MSc Electronics CBCS Course Structure

1 Semester

Hard Core

Sl. No.	Course	Credits
1	ELH 401- Solid State Electronics	4
2	ELH 402- Digital System Design with Verilog HDL	3
3	ELH 403 - Microcontrollers	3

Soft Core

Sl. No.	Course	Credits
1	ELS 404 - Microprocessors	4
2	ELS 405 - Programming in C	
3	ELS 406 - Embedded System	4
4	ELS 407 - Linux shell Programming	
5	ELS 410 - Analog Devices and Circuits	

Practical

1	ELP 408 - Digital System Design with Verilog HDL Practical	2
2	ELP 409 –Microcontrollers Practical	2

II Semester

Hard Core

Sl. No.	Course	Credits
1	ELH 451 - Analog and Digital Communication	3
2	ELH 452 - Digital Signal Processing	3
3	ELH 453 - Basic VLSI Design	4

Soft Core

Sl. No.	Course	Credits
1	ELS 454 - Embedded System Design using PIC	3
2	ELS 455 - Network Analysis	
3	ELS 456 - Control System	3
4	ELS 457 - Power Electronics	

Practical

1	ELP 458 - Analog and Digital Communication Practical	2
2	ELP 459 - Digital Signal Processing Practical	2

Open Elective

Sl. No.	Course	Credits
1	ELE 460 - Electronic Communication	3

III Semester

Hard Core

Sl. No.	Course	Credits
1	ELH 501 – Digital Image Processing	3
2	ELH 502 - Low Power VLSI	3
3	ELH 503 - Wireless Communication System	4

Soft Core

Sl. No.	Course	Credits
1	ELS 504 - Nano Electronics	3
2	ELS 505 - Microwave Engineering	
3	ELS 506 - DSP Processor	3
4	ELS 507 - Speech Processing	

Practical

1	ELP 508 - Digital Image Processing Practical	2
2	ELP 509 - Low Power VLSI Practical	2

Open Elective

Sl. No.	Course	Credits
1	ELE 510 - Medical Electronics	3

IV Semester

Hard Core

Sl. No.	Course	Credits
1	ELP 551 - Project	16

Soft Core

Sl. No.	Course	Credits
1	ELS 552 - Introduction to Arduino, Raspberrypi and Beaglebone Black	4
2	ELS 553 - Video Processing	
3	ELS 554 - VLSI Design using CAD	4
4	ELS 555 - Biomedical Electronics	

I Semester

ELH 401 - SOLID STATE ELECTRONICS

Unit-I

15 Hours

Crystal properties and growth of semiconductors; semiconductor materials, crystal lattice, bulk crystal growth, epitaxial growth.
Atom and electrons; introduction to physical models, experimental observation, quantum mechanics, atomic structure and the periodic table.
Energy bands and charge carrier in semiconductors; bonding forces and energy bands in solids, charge carrier in semiconductors, carrier concentrations, drift of carrier in electric and magnetic fields, invariance of the Fermi level at equilibrium.

Unit-II

12 Hours

Excess carrier in semiconductors; optical absorption, luminescence, carrier life time and photo conductivity, diffusion of carriers,
Junctions; fabrication of pn-junction, equilibrium conditions, forward and reverse biased junctions: steady state conditions reverse biased breakdown, transient and AC conditions. Derivations from the simple theory, metal semiconductor junction, hetero junction.

Unit-III

15 Hours

Field effect transistor; transistor operation, the junction FET, the metal semiconductor FET, the metal insulator semiconductor FET, the MOS field effect transistor.
Bipolar junction transistor; fundamentals of BJT operations, amplifications with BJT, BJT fabrication, minority carrier distributions and terminal currents, generalized biasing, switching, other important effects, frequency limitations of transistors, hetero-junction BJT transistor.

Text Book

1. "solid state electronic devices," B.G Streetman and S.K Banergee, PHI Pvt Ltd, 6thed, 2006.

Reference:

1. "Semiconductor Physics and Devices," D. A. Neamen, 4th Ed, McGraw-Hill, 2012
2. "Physics of Semiconductor Devices" S.M. Sze and Kwok K. Ng, 3rd Ed, Wily Interscience, 2007

ELH 402 - DIGITAL SYSTEM DESIGN WITHVERILOG HDL

Unit -I

14 hours

Introduction to Digital Design Methodology: Design Methodology, IC Technology Options
Review of Combinational Logic Design:Combinational Logic and Boolean algebra, Representation of Combinational Logic, simplification of Boolean Expression, glitches and Hazards, Building Block for Logic Design.
Fundamental of Sequential Logic Design: Storage Element, Flip-Flops, Busses and Three-state Device, Design Sequential Machines, and State- Transition Graph, Serial-Line code converter for Data Transmission, State Reduction and Equivalent States.

Unit -II

14 hours

Introduction to Logic Design with Verilog : Structural Models of combinational logic, Logic simulation, design verification and test methodology, propagation delay. Truth table Model of Combinational and Sequential Logic with Verilog, Logic Design with Behavioural Models of Combinational and Sequential logic
Synthesis of Combinational and Sequential Logic:Introduction to Synthesis, Synthesis of Combinational Logic, Synthesis of Sequential Logic, Synthesis of Explicit and Implicit State Machines, Registered Logic, State Encoding

Unit - III

14 hours

Design and Synthesis of Data path controllers: Partitioned Sequential Machines, Design Example: Binary Counter, design and synthesis of RISC stored Program Machine, Design Example: UART
Programmable Logic and Storage Devices: Programmable Logic Devices, Storage Devices, Programmable Logic Array, Programmable Array Logic, Programmability of PLDs. Complex PLDs, Altera Max 7000 CPLDs, Field- Programmable Gate Arrays, Altera Flex 8000 FPGAs.

Text Books:

1. "Advanced Digital Design with the Verilog HDL" Michael D. Ciletti,Prentice-Hall of India Pvt. Ltd, 2006.

Reference Books:

1. "Digital Design", Mano M M,Pearson Education Asia,3rd Edn. 2002.
2. "Digital Fundamentals", Floyd T L,Pearson Education Asia,8th Edn.2002.

ELH 403 - MICROCONTROLLERS

Unit-I

15 Hours

Microcontroller, microprocessor, difference between microprocessor and microcontroller, Criteria for choosing a microcontroller, 8051 microcontroller architecture
Overview of PIC family and features.
PIC architecture and assembly language programming**:** The WREG register, PIC file register, instructions with default access bank, status register, PIC data formats and directives, Introduction to PIC assembly level programming, assembly and linking PIC programs, PIC program counter and ROM space in the PIC, RISC architecture of PIC Branch, call and time delay loop

Unit-II

12 Hours

PIC I/O port programming, arithmetic logic instructions and programs
PIC timer programming, serial port programming, interrupt programming, LCD, keyboard, ADC, DAC and sensor interfacing

Unit-III

15 Hours

Introduction to ARM, Architecture of ARM Cortex M3, Programming ARM Cortex M3 Nested Vector Interrupt Controller. Interrupt behaviour of ARM Cortex M3, Exceptions programming, Advanced programming features and system behaviour, Memory Protection, Debug Architecture.

