, UDP,TCP, Congestion Control, Quality of Service.

Domain Name System- Name space, Domain Name space, Distribution of Name Space, DNS in the Internet.

Remote Logging, Electronic Mail (SMTP), File Transfer, WWW, HTTP

5. Security **7**

Cryptography, Network Security- Security Services, Message Confidentiality, Message Authentication, Digital Signature, Entity Authentication.

Security in the Internet- IPSecurity (IPSec), Firewalls

Reference Books

1. Data Communication & Networking by B.A. Forouzen, TMH.
2. Computer Networks by A.S. Tanunbaum, PHI.
3. Data & Computer Communications by W. Stalling PHI.

Solapur University, Solapur

Class : M. Sc.-II
Semester :III
Subject : Electronics
Paper : Elective-ESI-01

ESI-01: ARM Microcontroller and System Design

Unit I Fundamentals of ARM Microcontrollers: 10

Introduction to ARM microcontroller, ARM Core Philosophy, Bus Architecture, AMBA Bus, AHB, APB, Registers, Current program status register(CPSR), Saved program status register(SPSR), Stack pointer, Link register, Modes of processor , States of the processor, ISA, Pipelining register , Current program status register(CPSR), Saved program status register(SPSR), TDMI, Interrupts and Exceptions, Interrupt latencies. Nomenclature of ARM families.

Unit II Instruction Set of ARM Microcontrollers: 10

ARM instruction set architectures, Barrel shifter, Data Transfer Instructions, Arithmetic and Logical, multiply instruction, SWI, Thumb Instruction set, Jazzele Instructions, comparison of ARM, Thumb and Jazzele ISA. Cortex series and its features.

Unit: III Architecture of LPC 2148 : 5

Block diagram of LPC2148, Pin Description, On-Chip memory, memory map, GPIO, clock and timing , power control modes,.

Unit: IV On chip peripherals of LPC 2148 : 10

On chip peripherals, Programming with ADC, DAC, DMA controller, UART, Timer /Counter, Real time clock ,Watchdog timer, PWM, CAN and Ethernet, I2C mode, USB host/slave.

Unit: V ARM LPC 2148 based embedded system development : 10

ARM based embedded system design, clock circuit, reset circuit, power supply, IDE SCARM, Examples in embedded C programming. Interfacing of LED, Relay, Optocouplers etc. Development of Embedded system for temperature, humidity, pH , displacement etc. measurements.

Reference Books:

1. ARM System Developers Guide- A. N. Sloss, D. Symes & C. Wright –Elsevier (2004)
2. ARM System on Chip Architecture- Steve, Furber Pearson Education, 2013
3. Product data sheet of LPC 2148.

Solapur University, Solapur

Class : M. Sc.-II
Semester :III
Subject : Electronics
Paper : Elective – ESI-02

ESI-02: Medical Instrumentation

Unit 1. Bioelectric signal : (6)

The origin of Biopotentials, measurement of Biopotentials, Electrical activity of excited cells, The concept of electrical impedance, impedance bridge circuits, determination of biological events by electrical impedance method.

Unit 2. Sensors and Electrodes: 10

The Nernst equation. Potentiometric sensors, amperometric sensors, chemical biosensors, Blood-Gas sensors, pH, pO_2, etc sensors, Noninvasive Blood gas sensors, Blood-Glucose sensors. Electrical conductivity of electrode Jellies and Creams skin contact measurement, Silver-silver Chloride electrode Electrodes for ECG, EEG & EMG.

Unit 3. Cardio-vascular system and Measurement: (5)

The heart and cardio-vascular system, concept of blood pressure, blood flow and heart sound, Measurement of BP.

Unit 4. Fundamentals of Biomedical recording system : (8)

Basic recording systems, General architecture of recording system, preamplifiers, differential amplifiers, instrumentation amplifiers, Isolation amplifier, Sources of the noise.

Unit 5. Modern recording system : (9)

- **Electrocardiograph (ECG**): Basic principle, block diagram of ECG, ECG Leads, microcontroller based ECG
- **Electroencephalograph (EEG):** Basic principle, block diagram of EEG, Computerized analysis of EEG
- **Electromyograph (EMG):** Basic principle, block diagram of EMG

Unit 6. Modern Imaging systems (7)

Basis of Diagnostics radiology, features of Diagnostics x-ray, General architecture of x-ray Machine, voltage and frequency requirements, Basic principles and general architecture of modern imaging systems MRI, and Ultrasound.

Reference Books:

1.Handbook of Biomedical Instrumentation, -R.S. Khandpur, 2nd edition, TMH, New Delhi Reprint 2007
2.Introduction to Biomedical Equipment Technology- J.J.Carr & J.M. Brown, PHI 1993.
3.Medial Instrumentations: Application and design – J.G. Webster, 3rd Edition, John Wiley & Sons, 2004.
4. Biomedical Instrumentation and Measurements –Cromwell, Weibell & Pfeiffer, PHI 2nd Ed.

