**Punyashlok Ahilyadevi Holkar Solapur University, Solapur**


**NAAC Accredited-2022**
**'B$^{++}$'Grade (CGPA 2.96)**

# Name of the Faculty: Science &Technology

(As per New Education Policy 2020)

# Syllabus: Electronics

# Name of the Course: M. Sc. II (Sem. III &IV)

**(Syllabus to be implemented from June 2024)**

# Punyashlok Ahilyadevi Holkar Solapur University, Solapur
# M.Sc. Electronics based on NEP-2020
(w.e.f. June 2023-24)

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 from June 2006, affiliated to Punyashlok Ahilyadevi Holkar Solapur University, Solapur, 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.Sc. with Computer Science / B.Sc. Entire Computer Science (BCS).
- Bachelor of Engineering with Electronics / E & TC.

6. **Fee Structure:** This MSc Electronics course is non-grantable. Therefore, fee structure is as per Rules and Regulations of Punyashlok Ahilyadevi Holkar Solapur University, Solapur.

7. **Intake Capacity: 24**

8. **Duration:** 2 Years (4 Semesters)

## 9. 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 (ESI), Communication Electronics (CE) and VLSI design (VD). Students can opt any one out of three at Semester-III and IV

## 10. 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. 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. 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 | CGPA |
|---|---|---|---|---|
| 1. | 85-100 | O | 10 | 9.50-10 |
| 2. | 75-84 | A+ | 9 | 8.50-9.49 |
| 3. | 65-74 | A | 8 | 7.50-8.49 |
| 4. | 55-64 | B+ | 7 | 6.50-7.49 |
| 5. | 50-54 | B | 6 | 5.50-6.49 |
| 6. | 40-49 | C | 5 | 5.00-5.49 |
| 7. | 0-39 | F (Fail) | Zero | 0.0-4.99 |
| 8. | Absent | - | Zero | -- |

**Class Chart:** The candidate securing minimum of 40% marks in each head of passing shall be declared as successful candidate and the percentage of marks class shall be as follows:

1. 40-49.99% ... Pass Class
2. 50-54.99% ... Second Class
3. 55-59.99% ... B+ Second Class
4. 60-69.99% ... First Class
5. 70% and above ... First Class with Distinction.

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

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

(ΣCi- The total number of credits offered by the student during a semester)

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

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

(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 ith course

Gi: Grade point scored in ith paper

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

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

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

## 11. 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 from specialization out of which one is 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)

**Punyashlok Ahilyadevi Holkar Solapur University, Solapur**

**Faculty of Science and Technology**

# Proposed structure for Two Year PG Program (M.Sc.- Electronics) Degree

# M.Sc. Electronics (Embedded System and Instrumentation / Communication Electronics /VLSI Design)

**M.Sc. I Electronics**

| Level/ Difficulty | Sem. | Major | | RM | FP/RP/OJT/ Internship/ Apprenticeship | Credits | Cumulative Credits |
|---|---|---|---|---|---|---|---|
| | | Mandatory | Elective | | | | |
| 6.0/400 | I | DSC1-1 (4+2) Advanced Microcontrollers<br>DSC1-2 (4+2) Industrial Power Electronics | DSE1-1 (4+2)<br>1. Virtual Instrumentation<br>2. Numerical Methods | Research Methodology (4) | --- | 22 | **44 PG Diploma in Discipline** |
| | II | DSC1-3(4+2) Modern Control Theory<br>DSC1-4 (4+2) Real Time Operating System | DSE1-2 (4+2)<br>1. Signals and Systems<br>2. Cellular and Mobile communication | --- | OJT/In-house Project/ Internship/ Apprenticeship (4) | 22 | |
| | **Total 1 Yrs** | **24** | **12** | **04** | **04** | **44** | |
| **Exit option: Award of UG degree in Major with 132 Credits OR Continue with Major** | | | | | | | |

