COURSE PATTERN - M.Sc. ELECTRONICS

Sem	Code	Subject title	Hrs/wk	Credits
I	16PEL1101	Design of Analog circuits	6	5
	16PEL1102	Design of Digital circuits	6	5
	16PEL1103	Signals and systems	6	5
	16PEL1104	Electronics Practical – I	8	5
	16PEL1401	IDC:WS - Electronics Media	4	4
	TOTAL FOR SEMESTERS -I		**30**	**24**
II	16PEL2105	Embedded system MSP430 and Interface protocols (OOC)	6	5
	16PEL2106	Digital signal processing	6	5
	16PEL2107	Power electronics and Solar PV systems	6	5
	16PEL2108	Electronics Practical –II	8	5
	SELF PACED LEARNING		-	2
	16PEL2109 A	Automotive Electronics		
	16PEL2109 B	IoT and Cloud computing		
	16PEL2109 C	Medical Electronics		
	16PEL2109 D	Programmable Digital signal Processor and CCS		
	16PSS2401	IDC: Soft Skills	4	4
	TOTAL FOR SEMESTERS -II		**30**	**26**
III	16PEL3110	AVR microcontroller and Open source hardware	5	5
	16PEL3111	VLSI design and VHDL programming	5	5
	16PEL3112	Electronics Practical –III	8	5
	16PEL3113	IPT		5
	16PEL3201 A	Embedded Android OS and ARM OR	4	4
	16PEL3201 B	Single board Computers and Python		
	@	Project - Phase I	4	-
	16PEL 3402	IDC : BS - computer hardware	4	4
	TOTAL FOR SEMESTER -III		**30**	**28**
IV	16PEL4114	Sensors and Transducers	5	5
	16PEL4115	Electromagnetic Theory	5	5
	16PEL4202 A	Control System OR	4	
	16PEL4202 B	Digital Communication systems		
	16PEL4203 A	Programmable logic controllers and programming (OOC) OR	4	4
	16PEL4203 B	FPGA Design (OOC)		
	16PEL4204 A	MEMS and Nano Electronics OR	4	4
	16PEL4204 B	Mobile Communications		
	16PEL4116	Project - Dissertation & Viva voce (Phase II)	8	7
	16PEL4117	Comprehensive Examination		2
	TOTAL FOR SEMESTER –IV		**30**	**27**
I - IV	16PCW4501	Shepherd & Gender studies		5
	TOTAL CREDITS FOR ALL THE SEMESTERS		**120**	**110**

Sem: I	L	P	C
16PEL1101	6	0	5

DESIGN OF ANALOG CIRCUITS

Assurance of Learning

- Ability to understand amplifiers and its working
- Ability to analyze the noise in integrated circuits
- Acquire knowledge about current mirrors, voltage and current reference circuits.
- Knowledge about frequency response in circuits
- Ability to design analog circuits with op amp.

UNIT-I: SINGLE AND MULTI-STAGE AMPLIFIERS (15 Hrs)

Device model selection - Two-Port modeling of amplifiers - Basic single transistor amplifier stages - Common emitter - Common source - Common base - Common gate - Common collector - Common drain configuration and common emitter amplifier - Multiple transistor amplifier stages - CC - CE, CC - CC and Darlington configurations - Cascode configuration - Active cascode and super source follower - Differential pairs - DC transfer characteristics emitter coupled pair - Emitter degeneration - Source coupled pair - Small signal analysis of differential amplifier - Balanced differential amplifiers - Device mismatch effects in differential amplifiers.

UNIT-II: CURRENT MIRRORS, ACTIVE LOADS AND REFERENCES (15 Hrs)

Current mirrors - General properties - Simple current mirror - Current mirror with Beta helper - Simple current mirror with degeneration- Cascode mirror - Wilson current mirror - Active loads-common emitter, common source amplifier with complementary load - Depletion load - Diode connected load - Differential pair with current mirror load - Voltage and current references - Low current biasing - Supply insensitive biasing.

UNIT-III: FREQUENCY RESPONSE OF AMPLIFIERS (14 Hrs)

Single stage amplifiers - Miller effect - Frequency response for differential amplifier - Voltage buffers - Emitter follower - Source follower - Current buffers - Common base and common gate amplifier response - Multistage amplifier frequency response - Dominant pole approximation - Zero value time constant analysis - Cascade voltage amplifier - Current mirror loading - Circuit time constants

UNIT-IV: OP AMP CHARACTERISTICS (14 Hrs)

Op amp topologies - current feedback amplifiers - single supply op amp issues - op amp input stages - FET input stages - rail to rail input stages - output stages - output stage surge protection - offset voltage trim process - op amp process technologies - Specifications - input off set voltage - offset adjustment - internal and external method - input offset voltage drift and ageing effects - input bias current - input bias current - input impedance - manipulating noise and gain - open loop gain - Frequency response - settling time - voltage feedback op amps - current feedback op amps - Op amp noise - voltage noise - current noise - shot noise - noise figure - popcorn noise - RMS noise considerations - noise calculations - CMRR - PSRR - Precision and High speed op amp.

UNIT-V: SPECIAL AMPLIFIERS AND DATA CONVERTERS (14 Hrs)

Instrumentation amplifiers - Difference amplifier - AD627 two op amp instrumentation amplifier - Programmable gain amplifiers - design issues - AD526 PGA - DAC programmed PGA. Isolation amplifiers - isolation techniques - AD210 three port isolator - Data converters - introduction - trends in data converters - ADC and DAC static transfer functions and dc errors - quantization noise - ADC/DAC specifications - driving ADC inputs - driving ADC/DAC reference inputs - buffering DAC outputs.

Books for study

1. Paul R. Gray, Paul J. Hurst, Stephen H. Lewis and Robert G. Meyer, "Analysis and design of Analog integrated circuits ", 5th edition, 2009, John Wiley.
2. Walt Jung, "Op amp applications handbook", 1st edition, 2005, Newnes.

Books for reference

1. Tony Chan Carusone, David A. Johns and Kenneth W. Martin, "Analog integrated circuit design" , 2nd edition, 2011, John wiley.
2. Robert Boylestad and Louis Nashelsky, "Electronic Devices and Circuit Theory", 7th edition Prentice Hall.

SECTIONS

UNIT	BOOK	SECTIONS
I	1	3.1, 3.2, 3.3.1 - 3.3.4, 3.3.6 - 3.3.8, 3.4, 3.5.1 - 3.5.6.1
II	1	4.1, 4.2, 4.3, 4.4.1 - 4.4.2
III	1	7.1, 7.2.1, 7.2.2, 7.3
IV	2	1.1-1.6
V	2	2.1 - 2.3, 3.1 - 3.5

Sem: I	L	P	C
16PEL1102	6	0	5

DESIGN OF DIGITAL CIRCUITS

Assurance of learning

- Understanding the logic functional theory and design.
- Ability to Acquiring the design concepts of counters and shift registers
- Capacity to analyze the state machine algorithm and clocking.
- Understand and identify the concepts of event driver circuits
- Program and implement the digital design circuits in software.

UNIT-I:COMBINATIONAL LOGIC CIRCUITS AND DESIGN PRINCIPLES (14 Hrs)

Introduction to combinational logic circuits - Gate signal conventions - Gate expansion - Noise margin - propagation time - fan-out - Multiplexers and data selection (2:1, 4:1) - Interconnecting multiplexers (64:1) - De Multiplexers(1:8) - Multiplexers /De Multiplexers data transmission system - Decoders (3:8) - Decoder networks - Display decoding - Encoder circuit principles - Encoding networks.

UNIT-II: COUNTERS AND REGISTERS (13 Hrs)

Introduction - Clock signal - Basic counter design - Scale of-five up counter - Integrated circuit counters - Cascading of IC counter chips -Use of shift registers as counters and sequence generators - Universal state diagram of shift registers - Design of decade counter - Multi-bit rate multipliers.

UNIT-III: CLOCK -DRIVEN SEQUENTIAL CIRCUITS (15 Hrs)

Basic synchronous sequential circuits - analysis of a clocked sequential circuit - design steps for synchronous sequential circuits - Design of sequence detector -Moore and mealy state machines - State reduction - State assignment - algorithmic state machine charts - clock skew - clock timing constraints.

UNIT-IV: EVENT -DRIVEN CIRCUITS (15 Hrs)

Design procedure: asynchronous sequential circuits - stable and unstable states - design of sequence detector - state reduction for incompletely specified machines - gate delays - generation of spikes the elimination of static hazards - design of hazard -free combinational networks-asynchronous circuit design.

UNIT-V: LABVIEW FOR DIGITAL CIRCUITS (15 Hrs)

LabVIEW basics: LabVIEW Environment - Panel and Diagram Windows - Shortcut menus - Palettes - Opening - Loading - and saving VI's -Virtual Instruments: Types of Virtual Instruments - Several worked examples - Block Diagram - Structures: For Loop - While loop - Shift Registers - Arrays - Data Acquisition - Components of DAQ System.

Books for study:

1. Brian Holdsworth and clive woods, "DIGITAL LOGIC DESIGN" Elsevier-4th edition,2005.

Reference books

1. M.Morris Mano, "Digital logic and Computer Design", PHI, 1979.
2. Charles.H.Roth, Jr, "Digital Systems Design using VHDL", PWS Publishing Company, 2001.
3. John B. Peatman, "Digital hardware Design", McGraw hill.

SECTIONS

UNIT	BOOK	SECTIONS
I	I	4.16-4.19,5.1-5.4,5.7-5.15
II	I	7.1-7.5,7.13-7.15,7.19-7.21,7.26
III	I	8.1-8.6,8.9-8.11,8.14,8.15
IV	I	9.2,9.3,9.8,9.9,9.15-9.21
V		Lecture notes

Sem: I	L	P	C
16PEL1103	6	0	5

SIGNALS AND SYSTEMS

Assurance of Learning

- Ability to analyze signals and LTI Systems
- Ability to classify Laplace Transformation and Fourier transformation.
- Programming in MATLAB for various types of signals and mathematical functions
- Understanding complex function and Z transform

UNIT - I: LAPLACE TRANSFORM (15 Hrs)

Definition of Laplace transform - Problems - Piecewise or sectional continuity - Sufficient condition for existence of Laplace transform - Some properties of Laplace transform - Some methods for finding Laplace transforms - Laplace transform of some special function.

UNIT - II: FOURIER SERIES (15 Hrs)

Function definition - Dirichlet conditions - Parselval's identity: Fourier series - Fourier's integral Fourier coefficients and identification - Convergence of Fourier series - Physical applications of Fourier series.

