

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)

**Structure and Syllabus: M. Tech. Electronics
Engineering**

**Name of the Course: First Year M. Tech.
(Syllabus to be implemented w.e.f. 2026-27)**

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

FACULTY OF SCIENCE & TECHNOLOGY

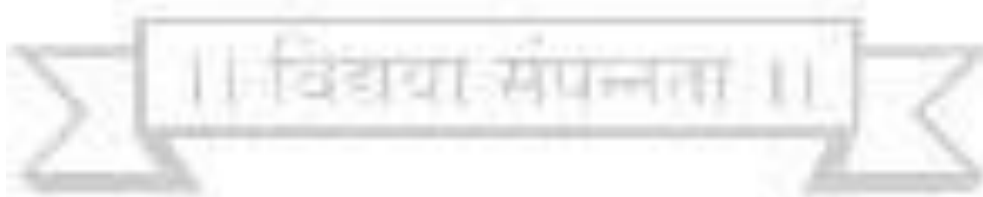
Curriculum for M. Tech. (Electronics Engineering) Choice

Based Credit System Syllabus w. e. f. 2026-27 Course

Type-wise Consolidated Table with Total Credits

Course Type	Course Code	Name of the Course	Credits
PCC	MTEL101	Digital Design and Verification	3
PCC	MTEL102	Advanced Digital Signal Processing	3
PCC	MTEL103	Voice and Data Networks	3
PCC	MTEL104	Machine Learning	3
RM	MTEL201	Research Methodology	3
PCC	MTEL202	Communication Buses & Interfaces	3
PCC	MTEL203	Advanced IOT	3
PCC	MTEL204	PLC, SCADA and Distributed Control Systems	3
PEC	MTEL106-A	Elective I Wireless Sensor Networks	3
PEC	MTEL106-B	Elective I Analog & Digital CMOS VLSI Design	
PEC	MTEL106-C	Elective I Image and Video Processing	
PEC	MTEL206-A	Elective II Mobile Technology	3
PEC	MTEL206-B	Elective II Real Time System	
PEC	MTEL206-C	Elective II VLSI in Signal Processing	
VSEC	MTEL105	Mini Project I	1
VSEC	MTEL205	Mini Project II	1
Total			42

सोलापूर विद्यापीठ



NAAC Accredited-2022

UGC Approved (CGPA-2010)

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

FACULTY OF SCIENCE & TECHNOLOGY

Curriculum for M. Tech. (Electronics Engineering)

Four Semester Course

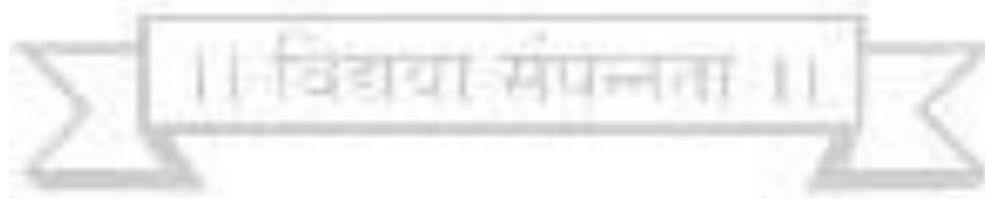
Choice Based Credit System (CBCS) - (w. e. f. 2026-27)

Semester I: Theory /Tutorial/ Lab Courses

Course Type	Course Code	Name of the Course	Engagement Hours			Credits	SA		FA		TOTAL
			L	T	P		ESE	ISE	ICA		
PCC	MTEL101	Digital Design and Verification	3	-	2	4	70	30	25	125	
PCC	MTEL102	Advanced Digital Signal Processing	3	-	2	4	70	30	25	125	
PCC	MTEL103	Voice and Data Networks	3	1	-	4	70	30	25	125	
PCC	MTEL104	Machine Learning	3	-	2	4	70	30	25	125	
PEC	MTEL106	Elective I	3	1	-	4	70	30	25	125	
VSEC	MTEL105	Mini Project I	-	-	2	1	-	-	50	50	
Total			15	2	8	21	350	150	175	675	

PCC	Program core course	L	Lecture	FA	Formative Assessment
PEC	Program Elective Course	T	Tutorial	SA	Summative Assessment
VSEC	Vocational and Skill Enhancement Course	P	Lab Session	ESE	End Semester Examination
				ISE	In Semester Evaluation
RM	Research Methodology			ICA	Internal Continuous Evaluation

सोलापूर विश्वविद्यालय



NAAC Accredited-2022

B++ Grade (CGPA-2.00)

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

FACULTY OF SCIENCE & TECHNOLOGY

Curriculum for M. Tech. (Electronics Engineering)

Four Semester Course

Choice Based Credit System (CBCS) - (w. e. f. 2026-27)

Semester II: Theory /Tutorial/ Lab Courses

Course Type	Course Code	Name of the Course	Engagement Hours			Credits	SA		FA		TOTAL
			L	T	P		ESE	ISE	ICA		
RM	MTEL201	Research Methodology	3	1	-	3	70	30	25	125	
PCC	MTEL202	Communication Buses & Interfaces	3	-	2	3	70	30	25	125	
PCC	MTEL203	Advanced IOT	3	-	2	3	70	30	25	125	
PCC	MTEL204	PLC, SCADA and Distributed Control Systems	3	-	2	3	70	30	25	125	
PEC	MTEL206	Elective II	3	1	-	3	70	30	25	125	
VSEC	MTEL205	Mini Project II	-	-	2	1	-	-	50	50	
Total			15	2	8	21	350	150	175	675	

PCC	Program core course	L	Lecture	FA	Formative Assessment
PEC	Program Elective Course	T	Tutorial	SA	Summative Assessment
VSEC	Vocational and Skill Enhancement Course	P	Lab Session	ESE	End Semester Examination
				ISE	In Semester Evaluation
				ICA	Internal Continuous Evaluation

- *List of elective courses for semester I and II –*

Sr. No.	<i>Elective - I</i>		<i>Elective – II</i>	
	Course Code	Name of the Course	Course Code	Name of the Course
1	MTEL106-A	Wireless Sensor Networks	MTEL206-A	Mobile Technology
2	MTEL106-B	Analog & Digital CMOS VLSI Design	MTEL206-B	Real Time Systems
3	MTEL106-C	Image and Video Processing	MTEL206-C	VLSI in Signal Processing

- Courses may be added in the list of Elective I and II as and when required

SEMESTER-I



PUNYASHLOK AHILYADEVI HOLKAR SOLAPUR UNIVERSITY, SOLAPUR

M. Tech. (Electronics) Semester-I

MTEL101: DIGITAL DESIGN AND VERIFICATION

Teaching Scheme

Lectures –3Hours/week, 3 Credits

Practical –2Hours/week, 1 Credit

Examination Scheme

ESE- 70 Marks

ISE- 30 Marks

ICA – 25Marks

Course Prerequisite:

- Knowledge of digital electronics (combinational & sequential circuits)
- Basics of logic design and FSM
- Understanding of HDL (Verilog/VHDL basics)
- Basic computer architecture

Course Objectives: During this course, student is expected to:

1. Explain advanced digital design concepts and methodologies.
2. Model digital systems using HDL-based approaches.
3. Apply verification techniques using System Verilog.
4. Analyze challenges in physical design and FPGA/ASIC implementations.
5. Implement IP-based design and prototyping techniques.

