MANGALORE UNIVERSITY

DEPARTMENT OF STUDIES AND RESEARCH IN ELECTRONICS

MSc Electronics CBCS Course Structure

1 Semester

Hard Core

Sl. No.	Course	Credits
1	ELH 401- Analog Devices and Circuits	4
2	ELH 402- Digital System Design	4
3	ELH 403 – Microprocessors and Microcontroller	3
Soft Core		
Sl. No.	**Course**	**Credits**
1	ELS 404 - Programming in C	3
2	ELS 405 – Power Electronics	
3	ELS 406 – Network Analysis	
4	ELS 407 – Verilog HDL	
5	ELS 408 – Signals and Systems	
Practical		
1	ELP 411 – Analog and Digital Experiments	3
2	ELP 412 – Microprocessor and Microcontroller programming	3

II Semester

Hard Core

Sl. No.	Course	Credits
1	ELH 451 - Analog and Digital Communication	4
2	ELH 452 - Digital Signal Processing	4
3	ELH 453 - Basic VLSI Design	3
Soft Core		
Sl. No.	**Course**	**Credits**
1	ELS 454 - Embedded System Design	3
2	ELS 455 – Computer Network	
3	ELS 456 - Control System	
4	ELS 457 – Programming with Embedded Platforms	
5	ELS 458 - Biomedical Instrumentation	
Practical		
1	ELP 461 - Communication Practical	3
2	ELP 462 - Digital Signal Processing Practical	3
Open Elective		
Sl. No.	**Course**	**Credits**
1	ELE 459 – Introduction to Music Technology	3
2	ELE 460 - Electronic Communication	3

III Semester

Hard Core

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

Soft Core

Sl. No.	Course	Credits
1	ELS 504 - Nano Electronics	3
2	ELS 505 - Microwave Devices and Circuits	
3	ELS 506 – Speech and Audio Processing	
4	ELS 507 – PIC Microcontroller	
5	ELS508 – ARM Processor	
6	ELS 513 - Design and Analysis of Algorithms	

Practical

1	ELP 511 - Digital Image Processing Practical	3
2	ELP 512 - VLSI Practical using CAD Tools	3

Open Elective

Sl. No.	Course	Credits
1	ELE 509 – Consumer Electronics	3

IV Semester

Hard Core

Sl. No.	Course	Credits
1	ELP 551 - Project	18

Programme Specific Outcomes of M.Sc (Electronics)

Scientific Temper: To inculcate the temperament required to pursue a scientific discipline with all the basic pillars of science understood, namely, Theory, Experiment and Computation

Mathematical Rigour : To incorporate the methodical way of dealing with the various branches of Electronics through the application of Mathematics

Critical Thinking: To critically evaluate various scientific and engineering problems through the prism of creative and parallel thinking.

Logical Analysis: To develop a strong logical and analytical mind in a students which shall make them good programmers and trouble shooters.

Active Learning: To cultivate a strong base for the active learning with interactive classes and make the students lifelong learners, which is an important demand of the IT and Electronics market place.

Entrepreneurship: To cultivate the spirit of entrepreneurship and to motivate the students to become their own masters, thus becoming 'job creators' rather than job seekers.

I SEMESTER

ELH 401 - ANALOG DEVICES AND CIRCUITS

Course Outcomes:

1. To get familiar with current voltage characteristics of semiconductor devices,
2. Skills to analyze dc circuits and relate ac models of semiconductor devices with their physical Operation
3. Design and analyze electronic circuits, evaluate frequency response to understand the behavior of Electronics circuits
4. To verify the theoretical concepts through laboratory and simulation experiments.
5. To implement mini projects based on concept of electronics circuit concepts.

UNIT I

Energy bands in solids: the energy band theory of crystals, insulator, semiconductor and metal, **Transport phenomena in semiconductor**: The Hall effect, Conductivity modulation, generation and recombination of charges, Diffusion.

Junction Diode characteristics: The pn-junction as rectifier, the components in a pn-junction, IV-Characteristics, diffusion capacitance, breakdown diodes, zener diode, tunnel diodes, Shockley Diode, laser diode, PIN diode, semiconductor photo diode, LED.

16 Hours

UNIT II

Basic Devices: The re 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.

Field Effect Transistor: JFET-Introduction, Construction and Characteristics of JFETs, Transfer Characteristics, Fixed-Bias Configuration, Self-Bias Configuration. MOSFET-working principle and construction of Depletion-MOSFET and Enhancement-MOSFET, Biasing. small signal analysis of JFET and MOSFET in CS configuration, Comparison of the results of CS configuration with CG and CD configuration.