UNIT - III: FOURIER TRANSFORM (15 Hrs)

Signals: Definition - Classification of signals - Basic operations on signals - Types of signals. Continuous-time Fourier Transform (CTFT) - CTFT representation of aperiodic signal - Properties of CTFT - Problems - Discrete Time Fourier Transform (DTFT): Definition - DTFT representation of aperiodic signal - Properties of DTFT - Problems.

UNIT- IV: Z-TRANSFORM (15 Hrs)

Z-Transforms (Double and Single sided) - Relationship between the Z-transform and discrete -time Fourier transform - Relationship between the Z - plane and S - plane - Methods of inverse Z- transforms - Power series method (long-division) - Partial-fraction method - Residual method.

UNIT - V: MATLAB PROGRAMMING (12 Hrs)

Introduction to MATLAB-Matrices - Working with matrices - Basic plotting - Basic signals and its functions - MATLAB Programming: Representation of basic signals - Discrete convolution - Stability test - Fourier transform - DTFT, CTFT, coefficient identification in Fourier series - stability analysis using Z transform -Up/Down sampling sinusoidal signal sequence.

Books for study

1. B.D Gupta, "Mathematical Physics", 3rd reprint, Vikas publishing House Pvt Limited, 2009.
2.Poornachandra S., "Signals and Systems", Vijay Nicole imprints Pvt. Ltd., 2004.

Books for references

1. Alan V. Opphenehim, Alan S. willsky and Hamid nawab S., "Signals and Systems", 2nd Edition, PHI, 2004.
2. Ramesh Babu P, Ananda Natarajan R., "Signals and System", 3rd Edition, Scitech publication private limited, 2007.

SECTIONS

UNIT	BOOK	SECTIONS
I	1	10.1,10.2, 10.6, 10.8, 10.9, 10.11
II	1	9.1,9.2, 9.5, 9.6, 9.8, 9.9
III	2	1.1-1.4, 7.1-7.4, 8.1-8.3
IV	2	11.1-11.4, 11.7-11.9, 11.12
V		Lecture Notes

Sem: I	L	P	C
16PEL1104	0	8	5

ELECTRONICS PRACTICAL - I

(Analog, Digital, Signals and Systems Experiments)

(Any 12 experiments)

1. Design of CB,CC and CE transistor amplifier
2. Programmable gain amplifier using op amp
3. Wheatstone bridge with instrumentation amplifier for temperature measurement
4. ADC performance parameter study
5. DAC performance parameter study
6. Encoder and decoder study (RF, gray to binary and binary to gray, DTMF decoder, BCD to seven segment)
7. Design of two pair 4-bit sequential counter (HEX).
8. Design of 8-bit registers using flip-flop and gate IC's
9. Design of mod-n counter.
10. Waveform generation using MATLAB
11. Sampling of sine wave using MATLAB
12. Coefficient identification in Fourier series using MATLAB
13. Stability test using bode plot using MATLAB.
14. Construct and study Op-Amp applications-I (Non-inverting, Inverting, Integrator, Differentiator, Unity gain amplifier)
15. Construct and study Op-Amp applications-II (Instrumentation Amplifier, V to I, I to V (4-20mA))
16. Construct and study Op-Amp applications-III (Clipper and Clamper)
17. Construct and study Op-Amp applications-IV (Comparator, Zero crossing detector, Window detector, Peak detector Precision rectifier)
18. FET amplifier design
19. Construct and study the Power control rectifier using SCR, TRIAC and UJT
20. Study of Adder, subtractor and IC based BCD adder and subtractor
21. Study of Encoder and Decoder
22. Study of Shift register (SISO, SIPO, PISO & PIPO) and Universal shift register IC
23. Study of multiplexer and de-multiplexer (Construction and chip study)
24. Solving simultaneous equation using op-amp.
25. Construction of UP and Down counter using flips flops.

Sem: I	L	P	C
16PEL1401	4	0	4

IDC (WS):

ELECTRONICS MEDIA

Assurance of Learning

- Recent technological innovation in electronic media
- Understanding PA systems
- Working Knowledge of digital video camera
- Familiar with components of digital production studio
- Understanding Smart Phone and Tablet PC's evolution

UNIT I: PUBLIC ADDRESSING MEDIA (10 Hrs)

Introduction to public addressing media - Block diagram of PA system - Basic of PA system - watts and volume - matching ohms - Avoiding hum Avoiding feedback - microphone - wired and wireless - wireless frequency consideration -Active and passive speakers - Size of speakers - Types of input on a mixer - mixer channel - cable and types of plugs - multicores Home theater network - connection diagram - home network connection diagram - Front projector connection diagram - Summary of Home theater networks and working.

UNIT II: AUDIO SYSTEM AND BROADCASTING SYSTEM (08 Hrs)

Audio System: Voice signal - Musical signal - Multi track recording - Mixing console: structure - channel input - master output control - Digital versus Analog mixing console - Studio Monitor -Broadcasting System: Pilot signal Information signal - Frequency and amplitude modulation -Transmission line.

UNIT- III: VIDEO SYSTEM (11 Hrs)

Introduction to digital video equipment: working principle of a digital video camera - major components - operation and functions of camera - types of cameras - characteristics and features of cameras - Angle of view - TV: transmission and propagation of TV signal, TV antenna - receiver: VHF tuners vision IF subsystem - inter carrier sound system - video amplifiers -television display technology: CRT, plasma, LCD - LED - 3D - television standards: NTSC, PAL, HDTV - distribution technology - cable television, DTH, - interactive television - IPTV -process of webcasting.

UNIT -IV VIDEO PRODUCTION AND TELECASTING (11 Hrs)

Introduction to digital production studio: basic studio structure and equipment - roles of the production - production process - video editing systems and their components - video mixers - Telecasting of audio and video signal - Role of satellite in TV system - satellite and terrestrial broadcasting - different transmission bands-multimedia projector.

UNIT V: TABS AND SMART PHONES IN MEDIA (08 Hrs)

A smart phone as communication device - Mobile devices hardware - ARM cortex processors evolution - Mobile operating system - Symbian - Linux windows - Java - Android - Garnet - Mobile applications - mobile TV - mobile radio mobile internet.

Books for Study

1.Material prepared by the Department.

Sem:II	L	P	C
16PEL2105	6	0	5

EMBEDDED SYSTEM MSP430 AND INTERFACE PROTOCOLS

Assurance of Learning

- Ability to recognize different blocks of embedded system
- Understanding the communication protocols SPI and I2C
- Programming MSP 430 in IAR embedded workbench
- Ability to understand timers and their usage in designing circuits.

UNIT I: EMBEDDED SYSTEM (15 Hrs)

Introduction to Embedded systems - Anatomy of a typical microcontroller - Memory-volatile and Non volatile memory - Architecture - Harvard and Von-Neumann architecture - Pin out of MSP430F2003 and F2013- Functional block diagram - Memory mapping - CPU - Memory mapped I/O - Clock generator - Interrupts and resets - Addressing modes and instruction set - Development environment - Assembly language programming –Startup code for C program- Build process: compiling- Linking- Locating – make file and its purpose- format of output file or image: intel Hex file- ELF File- Access to microcontroller programming and debugging.

UNIT II: MSP430 APPLICATION (12 Hrs)

MSP430 starter Kit -blinking LED in C programming and assembly - Read input from switch - Single loop with decision - Two loops one for each state - Addressing bits individually - Automatic control(Software delay) - Header files for C and ASM programming.

UNIT III: TIMER and PWM (15 Hrs)

Introduction to timers - Watchdog timer - Basic timer - Timer A - Measurement in capture mode - Output in continuous mode - Output in Up mode: Edge aligned PWM - Output in Up/Down mode: Centered PWM - Operation of timer A in sampling mode - Timer B - Setting the real time clock and state machines.

UNIT IV: SPI PROTOCOL (15 Hrs)

Communication peripherals in MSP430 - Serial Peripheral Interface - SPI with USI - SPI with USCI - Thermometer using SPI in mode3 with F2013 as Master - Thermometer interface using SPI in mode 0 with the FG4618 as Master - Implementation of SPI using IAR embedded workbench with launchpad

UNIT V: I2C PROTOCOL (15 Hrs)

Basics of two wire interface - Inter Integrated Circuit bus - Simple I2C Master with USCI-B0 on a FG4618 - Simple I2C slave with USI on a F2013 - State machines for I2C communication - A thermometer using I2C with the F2013 as Master - Implementation of I2C using IAR embedded workbench with Launchpad.

Books for study

1.John Davies, “MSP microcontroller basics”, Newnes publications, 2008
2.Michael Barr, “Programming embedded systems in c and c++” O Reilly publications, 1999.

Books for reference

1. “MSP430 Microcontroller Basics”, by Dr. Matthias Sturm
2. “Getting Started with the MSP430 Launchpad” by Adrian Fernandez and Dung Dang.

SECTIONS

UNIT	BOOK	SECTIONS
I	1	1.4-1.5, 2.2-2.5, 3.2-3.4
II	1	4.2-4.8
III	1	8.2-8.11
IV	1	10.1-10.6
V	1	10.7-10.11

Sem:II	L	P	C
16PEL2106	6	0	5

DIGITAL SIGNAL PROCESSING

Assurance of Learning

- Familiar with signal processing algorithms.
- Ability to design applications using DSP
- Understanding discrete-time systems and multirate DSP
- Ability to design digital filters using simulink

UNIT-I: DISCRETE FOURIER TRANSFORMS AND FAST FOURIER TRANSFORM (16 Hrs)

Frequency analysis of discrete - time signal - Properties of DFT- Problems. IDFT: Definition -Problems. FFT: Definition - Radix-2 FFT algorithm Decimation-in-time - Decimation-in-frequency - Problems - Inverse FFT Problems - Linear convolution: Cross table method - Matrix method - Circular convolution: Circle method - Matrix method - DFT-IDFT method - Section convolution: Overlap save method - overlap-add method.

UNIT - II: FINITE IMPULSE RESPONSE (FIR) FILTERS (16 Hrs)

Introduction of FIR filters - Magnitude response of digital filters - Design of linear phase FIR filters using windows: Rectangular window function - Blackman window function - Hamming window function - Hanning window function - Design of linear-phase FIR filters by frequency-sampling method - design of optimal linear-phase FIR filters

UNIT - III: INFINITE IMPULSE RESPONSE (IIR) FILTERS (16 Hrs)

IIR filter design- approximation of derivatives - Impulse invariance method - Bilinear transformation - design of Butterworth filter - design of Chebyshev filter - design of Elliptic filter - Frequency transformation analog and digital domain.