Text books:

1) "Pic Microcontroller and Embedded Systems: Using Assembly And C For Pic 18", Mazidi, Pearson Education, 2008
2)"Definitive Guide to the Arm Cortex M3",Joseph Yiu, Newness, 2008

Ref. books:

1) "The 8051 Microcontroller Architecture, Programming and Applications", K.J. Ayala,Penram Int. Pub., 1991.
2)"Microcontrollers: Theory and Applications",Ajay V deshmukh, Tata McGraw-Hill Education, 2005
3) "Design with PIC Microcontrollers", J. B. Preatman, Prentice Hall, 1st Ed,

ELS 404 - MICROPROCESSORS

Unit I

14 Hours

8086 processor- Internal architecture of 8086, Instruction set – Data transfer instruction, Arithmetic instructions – Binary and BCD arithmetic. Branch instructions – conditional and unconditional, Loop instructions, Logical instructions, Flag manipulation, Shift and rotate instructions and programming.

Unit II

14 Hours

8086 features- Assembler Directives, 8086 interrupts and interrupt applications. Digital Interfacing, Analog interfacing and industrial control.8086 Maximum mode, Co-processor Advanced Microprocessors – Introduction, Multiprogramming concepts, memory management concepts, virtual memory – segmentation scheme.

Unit III

14 Hours

80286 microprocessor- internal architecture – Real and Protected mode operations
80386microprocessor- 80386 architecture and features, the memory system, 80386 memory management unit(MMU) - real and protected mode operation, Virtual 8086 mode – paging mechanism.
80486 microprocessor – Introduction, architecture and advanced features.
Pentium- architecture, and advanced features.

Text Books:

"Microprocessor and interfacing, programming and hardware", Douglas V Hall, Tata McGraw Hill, Reprint 2nd Edn, 2000.

Reference Books:

1. "The 8088 and 8086 Microprocessors: Programming, Interfacing, Software, Hardware, andApplications : Including the 80286, 80386, 80486, and Pentium Processors", Walter A.Triebel, Avtar Singh, Prentice Hall, 4th Edn.

2. "The intel Microprocessor 8086/8088, 80186/80188, 80286, 80386, 80486, PENTIUM and PENTIUM PRO Processor – Architecture, Programming and Interfacing",Barry.B.Brey, Pearson Education Asia, 6th Edn., 2002.

3."Micro Computer Systems: The 8086/8088 family – architecture, programming and design",Yu-Cheng Liu, Glenn A Gibson, Prentice Hall of India Pvt. Ltd., New Delhi, 2nd Edn., 2000.

ELS 405 - PROGRAMMING IN C

Unit I

10 Hours

Engineering Problem Solving: Engineering in the 21 st Century, Computing Systems: Hardwareand Software, An Engineering Problem-Solving Methodology. Simple C Programs: Program Structure, Constants and Variables, Assignment Statements, Standard Input and Output, EstimatingHeight from Bone Lengths, Numerical Technique: Linear Interpolation, Freezing Temperature of Seawater, Mathematical Functions, Character Functions, Velocity Computation, Control Structuresand Data Files: Algorithm Development, Conditional Expressions, Selection Statements, FaceRecognition, Loop Structures, Wave Interaction, Data Files, Numerical Technique: Linear Modeling, Ozone Measurements.

Unit II

10 Hours

Modular Programming with Functions: Modularity, Programmer-Defined Functions,Computingthe Boundaries of the Iris, Iceberg Tracking, Random Numbers, Instrumentation Reliability, Numerical Technique: Roots of Polynomials, System Stability, Macros, RecursionArraysandMatrices: One-Dimensional Arrays,Hurricane Categories, Molecular Weights, StatisticalMeasurements, Speech Signal Analysis, Sorting Algorithms, Search Algorithms, Two-DimensionalArrays, Terrain Navigation, Matrices and Vectors, Numerical Technique: Solution to Simultaneous Equations,Electrical Circuit Analysis, Higher Dimensional Arrays (10hrs)

Unit III

10 Hours

Programming with Pointers: Addresses and Pointers, Pointers to Array Elements,E1 Niño-Southern Oscillation Data, Pointers in Function References,Seismic Event Detection, CharacterStrings, DNA Sequencing, Dynamic Memory Allocation, A Quicksort Algorithm. Programmingwith Structures: Structures, Using Functions with Structures,FingerprintAnalysis,ArraysofStructures, Tsunami Analysis, Dynamic Data Structures. (10hrs)

Textbook:

(1). "ENGINEERING PROBLEM SOLVING WITH C", Delores M. Etter,Pearson,4th Edition, 2013

References:

(1). "The C Programming Language"- Brian W.Kernighan, Dennis M.Ritchie, Prentice Hall, Second Edition, 1988
(2). " Programming in Ansi C" – E Balagurusamy, Tata McGraw Hill, Sixth Edition, 2012
(3). "Let Us C"- YashavantKanetkar, BPB Publications, 13th Edition, 2013

ELS 406 - EMBEDDED SYSTEMS

Unit I

14 Hours

Modeling Dynamic Behaviors: Introduction to CPS approach to embedded systems, Continuous Dynamics, Discrete Dynamics, Hybrid Systems, Composition of State Machines, Concurrent Models of Computation.

Unit II

14 Hours

Design of Embedded Systems: Sensors and Actuators, Embedded Processors, Memory Architectures, Input and Output,Multitasking, Scheduling.

Unit III

14 Hours

Analysis and Verification: Invariants and Temporal Logic, Equivalence and Refinement, Reachability Analysis and Model Checking, Quantitative Analysis, Security and Privacy.

Text Book:

(1). "Introduction to Embedded Systems – A Cyber Physical Systems Approach"- E.A.Lee and S.A.Seshia, U.C.Berkeley – Second Edition, 2015.

References:

(1). "The Art of Designing Embedded Systems" - Jack Ganssle, Elseveir, 2008
(2). "Advances in Design and Specification Languages for Embedded Systems" - SorinA.Huss, Springer, 2007
(3). "UML for Real Design of Embedded Real-Time Systems"- Luciano Lavagno, Grant Martin, Bran Selic, kluwer academic publishers, 2004

ELS 407 - LINUX SHELL PROGRAMMING

Unit I

10 Hours

Learning The Shell
Introduction, What Is The Shell, Navigation, Exploring The System, Manipulating Files And Directories, Working With Commands, Redirection, Seeing The World As The Shell Sees It, Advanced Keyboard Tricks, Permissions, Processes,

Unit II

10 Hours

Configuration, The Environment, Common Tasks And Essential Tools
The Environment, A Gentle Introduction To vi, Customizing The Prompt, Common Tasks And Essential Tools, Package Management, Storage Media, Networking, Searching For Files, Archiving And Backup, Regular Expressions, Text Processing, Formatting Output, Printing, Compiling Programs

Unit III

10 Hours

Writing Shell Scripts
Writing Your First Script,Starting A Project,Top-Down Design,Flow Control: Branching With if,Reading Keyboard Input,Flow Control: Looping With while / until, Troubleshooting, Flow Control: Branching With case, Positional Parameters, Flow Control: Looping With for,Strings And Numbers, Arrays, Exotica.

Textbook:

(1). "The Linux Command Line-A complete Introduction" -William E. Shotts, Jr, Second Edition,A LinuxCommand.org Book, 2013

References:

(1). "Advanced Bash-Scripting Guide-An in-depth exploration of the art of shell scripting"-Mendel Cooper, 2014
(2). "Mastering Linux Shell Scripting" -Andrew Mallett, Packt Publishing, 2015
(3). "Sams Teach Yourself Shell Programming in 24 Hours" - Sams Publishing, 1999

I - Semester

ELS 410 - **Analog Devices and Circuits**

UNIT I

Basic Devices: The r_e transistor model – Small signal analysis of CE configuration. Comparison of the result of CE with CB and CC configurations, Hybrid parameters, analysis of voltage divider bias CE configuration using hybrid equivalent model. Frequency response (low and high) of BJT CE amplifier.