18 Hours

UNIT III

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, Instrumentation Amplifier, Trans-conductance amplifier, Active filters (first order, second order Butterworth filters).

14 Hours

Books:

1. Jacob Millman and Christos C. Halkias, “Integrated Electronics: Analog and Digital Circuits and Systems”, International Student Edition. (McGrow-Hill Kogakusha, Ltd)
2. Boylestad and Nashelsky, “Electronic devices and Circuits theory”, 8th Edn. (Prentice Hall of India 2002)
3. R.A. Gayakwad, “Op-amps and linear integrated circuits”, 3rd edn. (Prentice Hall of India 2002).
4. Sedra and Smith “Microelectronic Circuits”, 4th Edn. (Oxford University Press (India))
5. Floyd T L “Electronic Devices”, 5th Edn. (Pearson Education Asia 2002).

ELH 402 - DIGITAL SYSTEM DESIGN

Course Outcomes:

1. To understand number representation and conversion between different representation in digital electronic circuits.
2. To analyze logic processes and implement logical operations using combinational logic circuits.
3. To understand concepts of sequential circuits and to analyze sequential systems in terms of state machines.
4. To understand the concept of Programmable Devices, PLA, PAL, CPLD and FPGA and implement digital system using VHDL.

Unit -I

Introduction to Digital Design: Electronic Aspects of Digital Design, Integrated Circuits, Programmable Logic Devices, ASIC, PCB, Design Levels.
Digital Circuits: Logic Signals and Gates, Logic Families, CMOS Logic, Electrical Behavior of CMOS Circuits – Steady State and Dynamic Behaviors.

16 hours

Unit -II

Combinational Logic Design Principles: Switching Algebra, Combinational Circuit – Analysis and Synthesis, Minimization Methods, Timing Hazards.
Combinational Logic Design Practices: Combinational PLDs, Decoders, Encoders, Three-State Devices, Mux, Parity Circuits, Comparators.

16 hours

Unit - III

Sequential Logic Design Principles: Bistable Elements, Latches and Flip-flops, Synchronous State Machine – Analysis and Design, Designing State Machines Using State Diagrams and Transition List, Counters, Shift Registers, Sequential Logic Design Practices.
Memory, CPLDs and FPGAs: ROM, RAM – Static RAM, Dynamic RAM. Architecture of CPLD and FPGA family.

16 hours

Books:

1. Digital Design – Principles and Practices, John F. Wakerly, Pearson Education Asia, Fourth Edition, 2008
2. "Digital Design with Introduction to Verilog HDL", Mano M M and Michael Ciletti, Pearson Education Asia,5th Edn. 2013
3. "Digital Fundamentals", Floyd T L, Pearson Education Asia,8th Edn.2002.

ELH 403 - MICROPROCESSORS and MICROCONTROLLER

Course Outcomes:

1. Describes the difference between the Microprocessor and Microcontroller.
2. Details architecture of the Microprocessor 8086,8087,80186, Microcontroller 8051 and its programming aspects.
3. Makes students aware of interrupts and describing about I/O ports to handle external signal
4. Handling Display system, DAC and ADC to performing interface, with real world application devices.
5. Ability to describe application based projects.

Unit – I

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, 8086 features - Assembler Directives.

12 Hours

Unit – II

8086 Interrupts and Interrupt applications, 8086 Maximum mode, Co-processor, Advanced Microprocessors – Introduction, Multiprogramming Concepts, Memory Management Concepts, virtual memory – segmentation scheme, 80286/ 80386 Microprocessor - Internal Architecture.

12 Hours

Unit – III

8051 Microcontroller - Architecture, Data type and Directives, Flags and PSW, Register Banks and Stack, Addressing Modes, I/O Ports. Instruction set – Data transfer instruction, Arithmetic and logical instructions. Jump, Loop and Call Instructions and Programming.

12 Hours

Books:

1. "Microprocessor and interfacing, programming and hardware", Douglas V Hall, Tata McGraw Hill, Reprint 2nd Edn, 2000.
2. "The 8088 and 8086 Microprocessors: Programming, Interfacing, Software, Hardware, and Applications: Including the 80286, 80386, 80486, and Pentium Processors", Walter Triebel, Avtar Singh, Prentice Hall, 4thEdn.
3. "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, 6thEdn., 2002.
4. "The 8051 Microcontroller and Embedded Systems: Using Assembly and C". Muhammed Ali Mazidi, Pearson Education, 2008.
5. "The 8051 Microcontroller Architecture, Programming and Applications", K. J. Ayala, Penram Int. Pub., 1991.