UNIT-IV: ADAPTIVE FILTERS AND MULTIRATE DSP (12 Hrs)

Adaptive filters: introduction - system modeling -adaptive equalization -adaptive line enhancer -adaptive noise canceling - minimum mean square error criterion - Multirate DSP: Introduction - sampling - Sampling theorem - sampling rate conversion - multi stage decimators and interpolators.

UNIT - V: DESIGN OF DIGITAL FILTERS USING SIMULINK (12 Hrs)

Create - import - export - display - manage signals -transfer function blocks for different signals and operations - Filter design and analysis: FIR, IIR, Frequency transformations - Transform analysis: FFT and DFT - Voice Processing - Speech analysis - Speech coding - compression and coding - Channel vocoder - sub band coding - voice privacy - digital FM stereo.

Books for Study

1. Poornachandra S, Sasikala B, "Signals and Systems", 3rd edition, Tata McGraw Hill Publishing, 2010.
2. Salivahanan S, Vallavaraj A, Gnanapriya C, "Digital Signal Processing", Tata McGraw Hill Publishing, 2003.

Books for Reference

1.Alan V. Opphenehim, Ronald W. Schafer, "Digital Signal Processing", 2nd edition, PHI,2004.

2.John G. Proakis, Dimitris G. Manolakis, "Digital Signal Processing Principles, Algorithm and Applications", 4th Edition, PHI, 2007.

3.Ramesh Babu P., "Digital Signal Processing", 4th Edition, Scitech Publication Pvt. Ltd, 2007

SECTIONS

UNIT	BOOK	SECTIONS
I	1	9.1-9.6, 4.4-4.6
II	2	7.1-7.3, 7.4.2-7.4.3, 7.5
III	2	8.1-8.9
IV	2	13.1-13.3, 11.8
V		lecture notes

Sem:II	L	P	C
16PEL2107	6	0	5

POWER ELECTRONICS AND SOLAR PV SYSTEMS

Assurance of Learning

- Understanding of power electronics and its applications
- Capability to classify different operating principles of power converters and inverters
- Ability to work on solar PV systems.
- Ability to program and simulate power systems in Scilab.

UNIT-I: POWER SEMICONDUCTOR DEVICES AND CIRCUITS (14 Hrs)

Introduction - Power diodes - Thyristors - transistors - control characteristics - characteristics and specifications of switches - types of power electronic circuits. Power diode types - series connected and parallel connected diodes - diodes with RC and RL loads - Diodes with LC and RLC loads - Freewheeling diodes. Single phase half - wave rectifiers - single phase full - wave rectifiers - single - phase full-wave rectifier with RL load-multiphase star rectifiers-three phase bridge rectifiers.

UNIT-II: POWER TRANSISTORS AND DC-DC CONVERTERS (15 Hrs)

BJT - steady state characteristics - switching characteristics - limits - Power MOSFET-characteristics - COOLMOS - SIT - IGBTs, Series and parallel operation - DC-DC converters - step-down operation - Generation of duty cycle - with RL load - Principle of step-up operation - with resistive load - performance parameters - converter classification-switching mode regulators - buck regulators - boost regulators - Buck-boost regulators - cuk regulators limitation of single stage conversion - comparison of regulators - chopper circuit design.

UNIT-III: POWER SUPPLIES AND CHARGE CONTROLLERS (15 Hrs)

Transformer model - flyback converter - forward converter - double ended converter - push pull converter - current fed converters - converter selection - power factor correction - power supply control - control loop stability - small signal analysis - switch transfer function - filter transfer function - PWM transfer function - PWM control circuits - PWM charge controller-MPPT - MPPT algorithm - MPPT charge controller.

UNIT-IV: INVERTERS AND SNUBBER CIRCUITS (14 Hrs)

Full bridge converter - Square wave inverter - Fourier series analysis - harmonic distortion - amplitude and harmonic control - half bridge inverter - multilevel inverters - PWM inverters - PWM harmonics - class D audio amplifiers - three phase inverters - induction motor speed control. MOSFET and IGBT Drive circuits - Bipolar Transistor Drive circuits -Thyristor Drive circuits - Transistor snubber circuits - Energy recovery snubber circuits - heat sinks and thermal management - Simple UPS and SMPS design - basics of current transformer - Cycloconverter - single phase - Three phase.

UNIT-V: SOLAR PV SYSTEMS & SCILAB PROGRAMMING (14 Hrs)

Photovoltaic systems overview - electricity generation with PV cells - Basic of Solar PV systems - blocks of solar PV system - PV modules - solar array (roof top panel connection) - function of inverter - energy storage - charge controllers - calculation of solar panel - battery based on power requirement - grids. Scilab- working with IDE - programming - power computation - instantaneous power - energy and average power - inductors and capacitors - RMS values of sinusoids - apparent power and power factor - Fourier analysis.

Books for study:

1. Muhammad H. Rashid, "Power electronics", 3rd edition, Pearson, 2009.
2. Daniel W. Hart, "Power Electronics", 1st edition, McGraw hill, 2011.

Books for reference:

1. Ned Mohan: First Course on Power Electronics and Drives (1st edition 2003, MNPERE).
2. Robert W. Erickson & Dragan Maksimovic: Fundamentals of Power Electronics (2nd edition, 2004, Kluwer Academic Publisher).

SECTIONS

UNIT	BOOK	SECTIONS
I	1	1.2 - 1.5, 2.5, 2.8 - 2.13, 3.4 - 3.7
II	1	4.2 - 4.7, 5.1 - 5.9, 5.12.
III	2	7.1 - 7.11, 7.13 - 7.16. Lecture notes: MPPT
IV	2	8.1 - 8.5, 8.7 - 8.13, 8.15, 8.17. 10.1 - 10.8. Lecture notes: SMPS,UPS, current transformer and cycloconverter
V		Lecture notes.

Sem:II	L	P	C
16PEL2108	0	8	5

ELECTRONICS PRACTICAL - II
(Embedded, DSP, Power Electronics Experiments)
(Any 16 Experiments)

1. Serial port interfacing with MSP430 microcontroller programming.
2. Study of SPI interface using MSP430 microcontroller programming.
3. Study of I2C interface using MSP430 microcontroller programming.
4. Study of PWM using MSP430 microcontroller programming.
5. Microcontroller I/O programming for switch read, single loop with decision, two loops one for each state, 5X7 matrix LED display interfacing.
6. Flashing LED using microcontroller timer.
7. DFT using simulink.
8. Adaptive filter design with simulink.
9. Multirate DSP with simulink.
10. Speech analysis with simulink.
11. Channel vocoder with simulink.
12. FIR & IIR filter design with simulink.
13. Scilab programming for power computation.
14. Power control using IGBT.
15. Design of buck boost regulator.
16. Study of PWM charge controller for solar.
17. PV system assembling for 12 V load.
18. Serial port and parallel port data acquisition using Labview.
19. Study of I/O ports in PIC microcontroller - DIP switch, LED pattern generation, Matrix display and relay
20. Study and interfacing SPI protocol in PIC microcontroller
21. Communicating through USB with PIC microcontroller input/output.
22. Study of timers and counters in PIC.
23. Study of serial communication with PIC.
24. Interfacing of DTMF IC with microcontroller
25. Interfacing of RFID module with microcontroller.

Sem:II	L	P	C
16PEL2109A	0	0	2

SELF PACED LEARNING
AUTOMOTIVE ELECTRONICS

Assurance of Learning

- Capacity to analyze and understand the electronics systems in modern automobile
- Familiar with ECU
- Understanding the operation and function of automotive communication protocols
- Familiarize the hybrid and electric vehicles

UNIT-I: AUTOMOTIVE ELECTRONICS

Introduction to Automotive Industry and Modern Automotive Systems - Vehicle classifications and specifications - need for electronics in automobiles - Application of electronics in automobiles - Current trends in modern automobiles – Component electronic engine management - Electronic management of chassis system- Vehicle motion control- Free scale controller's families - MPC5XXX series Microcontroller

UNIT-II: ELECTRONIC CONTROL UNIT

Concept for electronic engine controls - management - ECU architecture - power train control module- hardware and software components- interfacing with sensors - system integration Standards; Control objectives - fuel economy-volumetric- thermal- air-fuel ratio, emission limits and vehicle performance; advantages of Electronic engine controls -open and closed loop fuel control; Electronic ignition-Block diagram of ignition system - fuel injection system -Types -AUTOSAR

Unit -III: CAN PROTOCOL

Controller Area Network (CAN) Protocol: History and foundation of CAN- CAN Applications- Main characteristics of CAN- CAN in OSI Reference Model- CAN Data Link Layer- Principles of data exchange in CAN- Arbitration - Data Frame - Remote Frame- Error detection and management in CAN - CAN physical Layer- Bit encoding - Bit timing - synchronization- Relationship between data rate - bus length -Single wire - twin wire media- CAN repeaters- Medium-to-medium gateway- Protocol handlers- Micro-controllers and line drivers - Time-Triggered CAN (TTCAN)- Comparison with other IVN protocols

UNIT-IV: **LOCAL INTERCONNECT NETWORK (LIN) AND FLEXRAY PROTOCOL**

Introduction to LIN - LIN specification - LIN features - Technical overview, Work flow concept - LIN operation - LIN frame format - Scheduling table- Network management of LIN cluster, LIN Transport Layer- LIN node configuration and identification - LIN diagnostics- LIN physical layer. FlexRay Protocol- Future on board systems- Need for FlexRay- Origin of FlexRay, - FlexRay Objectives- FlexRay Features- Application requirements, Working of FlexRay- Network topologies

UNIT -V: HYBRID AND ELECTRIC VEHICLES

Battery Technology: Energy density of various energy sources - storage devices- basics of battery- working principle- construction - good practices of battery maintenance - Other Energy Storage Devices for Hybrid Vehicles: Super capacitor - Ultra capacitor - fly wheel technology Electric Vehicle (EV): Requirement of drive train of EV - various configurations of drive train in EV - transmissions systems - motor sizing for EV - transmission requirement - general EV configuration - Energy consumption pattern in EV- driving pattern in EV - control of EV.