Course Outcomes: At the end of this course, student will be able to:

1. Design digital systems using HDL.
2. Apply verification techniques for functional correctness.
3. Analyze FPGA and ASIC design flows.
4. Evaluate physical design challenges.
5. Develop prototype systems using IP cores.

SECTION-I

Unit 1: Revision of Basic Digital Systems

(6 Hrs)

Combinational circuits, sequential circuits, logic families, synchronous FSM and asynchronous design, metastability, clock distribution and issues, basic building blocks like PWM module, pre-fetch unit, programmable counter, FIFO, Booth's multiplier, ALU, barrel shifter etc.

Unit 2: Verilog / VHDL

(7 Hrs)

Verilog/VHDL comparisons and guidelines, Verilog: HDL fundamentals, simulation, and testbench design, examples of Verilog codes for combinational and sequential logic, Verilog AMS

Unit 3: System Verilog and Verification: (8 Hrs)

Verification guidelines, data types, procedural statements and routines, connecting the test bench and design, assertions, basic OOP concepts, randomization, introduction to basic scripting : language Perl, Tcl/Tk

SECTION II

Unit 4: Current Challenges in Physical Design: (8 Hrs)

Roots of challenges, delays: wire load models generic PD flow, challenges in PD flow at different steps, SI challenge – noise & crosstalk, IR drop, Process effects: process antenna effect& electro migration.

Unit 5: Programmable Logic Devices (6 Hrs)

Introduction, evolution: PROM, PLA, PAL, architecture of PAL's, applications, programming PLD's, FPGA with technology: antifuse, SRAM, EPROM, MUX, FPGA structures, and ASIC design flows, programmable interconnections, coarse grained reconfigurable devices

Unit 6: IP and Prototyping: (7 Hrs)

IP in various forms: RTL source code, encrypted source code, soft IP, netlist, physical IP, and use of external hard IP during prototyping, case studies and speed issues, testing of logic circuits: fault models, BIST, JTAG interface

● **Internal Continuous Assessment (ICA)**

ICA shall consist of minimum 6 laboratory experiments designed, developed and executed by students in relevant industry/ societal problem industry based upon above curriculum

● **Reference Books**

1. Douglas Smith, "HDL Chip Design: A Practical Guide for Designing, Synthesizing & Simulating ASICs & FPGAs Using VHDL or Verilog", Doone publications, 1998.
2. Samir Palnitkar, "Verilog HDL: A guide to Digital Design and Synthesis", Prentice Hall,
3. Doug Amos, Austin Lesea, Rene Richter, "FPGA based Prototyping Methodology Manual", Synopsys Press
4. Christophe Bobda, "Introduction to Reconfigurable Computing, Architectures, Algorithms and Applications", Springer
5. Janick Bergeron, "Writing Testbenches: Functional Verification of HDL Models", Second Edition, Springer



PUNYASHLOK AHILYADEVI HOLKAR SOLAPUR UNIVERSITY, SOLAPUR

M. Tech. (Electronics) Semester-I

MTEL102: ADVANCED DIGITAL SIGNAL PROCESSING

Teaching Scheme

Lectures –3Hours/week, 3 Credits

Practical –2Hours/week, 1 Credit

Examination Scheme

ESE- 70 Marks

ISE- 30 Marks

ICA – 25Marks

Course Prerequisite:

- Basic mathematics & probability
- Basic signals & systems
- Fundamentals of DSP Transforms & Digital Filters

Course Objectives: During this course, student is expected to:

1. Design advanced FIR and IIR digital filters.
2. Apply Multirate DSP techniques.
3. Explain adaptive and optimum filtering.
4. Analyze spectral estimation methods.
5. Explore DSP applications in real systems.
6. Apply wavelet transform.

Course Outcomes: At the end of this course, student will be able to:

1. Design and analyze digital filters
2. Implement Multirate DSP systems
3. Apply adaptive filtering algorithms (LMS, RLS)
4. Estimate power spectrum of signals
5. Use DSP techniques in practical applications
6. Illustrate Wavelet Transform & its application

SECTION-I

Unit 1: Design of Digital Filters

(07 Hrs)

Overview of DSP, characterization in time and frequency, FFT Algorithms, digital filter design and structures: basic FIR/IIR filter design & Structures, design techniques of linear phase FIR filters, IIR filters by Impulse invariance, bilinear transformation, FIR/IIR cascaded lattice structures.

Unit 2 : Multirate Digital Signal Processing

(07 Hrs)

Multi rate DSP, decimators and interpolators, sampling rate conversion, multistage decimator & interpolator, poly phase filters, QMF, digital filter banks, applications in sub band coding.

Unit 3: Linear Prediction & Optimum Linear Filters

(07 Hrs)

Linear prediction & optimum linear filters, stationary random process, forward-backward linear prediction filters, solution of normal equations, AR lattice and ARMA lattice-ladder filters, Wiener Filters for filtering and prediction.

SECTION-II

Unit 4: Adaptive Filters

(07 Hrs)

Adaptive filters, applications, gradient adaptive lattice, minimum mean square criterion, LMS algorithm, recursive least square algorithm

Unit 5: Power Spectrum Estimation

(07 Hrs)

Estimation of spectra from finite-duration observations of signals, nonparametric methods for power spectrum estimation, parametric methods for power spectrum estimation, minimum- variance spectral estimation, Eigen analysis, algorithms for spectrum estimation.

Unit 6: Wavelet Transform & Application of DSP

(07 Hrs)

Application of DSP & multi rate DSP, application to radar, introduction to Wavelets, application to image processing, design of phase shifters, DSP in speech processing & other applications

- **Internal Continuous Assessment (ICA)**

ICA shall consist of minimum 6 laboratory experiments designed, developed and executed by students in relevant industry/ societal problem industry based upon above curriculum

- **Reference Books**

1. J.G.Proakis and D.G.Manolakis, "Digital signal processing: Principles, Algorithm and Applications", 4th Edition, Prentice Hall, 2007
2. N. J. Fliege, "Multirate Digital Signal Processing: Multirate Systems -Filter Banks – Wavelets", 1st Edition, John Wiley and Sons Ltd, 1999
3. Sanjit K Mitra, "Digital Signal Processing-A Computer Bases Approach", 3rd Edition McGraw Hill, 2009
4. M. H. Hayes, "Statistical Digital Signal Processing and Modeling", John Wiley & Sons Inc., 2002
5. S.Haykin, "Adaptive Filter Theory", 4th Edition, Prentice Hall, 2001
6. D.G.Manolakis, V.K. Ingle and S.M.Kogon, "Statistical and Adaptive Signal Processing", McGraw Hill, 2000



PUNYASHLOK AHILYADEVI HOLKAR SOLAPUR UNIVERSITY, SOLAPUR

M. Tech. (Electronics) Semester-I

MTEL103: VOICE AND DATA NETWORKS

Teaching Scheme

Lectures –3Hours/week, 3 Credits

Tutorial –1 Hour/week, 1 Credit

Examination Scheme

ESE- 70 Marks

ISE- 30 Marks

ICA – 25Marks

Course Prerequisite:

- Basic computer networks
- Knowledge of communication systems
- Understanding of OSI/TCP-IP models
- Basics of probability and data transmission

Course Objectives: During this course, student is expected to:

1. Analyze design issues in voice and data networks.
2. Explain network protocols and architectures.
3. Analyze congestion control mechanisms.
4. Describe routing and Internet protocols.
5. Introduce network security concepts.