ELS 404 - PROGRAMMING IN C

Course Outcomes:

1. Understand the fundamentals of C programming.
2. Choose the loops and decision making statements to solve the problem.
3. Implement different Operations on arrays.
4. Use functions to solve the given problem.
5. Understand pointers, structures and unions.
6. Implement file Operations in C programming for a given application.

UNIT I

Simple C Programs: Program, Structure, Constants and Variables, Assignment Statements, Standard Input and Output, Mathematical Functions, Character Functions, Control Structures and Data Files: Algorithm Development, Conditional Expressions, Selection Statements, Loop Structures.

12 Hours

UNIT II

Data Files, Modular Programming with Functions: Modularity, Programmer-Defined Functions, Random Numbers, Macros, Recursion Arrays and Matrices: One-Dimensional Arrays, Sorting Algorithms, Search Algorithms, Two-Dimensional Arrays, Matrices and Vectors, Higher Dimensional Arrays.

12 Hours

UNIT III

Programming with Pointers: Addresses and Pointers, Pointers to Array Elements, Pointers in Function References, Character, Strings, Dynamic Memory Allocation, A Quicksort Algorithm. Programming with Structures: Structures, Using Functions with Structures, Arrays of Structures, Dynamic Data Structures.

12 Hours

Books:

1. "ENGINEERING PROBLEM SOLVING WITH C", FOURTH EDITION, Delores M. Etter, Pearson,2013
2. "Programming in ANSI C" – E Balagurusamy, Tata McGraw Hill, Sixth Edition, 2012
3. "Let Us C"- Yashavant Kanetkar, BPB Publications, 13 th Edition, 2013
4. "The C Programming Language"- Brian W. Kernighan, Dennis M. Ritchie, Prentice Hall, Second Edition,

ELS 405 – POWER ELECTRONICS

Course Outcomes:

1. The study will have in-depth understanding of the theory of electrical energy conversion using power electronic systems that perform AC/DC, DC/DC or DC/AC conversion.
2. Develop skill to understand the operating principles and modulation strategies for single-phase and three phase diode rectifiers, thyristor-based converters, as well as, switch- mode DC/DC power electronic converters and DC/AC inverters.
3. Develop skills to understand the advanced modeling and control of power electronic converters.
4. Makes being able to identify the most important design parameters and to recognize the impact of operating parameters on the planning and use of power electronic converters in the existing and future electric power grid infrastructure, and in industrial installations.

UNIT I

Introduction; Power Electronics Defined, Key Characteristics, Trends in Power Supplies, Conversion Examples, Tools for Analysis and Design, Sample Applications.
Power semiconductor devices: The Power Diode, Power Bipolar Transistors, The Power MOSFET, Insulated Gate Bipolar Transistor- Turn-on and turn-off characteristics.

12 HOURS

UNIT II

The Thyristors, Gate Turn-off Thyristors, MOS Controlled Thyristors, Static Induction Devices Turn-on and turn-off characteristics.
Power Conversion; Diode Rectifiers-Single-phase Diode Rectifiers, Three-phase Diode rectifiers.
Single-phase Controlled Rectifiers; Introduction, Line-commutated Single-phase Controlled Rectifiers. **12 HOURS**

UNIT III

DC–DC Converters; Introduction, DC Choppers, Step-down (Buck) Converter, Step-up (Boost) Converter, Buck–Boost Converter, Cuk Converter, Effects of Parasitics, Synchronous and Bidirectional Converters, Control Principles, Applications of DC–DC Converters.
Inverters; Introduction, Single-phase Voltage Source Inverters, Three-phase Voltage Source Inverters, Current Source Inverters.
AC–AC Converters; Introduction, Single-Phase AC–AC Voltage Controller, Three-Phase AC–AC Voltage Controllers, Applications of AC–AC Converters.

12 HOURS

Books:

1. M.H. Rashid, 'Power Electronics: Circuits, Devices and Applications', Pearson Education,
2. PHI Third edition, New Delhi 2004.
3. Philip T. Krein, "Elements of Power Electronics" Oxford University Press, 2004 Edition.
4. Ashfaq Ahmed Power Electronics for Technology Pearson Education, Indian reprint, 2003.
5. P.S. Bimbra "Power Electronics" Khanna Publishers, third Edition 2003.
6. Ned Mohan, Tore. M. Undeland, William. P. Robbins, 'Power Electronics: Converters,
7. Applications and Design', John Wiley and sons, third edition, 2003

ELS 406 - NETWORK ANALYSIS

Course Outcomes:

1. Develops skill to understand the behavior of different circuits and their response using various circuit analysis tools and theorems
2. Develops skill to understand the analysis in time domain and frequency domain.
3. Develops skill to understand basic concepts regarding the system definition mathematically and associated network function.
4. Develops skill to understand the concept of Network synthesis

Unit I

Introduction to Circuit Analysis, 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.