Characteristics of JFET and MOSFET –voltage divider bias – small signal analysis of JFET and MOSFET in CS configuration, Comparison of the results of CS configuration with CG and CD configuration.

14 HOURS

UNIT II

Op-Amps: Introduction to Op-amp, internal block diagram, Characteristics of practical op-amp. Negative feedback, Op-amp with negative feedback and its effect on op-amp impedances. Bias current and offset voltage compensation, open loop and closed loop response.

Op-amp Applications: Comparators, Summing amplifier, Integrator, Differentiator, Isolation amplifier, Instrumentation Amplifier, Active filters (first order, second order Butterworth filters).

14 HOURS

UNIT III

BJT power amplifier circuits – Efficiency and harmonic distortion – Class A, Class B and Class AB operation, Power transistor heat sinking.

Other Devices: SCR operation and its applications, UJT characteristics and its applications. Application of Triac in phase (power) control.

14 HOURS

Text Books:

1. Boylestad and Nashelsky, "Electronic devices and Circuits theory", 8th Edn. (Prentice Hall of India 2002)
2. Floyd T L "Electronic Devices", 5th Edn. (Pearson Education Asia 2002).
3. Samuel.Y.Liao, "Microwave devices and Circuits", 3rd Edn, Prentice Hall of India.

Reference Books:

1. R.A. Gayakwad, "Op-amps and linear integrated circuits", 3rd edn. (Prentice Hall of India 2002).
2. Sedra and Smith "Microelectronic Circuits", 4th Edn. (Oxford University Press (India))

II Semester

ELH 451 - ANALOG AND DIGITAL COMMUNICATION

Unit – I

14 hours

Modulation Process: Need for Modulation, Types-Amplitude Modulation–Principles, AM Transmitters, AM Receivers- Super-Heterodyne Receiver, Angle Modulation, Frequency Modulation- Principles, Pre-emphasis, De-emphasis, FM Transmitter, FM Receiver, Phase Modulation-Principles. Vestigial Side-band Modulation (VSB): Frequency-domain description, Generation of VSB-Modulation wave, Time-domain description, Comparision of Amplitude Modulation and FM techniques, Frequency translation, Frequency division multiplexing.

Unit-II

14 Hours

Digital Communication: Basic Signal Processing operation in Digital Communication, Sampling Principle, Sampling Theorem, Waveform coding technique, information theory and coding analogversusdigital communication.

Digital Data and Pulse Modulation: Pulse Amplitude Modulation, Pulse WidthModulation, Pulse Position Modulation, Pulse Code Modulation, Amplitude Shift Keying, Frequency Shift Keying Differential Phase shift Keying, Quadrature phase shift keying, Delta modulation, Differencial PCM, Comparisions of PAM, PPM, PWM and ASK, FSK, PSK.

Unit –IV

14 Hours

Noise in Communication Systems: Introduction, Shot noise, Thermal noise, White noise,Calculation – Noise figure and Noise factor, brief introduction to Noise in AM Systems, FM Systems and in digital modulation schemes.

Spread Sectrum signals for digital Communication: Introduction to spread spectrummodulation, DSSS, FHSS, CDMA signals, code acquisition and tracking, spread spectrum as multiple access techniques, Multichannel and multicarrier systems.

Text Books:

1. Wayne Tomasi-"Electronic Communication systems", Pearson Asia, 3rd edition.
2. George Kennedy & Bernard Davis, "Electronic Comminication Systems", TMH Publications.
3. Simon Haykins, "Communication Systems", 4th Edition, John wiley Publication.
4. An Indtroduction to Analog and Digital Communication, Simon Haykins, John Wiley India Pvt. Ltd, 2008

Reference Books:

1. "Digital Communication", J S Chitode, Technical Publications, Pune
2. "Digital Communications", J Proakis, McGraw Hill, 2000
3. K N hariBhat and D Ganesh Rao, "Analog Communication", 2nd edition, sanguine technical publication.
4. K N HariBhat and D Ganesh Rao, Digital Communication", 3rd edition, snguine technical publication.

ELH 452 - DIGITAL SIGNAL PROCESSING

Unit I

14 Hours

Introduction, Discrete-time signals and systems, The z -transform, Fourier representation of signals, Transform analysis of LTI systems,

Unit II

14 Hours

Sampling of continuous-time signals, The Discrete Fourier Transform, Computation of the Discrete Fourier Transform.

Unit III

14 Hours

Structures for discrete-time systems, Design of FIR filters, Design of IIR filters

Text book:

(1). "Applied Digital Signal Processing - Theory and Practice" - Dimitris G. Manolakis, Vinay K. Ingle, Cambridge University Press, First Edition, 2011

Reference Books:

(1). "Digital Signal Processing : Principles, Algorithms, and Applications"- Dimitris G. Manolakis, John G. Proakis, Pearson, 4th Edition, 2007
(2). "Understanding Digital Signal Processing" - Richard G.Lyons , Prentice Hall, Third Edition, 2011
(3). "The Scientist and Engineer's Guide to Digital Signal Processing" - Steven W. Smith, California Technical Publishing San Diego, California, Second Edition, 1999.

II Semester

ELH 453 - BASIC VLSI DESIGN

Unit I

12 Hours

A Review of Microelectronics and An Introduction to MOS Technology: Introduction to Integrated Circuit Technology, The Integrated Circuit (IC), Metal-Oxide-semiconductor (MOS) and Related VLSI Technology, Basic MOS Transistors, Enhancement Mode Transistor Action Depletion Mode Transistor Action, nMOSFabr:cation, CMOS Fabrication, Thermal Aspects of Processing, BiCMOS.

Unit II

15 Hours

Basic Electrical Properties of MOS and BiCMOS Circuits: Drain-to-Source Current *Ids* versus Voltage *Vds*Relationships, Aspects of MOS Transistor Threshold Voltage V_t, MOS Transistor Transconductance*gm*and Output Conductance *gds*, MOS Transistor Figure of Merit Wo, The Pass Transistor, The nMOS Inverter, Determination of Pull-up to Pull-down Ratio *(ZpulZp.d)* for an nMOSInverter Driven by another nMOS Inverter, Pull-up to Pull-down Ratio for an nMOS Inverter Driven throughOne or More Pass Transistors, Alternative Forms of Pull-up, The CMOS Inverter, MOS Transistor Circuit Model, Some Characteristics of npn Bipolar Transistors, Latch-up in CMOS Circuits, BiCMOS Latch-up Susceptibility.

Unit III

15 Hours

MOS and BiCMOS Circuit Design Processes : MOS Layers, Stick Diagrams, Design Rules and Layout, General Observations on the Design Rules, Layout diagrams, Symbolic Diagrams.

Basic Circuit Concepts : Sheet Resistance *Rs*, Sheet Resistance Concept Applied to MOS Transistors and Inveners, Area Capacitances of Layers, Standard Unit of Capacitance Cg, Some Area Capacitance Calculations, The Delay Unit t, Inverter Delays, Driving Large Capacitive Loads, Propagation Delays, Wiring Capacitances, Choice of Layers.