Course Outcomes: At the end of this course, student will be able to:

1. Analyze network performance and design issues
2. Apply link layer and transport protocols
3. Explain voice networks including communication models, switching techniques, and statistical multiplexing.
4. Implement routing and congestion control techniques
5. Understand internet architecture and protocols
6. Evaluate network security mechanisms

SECTION I

Unit 1-Network design issues-

(6 Hrs)

Network design issues, Network Performance Issues, Network Terminology, centralized distributed approaches for networks design, Issues in design of voice and data networks.

Unit-2 Voice Networks

(6 Hrs)

Layered and layer-less communication, cross layer communication, voice networks (wired and wireless) and switching, circuit switching and packet switching, statistical multiplexing.

Unit 3 Link layer protocols-

(8 Hrs)

Data Networks and their Design, Link layer design- Link adaptation, Link Layer Protocols, Retransmission Mechanisms (ARQ), Hybrid ARQ (HARQ), Go Back N, Selective Repeat protocols and their analysis.

SECTION II

Unit 4 Communication across network-

(8Hrs) Inter-networking, bridging, global internet, IP protocol and addressing, subnetting, classless inter domain routing (CDIR), IP address lookup, routing in internet, end to end protocols, TCP and UDP, additive increase / multiplicative decrease. Slow start, fast retransmit / fast recovery.

Unit 5 Congestion Control and Resource Allocation

(6 Hrs)

Congestion avoidance mechanisms, Random Early Detection (RED), TCP-throughput analysis, quality of service in packet networks, network calculus, packet scheduling algorithms, source-based congestion avoidance.

Unit 6 Network security and Application layer protocols -

(6 Hrs)

Network security and management, principles of cryptography, authentication, integrity, key distribution and certification, access control and firewalls, Domain Name System (DNS), World Wide Web (HTTP), Electronic mail.

● Internal Continuous Assessment (ICA)

ICA shall consist of minimum 6 laboratory experiments designed, developed and executed by students in relevant industry/ societal problem based upon above curriculum

● Reference Books

1. D. Bertsekas and R. Gallager, "Data Networks", 2nd Edition, Prentice Hall, 1992.
2. L. Peterson and B. S. Davie, "Computer Networks: A Systems Approach", 5th Edition, Morgan Kaufman, 2011.
3. Kumar, D. Manjunath and J. Kuri, "Communication Networking: An analytical approach" 1st Edition, Morgan Kaufman, 2004.
4. Walrand, "Communications Network: A First Course", 2nd Edition, McGraw Hill, 2002.
5. William Stallings, "Network security, essentials", Pearson education Asia publication, 4th Edition, 2011
6. TCP /IP Protocol Suite, Behrouz A Forouzan , 4th Edition, Tata McGraw- Hill, 2009, ISBN- 10: 0073376043



PUNYASHLOK AHILYADEVI HOLKAR SOLAPUR UNIVERSITY, SOLAPUR

M. Tech. (Electronics) Semester-I

MTEL104: MACHINE LEARNING

Teaching Scheme

Lectures –3Hours/week, 3 Credits

Practical –2Hours/week, 1 Credit

Examination Scheme

ESE- 70 Marks

ISE- 30 Marks

ICA – 25Marks

Course Prerequisite:

- Basic mathematics (linear algebra, probability)
- Programming knowledge (Python/MATLAB)
- Fundamentals of statistics
- Basic data structures

Course Objectives: During this course, student is expected to:

1. Explain machine learning concepts and models.
2. Describe supervised and unsupervised learning techniques.
3. Analyze regression and classification techniques.
4. Explore clustering and support vector machines (SVM).
5. Explain neural networks and deep learning concepts.

Course Outcomes: At the end of this course, student will be able to:

1. Apply ML algorithms for prediction and classification
2. Build regression and classification models
3. Analyze clustering and pattern recognition methods
4. Implement SVM and neural networks
5. Evaluate ML models for real-world problems

SECTION-I

Unit 1: Introduction to Machine Learning

(06 Hrs.)

Machine learning: what and why, supervised learning, unsupervised learning, some basic concepts in machine learning, definition of learning systems, goals and applications of machine learning, aspects of developing a learning system: training data, concept representation, function approximation
(Chapter 1 from Book 1, Chapter 1 from Book 2)

Unit 2: Linear and Logistic Regression

(08 Hrs.)

Linear regression: introduction, model specification, maximum likelihood estimation (least squares), robust linear regression, ridge regression, Bayesian linear regression, logistic regression: introduction, model specification, model fitting, Bayesian logistic regression, online learning and stochastic optimization, generative vs discriminative classifiers.

(Chapter 7 and 8 from Book 2)

Unit 3: Decision Tree Learning and Ensemble Methods (08 Hrs)

Representing concepts as decision trees, recursive induction of decision trees, picking the best splitting attribute: entropy and information gain, searching for simple trees and computational complexity, Occam's razor, overfitting, noisy data, and pruning, ensemble methods: bagging and boosting

(Chapter 3 from Book 1, Chapter 14 from Book 3)

SECTION-II

Unit 4: Clustering (05 Hrs)

Introduction, Dirichlet process mixture models, affinity propagation, spectral clustering, hierarchical clustering, delustering data points and features

(Chapter 25 from Book 2)

Unit 5: Sparse Kernel Machines (05 Hrs)

Introduction to Support Vector Machines (SVM), maximum margin classifiers, relevance vector machines, applications of Support Vector Machines

(Chapter 7 from Book 3)

Unit 6: Neural Networks and Deep Learning (08 Hrs)

Feed-forward network functions, network training, error backpropagation, regularization in neural networks, deep learning: introduction, deep neural networks, applications of deep networks *(Chapter 5 from Book 3, Chapter 28 from Book 2)*

Unit 7: Key Ideas in Machine Learning (04 Hrs)

Introduction, key perspectives on machine learning, key results, where machine learning is headed next

(Chapter 14 of upcoming 2nd Edition of Book 1)

● **Internal Continuous Assessment (ICA)**

ICA shall consist of minimum 6 laboratory experiments designed, developed and executed by students in relevant industry/ societal problem based upon above curriculum

● **Reference Books**

1. *Book 1: Machine Learning* by Tom Mitchell, McGraw Hill (1st Edition)
2. Draft content of chapter 14 of 2nd Edition of Book 1
<http://www.cs.cmu.edu/~tom/mlbook/keyIdeas.pdf>
3. *Book 2: Machine Learning: a Probabilistic Perspective* by Kevin Patrick Murphy
4. *Book 3: Pattern Recognition and Machine Learning (Information Science and Statistics)* by Christopher M. Bishop



PUNYASHLOK AHILYADEVI HOLKAR SOLAPUR UNIVERSITY, SOLAPUR

M. Tech. (Electronics) Semester-I

MTEL106-A: ELECTIVE I: WIRELESS SENSOR NETWORKS

Teaching Scheme

Lectures –3Hours/week, 3 Credits

Tutorial–1 Hour/week, 1 Credit

Examination Scheme

ESE- 70 Marks

ISE- 30

Marks **ICA** –

25Marks

Course Prerequisite:

- Basics of communication systems and networking
- Knowledge of digital electronics and microcontrollers
- Fundamentals of signals and systems
- Basic programming concepts

Course Objectives: During this course, student is expected to:

1. Explain the architecture and design issues of wireless sensor networks.
2. Describe MAC protocols, routing, and clustering techniques.
3. Analyze power management and energy-efficient design approaches.
4. Apply synchronization, localization, and relevant standards.