12 Hours

Unit II

Circuit analysis techniques; Linearity and Superposition, Source Transformations, Thévenin and Norton Equivalent Circuits, Maximum Power Transfer, Delta-Wye Conversion.
Capacitors and Inductors; The Capacitor, The Inductor, Inductance and Capacitance Combinations, Consequences of Linearity, Simple Op Amp Circuits with Capacitors, Duality, Modeling Capacitors and Inductors with PSpice.

12 Hours

Unit III

Basic RL and RC circuits; Source-Free RL Circuit, Properties of the Exponential Response, Source-Free RC Circuit, Unit-Step Function, Driven RL Circuits, Natural and Forced Response, Driven RC Circuits, Response of Sequentially Switched Circuits.
RLC circuit; Source-Free Parallel Circuit, Over-damped Parallel RLC Circuit, Critical Damping, Under-damped Parallel RLC Circuit, Source-Free Series RLC Circuit, Complete Response of the RLC Circuit, Lossless LC Circuit.
Two-port networks; One-Port Networks, Admittance Parameters, Some Equivalent Networks, Impedance Parameters, Hybrid Parameters, Transmission Parameters.

12 Hours

Books:

1. "Engineering Circuits Analysis," William H. Hayt, Jack E. Kemmerly, Steven M. Durbin, 8th Edition, McGraw-Hill Publication, 2012.
2. "Introduction to Modern Network Synthesis," Van Valkenberg M. E., John Wiley and Sons, Inc, 1960.
3. "Network Analysis and Synthesis," Franklin. F. Kuo, II Ed, John Wiley & sons, 1999.
4. "Network Analysis & Synthesis," Umesh Sinha, Satya Prakash Pub.

ELS 407 - VERILOG HDL

Course Outcomes:

1. Familiarize with the CAD tool to write HDL programs.
2. Design, simulate and synthesize digital logic circuits using Verilog HDL
3. Design sequential and combinational logic circuits for real-time applications.
4. Exposure to hardware-software co-design
5. Interface hardware to programmable logical devices like CPLDs/FPGAs/Microcontroller.

UNIT - I

Introduction: Overview of Digital Design with Verilog HDL Evolution of CAD, emergence of HDLs, typical HDL-flow, why Verilog HDL?, trends in HDLs.
Hierarchical Modeling Concepts: Top-down and bottom-up design methodology, differences between modules and module instances, parts of a simulation, design block, stimulus block
Basic Concepts: Lexical conventions, data types, system tasks, compiler directives. Modules and Ports Module definition, port declaration, connecting ports, hierarchical name referencing.

12 Hours

UNIT - II

Gate Level Modeling: Introduction, AND Gate Primitive, Module Structure, Other Gate Primitives, Illustrative Examples, Tristate Gates, Array of Instances of Primitives, Design of Flip-Flops with Gate Primitives, Delay, Strengths and Construction Resolution, Net Types, Design of Basic Circuit.
Behavioral Modeling: Introduction, Operations and Assignments ,Functional Bifurcation, 'Initial' Construct, Assignments with Delays, 'Wait' Construct, Multiple Always Block, Designs at Behavioral Level, Blocking and Non-Blocking Assignments, The 'Case' Statement, Simulation Flow, 'If' an 'if-Else' Constructs, 'Assign- De-Assign' Constructs, 'Repeat' Construct, for loop, 'The Disable' Construct, 'While Loop', Forever Loop, Parallel Blocks, Force-Release, Construct, Event.

12 Hours

UNIT - III

Modeling at Dataflow Level: Introduction, Continuous Assignment Structure, Delays and Continuous Assignments, Assignment to Vector, Operators.
Sequential Circuit Description: Sequential Models - Feedback Model, Capacitive Model, Implicit Model, Basic Memory Components, Functional Register, Static Machine Coding, Sequential Synthesis.
Components Test and Verification: Test Bench - Combinational Circuits Testing, Sequential Circuit Testing, Test Bench Techniques, Design Verification, Assertion Verification.

12 Hours

Books:

1. Samir Palnitkar, “Verilog HDL: A Guide to Digital Design and Synthesis”, Pearson Education, Second Edition.
2. Digital Design (Verilog) An Embedded Systems Approach Using Verilog, Peter Ashenden, Elsevier Publications, 1st Edition 2008
3. Advanced Digital Design with Verilog HDL - Michel D. Ciletti, PHI,2009.
4. T.R. Padmanabhan, B Bala Tripura Sundari, Design Through Verilog HDL, Wiley 2009.