Solapur University, Solapur

Class : M. Sc.-II
Semester :III
Subject : Electronics
Paper : Elective – ESI-03

ESI-03: Agro Instrumentation

Unit 1. Fundamentals of Agricultural Instrumentation. 10

Necessity of instrumentation for high tech Agriculture.
Definition of parameters involved in Agriculture: Environmental & Soil parameters Humidity, pH, light intensity, pest concentration, physiological effects, soil parameters, Soil moisture, conductivity..

Unit 2. Sensors for Agricultural Parameters 14

Sensors for measurement of temperature, Humidity, pH, conductivity, soil, moisture, salinity, etc. CO_2, O_2 etc gas sensors. Study of SY-HS-220, IR based sensors, Figaro TGS 813.

Unit 3. Instrumentations to Control the Polyhouse Environment 12

Development of Electronics system for Measurement and control of Humidity and Temperature of polyhouse. PC Based Instrumentation. Application of Wired Network for Greenhouse. Introduction to Wireless sensor and its application to polyhouse monitoring system.

Unit 4. Instrumentations to measure and control soil parameters 9

Instrumentation for measurement of pH, Conductivity, salinity and nutrients of the Soil.

Reference books;

1. Instrumentation hand book : Process & Control- B. G. Liptak
2. Process control & Instrumentation technology C. D. Johnson
3. Instrumental methods of chemical Analysis –williard mertte & dean
4. Industrial Instrumentation & control- S. K. singh 2edn. TMH

Solapur University, Solapur

Class : M. Sc.-II
Semester :IV
Subject : Electronics
Paper : Elective-ESI-04

ESI-04: **Nanoelectronics**

Unit 1: Fundamentals of nanoelectronics **12**

Introduction to nanotechnology and nanoelectronics, Impacts, Limitations of conventional microelectronics. Introduction to methods of fabrication of nano materials-different approaches. Atomic structure , molecules and phases, energy, molecular and atomic size, surface and dimensional space Molecular Nanotechnology,

Unit 2: Quantum electronics **12**

Quantum mechanical coherence, Quantum wells, wires and dots, basic properties of two dimensional semiconductor nanostructures, square quantum wells of finite depth, parabolic and triangular quantum wells, quantum wires and quantum dots Semiconductor quantum nanostructures and super lattices – MOSFET structures, Heterojunctions, Quantum wells, modulation doped quantum wells, multiple quantum wells,Transport of charge in Nanostructures under Quantum electronics devices(QED), Example of QDM: Short channel MOS transistor, Split gate transistor, Electron wave transistor, Electron spin transistor, Quantum cellular automata, Quantum dot array.

Unit 3: Nanostructured Devices **15**

Tunnelling elements: tunnelling effect and tunnelling elements, tunnelling diode (TD), Resonant tunnelling diode (RTD), three terminal Resonant tunnelling devices; Technology of RTD; Digital circuit based on RTD: memory applications, logic devices, dynamic logic devices; Digital circuit based on RTBT: MOBILE, threshold gate, multiplexer, Single electron transistor(SET), Principle of SET: Coulomb Blockade, performance of SET, technology, SET circuit design: wiring and drivers, logic and memory circuit, Comparison of FET and SET circuit design

Unit 4: Fundamentals of Organic Semiconductors: **06**

Organic semiconductors, realization of Energy bands in organic semiconductor carbon nanomaterials, nanotubes and fullerenes, Organic LED,

Reference Books

1. J.M. Martinez-Duart, R.J. Martin Palma, F. Agulle Rueda: Nanotechnology for Microelectronics and optoelectronics, Elsevier, 2006.
2. W.R. Fahrner: Nanotechnology and Nanoelctronics, Springer, 2005
3. K. Goser, P. Glosekotter, J. Dienstuhl: Nanoelectronics and nanosystems, Springer 2004.
4. Michael Wilson, Kamali Kannangara, Geoff Smith, Michelle Simmons and BurkhardRaguse, Nanotechnology: Basic Science and Emerging Technologies, Chapman & Hall / CRC, 2002
5. T. Pradeep, NANO: The Essentials – Understanding Nanoscience and Nanotechnology, TMH, 2007
6. Rainer Waser (Ed.), Nanoelectronics and Information Technology: Advanced Electronic Materials and Novel Devices, Wiley-VCH, 2003

Solapur University, Solapur

Class : M. Sc.-II
Semester :IV
Subject : Electronics
Paper : Elective – ESI-05

ESI-05: Virtual Instrumentation

Unit 1. Fundamentals of Virtual Instrumentation. 10

Historical perspectives, Basic concept of Virtual Instrumentation, Block diagram and architecture of Virtual Instrumentation, data- flow techniques, graphical programming in data flow, Comparison between Virtual instrumentation and Traditional Instrumentation, Advantages of Virtual Instrumentation. Development of VI using GUI.