Scaling of MOS Circuits: Scaling Models and Scaling Factors, Scaling Factors for Device Parameters, Some Discussion on and Limitations of Scaling, Limits Due to Sub-threshold Currents, Limits on Logic Levels and Supply Voltage Due to Noise, Limits Due to Current Density.

TEXT BOOKS:

2. "Basic VLSI Design," Douglas A. Pucknell& Kamran Eshraghian, PHI 3rd Edition, 2005.

Reference Books

2. "Principles of CMOS VLSI Design,"Neil H. E. Weste and K. Eshragian,2nd edition, Pearson Education (Asia) Pvt. Ltd., 2000. History of VLSI.

3. "CMOS VLSI Design,".Weste and David,3rd edition, 2011.

ELS 454 - EMBEDDED SYSTEM DESIGN USING PIC

Unit I

10 Hours

Minimum embedded Systems:Getting Started with Embedded Systems, Tiny computers, hidden control, Minimum Systems and the PIC 16F84A, Introducing the PIC mid-range family and the 16F84A, Parallel ports, power supply and the clock oscillator, Starting to program – an introduction to Assembler, Building Assembler programs, Working with time: interrupts, counters and timers.

Unit II

10 Hours

Larger Systems: Larger Systems and the PIC 16F873A, The human and physical interfaces, Taking timing further, Starting with serial, Data acquisition and manipulation, Some PIC microcontroller advances, Smarter Systems and the PIC 18F2420.

Unit III

10 Hours

Smarter and Bigger Systems: Introducing C, C and the embedded environment, More C and the wider C environment, Multi-tasking and the real-time operating system, The Salvo real-time operating system, Distributed Systems, a survey of larger PIC microcontrollers

TextBook:

(1). "Designing Embedded Systems using PIC microcontrollers - Principles and Applications"- Tim Wilmshurst, Second Edition, Elesevier, 2010

References:

(1). "Designing Embedded Systems with 32-Bit PIC Microcontrollers and MikroC" - Dogan Ibrahim, Elsevier Ltd, 2014

(2). "Interfacing PIC Microcontrollers to Peripherial Devices"-BohdanBorowik, Springer, 2011

(3). "The Art of Designing Embedded Systems" - Jack Ganssle, Elseveir, 2008

ELS 455 - NETWORK ANALYSIS

Unit I

10 Hours

Introduction; Relationship of Circuit Analysis to Engineering, Analysis and Design, Computer-Aided Analysis, Successful Problem-Solving Strategies.basic components and electric circuits; Units and Scales, Charge, Current, Voltage, and Power. Voltage and Current Sources, Ohm‟s Law.

voltage and current laws, Nodes, Paths, Loops, and Branches, Kirchhoff‟s Current Law and Voltage Law. The Single-Loop Circuit, The Single-Node-Pair Circuit, Series and Parallel Connected Sources, Resistors in Series and Parallel, Voltage and Current Division. basic nodal and mesh analysis; Nodal Analysis, The Supernode, Mesh Analysis, The Super mesh, Nodal vs. Mesh Analysis: A Comparison, Computer-Aided Circuit Analysis.

Unit II

10 Hours

Handy circuit analysis techniques; Linearity and Superposition, Source Transformations, Thévenin and Norton Equivalent Circuits, Maximum Power Transfer, Delta-Wye Conversion, Selecting an Approach: A Summary of variousTechniques.

the operational amplifier; The Ideal Op Amp: A Cordial Introduction, Cascaded Stages, Circuits for Voltage and Current Sources, Practical Considerations, Comparators and the Instrumentation Amplifier.

capacitors and inductors; The Capacitor, The Inductor, Inductance and Capacitance Combinations, Consequences of Linearity, Simple Op Amp Circuits with Capacitors, Duality, Modeling Capacitors and InductorswithPSpice.

Unit III

10 Hours

Basic RL and RC circuits; The Source-Free RL Circuit, Properties of the Exponential Response, The Source-Free RC Circuit, A More General Perspective, The Unit-Step Function, Driven RL Circuits, Natural and Forced Response, Driven RC Circuits, Predicting the Response of Sequentially Switched Circuits. The RLC circuit; The Source-Free Parallel Circuit, The Overdamped Parallel RLC Circuit, Critical Damping, The Underdamped Parallel RLC Circuit, The Source-Free Series RLC Circuit, The Complete Response of the RLC Circuit, The Lossless LC Circuit.

two-port networks; One-Port Networks, Admittance Parameters, Some Equivalent Networks, Impedance Parameters, Hybrid Parameters, Transmission Parameters.

Text Books:

1. "Engineering Circuits Analysis," William H. Hayt, Jack E. Kemmerly, Steven M. Durbin, 8th Edition, McGraw-Hill Publication, 2012.

Reference Books:

1. "Introduction to Modern Network Synthesis,"VanValkenbergM.E.,John Wiley and Sons, Inc, 1960.
2. "Network Analysis and Synthesis," Franklin. F. Kuo, II Ed, John Wiley & sons, 1999.
3. "Network Analysis & Synthesis," UmeshSinha, SatyaPrakash Pub.

ELS 456 - CONTROL SYSTEM

Unit I

10 Hours

Introduction to Control Systems: Introduction to control Systems, Closed-Loop Control Versus open-Loop Control, Design and Compensation of Control Systems.
Mathematical Modelling of Control Systems: Introduction, Transfer Function and Impulse-Response Function, Automatic Control Systems, Modelling in State Space, State-Space Representation of Scalar Differential Equation Systems
Mathematical Modeling of Mechanical Systems and Electrical Systems: Introduction, Mathematical Modelling of Mechanical Systems, Mathematical Modelling of Electrical Systems

Unit II

10 Hours

Control Systems Analysis and Design by the Root-Locus Method: Introduction, Root-Locus Plots Root-Locus Plots of Positive Feedback Systems, Root-Locus Approach to Control-Systems Design, Lead Compensation, Lag Compensation, Lag–Lead Compensation, Parallel Compensation
Control Systems Analysis and Design by the Frequency-Response Method: Introduction, Bode Diagrams, Polar Plots, Log-Magnitude-versus-Phase Plots, Nyquist Stability Criterion, Stability Analysis, Relative Stability Analysis, Closed-Loop Frequency Response of Unity-Feedback Systems, Experimental Determination of Transfer Functions, Control Systems Design by Frequency-Response Approach, Lead Compensation, Lag Compensation, Lag–Lead Compensation.

Unit III

10 Hours

PID Controllers and Modified PID Controllers: Introduction, Ziegler–Nichols Rules for Tuning PID Controllers, Design of PID Controllers with Frequency-Response Approach, Design of PID Controllers with Computational Optimization Approach, Modifications of PID Control Schemes, Two-Degrees-of-Freedom Control, Zero-Placement Approach to Improve Response Characteristics,
Control Systems Analysis in State Space: Introduction, State-Space Representations of Transfer-Function Systems, Solving the Time-Invariant State Equation, Some Useful Results in Vector-Matrix Analysis, Controllability, Observability.

Text book:

1. "Modern Control Engineering" Katsuhiko Ogata. Pearson publication,Fifth Edition

Reference book:

1. "Control Systems Engineering". J. Nagrath and M. Gopal, New Age International (P) Limited, Publishers, Second Edition.