ELS 408 - SIGNALS AND SYSTEMS

Course Outcomes:

1. Analyze and classify the signals based on the continuity and discrete property of signals.
2. Mathematical description of systems, its properties that are suitable for real-world designs.
3. Analyze the signals in time domain using convolution, difference/differential equations
4. Analyze Linear Time Invariant (LTI) systems in time and transform domains.
5. A pre-programme to courses based on signals (DSP) and systems (Control Systems)

Unit I

Introduction and classification of Signals: Definition of signal and systems, Sampling of analog signals, Continuous time and discrete time signal, Classification of signals.

Elementary Signals and Operations on Signals: exponential, sine, impulse, step and its properties, ramp, rectangular, triangular, signum, sync functions. Operations on Signals – Amplitude scaling, addition, multiplication, differentiation, integration, time scaling, time shifting and time folding

Systems: Definition, Classification of Systems; **Signal Transmission through Linear System:** Linear system, Impulse response, Response of a linear system, Linear time invariant (LTI) system, Linear time variant (LTV) system, Transfer function of a LTI system. Filter characteristics of linear systems.

12 hours

Unit II

Fourier Representation: Periodic Signals- Introduction to CTFS and DTFS, definition, properties and basic problems. Aperiodic CT Signals - FT representation of aperiodic CT signals - FT, definition, FT of standard CT signals, Properties and their significance.

FT representation of aperiodic discrete signals: DTFT, definition, DTFT of standard discrete signals, Properties and their significance, Impulse sampling and reconstruction:

12 hours

Unit III

Laplace Transforms: Review of Laplace transforms, Partial fraction expansion, Inverse Laplace transform, Concept of region of convergence (ROC) for Laplace transforms, Properties of Laplace Transform, relation between L.T's, and F.T. of a signal.

Convolution and Correlation of Signals: Concept of convolution in time domain and frequency domain, Convolution property of Fourier transforms. Cross correlation and auto correlation of functions, properties of correlation function, Energy density spectrum, Parseval's theorem, Power density spectrum, Relation between convolution and correlation.

12 hours

Books:

1. Simon Haykins and Barry Van Veen, "Signals and Systems", 2nd Edition, 2008, Wiley India.
2. Signals, Systems & Communications - B.P. Lathi, BS Publications, 2003.
3. Ganesh Rao and Satish Tunga, "Signals and Systems", Pearson/Sanguine Technical Publishers, 2004.
4. Signals and Systems - A.V. Oppenheim, A.S. Willsky and S.H. Nawab, PHI, 2nd Edn.

II SEMESTER

ELH 451 - ANALOG AND DIGITAL COMMUNICATION

Course Outcomes:

1. Understand the basic working model of electronic communication system.
2. Study the different analog modulation techniques.
3. Explore more in digital modulation techniques.
4. Study the noise problems in communication circuits and discuss the solution to minimize them.
5. This is the trending technology and nowadays, everyone is connected with each other in wired or wireless network.
6. This course helps to understand the basic need and working of electronic communication system

Unit – I

Communication system: Modulation – AM concept, Frequency Spectrum of AM, Average power of Sinusoidal AM, AM Modulation Index-Examples, AM Transmitters, AM Receivers- Super-Heterodyne Receiver, FM concept, FM Bandwidth requirement-Examples FM Transmitter, FM Receiver, Time & Frequency domain- DSBSC modulation Generation & Detection, SSB-SC modulation.

Vestigial Side-band Modulation (VSB): Frequency-domain description, Generation of VSB-Modulation wave, Time-domain description, Comparison of Modulation techniques, Frequency translation, Frequency division multiplexing.

16 hours

Unit-II

Digital Communication & Source coding: Basic Signal Processing operation in Digital Communication, Sampling Principle, Sampling Theorem, Source information theory and error control coding-Entropy concept, linear block code, convolution code, Shannon's Channel capacity theorem, Hamming distance, Hamming weight.

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

18 hours

Unit –III

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 Spectrum signals for digital Communication: Introduction to spread spectrum modulation, DSSS, FHSS, CDMA signals, spread spectrum as multiple access techniques.

16 hours

Books:

1. Tomasi-"Electronic Communication systems", Pearson Asia, 3rd edition.
2. George Kennedy & Bernard Davis, "Electronic Communication Systems", TMH Publications.
3. Simon Haykins, "Communication Systems", 4th Edition, John wiley Publication.
4. An Introduction to Analog and Digital Communication, Simon Haykins, John Wiley, India Wayne Pvt. Ltd, 2008.
5. Thomas M. Cover, Joy A. Thomas, "Elements of Information Theory", 1st edition, Wiley science publications, 2006.
6. "Digital Communication", J S Chitode, Technical Publications, Pune
7. "Digital Communications", J Proakis, McGraw Hill, 2000
8. K N Hari Bhat and D Ganesh Rao, "Analog Communication", 2nd edition, sanguine technical publication.
9. K N Hari Bhat and D Ganesh Rao, Digital Communication", 3rd edition, sanguine technical publication.