Unit2. PC communication Ports 12

Introduction to Centronics parallel ports, Serial COM1/COM2, RS232 standards, Current loop,RS232/RS485,GPIB, Bus Interface: USB, PCI. Networking for office & Industrial applications VISA and IVI .

Unit3. Add on Peripheral cards: 8

Selection & applications , ADC, DAC, DIO, DMM, Waveform Generator.

Unit 4. LABVIEW based Virtual Instrumentation . 10

Introduction to LABVIEW the virtual Instrumentation software, Virtual Instrumentation programming techniques, "G" Programming Language, VI and sub-VI loops, charts, arrays, clusters and graphs, case and sequence structures, formula nodes, local and global variables, string and file IO

Unit 5. Case studies: 5

Designing of Virtual Instrumentation using LABVIEW for

1. Data Acquisition Systems for Measurement of physical parameters
2. Temperature controlling
3. Biomedical Instrumentation.

Reference Books:

1) LABVIEW Graphical programming Gary Johnson, 2nd Edition, MGH, 1997.
2) LABVIEW for everyone –Lisa K wells and Jeffery Travis PHI 1997.
3) Basic concept of LABVIEW 4-Skoff-PHI 1998.
4) "PC Interfacing for Data Acquisition and process control-S. Gupta & Joseph John A-2nd Edn.1994

Solapur University, Solapur

Class : M. Sc.-II
Semester :IV
Subject : Electronics
Paper : Elective – ESI-06

ESI-06: Mechatronics and Industrial Automation

Unit 1. Introduction to Mechatronics: 10

Introduction to Mechatronics, design Process, System, modeling of the system measurement systems, control systems, Open and closed loop systems, examples on mechatronics systems, Real Time Mechatronics systems, advantages and disadvantages of mechatronics systems, Applications of mechatronics systems .

Unit 2. Fundamentals of Programmable Logic Controllers : 10

Architecture of programmable controllers, Standard PLC's, IO modules and their characteristics, Memory, processor, Serial Communication, Power supply, PLC Devices, Switches, Relays, Coils, standard Symbols.

Unit 3. Programming of Programmable Logic Controllers : . 8

Concept of programming of the PLC, PLC's instructions, PLC programming, ladder diagram, programming for ON-OFF inputs and ON-OFF Outputs, Boolean algebra and PLC programming. Design of Ladder diagrams for process control description.

Unit 4. Components and functions of Programmable Logic Controllers : 8

Components of the PLC, Registers, Timers, Counters, Arithmetic functions, Master Control relay, Sequencer functions.

Unit 5. Industrial Automation 4

Concept of industrial automation, Centralized and Distributed control systems Centralized Control system(CCS): Basic Architecture, advantages & limitations Distributed Control System(DCS): Introduction, Basic architecture of DCS, display unit, DCS communication.

Unit 6. The SCADA: 5

Introduction to SCADA, SCADA Architecture, types of SCADA system Monolithic SCADA Systems Distributed SCADA Systems Networked SCADA Systems, the RTU, SCADA Protocols (Modbus / Profibus),

Books:

1. Mechatronics Electronic control system in mechanical and Electrical Engineering- W. Bolton, Pearson, 2013.
2. Mechanotronics Integrated Mechanical Electronics Systems, K. P. Ramchandra, G. K. Vijayaraghavan and M. S. Balasundaram, Wiley India, 2012.
3. Mechatronics System Design, Devdas Shetty and Richard A Kolk, Cengage Learning, 2012
4. Programmable logic controllers: Principles & applications- Webb & Reis (PHI)
5. Introduction to Programmable logic controllers- Garry Dunning, Thomson learning
6. Industrial Instrumentation & control 2nd ed. –S K Singh(TMH)

Solapur University, Solapur

Class : M. Sc.-II
Semester :III
Subject : Electronics
Paper : Elective-CE-01

CE-01: ARM Microcontroller and System Design

Unit I Fundamentals of ARM Microcontrollers: 10

Introduction to ARM microcontroller, ARM Core Philosophy, Bus Architecture, AMBA Bus, AHB, APB, Registers, Current program status register(CPSR), Saved program status register(SPSR), Stack pointer, Link register, Modes of processor , States of the processor, ISA, Pipelining register , Current program status register(CPSR), Saved program status register(SPSR), TDMI, Interrupts and Exceptions, Interrupt latencies. Nomenclature of ARM families.

Unit II Instruction Set of ARM Microcontrollers: 10

ARM instruction set architectures, Barrel shifter, Data Transfer Instructions, Arithmetic and Logical, multiply instruction, SWI, Thumb Instruction set, Jazzele Instructions, comparison of ARM, Thumb and Jazzele ISA. Cortex series and its features.

Unit: III Architecture of LPC 2148 : 5

Block diagram of LPC2148, Pin Description, On-Chip memory, memory map, GPIO, clock and timing , power control modes.