Books for study

1. Robert Bosch, "Automotive Hand Book" SAE, 5th edition, 2000
2. William B. Ribbens, Understanding Automotive Electronics, 5th Edition, Butterworth, Heinemann Woburn, 1998
3. Behrouz Forouzan. (2003) Data Communications and Networking, McGraw-Hill.
4. James Larminie and John Lowry. (2003) Electric Vehicle Technology Explained, John, Wiley and Sons

Sem:II	L	P	C
16PEL2109B	0	0	2

IOT AND CLOUD COMPUTING

Assurance of Learning

- Understanding of IoT and associated wireless technologies
- Ability to connect M2M through Web
- Programming with Viper IDE
- Ability to utilize Cloud computing in Data acquisition

UNIT I: IoT BASICS AND NETWORK STANDARD

Introduction - Objects or things - Identifier and Enabling technologies of IoT - Wireless standards ZigBee - Wireless HART and ISA100.11a - Wireless sensor Networks and IoT, Integration Approaches - Topology based stack based approaches - Low-power Interoperability for the IPv6 - based Internet of Things

UNIT-II: WoT

Machine to machine communication to Internet of things - Internet of things to web of things - Protocols: HTTP and CoAP - Wireless Sensor Networks - node - connecting nodes - networking nodes - Securing communication - Standards and FORA - ESP 8266 based NodeMCU - wireless network connectivity - Arduino like IO access - HTTP Client - HTTP Server - PWM - Blinking Led - Interfacing with sensor

UNIT III: PROGRAMMING WITH IDE

Introduction to Python and viper IDE - Code editor with syntax-multi tab support - Auto complete and error highlighting - Integrated compiler - smart uplinker - board discovery and management toolbar - debugging console - serial port monitor - Local storage and cloud syncing

UNIT -IV: CLOUD COMPUTING

Cloud computing - Properties and characteristics - Service Models - Deployment models - Infrastructure as a service (IaaS) - Platform as a service (PaaS) - Software as a service (SaaS) -Web 2.0 - Web OS - Cloud issues and challenges - cloud provider lock in-Security - Advantages and disadvantages of cloud computing

Unit V: CLOUD PROVIDERS & USAGE

Cloud providers: public- private- hybrid - Case study: temperature data logging - uploading the data to the cloud - Weather parameters monitoring with cloud - Health parameters and clouding

Reference

1.Material prepared by Department.

Sem:II	L	P	C
16PEL2109C	0	0	2

MEDICAL ELECTRONICS

Assurance of Learning

- Understanding various measuring techniques in the field of medical electronics.
- Ability to classify different electrodes used in bioelectric amplifiers
- Capacity to understand diverse imaging systems.
- Understanding various measuring techniques in Advances Biomedical Instrumentation

UNIT - I: ELECTRODES & TRANSDUCERS

Origin of bioelectric signals - Recording electrodes - Skin contact impedance - Electrodes for ECG - Electrodes for EEG - electrodes for EMG - Electrical conductivity of electrode jellies and cream - Transducers for biomedical parameters (table) - Pressure transducers - Pulse sensors - Respiration sensors.

UNIT - II: BIOMEDICAL RECORDERS

Basic recording system - General considerations for bioelectric recorder amplifiers - Sources of noise in low level recording circuits - Preamplifiers Main amplifier & driver stage - Writing systems - Electrocardiograph Phonocardiograph - Electroencephalograph - Electromyograph

UNIT- III: MEASUREMENT & ANALYSIS TECHNIQUES IN BLOOD

Blood flow meters: Electromagnetic blood flow meter- Blood gas analyzers: blood pH measurement - Measurement of blood pCO2 - Blood pO2 measurement - Blood cell counters: methods of cell counting - Coulter counters - Automatic recognition and differential counting of cells.

UNIT- IV: MODERN IMAGING SYSTEMS

X-ray machine - CT scanner: basic principle - Contrast scale - system components - NMR: principles of NMR imaging - Fourier transform of the FID - Bloch equation - Image reconstruction techniques - Discrimination based on relaxation rates - Basic NMR components – Applications- biological effects - advantages of NMR imaging system.

UNIT-V: ADVANCES IN BIOMEDICAL INSTRUMENTATION

Pacemakers - Artificial heart valves - Defibrillators - Ventilators - Audiometers - Anesthesia machine - Angiography - Endoscope - Cryogenic surgery.

Books for study

1. R. S. Khandpur, “Handbook of biomedical instrumentation”, Tata McGraw-Hill Publisher, New Delhi,2003.
2. M. Arumugam, “Biomedical instrumentation”Anuradha publications, 1994.

Book for Reference

1. Leslie Cromwell Fred J. Weibell, Erich A. Pfeiffer, “Biomedical instrumentation and measurements”, 2nd edition, Prentice Hall of India Pvt Ltd

Sem:II	L	P	C
16PEL2109D	0	0	2

PROGRAMMABLE DIGITAL SIGNAL PROCESSOR AND CCS

Assurance of Learning

- Understanding the basics of Architecture PDSP
- Ability to classify fixed point and floating point PDSP
- Programming PDSP using CCS
- Understanding the architecture and instruction set of TMS320C6713

UNIT - I: ARCHITECTURE OF FIXED POINT PDSP

Multiplier and multiplier accumulator (MAC) - Modified bus structure - memory access schemes - Multiple access memory - Multi ported memory VLIW architecture - Pipelining - Special addressing modes in PDSP's - On-chip peripheral - Architecture of TMS 320 C5X.

UNIT - II: ASSEMBLY LANGUAGE INSTRUCTION AND PROGRAMMING

Syntax - Addressing modes - Load / Store instruction - Addition/Subtraction instruction - Move Instruction - Multiplication instruction - NORM instruction - Program control instruction - Peripheral control - Program for familiarization of the addressing modes - Program for familiarization of the arithmetic instruction - Real time signal processing program

UNIT - III: ARCHITECTURE OF FLOATING POINT PDSP

Introduction - Overview of TMS 320C3X devices - Internal Architecture CPU - CPU register file - Memory organization - Cache memory - Peripheral - Data format - Addressing modes - Groups of addressing modes - Assembly language instruction - Processing real time signal - Serial port - Capture and display of sine wave

UNIT- IV: ARCHITECTURE AND INSTRUCTION SET OF TMS320C6713

Introduction -TMS320C6x Architecture- Functional Units-Fetch and Execute Packets-Pipelining-Registers- Linear and Circular Addressing Modes-Indirect Addressing-Circular Addressing-TMS320C6x Instruction Set - Assembly Code Format -Types of Instructions-Timers-Interrupts-Interrupt Control Registers - Interrupt Acknowledgment-Direct Memory Access

UNIT - V: PROGRAMMING OF TMS320C6713 USING CODE COMPOSER STUDIO

Code Composer Studio Development- Code Generation Tools -Creating New Project-Adding Files to Project-Reviewing Code-Building and Running Program-Changing Program Options - Fixing Syntax Errors. Examples: Sine Generation Using Eight Points with DIP Switch Control - Ramp Generation without Lookup Table - Amplitude Modulation- FIR Filter Implementation: Bandstop and Bandpass - IIR Filter Implementation Using Second-Order Stages in Cascade

Book for study

1. Venkataramani B, Bhaskar M., "Digital signal processors - Architecture, Programming and Applications", First Reprint, TATA McGraw Hill, 2003
2. Digital Signal Processing and Applications with the C6713 and C6416 DSK, Rulph Chassaing, a john wiley & sons, inc., publication, 2005.

Book for Reference

1. TMS320C6000 Code Composer Studio Tutorial
2. Salivahanan S, Vallavaraj A, Gnanapriya C, "Digital Signal Processing", Tata McGraw Hill Publishing, 2003.
3. TMS320C6713 data sheet.

Sem:III	L	P	C
16PEL3110	5	0	5

AVR MICROCONTROLLER AND OPEN SOURCE HARDWARE

Assurance of Learning

- Understanding the architecture of 8-bit ATmega32 AVR microcontroller.
- Programming AVR microcontroller and open source hardware
- Ability to work on different Arduino shields.
- Capability to interface external hardware with AVR microcontroller.

UNIT-I INTRODUCTION TO AVR MICROCONTROLLER AND I/O PROGRAMMING (12 Hrs)

Overview of AVR family - features - Atmega32 block diagram - AVR Status registers - program counter and PROM space - Harvard architecture - RISC architecture of AVR - ATmega32 I/O pins and its functions - I/O programming - Led delay - door sensor - logic operations - Data conversion - BCD to ASCII - ASCII to BCD - hex to decimal - data serialization - ATmega32 fuse bits.

UNIT-II AVR ON-CHIP PERIPHERAL PROGRAMMING IN C (12 Hrs)

Programming timers/counters - timer register - timer programming - counter programming - Interrupt programming - timer interrupts -external hardware interrupts - interrupt priority - Serial port programming - registers - program to transfer character - string - receive data - ADC programming - ADC features - ADMUX register - programming ADC with interrupts.

UNIT - III ATMEGA32 INTERFACING WITH EXTERNAL PERIPHERALS (13 Hrs)

LM35 interfacing with ATmega32 - LCD interfacing with ATmega32 - DAC0808 interfacing -program for stair step ramp generation - Stepper motor control - Input capture program to measure time period and pulse width - DC motor control using PWM programming - MAX7221 interfacing with seven segment display using SPI protocol - DS1307 interfacing using I2C protocol.

UNIT-IV OPEN SOURCE HARDWARE AND ARDUINO (12 Hrs)

Defining open source hardware - licensing - CERN OHL - TAPR OHL - creative commons - example of OSH projects - Arduino - hardware - different types of Arduino boards - Arduino UNO specifications - IDE - command structure and basic syntax - using the Arduino library - installing Arduino library - Programming microcontroller- Led blinking - Digital I/O - Analog channel read program - Serial program to read and write strings - PWM - interrupts.

UNIT-V EXTERNAL PERIPHERAL INTERFACE PROGRAMMING (11Hrs)

Arduino Shields: RS485 - GPS - Arduino YUN - CAN - Ethernet - Wifly CC3000 - GSM - Xbee - Bluetooth - microSD card - motor -TFT display. Interfacing (display data in LCD): PIR sensor based door status indicator with LED - AD5171 digital potentiometer to vary the DC motor speed - Light intensity measurement with BH1750 - Acceleration measurement with ADXL335 - distance measurement with ultrasonic sensor - DHT11 based temperature and humidity data logging with microSD card.