Course Outcomes: At the end of this course, student will be able to:

1. Analyze WSN architecture and protocol stack.
2. Design energy-efficient MAC and routing techniques.
3. Evaluate node architecture and power optimization methods.
4. Apply localization and synchronization techniques.
5. Explain real-world WSN applications.

SECTION-I

Unit 1: Introduction to Wireless Sensor Networks (WSN): (06 Hrs.)

Motivation, overview, network architecture, protocol stack, design objectives, challenges & constraints, technologies, hardware & software platforms, standards, applications

Unit 2: Medium Access Control (MAC): (06 Hrs.)

Overview of MAC, MAC for WSN- network characteristics, objectives, energy efficiency, contention MAC, contention free MAC, hybrid MAC

Unit 3: Routing & Clustering: (08Hrs)

Overview, challenges, metrics, data centric routing, proactive routing, on demand routing, hierarchical routing, location-based routing, QoS based routing, introduction to clustering

SECTION-II

Unit 4: Node Architecture and Power Management: (10 Hrs.)

Node Architecture - Architecture, sensing, processing, communication interface, prototypes, software subsystems,

Power Management - Need, classification, passive power conservation mechanism, active power conservation mechanism, power control at different protocol layer

Unit 5: Time Synchronization and Localization: (08 Hrs.)

Time Synchronization - Clocks and synchronization problems, basics of time synchronization, time synchronization protocols

Localization - Ranging techniques, range-based localization, range free localization, event driven localization

Unit 8: Standards (04 Hrs.)

IEEE 802.15- Overview, MAC layer, Zigbee- network layer, application layer

- **Internal Continuous Assessment (ICA)**

ICA shall consist of minimum 6 laboratory experiments designed, developed and executed by students in relevant industry/ societal problem based upon above curriculum

- **Reference Books**

1. Wireless Sensor Networks – A Networking Perspective, Jun Zheng, Abbas Jamalipour, Wiley- IEEE
2. Fundamentals of Wireless Sensor Networks- Theory and Practice, Walteneus Dargie, Christian Poellabauer, Wiley
3. Networking Wireless Sensors, Bhaskar Krishnamachari, Cambridge University Press
4. Wireless Sensor Networks- Technology, Protocols and Applications, KazemSohraby, Daniel Minoli, Taieb Znati, Wiley India Wireless Sensor Network Designs,



PUNYASHLOK AHILYADEVI HOLKAR SOLAPUR UNIVERSITY, SOLAPUR

M. Tech. (Electronics) Semester-I

MTEL106-B: ELECTIVE I: ANALOG AND DIGITAL CMOS VLSI DESIGN

Teaching Scheme

Lectures –3 Hours/week, 3 Credits

Tutorial–1 Hour/week, 1 Credit

Examination Scheme

ESE- 70 Marks

ISE - 30

Marks **ICA** –

25Marks

Course Prerequisite:

- Semiconductor devices and electronic circuits
- Digital logic design
- Basic analog electronics
- Fundamentals of VLSI design

Course Objectives: During this course, student is expected to:

1. Explain CMOS digital and analog circuit design.
2. Describe physical design flow and performance metrics.
3. Analyze sequential and combinational logic circuits.
4. Design amplifiers, current mirrors, and OPAMPs.

Course Outcomes: At the end of this course, student will be able to:

1. Design CMOS-based digital circuits with performance considerations.
2. Analyze power, delay, and noise in VLSI circuits.
3. Develop analog circuits such as amplifiers and OPAMPs.
4. Apply physical design techniques in IC design.
5. Evaluate advanced technologies such as FinFET.

SECTION I

Digital CMOS Design

Unit 1: Review

(7 Hrs.)

Basic MOS structure and its static behavior, quality metrics of a digital design: cost, functionality, robustness, power, and delay, stick diagram and layout, wire delay models inverter: static CMOS inverter, switching threshold and noise margin concepts and their valuation, dynamic behavior, power consumption.

Unit 2: Physical Design Flow:

(7 Hrs.)

Floor planning, placement, routing, CTS, power analysis and IR drop estimation-static and dynamic, ESD protection-human body model, machine model.

Combinational logic: Static CMOS design, logic effort, ratioed logic, pass transistor logic, dynamic logic, speed and power dissipation in dynamic logic, cascading dynamic gates, MOS transmission gate logic.

Unit 3: Sequential Logic

(8 Hrs.)

Static latches and registers, Bi-stability principle, MUX based latches, static SR flip-flops, master-slave edge-triggered register, dynamic latches and registers, concept of pipelining, pulse registers, non-bistable sequential circuit

Advanced technologies: giga-scale dilemma, short channel effects, high-k, metal gate technology, FinFET, TFET etc.

SECTION II

Analog CMOS Design:

Unit 4: Single Stage Amplifier

(8 Hrs.)

CS stage with resistance load, divide connected load, current source load, triode load, CS stage with source degeneration, source follower, common gate stage, cascade stage, choice of device models.

Differential Amplifiers: basic difference pair, common mode response, differential pair with MOS loads, Gilbert cell.

Unit 5: Passive and Active Current Mirrors:

(6 Hrs.)

Basic current mirrors, Cascade mirrors, Active current mirrors. Frequency response of CS stage: Source follower, Common gate stage, Cascade stage and difference pair, Noise

Unit 6: Operational Amplifiers:

(7 Hrs.)

One stage OPAMP, two stage OPAMP, gain boosting, common mode feedback, slew rate, PSRR, compensation of 2 stage OPAMP, other compensation techniques.

● Internal Continuous Assessment (ICA)

ICA shall consist of minimum 6 laboratory experiments designed, developed and executed by students in relevant industry/ societal problem based upon above curriculum

● Reference Books

1. J P Rabaey, A P Chandrakasan, B Nikolic, "Digital Integrated circuits: A design perspective", Prentice Hall electronics and VLSI series, 2nd Edition.
2. Baker, Li, Boyce, "CMOS Circuit Design, Layout, and Simulation", Wiley, 2nd Edition.
3. Behzad Razavi, "Design of Analog CMOS Integrated Circuits", TMH, 2007.
4. Phillip E. Allen and Douglas R. Holberg, "CMOS Analog Circuit Design", Oxford, 3rd Edition.
5. R J Baker, "CMOS circuit Design, Layout and Simulation", IEEE Inc., 2008.
6. Kang, S. and Leblebici, Y., "CMOS Digital Integrated Circuits, Analysis and Design", TMH, 3rd Edition.
7. Pucknell, D.A. and Eshraghian, K., "Basic VLSI Design", PHI, 3rd Edition.



PUNYASHLOK AHILYADEVI HOLKAR SOLAPUR UNIVERSITY, SOLAPUR

M. Tech. (Electronics) Semester-I

MTEL106-C: ELECTIVE I: IMAGE AND VIDEO PROCESSING

Teaching Scheme

Lectures –3Hours/week, 3 Credits

Tutorial–1 Hour/week, 1 Credit

Examination Scheme

ESE- 70 Marks

ISE- 30

Marks **ICA**

– 25Marks

Course Prerequisite:

- Signals and systems
- Digital signal processing (DSP)
- Linear algebra basics
- Programming (MATLAB/Python preferred)

Course Objectives: During this course, student is expected to:

1. Explain fundamentals of image and video processing.
2. Describe transforms such as DFT, DCT, and wavelets.
3. Analyze enhancement, restoration, and segmentation techniques.
4. Apply compression and computer vision techniques.