Unit: IV On chip peripherals of LPC 2148 : 10

On chip peripherals, Programming with ADC, DAC, DMA controller, UART, Timer /Counter, Real time clock ,Watchdog timer, PWM, CAN and Ethernet, I2C mode, USB host/slave.

Unit: V ARM LPC 2148 based embedded system development : 10

ARM based embedded system design, clock circuit, reset circuit, power supply, IDE SCARM, Examples in embedded C programming. Interfacing of LED, Relay, Optocouplers etc. Development of Embedded system for temperature, humidity, pH , displacement etc. measurements.

Reference Books:

1. ARM System Developers Guide- A. N. Sloss, D. Symes & C. Wright –Elsevier (2004)
2. ARM System on Chip Architecture- Steve, Furber Pearson Education ,2013
3. Product data sheet of LPC 2148.

Solapur University, Solapur

Class : M. Sc.-II
Semester :III
Subject : Electronics
Paper : Elective – CE-02

CE-02: Digital Communication

Unit 1: Fundamentals of the Signal and Analysis **10**

The signal, Types of the signal, Elements of the Digital Communication Systems, Digitization of the signals, sampling and quantization, Shannon's Channel Capacity Theorem. Power & Energy of the sampling signals

Unit 2: Digital Communication Techniques- **12**

Digital Communication Design Requirements, PWM, PPM, PCM, delta modulation, adaptive delta modulation, ASK, FSK, PSK, QAM, Modems,

Unit 3: Baseband Transmission- **8**

Analog base band Transmission, Digital base band transmission. The receivers

Unit 4: Coding Techniques- **10**

Introduction to the Coding, Alpha - Numeric coding, Parity Check Coding, Hamming Code, Concept of Systematic Code, RZ, NRZ, Manchester code, AMI, Error Detection and Error Correction.

Unit 5: Advanced Digital Communication Systems- **5**

Satellite Communication, Telephone, Cellular Phones, Dual Tone Multi Frequency (DTMF) dialing, Integrated Services Digital Network (ISDN).

Recommended Books:

1. Analog and digital communication system - M. S. Roden 5th Edition, Shroff publishers
2. Modern digital and analog communication systems – B. P. Lathi. 3rd Edn. Oxford.
3. Digital Communication- J.S. Katre
4. Digital communication fundamentals and applications – scalar, Pabitra Kumar Ray. 2nd Edn.
5. Communication techniques for digital and analog signals – M. Kanefsky, John Wiley and Son.
6. Digital communication – S. K. Khedkar. Technova Publishing House First Edition.

Solapur University, Solapur

Class : M. Sc.-II
Semester :III
Subject : Electronics
Paper : Elective – CE-03

CE-03: Cellular and Mobile Communication

1. Cellular Radio System Design & Specifications of Analog System 8

A basic cellular system, Performance criteria, Uniqueness of Mobile radio environment, Operation of cellular systems

Definitions of terms and functions of analog system, Specification of Mobile station & Land station, Different specification of the analog cellular system.

2. Cell Coverage & Antennas 12

Cell coverage- Introduction, Point-to-point model, Foliage loss, Propagation- over flat open area, Near distance, Long distance, Mobile-to-mobile, Cell-site antenna height & signal coverage cells.

Antennas- Cell site antennas, Unique situation of cell-site antennas, Mobile antennas, Design of an Omnidirectional & Directional antenna system

Interference: A) Cochannel interference- Cochannel interference area, Real-time cochannel interference, reduction of cochannel interference B) Nonchannel interference- Adjacent channel interference, Near-end-far-end interference & avoidance of interference, Effect of cell site components

3. Frequency Management & Channel Assignment 10

Frequency management- Frequency spectrum utilization, Set-up channels, Definition of channel assignment, Fixed channel assignment, Nonfixed channel assignment, Operating with additional spectrum, Traffic and channel assignment.

Handoffs & Dropped calls- Value of implementing handoffs, Initiating handoffs, Delaying a handoffs, Forced handoffs, Queuing of handoffs, Power difference handoffs, Mobile assisted handoffs & soft handoffs, Intersystem handoffs, Introduction to dropped call rate, Formula of dropped call rate.

4. Operational Techniques & Switching 8

Adjusting the parameters of the system, Hole filler, Leaky feeder, Cell splitting, Microcells. Concept of switching, Analog & Digital switching equipment, Features for handling traffic, MTSO interconnection

5. Digital Cellular Communication 9

Introduction to digital technology, ARQ techniques, Digital mobile telephony, GSM, Intelligent cell concept, Applications of intelligent micro-cell system

Reference Books:

1. Mobile Cellular Telecommunications Analog Digital System by W.C.Y. Lee, MGH 2nd Ed.
2. Mobile Communication Engineering Theroy & Applications by W.C.Y. Lee, MGH 2nd Ed.