ELH 452 -DIGITAL SIGNAL PROCESSING

Course Outcomes:

1. Understand the frequency domain analysis and synthesis of discrete time signal
2. Sampling and reconstruction of discrete time signals.
3. Understand the basics computation theory through DFT based algorithms
4. Realization of FIR and IIR filters in different structural forms.
5. Designing procedure to convert analog filters to digital (IIR) filters using BLT and other methods
6. Study on different windows to design FIR filters

Unit I

Introduction: Introduction to Digital Signal Processing: Discrete time signals & sequences, linear shift invariant systems, stability, and causality, linear constant coefficient difference equations. Frequency domain representation of discrete time signals and systems.
Z- Transforms: Discrete and Inverse Transform, Properties of Z-Transform, Rational Z Transforms, Inversion of the Z-transform, One-Sided Z transform, Analysis of LTI system in Z-domain. **16 hours**

Unit II

Sampling: Sampling theorem, impulse sampling, Natural and Flat top Sampling, Reconstruction of signal from its samples, Aliasing, Introduction to Band Pass sampling.
Discrete Fourier Transforms (DFT): Frequency domain sampling and reconstruction of discrete time signals. DFT as a linear transformation, its relationship with other transforms. Properties of DFT, multiplication of two DFTs- the circular convolution.
FFT Algorithms: Radix-2 FFT algorithm for the computation of DFT and IDFT–decimation-in-time and decimation-in-frequency algorithms. Goertzel algorithm, and chirp-z transform.
16 hours

Unit III

Structure for IIR Systems: Direct form, Cascade form, Parallel form structures. IIR filter design: Characteristics of commonly used analog filter – Butterworth and Chebyshev filters, analog to analog frequency transformations.
Structure for FIR Systems: Direct form, Linear Phase, Frequency sampling structure, Lattice structure. FIR filter design: Introduction to FIR filters, design of FIR filters using - Rectangular, Hamming, Hanning and Bartlett windows
16 hours

Books:

1. Digital signal processing – Principles Algorithms & Applications, Proakis & Monalakis, Pearson education, 4th Edition, New Delhi, 2007.
2. DSP Processor Fundamentals: Architectures and Features, P. Lapsley, J. Bier, A, Shoham and E. Lee, John Wiley & Sons, ISBN 0-7803-3405-1. 1996.
3. Discrete Time Signal Processing, Oppenheim & Schaffer, PHI, 2003.
4. Digital Signal Processing, S. K. Mitra, Tata Mc-Graw Hill, 3rd Edition, 2010.

ELH 453 - BASIC VLSI DESIGN

Course Outcomes:

1. Identify the various IC fabrication methods.
2. Express the Layout of simple MOS circuit using Lambda based design rules.
3. Apply the Lambda based design rules for subsystem design
4. Concepts of modeling a digital system using Hardware Description Language.

UNIT I

Introduction to CMOS Design: The CMOS IC Design Process, CMOS Background, An Introduction to SPICE. The Well: Patterning, Laying Out the N-well, Resistance Calculation, The N-well/Substrate Diode, The RC Delay through the N-well, Twin Well Processes.
The Metal Layers : The Bonding Pad, Design and Layout Using the Metal Layers, Crosstalk and Ground Bounce, Layout Examples. The Active and Poly Layers : Layout Using the Active and Poly Layers, Connecting Wires to Poly and Active, Electrostatic Discharge (ESD) Protection

12 Hours

UNIT II

MOSFET Operation: MOSFET Capacitance Overview/Review, The Threshold Voltage, IV Characteristics of MOSFETs, SPICE Modeling of the MOSFET. Models for Digital Design: The Digital MOSFET Model, The MOSFET Pass Gate. The Inverter : DC Characteristics, Switching Characteristics, Layout of the Inverter, Sizing for Large Capacitive Loads, Other Inverter Configurations.

12 Hours

UNIT III

Static Logic Gates : DC Characteristics of the NAND and NOR Gates, Layout of the NAND and NOR Gates, Switching Characteristics, Complex CMOS Logic Gates. Clocked Circuits: The CMOS TG, Applications of the Transmission Gate, Latches and Flip-Flops.