ELS 457 - POWER ELECTRONICS

Unit I

6 Hours

Power Semi-Conductor Devices
Study of switching devices, - Frame, Driver and snubber circuit of SCR, TRIAC,BJT, IGBT, MOSFET,- Turn-on and turn-off characteristics, switching losses, Commutation circuits for SCR

Unit II

6 Hours

Phase-Controlled Converters
2-pulse, 3-pulse and 6-pulse converters – Effect of source inductance – performance parameters – Reactive power control of cnverters – Dual converters - Battery charger.

Unit III

6 Hours

DC to DC Converter
Step-down and step-up chopper - Time ratio control and current limit control – Buck, boost, buck- boost converter, concept of Resonant switching - SMPS.

Unit IV

6 Hours

Inverters
Single phase and three phase (both 1200 mode and 1800 mode) inverters - PWM techniques: Sinusoidal PWM, modified sinusoidal PWM - multiple PWM – Introduction to space vector modulations - Voltage and harmonic control - Series resonant inverter - Current source inverter.

Unit V

6 Hours

AC to AC Converters
Single phase AC voltage controllers – Multistage sequence control - single and three phase cycloconverters –Introduction to Integral cycle control, Power factor control and Matrix converters.

Textbook

1. M.H. Rashid, „Power Electronics: Circuits, Devices and Applications‟,
Pearson Education, PHI Third edition, New Delhi 2004.
2. Philip T.Krein, “Elements of Power Electronics” Oxford University Press, 2004 Edition.

References

1. Ashfaq Ahmed Power Electronics for Technology Pearson Education, Indian reprint, 2003.
2. P.S.Bimbra “Power Electronics” Khanna Publishers, third Edition 2003.
3. Ned Mohan, Tore.M.Undeland, William.P.Robbins, „Power Electronics: Converters, Applications and Design‟, John Wiley and sons, third edition, 2003.

ELE 460 - ELECTRONIC COMMUNICATION
(Open Elective)

Unit I

10 hours

Electronic communication systems, electromagnetic spectrum, noise analysis.
Amplitude modulation: Principles of AM modulator circuits, AM transmitter, AM receivers,SSB communication systems,
Frequency modulation: Principles of FM, FM transmitter, FM receiver

Unit II

10 hours

Transmission lines: Transverse electromagnetic waves, Types of transmission lines,equivalent circuit, wave propagation
Antennas and waveguides: Antenna terminology, basic antennas, antenna loading, antennaarrays, special purpose antennas, UHF and microwave antenna, waveguides

Unit III

10 hours

Data communication:
Data communication codes, synchronization, data communication hardware, RS-232 interface, telephone network, telephone circuit
Data modems: Asynchronization modems, synchronization modems, low speed modems,medium high speed modems.
Data communication network: ISDN, LAN, Ethernet, Cellular telephone, CDMA, GSM formobile communication, Introduction to satellite communication

Textbooks:

1) "Electronic Communication Systems" by Wayne Tomasi, Pearson publication, 5th ed.,2009

2) "Communication Systems" by Simon Haykin, john wiley and sons inc., 4th ed., 2001

Ref. Books:

1) "Electronic Communication Systems" by Kennedy and Davis,Tata McGraw-Hill Edition,4th ed.

2) "Electronic Communication" by Roddy and Coolen, Pearson Education publication, 4th ed.

III semester

ELH 501 - DIGITAL IMAGE PROCESSING

Unit I

14 hours

Introduction and Digital Image fundamentals: Introduction to Digital Image Processing, Elements of Visual Perception, Light and the Electromagnetic Spectrum, Image Sensing and Acquisition, Image Sampling and Quantization,, Some Basic Relationships Between Pixels, Mathematical tools used in DIP.
Intensity Transformations and Spatial Filtering: Somebasic intensity Transformation Functions, Histogram Processing, Fundamentals of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters, Combining Spatial Enhancement Methods.

Unit II

14 hours

Filtering in Frequency Domain: Preliminary concepts, Sampling, Fourier Transform of sampled Functions, The DFT of one variable, Extension to functions of two variables, Properties of 2D DFT, Basics of Filtering in the Frequency Domain, Image Smoothing using Frequency-Domain Filters, Image Sharpening using Frequency Domain Filters, Selective Filtering, Implementation.
Image Restoration and Reconstruction: Model of the Image Degradation/Restoration Process, Noise Models, Restoration in the Presence of Noise Only–Spatial Filtering, Periodic Noise Reduction by Frequency Domain Filtering, Linear Position-Invariant Degradations, Estimating the Degradation Function, Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering, Constrained Least Squares Filtering, Geometric Mean Filter, Image reconstruction from projections.

Unit III

14 hours

Morphological Image Processing: Preliminaries, Erosion and Dilation, Opening and Closing, the Hit or Miss Transformation, Basic Morphological Algorithms, Gray Scale Morphology

Image Segmentation: Fundamentals, Point, Line and Edge Detection, Thresholding, Region-Based Segmentation
Color Image Processing: Color Fundamentals, Color Models, Pseudo-color Image Processing, Full-Color Image Processing, Color Transformations, Smoothing and Sharpening, Image Segmentation based on color, Noise in Color Images, Color Image Compression. .

Text Books:

1. "Digital Image Processing", Rafael Gonzalez and Richard Woods, PHI.2nd Edition.

Reference Books:

1. "Fundamentals of Digital Image Processing", A. K. Jain, Prentice Hall of India, 1989.
2. "Digital Image Processing", W. K. Pratt,Prentice Hall, 1989.

ELH 502 - LOW POWER VLSI CIRCUIT DESIGN

Unit-I

12 Hours

Low-Power CMOS VLSI: introduction, sources of power dissipation, designing for low power. Physics of power dissipation in CMOS FET devices: introduction, physics of power dissipation in MOSFET devices, power dissipation in CMOS, Low power VLSI design limits.

Power Estimation; Modeling of signals, signal probability calculation, probability technique for signal activity estimation, statistical techniques, estimation of glitching power, sensitivity analysis, power estimation using input vector compaction and dissipation on in Domino CMOS, circuit reliability, high level power estimation, information theory based approaches, estimation of maximum power.

Unit-II

15 Hours

Synthesis for low power; behavioral level transforms, logic level optimization for low power, circuit level.

Design and test on low voltage CMOS circuits; introduction, circuit design style, leakage current in sub-micrometer transistor, deep sub-micrometer device design issues, key to minimizing SCE, low voltage circuit design techniques, test deep sub-micrometer IC‟s with elevated intrinsic leakage, multiple supply voltages.

Unit-III

15 Hours

Low power static RAM architecture; introduction, organization of a static RAM, MOS static RAM memory cell, banked organization of SRAMs, reducing voltage swings on bit lines, reducing power swing in the write driver and sense amplifier circuits, method for achieving low core voltages from a single supply. Low energy computing using energy recovery technique; energy dissipation in transistor channel using an RC model, energy recovery circuit design, design with partially reversible logic, supply clock generation.

Text Books:

1. "Low-power CMOS VLSI circuit design" by Kaushik Roy and Shart C. Prasad, Wiley-Interscience publication, 2000.

Reference:

1. "CMOS Low Power Digital Design," A. Chandrakasan& R. Brodersen, Kluwer Academic Pubs. 1995.
2. "Low Power Design Methodologies,"J. Rabaey& M. Pedram (Editors), Kluwer Academic Pubs. 1996.

III - Semester

ELH 503 - Wireless Communication Systems

UNIT I

Introduction to Wireless Communication Systems: Evolution of Mobile Radio Communications, Mobile Radio Systems around the world, examples of Wireless Communication Systems, Paging System, Cordless Telephone System. Cellular Telephone Systems, Comparison of Common Wireless Communications Systems.