Solapur University, Solapur

Class : M. Sc.-II
Semester :IV
Subject : Electronics
Paper : Elective – CE-04

CE-04: Optical Fiber Communication

1. Fundamentals of Optical Fiber Communications 15

Optical spectral Bands, fundamentals of data communication concepts, analog and digital signal, Major elements of optical fiber communication systems, Nature of light polarization of light, propagation mechanism. Construction and working principle of optical fiber**,** Types of optical fiber, Numerical aperture, Pulse spread due to material dispersion, loss mechanism, modes in steps and grade index fiber.

2. Optical Transmitters & Receivers 6

Fundamentals of optical transmitter & receiver, Digital signal transmission, Error sources, Receiver configuration, Receiver performances, Receiver sensitivity, Analog receivers

3. Fundamentals of WDM 8

Operational principles of WDM, Classification of WDM, WDM standards, Dense WDM, Applications of WDM based systems

4. Optical Amplifiers 9

Basics of optical amplifiers, Types of optical amplifiers, Semiconductors optical amplifiers, High impedance FET amplifiers, Preamplifiers Powers amplifiers, Architecture of EDFA , Power conversion, Efficiency & Gain

5. Optical Fiber System performance 7

Performance measurement parameters, Measurement standards, Optical power measurements, Fiber characterization, Types of dispersion, Dispersion measurements, Attenuation measurements, Eye diagram tests, Optical Spectrum Analyzer, Optical Reflectometer

Reference Books:

5. Optical Fiber Communication by A. Selvarajan S Kar and T Srinivas, TMH, 2003.
6. Optical Fiber Communication by Gerd Keiser, Third Edition MGH , 2000.
7. Optical Fiber Communication by Gerd Keiser, Fourth Edition TMH , 2009.

Solapur University, Solapur

Class : M. Sc.-II
Semester :IV
Subject : Electronics
Paper : Elective – CE-05

CE-05: WIRELESS SENSOR NETWORKS

Unit 1. Introduction to Wireless Sensor Networks (8)

Introduction to Wireless Sensor Networks, Architecture of WSN, Types of WSN, Features of Category –I and Category-II WSN, Characteristics of WSN, Architecture of Wireless sensor Node, End Device, Co-ordinator, FFD, PFD, Standard WS nodes, Micaz, Mica2 etc. Applications of WSNs,.

Unit 2. Wireless Sensor Network (WSN) Protocols 10

Overview of Communication Protocols for Wireless Networking (IEEE 802), IEEE 802.15.4 standards, ISM band, modulation techniques, data rate, Network layers for WSN, Physical layer, MAC layers, Link layer, Application layers, Frame Format.

Unit 3. The Zigbee Technology : 11

Need of RF modules, the RF module for WSN, CC2520, CC2530, Zigbee, features of the Zigbee, Architecture of the Zigbee module, Pin description, On-chip resources of the Zigbee, serial communication(UART), modes of operation, Idle mode, Transmit mode, receiver mode, Command mode, sleep mode, Unicast, Broadcast, API mode, Programming the Zigbee, Device addressing, Designing of WS Node with Zigbee modules and AVR microcontroller

Unit 4. Energy efficient protocol (8)

Network topologies, Star, Mesh, and Ring, Peer- peer, Fundamental SPR Need of power saving, Hierarchical protocols, LEACH, PEGASIS, SPIN, TEEN, etc, Performance analysis of the WSN,

Unit 5. Key management and WSN security issues 4)

Key management and WSN security issues - Energy management in wireless sensor networks: Need for energy management, classification of energy management, battery management schemes, transmission power management schemes, system power management schemes, Location discovery, privacy, integrity, authentication, secure localization, secure aggregation, attacks and defense mechanisms.

Unit 6. Development of WSN (4)

a) for agricultural applications
b) for industrial application

REFERENCE BOOKS:

1. Wireless Sensor Networks technology, protocols and applications, Kazem Sohraby , Daniel Minoli, Taieb Znati, Wiley, 2013
2. Handbook of Sensor Networks: Compact Wireless and Wired Sensing Systems, CRC PRESS Publication, Edited by Mohammad Ilyas and Imad Maugoub.
3. Datasheet of Zigbee
4. Wireless communication and Networking V K Garg Elsevier, 2009

Solapur University, Solapur

Class : M. Sc.-II
Semester :IV
Subject : Electronics
Paper : Elective – CE-06

CE-06 :Satellite Communication

Unit 1 : Satellite Systems **9**

History of satellite communications, Orbital mechanics, Look angle determination, Orbital perturbations, Satellite subsystems – AOCS, TTC and M, power systems, communications subsystems, satellite antennas, Satellite frequency bands, satellite Multiple access formats

Unit 2 : Modulation, Encoding and Decoding **8**

Analog modulation, Digital Encoding, Spectral shaping, Digital decoding, Error correction Encoding, Block Waveform Encoding, Digital Throughput.