Books for study:

1. Muhammad Ali Mazidi, Sarmad Naimi and Sepehr Naimi "The AVR Microcontroller and Embedded Systems Using Assembly and C" 1st edition, Pearson education, 2011

Books for reference:

1. Steven F. Barrett and Daniel J. Pack: Atmel AVR microcontroller primer: programming and interfacing (1st edition, 2008, Morgan & Claypool)
2. Alica Gibb: Building open source hardware (1st edition 2014, Pearson education
3. Jonathan Oxer and Hugh Blemings: Practical Arduino (1st edition, 2009, Apress)
4. Julian Bayle: C Programming for Arduino (1st edition, 2013, Packt publishing)

SECTIONS

UNIT	BOOK	SECTIONS
I	1	1.2, 2.1, 2.2, 2.4, 2.8, 2.9, 7.1 - 7.6, 8.1, 8.2
II	1	9.1 - 9.3, 10.1 - 10.5, 11.1 - 11.4, 13.1 - 13.2.
III	1	13.3 - 13.4, 14.2, 15.3 - 15.4,16.4, 17.3, 18.4
IV		Lecture notes
V		Lecture notes

Sem:III	L	P	C
16PEL3111	5	0	5

VLSI DESIGN AND VHDL PROGRAMMING

Assurance of learning

- Understanding on the basics of VLSI technology and VHDL programming.
- Ability to classify different MOS fabrication procedures
- Programming in VHDL for various digital devices
- Ability to work in Xilinx

UNIT - I: SEMICONDUCTOR DEVICES FOR VLSI TECHNOLOGY (11 Hrs)

Basic MOS transistor - Enhancement and depletion mode transistor action - NMOS fabrication - CMOS fabrication - BICMOS technology - Pass transistor - NMOS inverter, CMOS and BICMOS inverter - latch-up in CMOS & BICMOS circuits - MOS layer - Design rules and layout diagram - Lambda based design rules - Contact cuts - Double metal MOS process rules - CMOS lambda based design rules- symbolic diagram.

UNIT - II: SCALING AND TESTING FOR VLSI SYSTEM (13 Hrs)

Basic circuit concepts - Sheet resistance - Capacitance - Delays - Driving large capacitive loads - Propagation delays - wiring capacitance -Scaling factor for device parameter factors - limitation of scaling - switch logic — Pass transistors and transmission gates - Gate logic - The inverter -CMOS logic - real world VLSI design - Design styles and philosophy - interface with fabrication house - CAD tools for design and simulation - Aspects of design tools - Graphical entry layout - Design verification prior to fabrication - DRC - circuit extractors - Test and test ability - System partitioning.

UNIT - III: BASIC CONCEPTS OF VHDL (13 Hrs)

VHDL Terms - Describing Hardware in VHDL - Entity - Architectures - Concurrent Signal Assignment - Event Scheduling - Statement Concurrency - Structural Designs - Sequential Behavior - Architecture Selection - Configuration Statements - Power of Configurations - Behavioral modeling Transport versus inertial delay - simulation deltas - drivers - generics - block statements - Sequential processing - Process statement - Signal assignment Vs Variable assignment - Sequential statement.

UNIT - IV: DATA TYPES AND SYNTHESIS CONCEPTS OF VHDL (13 Hrs)

Object types - Data types - File type caveats - subtypes Register transfer level description - Constraints - Attributes - technology libraries - synthesis - simple gate - IF control flow statements - case control flow statements - Simple sequential statements - Asynchronous reset - Asynchronous preset and clear - More complex sequential statements - State machine example - RTL simulation - VHDL synthesis - function Gate-level verification - Place and Route - post layout timing simulation - Static timing.

UNIT - V: CIRCUIT DESIGN AND SIMULATION USING XILINX IDE (10 Hrs)

Xilinx - create a new project - create a VHDL source - language templates (VHDL) - final editing of the VHDL source - checking the syntax of new counter module - design simulation - verifying functionality using behavioral simulation - simulating design functionality - entering time constraints - implementing design - assigning pin location constraints.

Books for study

1. Douglas A. Pucknell & Kamran Eshraghian, "Basic VLSI design", 3rd edition, Prentice Hall of india pvt ltd, new delhi,1994.
2. Douglas L perry, "VHDL programming by example" 4th edition, Tata McGraw hill, New Delhi, 2008.

Books for Reference

1. Xilinx software Tutorial

2. **VLSI Design – by K. Lal Kishore , V.S.V. Prabhakar** , 2009.

SECTIONS

UNIT	BOOK	SECTIONS
I	1	1.4,1.5, 1.7, 1.8, 1.10, 2.5, 2.6, 2.10, 2.12.3, 2.13, 2.14, 3.1, 3.3, 3.4, 3.8
II	1	4.1, 4.2, 4.6, 4.8-4.10, 5.1-5.3, 6.1-6.3, 10.8-10.13
III	2	Chapters 1, 2, 3
IV	2	Chapters 4, 9, 10, 11
V		Lecture Notes

Sem:III	L	P	C
16PEL3112	0	8	5

ELECTRONICS PRACTICAL - III

VHDL Programming, AVR and ARM Microcontroller Experiments

(Any 16 experiments)

1. Construction of Arduino board and I/O programming
2. Design of data logger using arduino and microSD card for temperature measurement.
3. Wi-Fi shield interfacing with arduino
4. ADXL335 interfacing with arduino.
5. Atmega32 I/O study
6. Humidity measurement with Atmega32.
7. Bluetooth module interfacing with ATmega32.
8. RPM counter using Atmega32.
9. Multiplexer and demultiplexer with quartus II
10. Adder subtractor with quartus II
11. Study of loading OS and GPIO (DHT11) with Raspberry Pi
12. Web hosting with Raspberry Pi
13. PCF8591 interfacing with Raspberry Pi
14. Nodemcu for IoT node configuration
15. Android application development for home automation using Eclipse
16. GLCD interfacing with ARM
17. USB host interface with ARM
18. CAN interface with ARM
19. Developing test bench for MUX and DEMUX and verifying the same in ModelSIM
20. Implementing Full adder, Full subtractor, Multiplexer, divider and ALU in FPGA
    Implementing Decoder, priority encoder, 8-bit comparator and 8-bit latch in FPGA
21. Implementing D flip-flop with synchronous and asynchronous inputs, 4-bit up/down counter with control input in FPGA (clock source to be switch)
22. Implementing clock divider, pulse counter (for delay program) shift register and barrel shifter in FPGA
23. Interfacing FPGA with PC through DB9 by implementing UART
24. Interfacing keypad with FPGA.
25. Interfacing LCD with FPGA

Sem:III	L	P	C
16PEL3201A	4	0	4

Elective-1A:

EMBEDDED ANDROID OS AND ARM

Assurance of Learning

- Ability to classify different ARM architectures
- Ability to work on Android based Embedded System Design
- Capacity to Install IDE for ARM Cross Development with Eclipse
- Understanding programming with peripheral interface

UNIT I: ARM PROCESSOR FAMILIES (08 Hrs)

RISC design philosophy- ARM Design Philosophy-Embedded System Hardware-ARM Bus Technology-Embedded System Software-ARM Processor fundamentals- architecture revisions - ARM Processor Families-ARM7, ARM9, ARM10 and ARM11 processors features

UNIT II: **ARM 7 CPU CORE (10 Hrs)**

Outline - Pipeline - Registers - Current Program status register - exception modes - system peripherals: bus structure - memory map - register programming - memory accelerator module - LPC2000 Interrupt system - Interrupt structure - FIQ Interrupt - Vector IRQ - Non vectored interrupts.

UNIT III: **PROGRAMMING WITH PERIPHERAL INTERFACE (10 Hrs)**

General IO - General Purpose Timers - PWM Modulator - Real Time Clock - UART - I2C Interface - SPI interface - Analog to Digital Converter - Digital to Analog Converter - CAN Controller. (Programming only)

UNIT IV: **ANDROID BASED EMBEDDED SYSTEM DESIGN (11 Hrs)**

Android Operating System: Introduction to Android technology- Open Handset Alliance-Getting "Android"- Hardware and Compliance Requirements- Android Concepts-Framework Intro- App Development Tools- Native Development- Overall Architecture. Android Open Source Project- Getting AOSP - Build basics- Building Android - Running Android. **Case study**: ARM and Android Based Smart Home Automation system

UNIT V: **ARM WITH ECLIPSE (09Hrs)**

Installing the Necessary Components - JAVA Runtime - Eclipse IDE - Eclipse CDT - CYGWIN GNU Toolset for Windows - Verifying the PATH Settings - Creating a Simple Eclipse Project - Description of Startup File CRT.S - Description of Main Program main.c - Description of Makefile - Compiling and Linking Sample Application - Setting Up Hardware - Create a New Project to Run Code in RAM.

Books for study

1. Andrew N. Sloss Dominic Symes, "ARM System Developer's Guide Designing and Optimizing System Software"- ELSEVIER publications, 2004.
2. Trevor Martin, "The Insider's guide to the Philips ARM 7 based microcontrollers - An Engineer's introduction to the LPC2100 series" Hitex limited, 2006.
3. Karim Yaghmour, "Embedded Android" O Reilly publications, 2013.
4. James P. Lynch, "ARM Cross Development with Eclipse" 2005.

Reference books:

1. The ARM system on chip architecture 2nd edition - Addison wisley
2. Andrew Sloss ARM System Developer's Guide by ELSEVIER

SECTIONS

Unit	Book	Sections
I	1	Chapter 1 and 2
II	2	Chapter 1 and 3
III	2	Chapter 4, Pg 78 – 104
IV	3	Chapter 1 and 2
V	4	Chapter 1

Sem:III	L	P	C
16PEL3201B	4	0	4

Elective-1B:
SINGLE BOARD COMPUTERS AND PYTHON

Assurance of learning

- Understanding the architecture of Single Board Computers
- Ability on setting up Raspberry Pi board
- Capacity to understanding Python programming
- Developing web based application on Raspberry Pi using python

UNIT - I: INTRODUCTION TO SINGLE BOARD COMPUTERS (7 Hrs)

Introduction - history of Single Board Computers - Classification - Comparison - Evolution - Architecture - applications - Overview on Raspberry Pi - GPIO - shields - overview on Beaglebone - features.

UNIT - II: SETTING UP RASPBERRY PI (8 Hrs)

Installing and preparing Raspberry Pi - flashing SD Card - Booting up - Configuring Pi - Troubleshooting - Using Command Line interface - root user commands - configuring network connection - remote desktop access using Putty software.

UNIT - III: BASICS OF PYTHON (15 Hrs)

Python 2.7 idle - Programming Basics - handling strings - Numbers and Operators - Variables - basic arithmetic operations - Making decisions - Functions - Classes and Objects - Numerical Programming.

UNIT - IV: ADVANCED PYTHON (9 Hrs)

Creating modules in python idle - audio and video file handling - configuring webcam - SimpleCV: installation - testing - displaying an image - modifying an image - accessing the webcam - Case study: Raspberry Pi based Photobooth.

UNIT - V: APPLICATION PROGRAMMING PYTHON (9 Hrs)

I/O and shell programming**:** basics of shell programming - installing and testing GPIO in Python - programming LED- reading a button- using devices with I2C bus - reading analog data using an analog to digital converter - logging and plotting data - extending Raspberry Pi GPIO with an I/O expander. Web application programming**:** creating Web server - downloading data from a web server - configuring Raspberry Pi as web server - introduction to flask - flask basics - connecting real world application on Web.