Course Outcomes: At the end of this course, student will be able to:

1. Apply transforms for image/video analysis
2. Perform enhancement and restoration of images
3. Implement segmentation and feature extraction techniques
4. Analyze image/video compression standards
5. Develop basic computer vision applications

SECTION I

Unit1: Image and Video Fundamentals

(04 Hrs.)

Image and video formats, Sampling in 2-dimension (2-D) and 3-dimension (3-D), image processing operations, digital video basics

Unit 2: Image Transforms:

(06 Hrs.)

2D orthogonal & unitary transforms, discrete Fourier transform (DFT), discrete cosine transform (DCT), Hadamard transform, Haar transform, wavelet transform, Karhunen-Loeve transform (KLT), Singular value decomposition (SVD) transform.

Unit 3: Image and Video Enhancement

(06 Hrs.)

Histogram, Point processing, spatial operations, transform operations, multi-spectral image enhancement, fundamentals of 2-D motion estimation and motion compensation, algorithms for 2-D motion estimation, motion-compensated filtering, frame rate conversion, deinterlacing.

Unit 4: Image and Video Restoration (06 Hrs.)

Image observation models, inverse & Wiener filtering, generalized inverse, SVD and iterative methods, maximum entropy restoration, Bayesian methods, blind de-convolution, modeling in case of video restoration, intraframe shift invariant restoration, multiframe restoration

SECTION– II

Unit 5: Image and Video Segmentation (06 Hrs.)

Discontinuity based segmentation- line detection, edge detection, thresholding, region-based segmentation, scene change detection, spatiotemporal change detection, motion segmentation, simultaneous motion estimation and segmentation, semantic video object segmentation.

Unit 6: Image and Video Compression (06 Hrs.)

Lossless image compression including entropy coding, lossy image compression, video compression techniques, international standards for image and video compression (JPEG, JPEG 2000, MPEG-2/4, H.264, HEVC), video quality assessment

Unit 7: Image analysis & computer vision (06 Hrs.)

Spatial feature extraction, transform features, edge detection, boundary extraction, boundary representation, region representation, moment representation, structure, shape features, texture, scene matching & detection, image segmentation, classification techniques.

● **Internal Continuous Assessment (ICA)**

ICA shall consist of minimum 6 laboratory experiments designed, developed and executed by students in relevant industry/ societal problem based upon above curriculum

● **Reference Books**

1. Fundamentals of Digital Image Processing, K. Jain, Pearson education(Asia) Pte. Ltd. / Prentice Hall of India, 2004
2. Handbook of Image & Video Processing, Al Bovik, Elsevier Academic Press, 2nd Edition
3. Multidimensional Signal, Image and Video Processing and Coding, John W. Woods, Academic Press, Elsevier, 2006.
4. Fundamentals of Multimedia, Z. Li, M.S. Drew, Pearson education (Asia) Pte. Ltd., 2004
5. Digital Image Processing, R. C. Gonzalez, R. E. Woods, Pearson education (Asia) Pte. Ltd. / Prentice Hall of India, 2004, 2nd Edition
6. Digital Video Processing, M. Tekalp



PUNYASHLOK AHILYADEVI HOLKAR SOLAPUR UNIVERSITY, SOLAPUR

M. Tech. (Electronics), Semester-I

MTEL105: MINI-PROJECT-I

Teaching Scheme
Practical: 02 Hours/Week, 01 credit

Examination Scheme ICA:
50 Marks

Course Objectives:

1. To understand the product development process including planning and budgeting through a mini project.
2. To develop the ability to plan and organize various activities involved in project execution.
3. To identify a research problem in the field of Electronics Engineering through literature survey.
4. To develop skills in simulation, modeling and preliminary design using engineering software tools relevant to Electronics Engineering.

Course Outcomes:

After successful completion of this course, students will be able to:

1. Identify and analyze an engineering problem relevant to Electronics Engineering.
2. Conduct literature review and formulate objectives and methodology for a mini project.
3. Develop simulation models or preliminary design concepts using suitable engineering tools relevant to Electronics Engineering.
4. Prepare a technical report and present the proposed work effectively

Guidelines:

1. Each student shall select a mini project topic related to Electronics Engineering under the guidance of an allotted Project Guide.
2. The project topic should preferably be related to the student's future MTech dissertation work.
3. Students must perform literature review using journals, patents, and technical databases.
4. Use of analysis software, simulation tools, and design software is encouraged.
5. Students should prepare a technical report including objectives, literature review, and proposed methodology.
6. The progress of the mini project should be evaluated through periodic reviews

Weekly Activity Plan		
Week	Work to be carried	Hours
Week 1-2	Mini-project guide allotment, topic selection and project planning	03
Week 3-4	Literature review and identification of research problem	04
Week 5-6	Use analysis software, research tools, advanced methods, standards, and practices	04
Week 7-8	Simulation/modeling using appropriate software tools	04
Week 9-10	Preliminary design and analysis	04
Week 11-12	Preparation of technical report and seminar presentation	04

SEMESTER-II



PUNYASHLOK AHILYADEVI HOLKAR SOLAPUR UNIVERSITY, SOLAPUR

M. Tech. (Electronics) Semester-II

MTEL201: RESEARCH METHODOLOGY

Teaching Scheme

Lectures –3 Hours/week, 3 Credits

Tutorial –1 Hour/week, 1 Credit

Examination Scheme

ESE- 70 Marks

ISE- 30 Marks

ICA – 5Marks

Course Prerequisite:

- Basic knowledge of engineering concepts
- Awareness of research and technical writing
- Basic statistics

Course Objectives: During this course, student is expected to:

1. Explain research processes and methodologies.
2. Develop technical writing and presentation skills.
3. Apply modelling and simulation techniques.
4. Describe intellectual property rights.
5. Demonstrate patent filing procedures.

Course Outcomes: At the end of this course, student will be able to:

1. Formulate research problems and objectives.
2. Analyze literature for research work.
3. Prepare technical reports and papers.
4. Apply modeling and simulation techniques.
5. Explain intellectual property rights and patenting process.

SECTION-I

Unit 1: Research fundamentals and process:

(10 Hrs.)

Definition, objectives, motivation, types of research and approaches, research- descriptive, conceptual, theoretical, applied and experimental, Literature review, research design, assortment of the problem, identification of problem, defining a problem, objective, sub objective and scope, assumptions, validation criteria, research proposal(synopsis)

Unit 2: Report writing and presentation of results:

(5 Hrs.)

Need, report structure, formulation, sections, protocols, graphs, tables, IEEE format, evaluation of report, writing abstract, writing technical paper

Unit 3: ICT in research:

(3 Hrs.)

Introduction, e-research, indices, virtual lab, digital lab, ethical issues in research

SECTION-II

Unit 4: Mathematical modeling and simulation: (7 Hrs.)

Mathematical modeling – need, techniques and classification, system models –types, static, dynamic, system simulation – why to simulate, technique of simulation, Monte Carlo simulation, types, continuous modeling, discrete model, role of probability and statistics in simulation, statistical distributions,

Unit 5: Intellectual Property Fundamentals: (7 Hrs.)

Patents, designs, trade and copyright, process of patenting and development: technological research, innovation, patenting, development, international scenario: international cooperation on intellectual property, procedure for grants of patents, patenting under PCT.

Unit 6: Patent Rights and management: (6 Hrs.)