The Satellite Channel

Electromagnetic field propagation, Antennas, Atmospheric losses, receiver Noise, Carrier to Noise ratios, satellite link analysis, Frequency Reuse by dual polarization, Spot beams in satellite downlinks.

Unit 3 : The Satellite Transponder 9

The transponder model, the satellite front end, RF filtering of digital carriers, Satellite signal processing, Transponder Limiting, Non linear satellite amplifiers, Effect of non linear amplification on digital carriers.

Unit 4 : Satellite Ranging System **7**

Ranging system, Component Range Codes, Tone Ranging Systems

Unit 4 : Multiple access formats 12

FDMA - FDMA system, Nonlinear amplification with multiple FDMA Carriers, FDMA, FDMA Nonlinear analysis, FDMA characterization, AM/PM conversion with FDMA, Satellite switched FDMA.

TDMA -The TDMA system, preamble design, Satellite Effects on TDMA performance, Network synchronization, SS TDMA.

CDMA - Direct Sequence CDMA system, Performance of DS CDMA, satellite systems, Frequency Hopped CDMA, Antijam advantages of spectral spreading, Code Acquisition and Tracking

Reference Books

1. Robert M. Gagliardi, Satellite Communications, New Delhi : CBS Publishers and Distributors, 2000
2. Timothy Pratt, Charles W. Bostian, Jeremy E. Allnutt, Satellite Communications, Singapore : John Wiley and Sons Inc. 2003
3. Dennis Roddy, Satellite Communications. New York : McGraw-Hill, 2001

Solapur University, Solapur

Class : M. Sc.-II
Semester :III
Subject : Electronics
Paper : Elective – VD-01

VD-01: CMOS Design Technologies

Unit:1. Basic of MOS Transistor **10**

Physics of semiconductors, MOS transistor, pMOS, nMOS enhancement transistors, Id-VDS relationship, Threshold voltage equation, MOS device design equations, Second-order effects, DC characteristics, Static load MOS inverters.

Unit:2 Design of the CMOS **10**

Basic CMOS technology, CMOS process flow, Wafer cleaning, Lithography, Thermal oxidation, Diffusion, Ion Implantation, Etching, Material used for MOS device fabrication, the n-well, p-well twin tube process. Interconnect and circuit elements, Layout design rules, Lambda rule and micron rule, W/L ratio, Latch up, pull up to pull down ratio, Switching characteristics, Transistor sizing, Power dissipation, Charge sharing, Design margining, Scaling of device dimensions.

Unit:3 CMOS Circuit and Logic Design: **10**

CMOS Logic Gate Design, Design of simple logic gates, Clocking strategies, I/O Structures, Transmission gate, Stick diagrams and layout designs for CMOS NAND, NOR gates, 2 input Multiplexer, Cell based design methodology , Standard cell, compiled cell, microcells, megacells, semi-custom design flow.

Unit:4 Fundamentals of Computer aided design: **15**

The Characteristics of Digital Electronic Design and Representation issues, Design abstraction , Hierarchy Views, Connectivity, Spatial Dimensionality, Design Environments, System Level, Algorithm Level, Component Level, Layout Level, Design flow, Design Flow: Schematic Entry, HDL, Synthesis, Verification, Implementation, Design Hand-off, Y- diagram, Simulation, Synthesis, Physical level, RTL level, Floor Planning, Placement and Routing,

Reference Books:

1. Silicon VLSI technology Fundamentals, Practicing and modeling, J. D. Plummer, M. D. Deal and P.B. Griffin, Pearson, 2013.
2. Principles of CMOS VLSI Design: A Systems Perspective - Neil H. E. Weste, Kamran Eshraghian Pearson Education , 8th Ed. 2002.
3. Design of Analog CMOS Integrated Circuits, B. Razavi, TMH, 2013.
4. Computer Aids for VLSI Design, Second Edition, Steven M. Rubin

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Class : M. Sc.-II
Semester :III
Subject : Electronics
Paper : Elective – VD-02

VD-02: CMOS Analog Circuit Design

Unit 1. Fundamentals CMOS Analog Design: 07

Need of analog Integrated circuit design, Single Stage Amplifiers, CS amplifier, Large signal model, small signal model. BiCMOS.

Unit 2: Analog CMOS circuit elements 08

MOS Switch and its characteristics, MOS Resistor, MOS Capacitors, MOS Diode, Current sink and current source circuits, Current mirrors, passive and active current mirrors. References for Analog MOS circuits, Voltage and Current reference, Band gap reference.

Unit 3:CMOS Amplifiers 10

CMOS amplifiers, frequency response of CMOS amplifier, Cascode amplifier, class A Amplifiers, Push-pull CS amplifier, differential amplifier.

Unit 4:CMOS Operational Amplifiers 10

Design of CMOS OP Amps, Single stage Op amp, Block diagram of two stage Op amp, Op am design requirements, Concept of High performance CMOS op amp, CMOS open loop Comparator.