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

## M.Sc. II Electronics for ESI (Embedded System and Instrum entation) w.e.f. 2024-25

| Level/ Difficulty | Sem. | Major | | RM | FP/RP/OJT/ Internship/ Apprenticeship | Credits | Cumulative Credits |
|---|---|---|---|---|---|---|---|
| | | Mandatory | Elective | | | | |
| 6.5/400 | III | DSC1-5 (4+2) Digital Signal Processing<br>DSC1-6 (4+2) ARM Microcontroller and System Design | DSE1-3 (4+2)<br>1. Advanced Digital Design with VHDL<br>2. Device Drivers and Embedded System | -- | RP (4) | 22 | **88 PG Degree in Discipline** |
| | IV | DSC1-7 (4+2) Networking and Data Communication<br>DSC1-8 (4) Mechatronics and Industrial Automation | DSE1-4 (4+2)<br>1. Medical Instrumentation<br>2. Microwave Devices, Antennas and Measurements | -- | RP (6) | 22 | |
| | **Total 2 Yrs** | **46** | **24** | **04** | **14** | **88** | |

## M.Sc. II Electronics for CE (Communication Electronics)

| Level/ Difficulty | Sem. | Major | | RM | FP/RP/OJT/ Internship/ Apprenticeship | Credits | Cumulative Credits |
|---|---|---|---|---|---|---|---|
| | | Mandatory | Elective | | | | |
| 6.5/400 | III | DSC1-5 (4+2) Digital Signal Processing<br>DSC1-6 (4+2) Digital Communication | DSE1-3 (4+2)<br>1. Fundamentals of Optoelectronics<br>2. Internet of Things (IoT) | -- | RP (4) | 22 | **88 PG Degree in Discipline** |
| | IV | DSC1-7(4+2) Networking and Data Communication<br>DSC1-8 (4) Microwave Devices, Antennas and Measurements | DSE1-4 (4+2)<br>1. Wireless Sensor Network<br>2. Optical Fiber Communication | -- | RP (6) | 22 | |
| | **Total 2 Yrs** | **46** | **24** | **04** | **14** | **88** | |

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

**M.Sc. II Electronics for VD (VLSI Design)**

| Level/ Difficulty | Sem. | Major | | RM | FP/RP/OJT/ Internship/ Apprenticeship | Credits | Cumulative Credits |
|---|---|---|---|---|---|---|---|
| | | **Mandatory** | **Elective** | | | | |
| 6.5/400 | III | DSC1-5 (4+2) Digital Signal Processing<br>DSC1-6 (4+2) CMOS Design Technologies | DSE1-3 (4+2)<br>1. Nanoelectronics & Devices<br>2. CMOS Analog Circuit Design | -- | RP (4) | 22 | **88 PG Degree in Discipline** |
| | IV | DSC1-7(4+2) Networking and Data Communication<br>DSC1-8 (4) Mixed Signal Based SoC Design | DSE1-4 (4+2)<br>1. Smart Fusion Technology Based System Design<br>2. Microwave Devices, Antennas and Measurements | -- | RP (6) | 22 | |
| | **Total 2 Yrs** | **46** | **24** | **04** | **14** | **88** | |

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

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Class : M. Sc.-II, Semester : III for ESI (Embedded System and Instrumentation), CE (Communication Electronics) & VD (VLSI Design)

Subject : Electronics

## Paper Code : DSC1-5: Digital Signal Processing

Credit: 4 (Periods: 60)

**Unit 1 : Continuous Time Fourier Transform** **12**

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** **13**

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** **15**

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** **10**

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.

# Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Class : M. Sc.-II, Semester : III for ESI (Embedded System and Instrumentation)
Subject : Electronics

## Paper Code: DSC1-6 : ARM Microcontroller and System Design

Credit: 4 (Periods: 60)

**Unit 1: Fundamentals of ARM Microcontrollers** **15**

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, TDMI, Interrupts and Exceptions, Interrupt latencies. Nomenclature of ARM families.

**Unit 2: Instruction Set of ARM Microcontrollers** **12**

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 3: Architecture of LPC 2148** **8**

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

**Unit 4: On chip peripherals of LPC 2148** **13**

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 5: ARM LPC 2148 based embedded system development** **12**

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.

# Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Class : M. Sc.-II, Semester : III for CE (Communication Electronics)
Subject : Electronics

## Paper Code: DSC1-6 : Digital Communication

Credit: 4 (Periods: 60)

**Unit 1: Fundamentals of the Signal and Analysis** **13**

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** **15**

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

**Unit 3: Baseband Transmission** **10**

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

**Unit 4: Coding Techniques** **12**

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** **10**

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.

# Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Class : M. Sc.-II, Semester : III for VD (VLSI Design)
Subject : Electronics

## Paper Code: DSC1-6 : CMOS Design Technologies

Credit: 4 (Periods: 60)

**Unit 1. Basic of MOS Transistor** **15**

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** **15**

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** **15**

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, Ydiagram, 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

# Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Class : M. Sc.-II, Semester : III for ESI (Embedded System and Instrumentation),
Subject : Electronics

## Paper Code: DSE1-3 : Advanced Digital Systems Design with VHDL

Credit: 4 (Periods: 60)

**Unit1: VLSI Devices** **10**

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

**Unit2: Introduction to Hardware description Language.** **15**

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.

**Unit3: VHDL Statements** **15**

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

**Unit4 : Combinational & Sequential Circuit Design** **12**

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

b) Models and Simulation of Sequential Circuits Shift Registers, Counters etc.

**Unit5: Prototyping and case studies** **8**

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 TMH New Delhi.
4. VHDL-Analysis & Modelling of Digital Systems: Navabi Z; McGraw Hill.
5. VHDL by Douglas L. Perry, Mc Graw Hill Publications

# Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Class : M. Sc.-II, Semester : III for ESI (Embedded System and Instrumentation)
Subject : Electronics

## Paper Code: DSE1-3 : Device Drivers and Embedded System

Credit: 4 (Periods: 60)

**Unit 1 Fundamentals of Device Drivers for Embedded System. 15**

Meaning and need of device drivers/programmers for embedded system development, Hardware for devices drivers in UART, SPI, I2C communications, Basic software architecture of device driver as middle ware, types of device drivers. Device driver architecture for 89S51 microcontroller based embedded system design. Boot programming and Application program.

**Unit 2 Polling Mode Device Drivers. 15**

Basic concept, hardware design, embedded C program for device driver, communication with PC, communication with microcontroller, Baud rate setting, use of SFRs, buffer registers, setting and resetting of the flag bits, Programming the target device.

**Unit 3 Interrupt Driven Device Drivers. 15**

Interrupt mode of data transfer, flags to check, accessing of the flags during data communication, handshaking of the signals, hard for device programmer, software for data communication in serial mode, SPI mode and I2C mode, Programming the target device.

**Unit 4 Device Driver Designing 15**

Design of device driver for AVR ATmega8L based embedded system design in SPI and I2C mode. Design of device driver for PIC 18F877microcontroler based embedded system

**Reference Books:**


1. "Embedded Systems - Architecture, Programming and Design", Raj Kamal, Publs.: McGraw-Hill Education 2015.
2. Master Microcontroller and Embedded Driver Development, Kiran Nayak Embedded Brain Academy,2021
3. Linux Driver Development for Embedded Processors - Second Edition: Learn to develop Linux embedded drivers with kernel 4.9 LTS, Alberto Liberal de los Ríos, 2018

# Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Class : M. Sc.-II, Semester : III for CE (Communication Electronics)
Subject : Electronics

## Paper Code: DSE1-3 : Fundamentals of Optoelectronics

Credit: 4 (Periods: 60)

**Unit 1. Optical fibers** **13**

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** **10**

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**. **15**

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** **12**

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, P

# Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Class : M. Sc.-II, Semester : III for CE (Communication Electronics)
Subject : Electronics

## Paper Code: DSE1-3 : Internet of Things (IoT)

Credit: 4 (Periods: 60)

**Unit 1: Introduction to Internet of Things (IoT) 15**

Internet of Things (IoT), Definition, concept, Characteristics, Block diagram and Architectural view, Things in IoT, Sensor Technology, Actuators, Domestics IoT, IndustrialIoT and Automotive IoT, Physical Design of IoT, IoT Protocols, Logical design of IoT, functional blocks, communication model, Comparison of IoT with WSN. Difference between IoT and M2M.