Scope of patent rights, licensing and transfer of technology, patent information and databases, geographical indications

- **Internal Continuous Assessment (ICA)**

ICA consist of minimum six assignments based upon above syllabus

- **Reference Books**

1. Fundamental of Research Methodology and Statistics, Yogesh Kumar Sing, New Age International Publishers
2. Research Methodology: Methods and Techniques, C.R. Kothari, New Age International Publishers, 2nd revised Edition
3. Research Methodology, Concepts and Cases, Deepak Chawla, Neena Sondhi, Vikas
4. Intellectual Property in New Technological Age, Robert P. Merges, Peter S. Menell, Mark A. Lemley, 2016.
5. Intellectual Property Rights by Neeraj Pandey And Khushdeep Dharn
6. Intellectual Property Rights Under WTO, T. Ramappa, S. Chand, 2008
7. Intellectual Property Rights Journal by CSIR-National institute of science Communication and Information Resources. (January 2017 and March-May-2018)

NAAC Accredited-2022

Grade 'C' (CGPA-2.00)



PUNYASHLOK AHILYADEVI HOLKAR SOLAPUR UNIVERSITY, SOLAPUR

M. Tech. (Electronics) Semester-II

MTEL202: COMMUNICATION BUSES AND INTERFACES

Teaching Scheme

Lectures –3 Hours/week, 3 Credits

Practical-2 Hours/week, 1 Credit

Examination Scheme

ESE- 70 Marks

ISE- 30 Marks

ICA –25Marks

Course Prerequisite:

- Digital electronics fundamentals
- Microprocessors/microcontrollers basics
- Communication systems basics

Course Objectives: During this course, student is expected to:

1. Describe serial communication protocols.
2. Explain bus architectures such as PCI, USB, and CAN.
3. Analyze hardware interfaces and standards.
4. Explain data transfer techniques.
5. Describe industrial communication systems.

Course Outcomes: At the end of this course, student will be able to:

1. Analyze various communication buses and interfaces
2. Implement serial communication protocols
3. Evaluate performance of bus systems
4. Design interfacing solutions for embedded systems
5. Apply communication standards in real applications

SECTION-I

Unit 1: Bus Systems

Serial Buses, physical interface, data and control signals, features.

(5 Hrs)

Unit 2: Serial interfaces-

RS232, RS485, I²C, SPI with their limitations and applications.

(8 Hrs)

Unit 3: CAN in automation-

CAN - architecture, data transmission, layers, frame formats, applications

(7 Hrs)

SECTION-II

Unit 4: Peripheral component interconnect- (8 Hrs)
PCI, PCIexpress - revisions, configuration space, hardware protocols and applications

Unit 5: Universal serial bus- (6 Hrs)
Transfer types, enumeration, descriptor types and contents, device driver

Unit 6: Data transfer- (6 Hrs)
Data streaming serial communication protocol- serial front panel data port (SFPDP) using fiber optic and copper cable

● **Internal Continuous Assessment (ICA)**

ICA shall consist of minimum 6 laboratory experiments designed, developed and executed by students in relevant industry/ societal problem based upon above curriculum

● **Reference Books**

1. Jan Axelson, "Serial Port Complete - COM Ports, USB Virtual Com Ports, and Ports for Embedded Systems", Lakeview Research, 2nd Edition
2. Jan Axelson, "USB Complete", Penram Publications
3. Mike Jackson, Ravi Budruk, "PCI Express Technology", Mindshare Press
4. Wilfried Voss, "A Comprehensible Guide to Controller Area Network", Copperhill Media Corporation, 2nd Edition, 2005.
5. Serial Front Panel Draft Standard VITA 17.1 – 200x
6. Technical references on www.can-cia.org, www.pcisig.com, www.usb.org



NAAC Accredited-2022

Grade: CGPA-2.00



PUNYASHLOK AHILYADEVII HOLKAR SOLAPUR UNIVERSITY, SOLAPUR

M. Tech. (Electronics) Semester-II

MTEL203: ADVANCED INTERNET OF THINGS (IoT)

Teaching Scheme

Lectures –3 Hours/week, 3 Credits

Practical –2 Hours/week, 1 Credit

Examination Scheme

ESE- 70 Marks

ISE- 30 Marks

ICA – 25Marks

Course Prerequisite:

- Basics of embedded systems
- Computer networks fundamentals
- Programming knowledge

Course Objectives: During this course, student is expected to:

1. Explain IoT architecture and applications.
2. Describe communication protocols and networking.
3. Explore IoT platforms and operating systems.
4. Analyze edge and fog computing concepts.
5. Examine real-world IoT applications.

Course Outcomes: At the end of this course, student will be able to:

1. Explain the fundamentals of IoT, smart cities, M2M, and IP addressing.
2. Describe IoT communication protocols.
3. Explain wireless sensor network concepts and IoT network types.
4. Analyze IoT platforms, embedded systems, and multithreading concepts.
5. Describe IoT operating systems and big data requirements.
6. Design IoT solutions for different applications.

SECTION- I

Unit 1: Introduction to IoT

(7 Hrs.)

Smart cities and IoT revolution, Fractal cities, From IT to IoT, M2M, IoT vs M2M and peer networking concepts, Ipv4 and IPV6

Unit 2: Communication Protocols

(7 Hrs.)

Software defined networks SDN, from cloud to fog and MIST networking for IoT communications, principles of edge/P2P networking, protocols to support IoT communications, modular design and abstraction, security and privacy in fog.

Unit 3: Wireless Sensor Networks

(6 Hrs.)

Introduction, IOT networks (PAN, LAN and WAN), edge resource pooling and caching, client-side control and configuration

SECTION II

Unit 4: IoT Platforms.

(7 Hrs.)

Smart objects as building blocks for IoT, open-source hardware and embedded systems platforms for IoT, edge/gateway, IO drivers, C Programming, multithreading concepts

Unit 5:IoT Operating Systems

(7 Hrs.)

Operating systems requirement of IoT environment, study of embed, RIoT, and Contiki operating systems, introductory concepts of big data for IoT applications.

Unit 6: Applications of IoT

(6 Hrs.)

Connected cars IoT transportation, smart grid and healthcare sectors using IoT, Smart agriculture

- **Internal Continuous Assessment (ICA)**

ICA shall consist of minimum 6 laboratory experiments designed, developed and executed by students in relevant industry/ societal problem based upon above curriculum

- **Reference Books**

1. A Bahaga, V. Madiseti, "Internet of Things- Hands on approach", VPT publisher, 2014.
2. The Internet of Things: Enabling Technologies, Platforms, and Use Cases", by Pethuru Raj and Anupama C. Raman (CRC Press)
3. Industry 4.0: The Industrial Internet of Things", by Alasdair Gilchrist (Apress)
- A. McEwen, H. Cassimally, "Designing the Internet of Things", Wiley, 2013.
4. CunoPfister, "Getting started with Internet of Things", Maker Media, 1st edition, 2011.
5. Samuel Greenguard, "Internet of things", MIT Press, 2015.

सालापुर विद्यापीठ

॥ विद्यया संपन्नता ॥

NAAC Accredited-2022

Grade (CGPA-2.00)



PUNYASHLOK AHILYADEVI HOLKAR SOLAPUR UNIVERSITY, SOLAPUR

M. Tech. (Electronics) Semester-II

MTEL204: PLC, SCADA AND DISTRIBUTED CONTROL SYSTEMS

Teaching Scheme

Lectures –3 Hours/week, 3 Credits

Practical –2 Hours/week, 1 Credit

Examination Scheme

ESE- 70 Marks

ISE- 30 Marks

ICA – 25Marks

Course Prerequisite:

- Control systems basics
- Electrical circuits knowledge
- Industrial automation basics

Course Objectives: During this course, student is expected to:

1. Explain automation systems and architectures.
2. Describe PLC hardware and programming.
3. Explain SCADA and DCS systems.
4. Analyze industrial control applications.
5. Implement automation solutions.