Unit 5:Switched Capacitor circuits 10

Basic principle of switching capacitor, Resistor emulation, series capacitor and parallel capacitors, effect frequency and phase of clock, switch capacitor amplifiers, inverting, non-inverting, summing amplifiers, difference amplifier, Integrator, differentiator, Low pass filter.

Reference Books:

1. CMOS Analog Circuit Design, P. E. Allen, D. R. Holberg, International students edition Oxford, 2009
2. CMOS Analog Circuit Design, P. E. Allen, D. R. Holberg, Indian students edition Oxford, 2013
3. Design of analog CMOS integrated circuits, B. Razavi, TMH, 2013
4. CMOS Circuit design layout and simulation, R. J. Baker, H. W. Li and D. E. Boyce, PHI, 2005

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Class : M. Sc.-II
Semester :III
Subject : Electronics
Paper : Elective – VD-03

VD-03: Programming with Verilog HDL

Unit 1: Fundamentals of Verilog HDL **12**

Design flow, operators, data types, modules and ports.
Gate-level modelling: gate types and gate delays,
Dataflow modelling: Continuous assignments, delays, expressions, operands, operator types.
Behavioral modelling: Structured procedures, Procedural assignments, Timing controls, conditional statements, Multiway branching, Loops, Seqential and parallel blocks, generate blocks, Tasks and functions

Unit 2. Combinational Logic Design **10**

Introduction to combinational circuits, NAND-NOR structures, comparator, code converters, multiplexers, demultiplexers, encoder and decoders, priority encoders, parity generator/checker,arithmetic circuits (full adder, full subtractor) 4-bit ripple adder, ALU
(VERILOG models of above combinational circuits)

Unit 3. Sequential Logic Design **12**

Introduction to sequential circuits, Flip Flops (D, T and M-S JK)
Counters: synchronous and asynchronous 4-bit counters, up/down counter,
Registers: various types of registers, ring counter, Johnson counter
Finite State Machine (FSM) Design: Mealy and Moore state machines.
(VERILOG Models and Simulation of above Sequential Circuits)

Unit 4 Advanced Verilog issues **11**

Timing and delays: Types of delay models, Timing checks, Delay back-annotation,User defined primitives (Combination and sequential), Programming language interface: Linking and invocation, Internal data representation, PLI library routines. Verilog synthesis, Synthesis design flow

Reference Books:

1. Verilog HDL; A Guide to Digital Design and Synthesis by Samir Palnitkar, Pearson Education, 2nd edition, 2003.
2. Verilog HDL synthesis; A Practical Primer by J. Bhaskar, Star Galaxy Publishing, 1998.
3. Digital System Design with VERILOG Design by Stephen Brown, Zvonko Vranesic,TMH, 2nd Edn, 2007.
4. Advanced Digital Design with the Verilog HDL by M. D. Ciletti, PHI. 2009.

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Class : M. Sc.-II
Semester :IV
Subject : Electronics
Paper : Elective – VD-04

VD-04: Nanoelectronics

Unit 1: Fundamentals of nanoelectronics **12**

Introduction to nanotechnology and nanoelectronics, Impacts, Limitations of conventional microelectronics. Introduction to methods of fabrication of nano materials-different approaches. Atomic structure , molecules and phases, energy, molecular and atomic size, surface and dimensional space Molecular Nanotechnology

Unit 2: Quantum electronics **12**

Quantum mechanical coherence, Quantum wells, wires and dots, Density of states and dimensionality, the physics of low dimensional structures - basic properties of two dimensional semiconductor nanostructures, square quantum wells of finite depth, parabolic and triangular quantum wells, quantum wires and quantum dots Semiconductor quantum nanostructures and super lattices – MOSFET structures, Quantum electronics devices(QED), Example of QDM: Short channel MOS transistor, Split gate transistor, Electron wave transistor, Electron spin transistor, Quantum cellular automata, Quantum dot array.

Unit 3: Nanostructured Devices **12**

Tunnelling elements: tunnelling effect and tunnelling elements, tunnelling diode (TD), Resonant tunnelling diode (RTD), three terminal Resonant tunnelling devices; Technology of RTD; Digital circuit based on RTD: memory applications, logic devices, dynamic logic devices; Digital circuit based on RTBT: MOBILE, threshold gate, multiplexer, Single electron transistor(SET), Principle of SET: Coulomb Blockade, performance of SET, technology, SET circuit design: wiring and drivers, logic and memory circuit, Comparison of FET and SET circuit design

Unit 4: Fundamentals of Organic Semiconductors: **9**

Organic semiconductors, realization of Energy bands in organic semiconductor carbon nanomaterials, nanotubes and fullerenes, Organic LED,