12 Hours

Book :

1. CMOS: Circuit Design, Layout, and Simulation, 3rd Ed, R. Jacob Baker, IEEE Press Series on Microelectronic Systems.
2. "Basic VLSI Design," Douglas A. Pucknell & Kamran Eshraghian, PHI 3rd Edition, 2005.
3. "CMOS VLSI Design: A Circuits and Systems Perspective", Fourth Edition, Neil H. E. Weste, David Money Harris

ELS 454 - EMBEDDED SYSTEM DESIGN

Course Outcomes:

1. Describes the difference between the general computing system and embedded system.
2. Details classification of embedded system
3. Make aware of the architecture and its programming aspects
4. Makes aware of interrupts, hyper threads and software optimization.
5. Ability to describe real time embedded system using RTOS.

Unit I

A Systems Engineering Approach to Embedded Systems Design, Embedded Hardware: Embedded Hardware Building Blocks and the Embedded Board- The Embedded Board and the von Neumann Model, Embedded Processors- Introduction, Internal Processor Design, Board Memory, Board I/O (Input/Output), Bus Arbitration and Timing. **12 Hours**

Unit II

Embedded Software Introduction: Device Driver Code Layers, Embedded Operating Systems- Process, Multitasking and Process management, Memory management, I/O and file system management, Memory Management, I/O and File System Management, OS Performance Guidelines Middleware and Application Software- Middleware, Application, Middleware Examples, Application Layer Software Examples.

12 Hours

Unit III

Putting It All Together: Design and Development: Defining the System—Creating the Architecture and Documenting the Design, the Final Phases of Embedded Design: Implementation and Testing. Hardware software co-design, Hardware software partitioning.

12 Hours

Books:

1. "Embedded Systems Architecture A Comprehensive Guide for Engineers and Programmers", Tammy Noergaard, Elsevier, 2005
2. "Hardware/Software Co-Design: Principles and Practice", Jorgen Staunstrup and Wayne Wolf, Springer-Science+Business Media
3. "Embedded Systems: A Contemporary Design Tool – James K. Peckol", John Wiley India Pvt. Ltd, 2008.
4. "Embedded system architecture, Programming and design", Raj Kamal, 2nd End, Tata Mc'Graw Hill.

ELS 455 -COMPUTER NETWORK

Course Outcomes:

1. To get familiar with basic of data communication and various type of computer network.
2. Describes the difference type of system and identifying ability to describe suitable model.
3. Design a small or medium sized computer network including media types, end devices, and interconnecting devices that meets a customer's specific needs.
4. To perform basic configurations on routers and Ethernet switches.
5. To demonstrate knowledge of programming for network communications and learn to simulate computer networks and analyze the simulation results
6. To troubleshoot connectivity problems in a host occurring at multiple layers of the OSI model

UNIT I

Introduction to Computer Networks-Uses of Computer NetworksNetwork, Hardware, Network Software, Reference Models, Example Networks, Network Standardization
The Physical Layer: -The Theoretical Basis For Data Communication, Guided Transmission Media, Wireless Transmission, Communication Satellites, Digital Modulation And Multiplexing, The Public Switched Telephone Network, The Mobile Telephone System, Cable Television.

12 Hours

UNIT II

The Data Link Layer - Data Link Layer, Design Issues, Error Detection and Correction, Elementary Data Link Protocols, Sliding Window Protocols, Example Data Link Protocols.
The Medium Access Control Sub layer - The Channel Allocation Problem, Multiple Access Protocols, Ethernet, Wireless LANs, Broadband Wireless.

12 Hours

UNIT III

The Network Layer -Network Layer Design Issues, Routing Algorithms, Congestion Control Algorithms. **The Transport Layer** - The Transport Service, Elements of Transport Protocols, Congestion Control. **The Application Layer:** - The Domain Name System, Electronic Mail, the World Wide Web.

12 Hours

Books:-

1. "Computer Networks" Andrew S. Tanenbaum, 5th Edition, Prentice Hall.
2. "Computer Networking: A Top-Down Approach" James F. Kurose 5th Edition Pearson India
3. "Data Communications and Networking" Ehrouz A. Forouzan 5th Edition McGraw-Hill

ELS 456 - CONTROL SYSTEM

Course Outcomes:

1. Describes the different types of system and identifying expression to represent a complicated system into simpler system.
2. Characterizing system using Laplace domain to illustrate specification of the system transfer function.
3. Interpreting different physical and mechanical system in terms of model for analysis.
4. Employing time domain analysis to predict and identify transient performance for standard model inputs.

Unit I

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.

12 Hours

Unit II

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.
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.

12 Hours

Unit III

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.