Course Outcomes: At the end of this course, student will be able to:

1. Design PLC-based control systems
2. Develop ladder logic programs
3. Analyze SCADA and DCS architectures
4. Implement industrial automation solutions
5. Evaluate real-time control applications

SECTION-I

Unit 1: Automation fundamentals

(7 Hrs)

Automation and its importance, applications, expectations, process and factory automation. Types of plant and control- categories in industry, open loop and closed loop control functions, continuous, discrete and mixed processes, automation hierarchy – large control systems, data quantity, quality. Control system architecture – evolution and current trends, comparison of different architectures

Unit 2: Programmable Logic Controller Hardware

(7 Hrs)

Evolution of PLC, functions of PLC, advantages and architecture, scan time, types & specifications, digital and analog I/O modules with examples and ratings, local and remote I/O expansion, communication modules & special purpose modules, memory and addressing – memory organization, I/O addressing, hardware to software interface.

Unit 3: PLC Programming

(7 Hrs)

Ladder diagram, programming devices, IEC standard PLC programming languages, PLC timers and counters: types and examples, data transfer & program control instructions, advanced PLC instructions, PID control using PLC. Case study: PLC selection and configuration for a process.

SECTION-II

Unit 4: Distributed control System (DCS)

(7 Hrs)

Introduction to DCS, evolution of DCS, DCS flow sheet symbols, architecture of DCS, controller, input and output modules, communication module, data highway, local I/O bus, workstations, specifications of DCS, DCS system integration with PLCs: HMI, sequencing, supervisory control and integration with PLC, personal computers and direct I/O, serial linkages, network linkages, DCS programming.

Unit 5: Supervisory Control and Data Acquisition Systems (SCADA)

(7 Hrs)

SCADA: Introduction, brief history, elements of SCADA, features of SCADA, MTU- functions of MTU, RTU- functions of RTU, protocol details of SCADA- types and methods used, components, protocol structures and mediums used for communications, SCADA development for any one typical application, programming for GUI development using SCADA software.

Unit 6: Applications of PLC and SCADA

(7 Hrs)

Systems block diagram, operation, ladder diagram and explanation for following applications: steam boiler control system using PLC, conveyor belt automation system, automation of bottle filling plant, material flow measurement systems and traffic light controller using PLC.

● Internal Continuous Assessment (ICA)

ICA shall consist of minimum 6 laboratory experiments designed, developed and executed by students in relevant industry/societal problem based upon above curriculum.

● Reference Books

1. John. W. Webb & Ronald A. Reis, “Programmable Logic Controllers- Principles and Applications”, PHI , 5th Edition, 2002
2. Frank D. Petruzella, “Programmable Logic Controllers”, Mc Graw Hill Education, 4th Edition, 2016
3. Gary Dunning, “Introduction to Programmable Logic Controllers”, Thomson Learning, Pck Edition 2001
4. Stuart Boyer, “ SCADA : Supervisory Control And Data Acquisition”, International Society of Automation publication, 4th Edition, 2009
5. Samuel M. Herb, “Understanding Distributed Processor Systems For Control”, International Society of Automation Publication, 1st Edition 1999
6. Krishna Kant, “Computer Based Process control”, PHI 2nd Edition 2010



PUNYASHLOK AHILYADEVI HOLKAR SOLAPUR UNIVERSITY, SOLAPUR

M. Tech. (Electronics) Semester-II

MTEL206-A: ELECTIVE II -MOBILE TECHNOLOGY

Teaching Scheme

Lectures –3 Hours/week, 3 Credits

Tutorial –1 Hours/week, 1 Credit

Examination Scheme

ESE- 70 Marks

ISE- 30 Marks

ICA – 25Marks

Course Prerequisite:

- Communication systems
- Computer networks
- Basics of wireless communication
- Digital electronics fundamentals

Course Objectives: During this course, student is expected to:

1. Explain GSM, GPRS, and mobile network architecture.
2. Describe wireless protocols and mobile communication standards.
3. Illustrate modern mobile technologies such as UMTS and CDMA.
4. Analyze UMTS, CDMA, and modern mobile systems.
5. Explain security issues in mobile networks.

Course Outcomes: At the end of this course, student will be able to:

1. Explain architecture of GSM, GPRS, and mobile systems
2. Analyze wireless communication protocols and services
3. Evaluate modern mobile technologies (UMTS, CDMA)
4. Identify security threats and protection techniques
5. Apply concepts to real-world mobile networks

SECTION-I

Unit 1: GSM System Overview:

(8 Hrs)

GSM architecture, location tracking and call set up, security, data services, network signaling, MAP protocol and dialogue, mobility management, databases, failure restoration, overflow control, SMS protocol, international roaming, operations, administration and maintenance

Unit 2: General Packet Radio Services (GPRS):

(6 Hrs.)

Functional groups, architecture, network nodes, interfaces, procedures, billing, mobility management, applications, EDGE

Unit 3: Wireless Application Protocol (WAP): (6 Hrs.)

Model, gateway, protocol, user agent profile and caching, wireless bearers, development toolkit, network and application environments, wireless markup language, telephony applications, MMS, other applications

SECTION II

Unit 4: Universal Mobile Telecommunication Services (UMTS): (7 Hrs.)

Migration path, air interfaces, URRAN architecture, speech call, packet data, handover, core network evaluation

Unit 5: CDMA 2000: (7 Hrs.)

Evaluation, network architecture and structure, radio network, 1xEVDO, 1xRTT

Unit 6: Security Issues in Mobile Technology: (6 Hrs.)

Information security, attacks, components of information security, security techniques and algorithms, security protocols, security models and frameworks

● **Internal Continuous Assessment (ICA)**

ICA shall consist of minimum 6 laboratory experiments designed, developed and executed by students in relevant industry/ societal problem based upon above curriculum

● **Reference Books**

1. Mobile Computing, Technology, applications and Service Creation, Asoke K. Talukder, Hasan Ahmed, Rupa R. Yavagal, Tata McGraw Hill Education Pvt. Ltd., 2nd Edition
2. 3G Wireless Networks, Clint Smith, Daniel Collins, Tata McGraw Hill Publishing Company Ltd., 2nd Edition
3. Wireless and Mobile Network Architecture, Yi-Bing Lin, ImrichChlamtac, Wiley India



PUNYASHLOK AHILYADEVI HOLKAR SOLAPUR UNIVERSITY, SOLAPUR

M. Tech. (Electronics) Semester-II

MTEL206-B: ELECTIVE-II: REAL TIME SYSTEMS

Teaching Scheme

Lectures: 3 hrs/week, 3 Credits

Tutorial: 1 hr /week, 1 Credit

Examination Scheme

ESE –70 Marks

ISE – 30

Marks ICA- 25

Marks

Course Prerequisite:

- Operating systems
- Data structures and algorithms
- Computer architecture
- Programming (C/C++ preferred)

Course Objectives: During this course, student is expected:

1. Explain real-time system concepts and scheduling.
2. Describe programming tools and timing constraints.
3. Analyze real-time databases and communication.
4. Evaluate reliability and fault tolerance.

Course Outcomes: At the end of this course, student will be able to:

1. Analyze scheduling algorithms for real-time tasks
2. Design real-time systems with timing constraints
3. Apply real-time programming concepts
4. Evaluate fault tolerance and reliability techniques
5. Develop solutions for real-time applications.