Modern Wireless Communications Systems: Second generation (2G), Cellular Networks, evolution of 2.5G, TDMA Standards, Third Generation (3G) Wireless Networks, Wireless Local Loop (WLL) and LMDS, Wireless Local Area Networks (WLANs), Bluetooth and Personal Area Networks (PANS) **14 hours**

UNIT II

The Cellular Concept: System Design Fundamentals, Introduction, Frequency reuse, channel assignment strategies, handoff strategies – prioritizing handoffs, Practical Handoff considerations, Interference and system capacity, co-channel interference and system capacity, channel planning for wireless systems, adjacent channel interference, power control for reducing interference

Mobile Radio Propagation: Introduction to radio wave propagation, Free space propagation model, Relating power to electric field, Reflection, Diffraction, Scattering. **14 hours**

UNIT III

Multiple Access Techniques for Wireless Communications: Introduction to Multiple access, Frequency Division Multiple Access (FDMA), Time Division Multiple Access (TDMA), Spread Spectrum Multiple Access, Space Division Multiple Access (SDMA). Packet radio.
Wireless Networking: Introduction to wireless networks, Differences between wireless and fixed telephone network-PSTN network, Development of Wireless network, Fixed network transmission hierarchy, personal communication services/ networks, Wireless data services, ISDN & ATM, PRMA & UMTS **14 hours**

Text Books:

1. Theodore S Rappaport: Wireless Communications, Principles and Practice, 2 nd Edition, Pearson Education Asia, 2002.

Reference Books:

3. William C Y Lee: Mobile Communications Engineering Theory and Applications, 2nd Edition, McGraw Hill Telecommunications 1998.
4. William Stallings: Wireless Communications and Networks, Pearson Education Asia, 2002.

III Semester

ELS 504 – NANOELECTRONICS

Unit -I **8 Hours**

Nanoscience and Nanoelectronics

Introduction to Nanoscience and nanoelectronics, the top-down approach, the bottom- up approach, Miniaturization of Electrical and Electronic Devices, Moore's Law and the SIA Roadmap.

Nanolayers

Production of Nanolayers, Physical Vapour Deposition (PVD), Chemical Vapour Deposition (CVD) Epitaxy, Ion Implantation, Formation of Silicon Oxide, Characterization of Nanolayers, Thickness, Surface Roughness, Crystallinity, Chemical Composition, Doping Properties, Optical Properties, Applications of Nanolayers, Evaluation and Future Prospects.

Unit -II **12 Hours**

Nanoparticles

Fabrication of Nanoparticles, Grinding with Iron Balls, Gas Condensation Laser Ablation, Thermal and Ultrasonic Decomposition, Reduction Methods, Self-Assembly, Low-Pressure, Low-Temperature Plasma, Thermal High-Speed Spraying of Oxygen/Powder/Fuel, Atom Optics, Sol gels, Precipitation of Quantum Dots, Other Procedures, Characterization of Nanoparticles, Optical Measurements, Magnetic Measurements, Electrical Measurements, Applications of Nanoparticles, Evaluation and Future Prospects.

Extension of Conventional Devices by Nanotechniques

MOS Transistors, Structure and Technology, Electrical Characteristics of Sub-100 nm MOS Transistors, Limitations of the Minimum Applicable Channel Length, Low-Temperature Behavior, Evaluation and Future Prospects, Bipolar Transistors, Structure and Technology, Evaluation and Future Prospects.

Unit -III **10 Hours**

Innovative Electronic Devices Based on Nanostructures

General Properties, Resonant Tunneling Diode, Operating Principle and Technology, Applications in High Frequency and Digital Electronic, Circuits and Comparison with Competitive Devices, Quantum Cascade Laser, Operating Principle and Structure, Quantum Cascade Lasers in Sensing and Ultrafast Free, Space Communication Applications, Single Electron Transistor, Operating Principle, Technology, Applications, Carbon Nanotube Devices, Structure and Technology, Carbon Nanotube Transistors

1) **Nanotechnology and Nanoelectronics:** Materials, Devices, Measurement Techniques by W. R. Fahrner (Editor)

ELS 505 - MICROWAVE ENGINEERING

Unit I **10 Hours**

Microwave devices: Klystron, Velocity Modulation, Bunching process reflex Klystron efficiency, magnetron and traveling wave tubes: Principle of operation of Magnetron, Microwave characteristics, Helix TWT‟s, amplification process, microwave transistor, MESFETs, Transfered Electron Devices, Gunn effect, principle of operations, mode of operation , IMPATT, TRAPATT diodes.

Unit II

10 Hours

RADAR: Introduction, Radar block diagram and operation, RADAR equation, factor affecting range of RADAR, maximum unambiguous range, Pulse RADAR System, RADAR display, scaning and tracking with radar, Doppler effect, CW Doppler radar, MTI, Frequency Modulated CW RADAR and RADAR antennas.

Unit III

10 Hours

Satellite Communication: Introduction, Kepler‟s law, Orbits geostationary orbits, powersystems, attitude Control, TT&C. Transponders, antenna subsystems, station keeping, uplink and downlink budget calculations.

Text Books:

1. S Y Liao: Microwave devices and circuits, PHI 1980
2. M I Skolik: Introduction to radar system, 2/c McGram Hill, 1990
3. A K Sen and A B Bhattacharya, Radar Systems and radio aids to navigation 2/c Khanna Publications, New Delhi 1992.
4. Roddy and Coolen: Electronic Communications, 4/c, PHI, 1995.
5. B C Agrawal: satellite Communication, Khanna Publications
6. A S Tabebbaym: Computer Network, 3/c, PHI, 1999
7. M Kulakarni: Microwave and radar engineering, Umesh publications.

ELS 506 - DSP PROCESSORS

Unit I

10 Hours

Programmable Digital Signal Processors: A Survey, VLIW Processor Architectures and Algorithm Mappings for DSP Applications, Multimedia Instructions in Microprocessors for Native Signal Processing

Unit II

10 Hours

Reconfigurable Computing and Digital Signal Processing:Past, Present, and Future, Parallel Architectures for Programmable Video Signal Processing, OASIS: An Optimized Code Generation Approach for Complex Instruction Set PDSPs

Unit III

10 Hours

Digital Signal Processing on MMX Technology, Hardware/Software Cosynthesis of DSP Systems, Data Transfer and Storage Architecture Issues and Exploration in Multimedia Processors

Text Book:

(1). "Programmable Digital Signal Processors Architecture, Programming, and Applications"-edited by Yu Hen Hu, Marcel Dekker, Inc., 2002

References:

(1). "DSP Processor Architectures Fundamentals -Architectures and Features"-Phil Lapsley, Jeff Bier,AmitShoham,Edward A. Lee, IEEE & a john wiley& sons, inc., publication, 1996

(2). " Embedded DSP processor Design - Application Specific Instruction Set Processors"-Duke Liu, Morgan Kaufmann, 2008

ELS 507 - SPEECH PROCESSING

Unit I

14 Hours

Introduction to Discrete- Time Speech Signal Processing, A Discrete- Time Signal Processing Framework, Production and Classification of Speech Sounds, Acoustics of Speech Production.

Unit II

14 Hours

Analysis and Synthesis of Pole-Zero Speech Models, Homomorphic Signal Processing, Short-Time

Fourier Transform Analysis and Synthesis.