Books for study

1.Rui Santos and Luís Perestrelo, "BeagleBone For Dummies", published by John Wiley & Sons Inc., 2015.
2.Matt Richardson and Shawn Wallace, "Getting started with Raspberry Pi", by O'Reilly Media, Inc, First edition, 2012.
3.James Payne, "Beginning Python", published by Wiley Publishing, Inc, 2010.

Books for reference

1.Anna Martelli Ravenscroft, and David Ascher, "Python Cookbook™", Second Edition Edited by Alex Martelli, 2005.
2.Tim Cox, "Raspberry Pi Cookbook for Python Programmers", 2014.

SECTIONS

UNIT	BOOK	SECTIONS
I		Lecture notes
II	1	Chapters 1 - 7, 12
III	2	Chapters 1, 2, 7
IV	3	Chapters 1 - 6, 8
V	2 3	Chapter 10 Chapter 7

Sem:III	L	P	C
16PEL3402	4	0	4

IDC-II:

COMPUTER HARDWARE

Assurance of learning

- Familiar on basic hardware configuration of a computer System.
- Ability to troubleshoot PC and its network
- Understanding motherboard organization
- Ability to configure boot sequence

UNIT-I: ORGANIZATION OF COMPUTER MOTHER BOARD ORGANIZATION (10 Hrs)

Motherboard Architecture - Form factors Motherboard connectors - Chipset and controllers - Bus architecture - BIOS and BIOS setup - System configuration data - Standard settings- Advanced setting- Security - Power management setting - Bios update.

UNIT-II: PC ASSEMBLING AND TESTING (09 Hrs)

Assembling Tools - Precautions - Power supply - SMPS- Output voltage measurement- Assembling producer - verify the computer peripheral and assembling parts - followed some step precaution - Bios level diagnosis Beep sounds - On screen POST indication - Proper Earth.

UNIT-III: OS INSTALLATION (10 Hrs)

Overview of operating systems (32 / 64 bit) - Booting sequence - BIOS setting - Installation Menu - Selection Partitioning- Formatting-Copying and installation - Account creation- Device driver installation.

UNIT-IV: TROUBLESHOOTING (09 Hrs)

Troubleshooting: SMPS - motherboard -bios battery - RAM-RAM slot- PCI slot - AGP slot - Display card - types of display cards-HDD- Pumping problem - Detection problem - Bad sectors - PS/2 port - USB Port - Monitor - keyboard mouse - sound card

UNIT-V: SMALL OFFICE NETWORKS (10 Hrs)

Network concept: WAN -MAN-LAN - Ethernet - Wi-Fi - Server - Peer to Peer Network - Network accessories: Hub- switches - access point - Cable and cable coding - RJ45 connector - Cabling - Protocols - TCP/IP setting - Internet connectivity: Broadband modem and setting.

Book for Study

1.Material prepared by the Department.

Sem:IV	L	P	C
16PEL4114	5	0	5

SENSORS AND TRANSDUCERS

Assurance of Learning

- Exposure on working principle of sensors and transducers.
- Ability to measure the non - electrical quantities
- Capability to design signal conditioning circuits used in instrumentation
- Understanding the modern sensor characteristics

UNIT - I: TRANSDUCERS (12 Hrs)

Introduction to measurement - Direct and indirect measuring methods - Accuracy - Errors - Transducers - Resistive transducers - Potentiometers - Non-linear potentiometers function generators - Strain gauges - Types of strain gauges - Resistance thermometers - Variable inductance transducers - Linear variable differential transformer - Capacitive transducers - Piezo electric transducers - Hall Effect transducers - Magneto resistors

UNIT - II: MEASUREMENT OF NON-ELECTRICAL QUANTITY (12 Hrs)

Measurement of vibrations - Seismic transducers - Measurement of flow rate - Measurement of thickness - Measurement of humidity - Measurement of sound using microphones - Measurement of pH value - Measurement of thermal conductivity - Measurement of pressure.

UNIT - III: INTEGRATED SENSORS (13 Hrs)

LM 35 temperature sensor - DS18s20 1-wire digital thermometer - TSOP 17 photo modules for PCM remote control system - MOC3041 zero cross optoisolators - TL173L linear hall effect sensor - KMZ51 magnetic field sensor - MPXV5004G pressure sensor - A1425 analog speed sensor - LM1830 water level sensor - HC610 humidity sensor - ICM105A VGA CMOS sensor

UNIT - IV: BIOSENSORS AND MEMS BASED SENSORS (13 Hrs)

Introduction - FET & MOSFET chemical sensor - Bio sensors - Ion exchange membrane electrodes - Oxygen electrodes - CO2 electrodes enzyme electrode - Construction - ISFET for glucose, urea - Electrolytic sensors - Optical sensor - Fiber optic sensors - ADXL 335 accelerometer - MPU 6050 IMU Sensor.

UNIT -V: SIGNAL CONDITIONING CIRCUITS (10 Hrs)

Signal conditioning basics - Op-amp circuits - Differential amplifier - Voltage follower - data sampling and optimization - Instrumentation amplifier - Filters: RC filter - active filter - Wheatstone bridge - AC bridges- noise reduction techniques.

Books for study

1. A.K. Sawhney, "A course in Electrical and Electronic Measurements and Instrumentation", Dhanpat Rai & Co. publishers,2011.
2. N.Mathivanan, "PC Based Instrumentation: Concepts and Practice", PHI, 2007.

Books for Reference

1. H. S. Kalsi, "Electronic Instrumentation", Tata McGraw-Hill publishers
2. Albert D. Helfrick and William D.Cooper, "Modern Electronic Instrumentation and Measurement techniques", New Delhi: Prentice Hall of India, 1995.

SECTIONS

Unit	Book	Sections
I	1	25.2-25.9
II	1	25.11-25.13, 25.16, 25.17, 25.19, 25.22-25.24, 25.28-25.31
III		Lecture Notes
IV		Lecture Notes
V	1	31.3-31.5, 31.7, 31.10

Sem:IV	L	P	C
16PEL4115	5	0	5

ELECTROMAGNETIC THEORY

Assurance of Learning

- Understanding the theory of Electromagnetism.
- Ability to classify the directional properties of antennas.
- Understanding the fundamentals of transmission lines
- Ability to understand the principle and operation of Magnetron.

UNIT I: APPLIED ELECTROMAGNETIC WAVES (14 Hrs)

Equation of continuity for time varying fields - inconsistency of Ampere's law - Maxwell's equations - conditions at a boundary surface - electromagnetic waves: solution for free space conditions - uniform plane wave propagation and its characteristics - wave equations for conducting medium

UNIT II: POYNTING VECTOR AND WAVE GUIDES (12 Hrs)

Poynting's theorem - statement and proof - Interpretation of Poynting's vector - Instantaneous, average and complex Poynting vector- Waveguides: rectangular guides - TM waves in rectangular guides - TE waves in rectangular guides - Impossibility of TEM wave in waveguides

UNIT III: ANTENNAS & WAVE PROPAGATION (12 Hrs)

Antennas - Network theorems - directional properties of dipole antennas - travelling wave antennas - point of feed on standing wave antennas - two elemental array - antenna gain - wave propagation: Ground Wave Propagation - plane earth reflection - wave propagation in the ionosphere.

UNIT IV: TRANSMISSION LINES AND PRACTICAL ANTENNAS (12 Hrs)

Transmission lines: Basic principles - fundamentals of transmission lines - characteristic impedance - smith chart and its applications. VHF, UHF, SHF antennas: folded dipole antenna - Yagi Uda antenna - biconical antenna-corner reflector antenna - helical antenna - horn antenna - frequency independent antennas - microwave antennas - lens antennas.

UNIT V: MICROWAVE GENERATORS (10 Hrs)

Microwave Generation- Multicavity Klystron-Reflex Klystron- principle and operation of Magnetron -Travelling Wave Tubes (TWT) - Microwave Transistors - GaAsFET- Gunn Diode- PIN diode for detection of micro waves.

Books for Study

1. Edward C.Jordan, Keith G. Balmain, "Electromagnetic Waves and Radiating Systems", 2nd edition. Prentice Hall Of India,1964.
2. K.D.Prasad, "Antenna and Wave Propagation", 2nd Edition, Sathya Prahashan, 2009.
3. George Kennedy, Bernard Davis, "Electronic Communication Systems" 4th Edition, Tata McGraw- Hill,2001.

Books for Reference

1. N.D. Deshpande, D.A. Deshpande and P.A. Rangole, "Communication electronics", Tata McGraw- Hill.

SECTIONS

UNIT	BOOK	SECTIONS
I	1	4.01-4.04, 5.01-5.04
II	1	6.01-6.03,8.01-8.04
III	1	11.01-11.05, 11.11, 16.01, 16.02, 17.09
IV	2	9.2, 9.3.1, 9.3.2, 9.5-9.7, 9.15, 9.17, 9.19.1-9.19.3
V	3	11.2.1, 11.3.1, 11.4.1-11.4.2, 11.5.1, 12.2.2, 12.6, 12.8.1

Sem:IV	L	P	C
16PEL4202A	4	0	4

Elective-IIA: CONTROL SYSTEM

Assurance of Learning

- Familiar on design concepts of control system
- Understanding the concepts of stability and root locus.
- Ability to understand mathematical models of control systems.
- Understanding frequency domain specifications

UNIT - I: MATHEMATICAL MODELS OF CONTROL SYSTEMS (10 Hrs)

Control system - Examples of control system - Block diagram reduction techniques - Signal flow graph using Mason's gain formula - M mathematical models : Mechanical system - electrical system - Electrical analogous of mechanical translational systems (two notes) - Electrical analogous of mechanical rotational systems (Force voltage &current).

UNIT - II: TIME RESPONSE ANALYSIS (10 Hrs)

Time response - Test signals - Transfer function of a system - Laplace transform review Response of first order system for unit step input - Second order system response: Under damped - over damped - critically damped. Time domain specifications: Rise time - Time constant - Settling time.

UNIT - III: CONTROLLERS AND ERRORS (09 Hrs)

Response of 2nd order systems with P, PI & PID controllers - Comparison of the responses - Steady state error constants - Steady state error - unit step - unit ramp - unit parabolic signal - Generalized error coefficients - Correlation between static and dynamic error coefficients.