SECTION I

Unit 1: Introduction

(7 Hrs)

Introduction, issues in real time computing, structure & application of a real time system , task classes, performance measures for real time systems, estimating program run times, task assignment and scheduling, classical uniprocessor scheduling algorithms, uniprocessor scheduling of iris tasks, task assignment, modelling timing constraints

Unit 2: Programming Languages and Tools- I

(7 Hrs)

Programming languages and tools, desired language characteristics, data typing, control & conditional structures, facilitating hierarchical decomposition, packages

Unit 3: Programming Languages and Tools -II

(7 Hrs)

Run time (exception) error handling, overloading and generics, multitasking, low level programming, task scheduling, timing specifications, programming environments, run time support

SECTION B II

Unit 4: Real Time Databases

(7 Hrs)

Real time databases, basic definition, real time vs general purpose databases, main memory databases, temporal data, transaction priorities, transaction aborts, concurrency control issues, disk scheduling algorithms, two phase approach to improve predictability, serialization consistency , databases for hard real time systems.

Unit 5:Real –Time Communication

(7 Hrs)

Real time communication, communications media, network topologies protocols, fault tolerant routing, fault tolerance techniques, fault types, fault detection, fault error containment redundancy, data diversity, reversal checks, integrated failure handling.

Unit 6: Evaluation techniques

(7 Hrs)

Reliability evaluation techniques, obtaining parameter values, reliability models for hardware redundancy, software error models, clock synchronization, clock, an on fault, tolerant synchronization algorithm, impact of faults, fault tolerant synchronization in hardware, fault tolerant synchronization in software.

- **Internal Continuous Assessment (ICA)**

ICA shall consist of minimum 6 laboratory experiments designed, developed and executed by students in relevant industry/ societal problem based upon above curriculum

- **Reference Books**

1. C.M. Krishna, Kang G. Shin, “Real – Time Systems”, McGraw – Hill International Editions, 1997.
2. Rajib Mall, ”Real-time systems: theory and practice”, Pearson Education, 2007
3. S. T. Allworth and R. N. Zobel, “ Introduction to real time software design”, McMillan, 2nd Edition, 1987
4. R.J.A Buhur, D.L Bailey, “An Introduction to Real – Time Systems”, Prentice – Hall International, 1999.
5. Philip.A.Laplante, “Real Time System Design and Analysis”, Prentice Hall of India, 3rd



PUNYASHLOK AHILYADEVI HOLKAR SOLAPUR UNIVERSITY, SOLAPUR

M. Tech. (Electronics) Semester-II

MTEL206-C: ELECTIVE II - VLSI IN SIGNAL PROCESSING

Teaching Scheme

Lectures: 3 hrs/week, 3 Credits

Tutorial: 1 hrs/week, 1 Credit

Examination Scheme

ESE –70 Marks

ISE – 30 Marks

ICA- 25 Marks

Course Prerequisite:

- Digital signal processing
- VLSI design fundamentals
- Linear algebra
- Digital electronics

Course Objectives: During this course, student is expected to:

1. Explain DSP algorithm representation using Data Flow Graph (DFG).
2. Describe pipelining, parallel processing, and retiming techniques.
3. Analyze unfolding, folding, and systolic architectures.
4. Design efficient VLSI architectures for DSP applications.

Course Outcomes: At the end of this course, student will be able to:

1. Represent DSP algorithms using data flow graphs.
2. Apply pipelining and parallel processing techniques.
3. Optimize architectures using retiming and folding.
4. Design systolic arrays for DSP applications.
5. Analyze performance and hardware efficiency.

SECTION- I

Unit1: DFG Representation and Iteration Bound

(6 Hrs)

Representations of DSP algorithms, data flow graph representations, critical path, loop bound, iteration bound, algorithms for computing iteration bound

Unit2: Pipelining and Parallel Processing

(6 Hrs.)

Pipelining approach to reduce critical path, parallel processing to handle higher sample rates, power reduction computations, combined pipelining and parallel processing

Unit 3: Retiming

(8 Hrs.)

Introduction to retiming, definitions and properties, solving system of inequalities, cut set retiming and pipelining, retiming for clock period minimization, retiming for register minimization

SECTION II

Unit 4: Unfolding & Folding

(9 Hrs.)

Introduction to unfolding, algorithm for unfolding, properties of unfolding, applications of unfolding; folding, folding transformation, lifetime analysis for register minimization in folded architecture

Unit 5: Systolic Array Design

(6 Hrs.)

Methodologies, family of systolic arrays (FIR filter) using linear mapping techniques, matrix – matrix multiplication.

Unit 6: Bit Level Arithmetic Architectures

(5 Hrs.)

Parallel multiplication with sign extension, parallel carry ripple array multipliers, parallel carry save array multipliers, parallel multipliers with modified booth recording

- **Internal Continuous Assessment (ICA)**

ICA shall consist of minimum 6 laboratory experiments designed, developed and executed by students in relevant industry/ societal problem based upon above curriculum

- **Reference Books:**

1. VLSI Digital Signal Processing Systems- Design and Implementation, Keshav K. Parhi, Wiley (India)
2. Architecture for Digital Signal Processing, Peter Pirsch, Wiley India
3. Digital Signal Processing in VLSI, Richard J. Higgins
4. VLSI Synthesis of DSP Kernels-Algorithmic and Architectural Transformations, Mahesh Mehendale, Sunil D. Sherlekar

।। विद्यया संपन्नस ।।

NAAC Accredited-2022

Grade (CGPA-2.00)



PUNYASHLOK AHILYADEVI HOLKAR SOLAPUR UNIVERSITY, SOLAPUR

M. Tech. (Electronics) Semester-II

MTEL205: MINI-PROJECT-II

Examination Scheme

ICA: 50 Marks

Teaching Scheme

Practical : 02 Hours/Week, 01 credit

Course Objectives: During this course, student is expected to:

1. Apply electronics engineering concepts for solving practical engineering problems.
2. Design real-time engineering applications using simulation and implementation techniques.
3. To build competence in technical documentation, presentation, and research publication.

Course Outcomes: After successful completion of this course, students will be able to:

1. Plan, design and execute a mini project in the Electronics Engineering domain.
2. Develop and implement a real-time engineering solution or prototype model.
3. Prepare a comprehensive technical report based on the project work.
4. Present and demonstrate the project effectively through a seminar.
5. Explain the process of research publication, patents, and copyright

Guidelines:

1. Each student shall design and demonstrate the mini project under the supervision of a faculty guide.
2. The project area should preferably be related to the dissertation work planned in the second year.
3. The project should involve design analysis, simulation, or experimental validation.
4. Hardware implementation or software simulation should be carried out wherever applicable.
5. Submission of mini project report is mandatory for internal assessment.
6. Publication of a research paper or preparation for patent filing based on the project work is encouraged.
7. Mini project work should preferably be completed in laboratory/research environment

Weekly Activity Plan		
Week	Work to be carried	Hours
Week 1-2	Guide allotment, topic finalization, project planning considering societal, environmental and economic aspects	03
Week 3-4	Literature review, problem specification and methodology finalization (Review-1)	04
Week 5-6	Simulation and analysis using software tools; hardware/software platform selection	04
Week 7-8	Implementation of design model and block level design (Review-2)	04
Week 9-10	Mini project report writing and planning for publication/patent	04
Week 11-12	Demonstration of project work and final evaluation	04



NAAC Accredited-2022

UGC Grade (CGPA-2.00)