Unit III

14 Hours

Filter-Bank Analysis/Synthesis, Nonlinear Measurement and Modeling Techniques, Speech Coding,

Speech Enhancement, Speaker Recognition.

Textbook:

(1). "Discrete- Time Speech Signal Processing"- Thomas F. Quatieri, prentice hall signal processing series, 2002

Reference Books:

(1). "Introduction to Digital Speech Processing"- Lawrence R. Rabiner, Ronald W. Schafer, Foundations and Trends ® in Signal Processing, 2007
(2)."Applied Speech and Audio Processing With M ATLAB Examples" - Ian Mcloughlin, cambridge university press, 2009
(3). "Digital Speech Processing Using Matlab"- E. S. Gopi, Springer India, 2014

ELE 510 - MEDICAL ELECTRONICS
(Open Elective)

Unit – I

10 hours

Introduction: History of Medical Devices, the Role of Biomedical Engineering Technologists in Health Care Characteristics of Human Anatomy and Physiology That Relate to Medical Devices

Diagnostic Devices: Physiological Monitoring Systems Overview Integration and Connectivity, Central Stations, Telemetry.

Diagnostic Device for Heart: Electrocardiogram (ECG) Monitors and Machines, Electrocardiograph – ECG Electrodes, Amplifiers Interference, Filters, Lead Arrangements, Patient Isolation, Digital Systems, Waveform Analysis and Measurements, Stress Testing, Ambulatory ECG Recorders/Analysis Systems.

Unit –I I

10 hours

Diagnostic Device for Circulatory System and Blood: Introduction, Hypertension, Hypotension, Blood Pressure Measurement,PulseOximeters,Transcutaneous CO2 Analyzers, Blood Chemistry Analyzers, Glucometers. Doppler Blood Flow Detectors

Diagnostic Device for Respiratory System: Pulmonary Function Analyzers, Respiration Monitors, Capnography Monitors, Oxygen Analyzers, Bronchoscopy Systems.

Diagnostic Device for Nervous System: Clinical significance of EEG, Multi-channel EEG recording system, Epilepsy, Evoked Potential recording system, MEG (Magneto Encephalon Graph). EEG Bio Feedback Instrumentation

Diagnostic Device for Digestive System: Endoscopes, Types of Endoscopes, Rigid Endoscopes, Flexible Endoscopes, Other System Components, Video Recorder/Storage, Video Monitor

Unit- III

10 hours

Diagnostic Imaging system: X-Rays, Computed (Axial) Tomography Scanners, Magnetic Resonance Imaging Scanners, Positron Emission Tomography, Diagnostic Ultrasound

Treatment Devices: Heart, Circulatory System and Blood, Respiratory System, Nervous System, Renal System, Sensory Organs, Reproduction, Skin, Bone, Muscle, and Miscellaneous

Text Book:

1. "Introduction to Biomedical Engineering Technology" Laurence Street, CRC Press Taylor & Francis Group
2. , "Medical Devices and Systems" ,Joseph D. Bronzino, CRC Press Taylor & Francis Group, Third Edition.
3. "Biomedical Instrumentation and Measurements" Leslie Cromwell, Fred J. Weibell, PHI, 15th Edition.

Reference Book:

1. "Medical Instrumentation Application and Design, third edition", John G. Webster, Wiley India Edition, 2007.
2. "Introduction to Biomedical equipment technology", Joseph J. Carr and John M. Brown, PHI, 2003.

IV Semester

ELS 552 - INTRODUCTION TO ARDUINO,RASPBERRY- PI AND BEAGLEBONE BLACK

Unit I

14 Hours

Home Automation using Raspberry Pi and Arduino: An Introduction to the Raspberry Pi, Arduino,andHomeAutomation,SettingupRaspberryPi,SettingupRaspberryPitoArduino BridgeShield,FirstProject–ABasicThermometer,FromThermometertoThermostat.

Unit II

14 Hours

Home Automation using Raspberry Pi and Arduino: Building upon the FirstProject, TemperatureStorage–SettingupaDatabasetoStoreYourResults,CurtainAutomation–Openand Close the Curtains Based on the Ambient Light, The future of homeautomation

Unit III

14 Hours

Programming the Beagle Bone Black: JavaScript Basics, JavaScript Functions andTimers, Arrays, Objects, and Modules, BoneScript, Hardware Interfacing, Using Capes and Modules,WebInterfaces,ARovingRobot,E-mailNotifier

TextBooks:

(1). "RaspberryPiHomeAutomationwithArduino"-AndrewK.Dennis,Packt,2013
(2). "Programming the BeagleBone Black-Getting Started with JavaScript and BoneScript" -Simon Monk, McGraw Hill,2014

References:

(1). "Bad to the Bone - Crafting Electronic SystemsvwithBeagleBone and BeagleBone Black"-
Steven F. Barrett , Jason Kridner, Morgan and Claypool Publishers,2013
(2). "Exploring Beagle Bone Tools and Techniques for Building with Embeddded Linux" -Derek Molloy, Wiley,2015
(3). "The official raspberry pi projects book"- from the makers of magpi, the official RaspberryPi magazine
(4). "Raspberry Pi Cookbook" - Simon Monk, Oreilly ,2013

ELS 553 - VIDEO PROCESSING

Unit – I

15 hours

introduction to video processing, sampling and aliasing, introduction to digital filtering, video scaling, video deinterlacing, alpha blending, sensor processing for image sensors, video interfaces, video rotation,

Unit-II

15 hours

entropy, predictive coding and quantization, image compression fundamentals, video compression fundamentals, MPEG-2, h.264 video compression standard, video noise and compressionartifacts,

Unit-III

12 hours

video modulation and transport, video over ip, segmentation and focus, memory considerations when building a video processing design, debugging FPGA-based video systems

Text book:

(1). “Digital Video Processing For Engineers - A Foundation For Embedded Systems Design” - Michael Parker, SuhelDhanani, Elsevier, 2013.

ELS 554 - VLSI DESIGN USING CAD

Unit-I

10 Hours

The Characteristics of Digital Electronic Design, Design Environments; Introduction,SystemLevel, Algorithm Level, Component Level, Layout Level. Representation; Introduction,General Issues of Representation, Hierarchy Representation, View Representation,Connectivity Representation, Geometry Representation.
Synthesis Tools; Introduction, Cell Contents Generation and Manipulation, Generators ofLayout Outside the Cells, Cells and Their Environment, Silicon Compilers, PostlayoutGenerators.

Unit-II

10 Hours

Static Analysis Tools; Node Extraction, Geometrical Design-Rule Checkers, Electrical-RuleCheckers, Verification, Dynamic Analysis Tools; Circuit-Level Simulators, Logic-LevelSimulators, Functional- and Behavioral-Level, Simulation Issues, Event-Driven Simulation,Hardware and Simulation.The Output of Design Aids; Circuit Boards, Integrated Circuits,Implementation Issues.

Unit-III

10 Hours

Programmability; Imperative Programming, Declarative Programming, Hierarchy.Graphics;IntroductionDisplay Graphics, Hardcopy Graphics, Input Devices, Human Engineering; Introduction, Task and User Modeling, Information Display, Command Language, Feedback. Electric; Introduction, Representation, Programmability, Environments, Tools, Designing aChip.