UNIT - IV: FREQUENCY RESPONSE ANALYSIS (09 Hrs)

Review of Fourier transform - Frequency domain specifications - Estimation of frequency domain specifications for II order system - Correlation between time and frequency response - Frequency response plots: Bode plot - Nichols plot - M &N circles Nichols chart

UNIT - V: CONCEPTS OF STABILITY AND ROOT LOCUS (10 Hrs)

Definitions of stability - Location of roots on the S-plane for stability - Routh Hurwitz criterion - Mathematical preliminaries for Nyquist stability criterion - Relative stability - Estimation range of system gain - Root locus construction - Root locus for systems with dead time - transportation lag - Steps for designing a lead and lag compensator.

Books for study

1. Nagoor Gani, "Control system", 1st Edition, RBA publications, 2006.

Books for reference

1. R. Anandanatarajan & P. Ramesh Babu, "Control Systems Engineering", 2nd Edition, Scitech Publications, 2010
2. M. Gopal, "Control system principles and design", TMH, 1998.
3. B. C. Kuo, "Automatic Control Systems", 7th Edition, PHI, 1995.

SECTIONS

UNIT	BOOK	SECTIONS
I	1	1.1 - 1.3, 1.6,1.9 - 1.12
II	1	2.1 - 2.4, 2.9 - 2.10, EXAMPLE 2.4
III	1	3.1 - 3.3, 3.5 - 3.15, 3.17
IV	1	4.1 - 4.8, 4.10, 4.11
V	1	5.1 - 5.5, 5.7, 5.8

Sem:IV	L	P	C
16PEL4202B	4	0	4

Elective-IIB: DIGITAL COMMUNICATION SYSTEMS

Assurance of Learning

- Understanding the fundamentals of sampling and pulse modulation systems.
- Capability to understand the various Digital Modulation Techniques
- Ability to understand the process of Fiber Optic Communication and its various components of an FOC system.
- Understanding the basics of multiplexing & multiple access techniques

UNIT-I: PULSE MODULATION SYSTEMS (10 Hrs)

The sampling theorem: low pass signals and band pass signals - PAM - Channel bandwidth for PAM signal - Natural sampling - Flat top sampling - PCM - Electrical representation of binary digits - PCM system - Companding - Multiplexing PCM signal -Differential PCM - Delta modulation.

UNIT-II: DIGITAL MODULATION TECHNIQUES (09 Hrs)

Phase shift keying-binary PSK - Differential PSK - Differentially encoded PSK (DEPSK) - Quadrature PSK - M-ary PSK - FSK - Binary FSK - Similarity of BFSK and BPSK - M-ary FSK.

UNIT-III: PRINCIPLES OF FIBRE OPTIC COMMUNICATION (10 Hrs)

Need for optical communication - Physical nature of optical fibre -Basic principle involved in optical fibre technology - Fibre classification - Acceptance angle- acceptance cone and numerical aperture of fibre - Optical fibre bundles and cables - Fibre splices- connector and couplers - Fibre attenuation - Advantages/disadvantages of using optical fibre as communication medium - optical fibre application.

UNIT IV: LIGHT SOURCES FOR OPTICAL FIBRE SYSTEM (10 Hrs)

LED - Processes - Structures of LED - Modulation Bandwidth of LED - LASER - Types of laser - Application of laser Organic LEDs - Photo Detectors - characteristics - photo emissive photo detector - P-N Junction photo Detector - PIN photo diode- APD photo Transistor -bit error rate- optical Transmitter-optical receiver - Repeater- MUX-DMUX-Line coding- Fibre optic switches - Bypass switches.

UNIT - V: MEDIUM ACCESS CONTROL (09 Hrs)

Motivation for Specialized MAC- SDMA- FDMA- TDMA- CDMA- Comparison of Access mechanisms - Basics of Long Term Evolution network (LTE) - broad band networks- Mobile cloud networks-Satellite Systems: Basics- Routing; Introduction to Ad Hoc networks – definition- characteristics features- applications.

Books for Study

1. Taub and Schilling, "Principles of communication systems", 2nd edition, New Delhi: Tata McGraw Hill Ltd., 1998.
2. Anuradha De, "Optical fibre & LASER, principles & applications", New age international publishers, 2009.
3. Joseph C, Palais, "Fiber optic communications", 4th edition, Prentice Hall international Inc, 2008.

Reference Books

1. Trimothy Pratt, Charles W. Bostian, Jeremy E. Allnutt "Satellite Communications", John Wiley & Sons, 2002.S. Senturia, "Microsystem Design " , Kluwer, Springer, 2001.
2. Agarwal, D.C, "Fiber optic communication", 2nd edition, Wheeler publishing, 1998

SECTIONS

UNIT	BOOK	SECTIONS
I	1	5.1-5.5, 5.9 - 5.15
II	1	6.2 - 6.6, 6.8 - 6.10
III	2	1.7; 2.1 - 2.12
IV	3	6.1 - 6.7, 7.1, 7.3 - 7.5
V		Lecture Notes

Sem:IV	L	P	C
16PEL4203A	4	0	4

Elective-IIIA:

PROGRAMMABLE LOGIC CONTROLLERS AND PROGRAMMING

Assurance of Learning

- Understanding the concepts of PLC.
- Ability to work on Ladder logic programming and Simulation using OMRON and KEYENCE.
- Capability to implement wiring diagram along with ladder logic program.
- Understanding PLC ladder diagrams

UNIT-I: INTRODUCTION TO PLC, LADDER DIAGRAM FUNDAMENTALS (09 Hrs)

Introduction to PLC - PLC Vs Microcontroller - Basic Components and their Symbols - Control Transformers - Fuses - Switches - Relays - Time Delay Relays - Fundamentals of Ladder Diagram - Basic diagram framework - Wiring Reference Designators - Boolean Logic & Relay Logic - AND-OR & ORAND - Ground Test - Latch - Two handed Anti-Tie Down- Anti-Repeat - Combined Circuit - Machine Control Terminology.

UNIT-II: PROGRAMMABLE LOGIC CONTROLLER & FUNDAMENTAL PROGRAMMING (10 Hrs)

PLC Configurations - System Block Diagram - Update - Solve Ladder Physical Components Vs Program components - Light Control - Internal Relays - Disagreement Circuit - Majority Circuits - Oscillators - Holding Contacts - Always ON & OFF Contacts - Ladder Diagrams having complex Rung.

UNIT-III: ADVANCED PROGRAMMING TECHNIQUES AND OVERVIEW OF MNEMONIC PROGRAMMING CODE (10 Hrs)

Ladder Program execution Sequence - One Shot- JK-Flip Flop - Counters Sequencers - Timers - Master control Relays and control Zones - AND Ladder Rung - Entering Normally Closed Contacts - OR Ladder Rung - Simple Branches - Complex Branches.

UNIT- IV: WIRING TECHNIQUES, ANALOG I/O & SENSORS (09 Hrs)

PLC Power Connection - Input wiring - Inputs having a single common Isolated inputs - Output wiring - Relay outputs - Solid state outputs - Analog (A/D) inputs - Analog (D/A) output - Sensor Output classification Connecting Discrete sensors to PLC inputs - Proximity sensors - Optical Proximity Sensors.

UNIT- V: WORKING IN OMRON & KEYENCE IDE WITH LADDER LOGIC (10 Hrs)

Introduction to OMRON & KEYENCE - Creating a project - Ladder Programming - Compiling and Executing - Ladder Programs - Logic Gate functions (AND, OR, NOT, NAND, NOR, XOR) - Using Timers (ON delay timer, OFF delay timer, one shot pulse, flashing pulse), Counters - Using Calendar functions

Books for Study

1. John R. Hackworth, Frederick D. Hackworth, Jr., "Programmable Logic Controllers, Programming Methods and Applications", New Delhi: Pearson Education, 3rd edition, 2003.

Books for Reference

1. John. W .Webb, Renoald A. Rein, "Programmable Logic Controller Principles and Application", Prentice Hall India, 5th Edition.

SECTIONS

UNIT	BOOK	SECTIONS
I	1	Lecture Notes (for 1st two topics), 1.1 - 1.3
II	1	2.2 - 2.6, 3.1 - 3.9
III	1	4.1, 4.2, 4.4, 4.8 - 4.11, 5.1 - 5.5
IV	1	6.1 - 6.7, 7.1, 7.2, 8.1 - 8.3, 8.7
V		Lecture Notes

Sem:IV **L P C**
16PEL4203B **4 0 4**

Elective-IIIB:
FPGA DESIGN

Assurance of Learning

- Understanding the CMOS logic and its fabrication Process
- Capability to know the CMOS logic design
- Ability to understand the architecture of CPLD and FPGA.
- Programming FPGA with QUARTUS-II IDE

UNIT –I :CMOS LOGIC FABRICATION AND LAYOUT (10 Hrs)

MOS Transistors -. CMOS Logic- The NAND Gate - CMOS Logic Gates - Compound Gates - Pass Transistors and Transmission Gates – Tri states - Multiplexers -Sequential Circuits- CMOS Fabrication and Layout- Inverter Cross-Section - Fabrication Process - Layout Design Rules - Gate Layouts - Stick Diagrams - Design Partitioning. - Design Abstractions - Structured Design - Behavioral, Structural, and Physical Domains - Simple MIPS Microprocessor - MIPS Architecture- Multicycle MIPS Micro architecture

UNIT –II:FLOOR PLANN AND DESIGN (9 Hrs)

Logic Design. Top-Level Interfaces- Block Diagrams-Hierarchy - Hardware Description Languages - Circuit Design. -Physical Design . - Floor planning - Standard Cells-Pitch Matching- Slice Plans-Arrays -**6** Area Estimation Design Verification. . Fabrication, Packaging, and Testing.

UNIT- III: CPLD and FPGA ARCHITECTURE (9 Hrs)

Architecture of Altera CPLDs- Applications of CPLDs- Altera FLASH logic PLDs- Commercially Available FPGAs- Structure of Xilinx SRAM-based FPGAs- Architecture of Altera FLEX 8000 and FLEX 10000 FPGAs-Actel FPGAs-Quick logic pASIC FPGAs

UNIT - IV: CIRCUIT DESIGN AND SIMULATION USING QUARTUS-II IDE (10 Hrs)

Quartus I I-VHDL Design - CAD Flow Diagram- working with IDE - Project creation- VHDL Design Entry - Design Compilation - Pin Assignment- Design Simulation- FPGA Device Programming and Configuration -Testing the Designed Circuit-Design examples: basic gates-J K flip flop- S R flip flop- D flip flop.