**Unit 2: Design Principles for Web connectivity 13**

Introduction, Web communication protocols for connected Devices, Network using Gateways, SOAP, REST, HTTP and Websockets. Internet based communication, IP addressing in the IoT, MAC and PHY layers for IoT.

**Unit 3 : Data collection, Storage and Computing using cloud platform 10**

Introduction, Cloud computing paradigm for data collection, storage and computing, Cloud service model, Nimbits platform.

**Unit 4 Prototyping of Embedded Devices for IoT 12**

Introduction, Basic block diagram, Prototype hardware for IoT, Connectivity of the device to Internet or cloud. Development of embedded software for internet and cloud services.

**Unit 5: IoT Case Studies 10**

Development of IoT system for following applications.

1. IoT for smart home.
2. IoT for smart city Streetlights controlling
3. IoT for environmental monitoring and agricultural applications
4. IoT for medical application and patient monitoring

**Reference Books:**


1. Internet of Things, Architecture and Design Principles – Raj Kamal, McGraw Hill Education, Chennai, 2017
2. Internet of Things, A Hands-on Approach- Arshdeep Bahga and Vijay Madisetti, University Press, (India) 2017.
3. Internet of Things, Key Applications and Protocols- Olivier Hersent, David Boswarthick and Omar Elloumi, Wiley Student Ediation, 2012.

# Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Class : M. Sc.-II, Semester : III for VD (VLSI Design)
Subject : Electronics

## Paper Code: DSE1-3 : Nanoelectronics & Devices

Credit: 4 (Periods: 60)

**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** **18**

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: Tunneling Deices** **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.

**Unit 4: Single Electron Transistor (SET)** **09**

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 5: Fundamentals of Organic Semiconductors** **09**

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.
2. Fundamentals Of Nanoelectronics - George W. Hanson
3. Nanotechnology and Nanoelctronics - W.R. Fahrner, Springer.
4. Nanoelectronics and Nanosystems- K. Goser, P. Glosekotter, J. Dienstuhl :, Springer 2004.
5. Nanoelectronics and Information Technology: Advanced Electronic Materials and Novel Devices - Rainer Waser (Ed.), Wiley-VCH.

# Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Class : M. Sc.-II, Semester : III for VD (VLSI Design)
Subject : Electronics

## Paper Code: DSE1-3 : CMOS Analog Circuit Design

Credit: 4 (Periods: 60)

**Unit 1 Fundamentals CMOS Analog Design** **10**

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

**Unit 2 Analog CMOS circuit elements** **15**

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 amp design requirements, Concept of High performance CMOS op amp, CMOS open loop Comparator.

**Unit 5 Switched Capacitor circuits** **15**

Basic principle of switching capacitor, Resistor emulation, series capacitor and parallel capacitors, effect frequency and phase of clock, switch capacitor amplifiers, inverting, noninverting, 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, 005

# Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Class : M. Sc.-II, Semester : IV for ESI (Embedded System and Instrumentation), CE (Communication Electronics) & VD (VLSI Design)

Subject : Electronics

## Paper Code: DSC1-7 : Networking and Data Communication

Credit: 4 (Periods: 60)

**Unit 1. Introduction to Networking** **10**

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

**Unit 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)

**Unit 3. Data Link Layer** **13**

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

**Unit 4. Principles of Internetworking** **15**

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

**Unit 5. Security** **10**

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.

# Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Class : M. Sc.-II, Semester : IV for ESI (Embedded System and Instrumentation)
Subject : Electronics

## Paper Code: DSC1-8 : Mechatronics and Industrial Automation

Credit: 4 (Periods: 60)

**Unit 1. Introduction to Mechatronics** **13**

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** **12**

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** **10**

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

**Unit 5. Industrial Automation & SCADA** **15**

a) 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.