Text Books:

1. "Computer Aids for VLSI Design,"Steven M. Rubin, 2nd, 1994.
2. "Computer Design Aids for VLSI Circuits," P. Antognetti, D.O. Pederson and H. de Man, NATO ASI Series, MartinusNijhoff Publication, USA, 1980.

Reference Books:

1. Modern VLSI Design, Wayne Wolf, 3rd Ed, Prentice-Hall, 2002.
2. Genetic Algorithms: For Vlsi Design, Layout & Test Automation, P Mazumder and E M RUdniak, Pearson, 1999.

ELS 555 - BIO-MEDICAL ELECTRONICS

Unit-I

10 Hours

Introduction to biomedical instrumentation: Basic concept of medical instrumentation, Basic sensor and principles, amplifier and signal processing. Sources of bioelectric potentials: Resting and action potentials, propagation of action potentials, the bioelectric potential

Bio Potential Electrodes: Origin of bio potential and its Propagation, Electrode theory, Electrode-electrolyte interface, electrode– skin interface, half-cell potential, electrode impedance, polarization effects of electrode- non-polarizable electrodes, Types of electrodes, electrolysis & arching, Stimulating electrodes, capacitive electrodes,

Electrode-tissue interaction, internal electrodes, electrodes on a subject, tissue response to electrolytes, skin abrasion

Unit-II

10 Hours

Bio-potential Amplifier: Basic requirements, the electro cardiograph, problem frequently encountered, transient protection, common-mode and other interference reduction circuits, amplifier for other Bio-potential pre-amplifier, other Bio-potential signal processor. Blood Pressure: Direct Measurements, Harmonic Analysis of Blood Pressure Waveform, Dynamic Properties of Pressure Measurement System response, Band width required for measuring blood pressure, typical pressure waveform distortion system for measuring venous pressure, heart sound, phonocardiography, and cardiac catheterization, effect of potential and kinetic energy on pressure measurements, indirect measurement of blood pressure, tonometry.

Unit –III

10 Hours

Measurement of flow and volume: indication-Dilution method that use continuous infusion, indicator-dilution method that use Rapid Injection, Electromagnetic Flow meters ,ultrasonic flow meters, thermal convection velocity sensors, chamber plethysmography, electrical impedanceplethysmography, Photoplethysmography.

Measurement of the respiratory system:modelling the respiratory system, measurement of pressure, measurement of gas flow, lung volume, and respiratory plethysmography, some test for respiratory mechanism, and measurement of gas concentration.

Diagnostic Imaging system: X-Rays, Computed (Axial) Tomography Scanners, Magnetic Resonance Imaging Scanners, Positron Emission Tomography, Diagnostic Ultrasound

Text Book:

1. "Medical Instrumentation Application and Design",John G. Webster, John Wiley, New York, 2004.
2. "Biomedical Instrumentation and Measurements" Leslie Cromwell, Fred J. Weibell, PHI,15th edition

Reference Book:

1. "Principles of Applied Biomedical Instrumentation", Geddes and Baker ,John Wiley, 3rd Edition, 1989.
2. "Introduction to Biomedical Equipment Technology", Joseph J. Carr and John M. Brown, Prentice Hall, 1998.
3. "Bio-medical Instrumentation", R.S. Khandpur,TataMcGraw-hill, 2nd Edition 2008

Examination Pattern

I SEMESTER								
Subject Code	Subject	Theory Hours/ Week	Practical Hourse/ Week	Duration of Exams (Hrs)	Marks & Credits			
					IA	Exam	Total	Credits
HARD CORE								
ELH 401	Solid State Electronics	3L	1T	3	30	70	100	4
ELH 402	Digital System Design with Verilog HDL	3L	-	3	30	70	100	3
ELH 403	Microcontrollers	3L	-	3	30	70	100	3
SOFT CORE								
ELS 404	Microprocessors	3L	1T	3	30	70	100	4
ELS 405	Programming in C	3L	1T	3	30	70	100	4
ELS 406	Embedded System	3L	1T	3	30	70	100	4
ELS 407	Linux shell Programming	3L	1T	3	30	70	100	4
ELP 408	Digital System Design with Verilog HDL Practical	-	2P	3	30	70	100	2
ELP 408	Microcontrollers Practical	-	2P	3	30	70	100	2

II SEMESTER								
Subject Code	Subject	Theory Hours/ Week	Practical Hourse/ Week	Duration of Exams (Hrs)	Marks & Credits			
					IA	Exam	Total	Credits
HARD CORE								
ELH 451	Analog and Digital Communication	3L	-	3	30	70	100	3
ELH 452	Digital Signal Processing	3L	-	3	30	70	100	3
ELH 453	Basic VLSI Design	3L	1T	3	30	70	100	4
SOFT CORE								
ELS 454	Embedded System Design using PIC	2L	1T	3	30	70	100	3
ELS 455	Network Analysis	2L	1T	3	30	70	100	3
ELS 456	Control System	2L	1T	3	30	70	100	3
ELS 457	Power Electronics	2L	1T	3	30	70	100	3
ELP 458	Analog and Digital Communication Practical	-	2P	3	30	70	100	2
ELP 459	Digital Signal Processing Practical	-	2P	3	30	70	100	2
OPEN ELECTIVE								
ELE 460	Electronic Communication	2L	1T	3	30	70	100	3

III SEMESTER

Subject Code	Subject	Theory Hours/ Week	Practical Hourse/ Week	Duration of Exams (Hrs)	Marks & Credits			
					IA	Exam	Total	Credits
HARD CORE								
ELH 501	Digital Image Processing	3L	-	3	30	70	100	3
ELH 502	Low Power VLSI	3L	-	3	30	70	100	3
ELH 503	Wireless Communication and Networks	3L	1T	3	30	70	100	4
SOFT CORE								
ELS 504	Nano Electronics	2L	1T	3	30	70	100	3
ELS 505	Microwave Engineering	2L	1T	3	30	70	100	3
ELS 506	DSP Processor	2L	1T	3	30	70	100	3
ELS 507	Speech Processing	2L	1T	3	30	70	100	3
ELP 508	DIGITAL Signal Processing Practical	-	2P	3	30	70	100	2
ELP 509	Low Power VLSI Practical	-	2P	3	30	70	100	2
OPEN ELECTIVE								
ELE 510	Medical Electronics	2L	1T	3	30	70	100	3

IV SEMESTER

Subject Code	Subject	Theoretical Explanation/ Demonstration/ week	Practical Hours/ Week	Duration of Exams (Hrs)	Marks & Credits			
					IA	Dissertation	Total	Credits
HARD CORE								
ELP 551	Project	-	16	-	120	280	400	16

Subject Code	Subject	Theory Hours/Week	Practical Hourse/ Week	Duration of Exams (Hrs)	Marks & Credits			
					IA	Exam	Total	Credits
SOFT CORE								
ELS 552	Introduction to Arduino, Raspberrypi and Beaglebone Black	3L	1T	3	30	70	100	4
ELS 553	Video Processing	3L	1T	3	30	70	100	4
ELS 554	VLSI Design using CAD	3L	1T	3	30	70	100	4
ELS 555	Biomedical Electronics	3L	1T	3	30	70	100	4

Note: Summary of Credit Pattern

Semester	Hard Core	Soft Core	Open Elective	Total Credit
I Semester	14	08	-	22
II Semester	14	06	03	20
III Semester	14	06	03	20
IV Semester	16	08	-	24
Total	**58**	**28**	**6***	**86**

*** Not Included for CGPA**