UNIT -V: PROGRAMMING WITH FPGA USING VHDL: (10 Hrs)

Binary to BCD converter-VHDL code for De bounce circuit --VHDL code for clock divider--VHDL code for s circuit - VHDL code for simple comparator- VHDL code for simple multiplier- VHDL code for mod n counter- VHDL code for- VHDL Code for 2 to 4 decoder-VHDL Code for 4 to 1 Encoder

Books for study

1. Neil H.E. Weste, David money harris "CMOS VLSI Design: A Circuits and Systems Perspective." 4th edition, Addison – Wesley publications, 2011.
2. Stephen Brown and Jonathan Rose "Architecture of FPGAs and CPLDs**",** 1996.

Books for reference

1. FPGA-Based System Design (Prentice Hall Signal Integrity Library) Kindle Edition
2. Reconfigurable Computing: The Theory and Practice of FPGA Based Computation Paperback – 2011
3. Quartus® II Software Version 10.0
4. Andrew Moore "FPGA FOR DUMMIES' Altera Special Edition

SECTIONS

UNIT	BOOK	SECTIONS
I	1	1.3,1.4,1.4.1-1.4.3,1.4.5-1.4.9,1.5,1.6,1.7
II	1	1.8,1.9,1.10,1.11,1.12
III	2	1.4,2.1,2.2,2.2.1,2.2.6,2.2.8,2.3,2.3.1,2.3.2,2.3.4,2.3.5
IV		Lecture notes
V		Lecture notes

Sem:IV	L	P	C
16PEL4204A	4	0	4

Elective-IVA:
MEMS AND NANO ELECTRONICS

Assurance of Learning

- Ability to understand recent trends in MEMS and its application.
- Understanding various applications of Nanotubes
- Familiar with quantum computation algorithms
- Understanding nano lithography

UNIT - I: MEMS INTRODUCTION (08 Hrs)

MEMS or MST- Micromachining - Materials for MEMS-Silicon compatible - Silicon, silicon dioxide and nitride - thin metal films and polymers, other materials - Glass and fused quartz, silicon carbide and diamond - shape memory alloys - Important material properties and physical effects.

UNIT - II: MICRO AND NANO FABRICATION (10 Hrs)

Processes for micromachining Processes for Micromachining - Basic Process Tools - Epitaxy - Oxidation - Sputter Deposition - Evaporation - Chemical Vapor Deposition - Spin-On Methods - Lithography - Etching - Supercritical Drying - Self-Assembled Monolayers - SU-8 Photosensitive Epoxy

UNIT - III: MEMS STRUCTURES (10 Hrs)

Signal integrity in RF MEMS-Micro machined passive components - Microelectromechanical Resonators - Micro electromechanical switches- membrane shunt switch - cantilever series switch.

UNIT- IV: NANO LITHOGRAPHY AND NANO MATERIALS (10 Hrs)

Introduction to Nano lithography-Cross cutting technologies- Emerging nano lithography-Carbon Nanotubes- Application of Nanotubes: storage application - field emission - sensor- application - electronic application - Introduction to Quantum dots - Introduction to nano composites.

UNIT-V: QUANTUM COMPUTATION AND MAGNETORESISTIVE MATERIALS AND DEVICES (10 Hrs)

Nano structures for quantum computation-Quantum computation algorithms - Requirements for physical realizations of quantum computers-Introduction to magnetic materials and devices - Acronyms for AMR, GMR, TMR, BMR and CMR semiconductor spintronics.

Books for Study

1. Nadim Maluf, Kirt Williams, "Introduction to microelectromechanical systems engineering" Second edition, Artech house, Boston, 2004.
2. Massimiliano Di ventra, Stephane Evory and James R. Hefline,Jr., "Introduction to nanoscale science and technology", , Kluwer Academic Publishers, London, 2004.

Books for Reference

1. Anupama B. Kaul, "Microelectronics to Nanoelectronics: Materials, Devices & Manufacturability" CRC press, 2011

SECTIONS

UNIT	BOOK	SECTIONS
I	1	1 1.2 & 1.3 and chapter 2 complete
II	1	Chapter 3 complete
III	1	Chapter 7 complete
IV	2	1.1, 1.2, 1.6, 6.1, 6.6, 6.6.1, 6.6.3, 6.6.4, 6.6.7, 7.1,8.1
V	2	12.1,12.2, 12.4, 13.1, 13.2.4, 13.3.6.3

Sem:IV	L	P	C
16PEL4204B	4	0	4

Elective-IVB:
MOBILE COMMUNICATION

Assurance of Learning

- Understanding the concepts of Mobile Communication.
- Ability to understand different layers of OSI reference model.
- Knowledge on wireless application protocol.
- Understanding the concepts of OOP
- Ability to Develop the mobile OS

UNIT - I: TELECOMMUNICATIONS SYSTEMS (08 Hrs)

GSM: Mobile services - System architecture - Radio interface - Protocols Localization and calling - Handover - Security - New data services.

UNIT - II: MOBILE NETWORK LAYER (10 Hrs)

Mobile IP: goals, assumptions and requirements - Entities and terminology - IP packet delivery - Agent discovery - Registration - tunneling and encapsulation - Optimizations - Reverse tunneling - IPv6 - IP micro-mobility support - Dynamic host configuration protocol.

UNIT - III: MOBILE TRANSPORT LAYER (10 Hrs)

Traditional TCP: congestion control - Slow start - Fast transmit/fast recovery - Implications on mobility - Classical TCP improvements: indirect TCP Snooping TCP - Mobile TCP - Fast transmit/fast recovery - Transmission/time-out freezing - selective transmission - Transaction-oriented TCP - TCP over 2.5/3G wireless networks - Performance enhancing proxies.

UNIT -IV : CONCEPTS OF OOP (10 Hrs)

Concepts of OOP : Introduction OOP- Procedural Vs. Object Oriented Programming- Principles of OOP- Benefits and applications of OOP. C++ Basics: Program structure- namespace- identifiers- variables- constants- enum- operators- typecasting- control structures -C++ Functions : Simple functions- Call and Return by reference -Inline functions- Macro Vs. Inline functions- Overloading of functions, default -arguments- friend functions- virtual functions

UNIT -V : C++ PROGRAMMING (10 Hrs)

Objects and classes : Basics - Private and public Members- static data and function members- constructors - types- destructors- operator overloading -Inheritance : Concept of Inheritance- types of inheritance: single- multiple- multilevel, hierarchical, hybrid, protected members, overriding, virtual base class-Polymorphism : Pointers in C++- Objects- virtual and pure virtual functions- Implementing -polymorphism- I/O and File management : stream- cin and cout objects - Unformatted and formatted I/O- manipulators- File stream -File stream classes- File management functions- File modes- Templates- Exceptions and STL : function - class t- exception- try-catch-throw- multiple catch- implementing user defined exceptions- Standard Template Library

Books for Study

1. Jochen Schiller, “Mobile communications”, second edition, Pearson Education Ltd, 2003.
2. E Balagurusamy, “Object Oriented Programming With C++” TMH publications, 2008.

Books for Reference

1. W.C.Y. Lee, “Mobile Communication Engineering”, 2nd edition, McGrawHill, 1998.
2. C++ Programming, Black Book, Steven Holzner, dreamtech
3. Object Oriented Programming with ANSI and Turbo C++, Ashok Kamthane, Pearson education.

SECTIONS

UNIT	BOOK	SECTIONS
I	1	1 4.1.1- 4.1.8
II	1	8.1.1 - 8.1.10;8.2
III	1	Chapter 9
IV	2	Chapter 2
V	2	Chapter 3 and 4

Sem:IV	L	P	C
16PEL4117	0	0	4

COMPREHENSIVE EXAMINATIONS

UNIT - I: ANALOG AND DIGITAL CIRCUITS AND ITS APPLICATION

The ideal op-amp - Summing - Scaling and averaging amplifier - Instrumentation amplifier - Integrator - Differentiator - Active filters - First order low pass and high pass butter worth filter - Band pass filter - Band reject filter - All pass filter - Oscillator - Square wave Triangular wave generator - Comparator - Zero crossing detector - Schmitt trigger - Sample and Hold circuit - V to I with floating & grounded load - R and 2R ladder method - Binary weighted resistors. Introduction to sequential circuits - Latches and Flip Flop: SR latch - Timing problems and clocked SR latches - JK latch - Master slave latch - Delay Flip Flop - T Flip Flop - Flip Flop excitation requirements - Registers: Serial load shift registers - Parallel load shift register - Parallel to serial conversion Universal shift registers.

UNIT - II: INTEL 8085, 8086 and 8051 ARCHITECTURE AND ITS PHERIPHERAL

Introduction to INTEL8085 -Instruction set - Addressing modes - Status flags - DMA controller 8257-Data transfer schemes - Interrupts of INTEL 8085 - interfacing and programming 8255 - 8259 programming and interfacing - 8251 programming and interfacing - 8253 programming and interfacing Programmable interval timer interfacing - 8279 keyboard interfacing. Introduction to 8086 microprocessor - Internal architecture - Addressing modes - Instruction set -Segment registers - Memory segmentation-Introduction to 8051 microcontroller - flag bits and PSW - Register banks and stack.

UNIT - III: POWER ELCTRONICS

Chopper-Type A chopper-Type B chopper-Type C four quadrant chopper Pulse width modulated IGBT AC chopper - Single-phase voltage source inverters- PWM inverters - Current source inverters series inverters- Single-phase parallel inverters-Principle of cycloconverter operation- DC motor Single phase SCR drive - Three phase SCR drive - Application of IGBT in DC Motor control for home appliances - Induction motor characteristics -Speed control methods of induction motor - Synchronous motor control.

UNIT - IV: TRANSDUCERS AND SENSORS

Introduction to measurement - Direct and indirect measuring methods Transducers - Resistive transducers - Potentiometers - Strain gauges - Types of strain gauges - Resistance thermometers - Variable inductance transducers - Linear variable differential transformer - Capacitive transducers - Peizo electric transducers - Hall Effect transducers - Magneto resistors - Differential amplifier - Voltage follower - Instrumentation amplifier - Wheatstone bridge - AC bridges.

UNIT V: COMMUNICATION SYSTEM

The sampling theorem - PAM - Natural sampling - Flat top sampling - PCM - Companding - Multiplexing PCM signal - Phase shift keying - binary PSK - Differential PSK - FSK - Binary FSK - Similarity of BFSK and BPSK Physical nature of optical fiber - Basic principle involved in optical fiber technology - Fiber classification - Acceptance angle, acceptance cone and numerical aperture of fiber -Fiber splices, connector and couplers - Fiber attenuation Advantages/disadvantages of using optical fiber as communication medium - LED - Structures of LED - LASER - Types of laser - Photo Detectors - characteristics - PIN photo diode - APD photo Transistor - Repeater- MUX-DMUX-Line coding - Fibre optic switches - Bypass switches.