Reference Books

1. Nanotechnology for Microelectronics and optoelectronics J.M. Martinez-Duart, R.J. Martin Palma, F. Agulle Rueda:, Elsevier, 2006.
2. Nanotechnology and Nanoelctronics W.R. Fahrner:, Springer, 2005
3. Nanoelectronics and nanosystems K. Goser, P. Glosekotter, J. Dienstuhl:, Springer 2004.
4. Nanotechnology: Basic Science and Emerging Technologies, Michael Wilson, Kamali Kannangara, Geoff Smith, Michelle Simmons and Burkhard Raguse, Chapman & Hall / CRC, 2002
5. The Essentials – Understanding Nanoscience and Nanotechnology T. Pradeep, NANO:, TMH, 2007
6. Nanoelectronics and Information Technology: Advanced Electronic Materials and Novel Devices,Rainer Waser (Ed.), Wiley-VCH, 2003

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Class : M. Sc.-II
Semester :IV
Subject : Electronics
Paper : Elective -VD-05

VD-05: Smart Fusion Technology based System Design

Unit 1.Introduction to Fusion Technology **10**

Concept of fusion and smart fusion technology, Antifuse, Static RAM, EPROM and EEPROM Technologies Logic modules 1, 2, 3. Shannons Expansion theorem, Mulplexure logic as function generator, ASIC Logic cell, Types of ASIC, ASIC design flow, Combinational, Sequential, Datapaths, I/O cells, Cell Compilers

Unit 2. Architecture of Smart Fusion device **10**

Introduction to customizable System-on-Chip (cSoC), Architecture of SmartFusion Device, Block diagram of SmartFusion A2F200M3F, Microcontroller Subsystem (MSS), Microcontroller Core, Programmable analog block, Programmable digital block, Programmable communication interfaces, FPGA fabric, : Clocking resources, SRAM , User I/Os, banks and standards . Review of evaluation board of Micro-semi cSoC.

Unit 3. Programmable Analog: **10**

Features of programmable Analog Compute Engine (ACE), Analog Front End (AFE), Features of ADC, DAC, ABPS, Current monitor, Temperature Monitor, High-Speed comparator.

Unit 4.Development tools for Microsemi smart fusion device. **7**

Reconfigurability and dynamic reconfigurability, concept of hardware software co-design, Design tools for smart fusion devices, design flow, Libero SoC, configuration of MSS, Sinplify, model sim Soft console.

Unit 5. Programmable SoC design with smart fusion **08**

Design of system for
a) Temperature measurement.
b) Humidity Measurement
c) Mobile communication
d) Core of 8051 microcontroller

REFERENCE Books

1. Application Specific Integrated Circuits, Michael Smith, Person Education Asia.
2. Datasheet of SmartFusion Customizable System-on-Chip,
3. SmartFusion Microcontroller Subsystem Users Guide,
4. SmartFusion Programmable Analog Users Guide,

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Class : M. Sc.-II
Semester :IV
Subject : Electronics
Paper : Elective – VD-06

VD-06: Mixed Signal Based SoC Design

Unit-1 Mixed-signal embedded SoC architectures. 12

Basic of CMOS and BiCMOS transistor, Op-Amp design. Concept of mixed signal design. Design Issues of Mixed Signal VLSI, Mixed-signal SoC ,architectures. Microcontroller M8C core. Instruction set. RAM and flash memory system. I/Os. System buses. Interrupt subsystem. Interrupt Service Routine (ISR). Boot program, Static & Dynamic reconfiguration.

Unit-2 Programmable Digital subsystem. 8

Performance improvement through architecture customization. Profiling. Performance profiling. PSoC programmable digital building blocks (timers, counters, CRC generator, PWM). Data communication in embedded systems. Serial communication using SPI and UART.

Unit-3. Continuous Time analog building blocks. 6

Basics of continuous time analog circuits. Presentation of basic building blocks, i.e., ideal op amps, comparators, PGA, Instrumentation amplifier, integrators, etc.

Unit-4. Switched-capacitor analog building blocks. 6

Basics of switched capacitor analog circuits. Presentation of basic building blocks, i.e., ideal op amps, comparators, gain, integrators, etc. Application of Switch-Capacitor circuits.

Unit-5. Delta-Sigma Analog to digital converters. 7

Basics of Delta-Sigma converters (DS). Sampling. Quantization. Oversampling. Noise shaping. Performance of DS ADC. First-order DS ADC. Second-order DS ADC. Implementation using PSoC. Impact of circuit nonidealities on ADC performance.

Unit-6. Design of Mixed signal based system 6

Design of mixed signal based system for

a) Temperature, Humidity and CO2 measurement
b) Interfacing of PIR sensor
c) Touch sensing

Reference Books:

1. Introduction to Mixed signal, Embedded Design A. N. Doboli and E. H Currie Cypress semiconductor corporation (2007)
2. Designers Guide to the Cypress PSoC by Robert Ashby Elsevier
3. CMOS Circuit design, Layout and Simulation, R. J. Baker, WSE, Willey (2009)