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

**Reference 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)

# Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Class : M. Sc.-II, Semester : IV for CE (Communication Electronics)
Subject : Electronics

## Paper Code: DSC1-8 : Microwave Devices, Antennas and Measurements

Credit: 4 (Periods: 60)

**Unit 1 Introduction** **12**

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** **13**

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)** **10**

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 & Measurements** **15**

a) Slot and Microstrip Antennas, Horn Antennas, Reflector Antennas

b) 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

# Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Class : M. Sc.-II, Semester : IV for VD (VLSI Design)
Subject : Electronics

## Paper Code: DSC1-8 : Mixed Signal Based SoC Design

Credit: 4 (Periods: 60)

**Unit 1 Mixed-signal embedded SoC architectures. 15**

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. 12**

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 building blocks (Continuous Time analog & Switched-capacitor analog) 15**

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

b) 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 4 Delta-Sigma Analog to digital converters. 10**

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 5 Design of Mixed signal based system 8**

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)

# Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Class : M. Sc.-II, Semester : IV for ESI (Embedded System and Instrumentation)
& VD (VLSI Design)

Subject : Electronics

## Paper Code: DSE1-4 : Microwave Devices, Antennas and Measurements

Credit: 4 (Periods: 60)

**Unit 1 Introduction** **12**

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** **13**

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)** **10**

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 & Measurements** **15**

a) Slot and Microstrip Antennas, Horn Antennas, Reflector Antennas

b) 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

# Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Class : M. Sc.-II, Semester : IV for ESI (Embedded System and Instrumentation)
Subject : Electronics

## Paper Code: DSE1-4 : Medical Instrumentation

Credit: 4 (Periods: 60)

**Unit 1. Bioelectric signal and electrodes** **15**

Sources of bioelectric potentials, Electrode-tissue interface, Polarization, Skin contact impedance, Motion artefacts, Electrode for ECG,EEG and EMG, Electrical conductivity of electrode jelly and creams. The Nernst equation. Potentiometric sensors, amperometric sensors, chemical biosensors, Blood-Gas sensors, pH, pO2, etc., Non-invasive Blood gas sensors, Blood-Glucose sensors.

**Unit 2. Cardio-vascular system and Measurement** **12**

The heart and cardio-vascular system, The Engineering model of the Heart, Measurement of ECG, Concept of blood pressure, blood flow and heart sound, Measurement of blood pressure, blood flow and heart sound.

**Unit 3. Monitoring Systems** **13**

Electroencephalograph (EEG), Electromyograph (EMG), Bedside patient monitoring system, Central monitoring system, Measurement of heart rate and pulse rate. Use of WSN technology in central monitoring system.

**Unit 4. Modern Diagnostic and Imaging Instruments** **12**

Temperature measurements, Basis of Diagnostics radiology, Ultrasonic measurements and diagnosis, Basic principles and general architecture of modern imaging systems, General architecture of x- ray Machine, Magnetic Resonance System (MRI). Medical use of radioisotopes.

**Unit 5. Safety of Patient** **8**

Electric shock hazards, Leakage current, Electrical safety analyser, Testing of biomedical equipment.

**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.

# Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Class : M. Sc.-II, Semester : IV for CE (Communication Electronics)
Subject : Electronics

## Paper Code: DSE1-4 : Wireless Sensor Networks

Credit: 4 (Periods: 60)

**Unit 1. Introduction to Wireless Sensor Networks** **10**

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** **15**

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** **15**

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** **08**

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** **12**

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 defence mechanisms.

**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

# Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Class : M. Sc.-II, Semester : IV for CE (Communication Electronics)
Subject : Electronics

## Paper Code: DSE1-4 : Optical Fiber Communication

Credit: 4 (Periods: 60)

**Unit 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.

**Unit 2. Optical Transmitters & Receivers** **10**

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

**Unit 3. Fundamentals of WDM** **12**

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

**Unit 4. Optical Amplifiers** **13**

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

**Unit 5. Optical Fiber System performance** **10**

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:**


1. Optical Fiber Communication by A. Selvarajan S Kar and T Srinivas, TMH, 2003.
2. Optical Fiber Communication by Gerd Keiser, Third Edition MGH , 2000.
3. Optical Fiber Communication by Gerd Keiser, Fourth Edition TMH , 2009.

# Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Class : M. Sc.-II, Semester : IV for VD (VLSI Design)
Subject : Electronics

## Paper Code: DSE1-4 : Smart Fusion Technology based System Design

Credit: 4 (Periods: 60)

**Unit 1. Introduction to Fusion Technology** **15**

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** **15**

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.** **10**

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** **10**

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,