12 Hours

Books:

1. "Modern Control Engineering" Katsuhiko Ogata. Pearson publication, Fifth Edition
2. "Control Systems Engineering". J. Nagrath and M. Gopal, New Age International (P) Limited, Publishers, Second Edition

ELS 457 - PROGRAMMING WITH EMBEDDED PLATFORMS

Course Outcomes:

1. To appreciate the use of different sensors and actuators in the design of modern embedded systems.
2. To understand the use of high level language like C/C++ and python in the design of embedded systems.
3. To apply different embedded platforms in the design of Internet of Things.
4. To appreciate the use of cloud platform.

Unit I

Introduction to the Raspberry Pi: Introduction to the Raspberry Pi, Setting up Raspberry Pi, Setting up Raspberry Pito Arduino, Bridge Shield, First Project–A Basic Thermometer, From Thermometer to Thermostat.

14 Hours

Unit II

Home Automation using Raspberry Pi and Arduino: Building upon the First Project, Temperature Storage–Setting up a Database to Store Your Results, Curtain Automation–Open and Close the Curtains Based on the Ambient Light, The future of home automation.

14 Hours

Unit III

Programming the Beagle Bone Black: JavaScript Basics, JavaScript Functions and Timers, Arrays, Objects, and Modules, BoneScript, Hardware Interfacing, Using Capes and Modules, Web Interfaces, A Roving Robot, E-mail Notifier.

14 Hours

Books:

1. “Raspberry Pi Home Automation with Arduino”-Andrew K. Dennis, Packt, 2013
2. “Programming the Beagle Bone Black-Getting Started with JavaScript and Bone Script” -Simon Monk, McGraw Hill,2014
3. “Bad to the Bone - Crafting Electronic Systems with Beagle Bone and Beagle Bone Black”-Steven F. Barrett , Jason Kridner, Morgan and Claypool Publishers,2013
4. “Exploring Beagle Bone Tools and Techniques for Building with Embedded Linux”, Derek Molloy, Wiley,2015
5. “The official raspberry pi projects book”- from the makers of magpi, the official Raspberry Pi magazine
6. “Raspberry Pi Cookbook” - Simon Monk, Oreilly ,2013

ELS 458 -BIOMEDICAL INSTRUMENTATION

Course Outcomes:

1. Describe the origin and properties of biosignals.
2. Study on biosensors and transducers based basic circuits for acquisition and processing the biosignals like ECG, EEG and EMG
3. Study on biological phenomena specifically related to internal organs to understand abnormal situations.
4. Understand the design and working principles of basic clinical laboratory equipments.
5. Understanding different scan techniques MRI, CT, digital X-ray etc.

Unit I

Biopotentials, Bioamplifiers and Bioelectrodes: Introduction to Bio-Electric Potential, Bioamplifier, Components of Man Instrument System, Types of Biomedical Systems, Design Factors and Limitations of Biomedical Instruments,Transducers to Measure Various Physiological Events, Types of Bio-Potential Electrodes (Body Surface Electrodes, Internal Electrodes, Micro Electrodes), Properties of Electrodes . Bioelectric Signals: ECG- EMG – EEG – and Their Characteristics

Patient Monitoring System: System Concepts, Cardiac Monitoring, Bedside Patient Monitoring System, Measurement of – Heart Rate, Pulse Rate, Blood Pressure Measurement.

12 Hours

Unit II

X-Ray Machines and Radiography: Basics of Diagnostic Radiology, Production of X-Ray, X-Ray Machine, Visualization of X-Ray. X-Ray Computed Tomography: Computed Tomography, System Components, System Electronics.

Nuclear Medical Imaging System: Radio-Isotopes in Medical Diagnosis, Radiation Detectors, Emission Computed Tomography, SPECT, PET Scanner. Magnetic Resonance Imaging System: Principles of NMR Imaging System, Image Reconstruction Techniques. Advantages of NMR Imaging System.

Ultrasonic Imaging System: Medical Ultrasound, Basic Pulse-Echo Apparatus, Imaging Modes, Real-Time UIS, Modern UIS, Portable Ultrasound Imaging Systems.

12 Hours

Unit III

Biomedical Telemetry: Single Channel Telemetry Systems, Multichannel Telemetry Systems, Multi-Patient Telemetry, Implantable Telemetry Systems, Biotelemetry Application on WiMax Networks, Transmission of Analog Physiological Signals Over Telephone

Telemedicine Technology: Essential Parameters for Telemedicine, Delivery Modes, Telemedicine System, Clinical Data Exchange Standards, Transmission of – Still Images, Video Images, Digital Audio, Cyber Medicine, Applications Of Telemedicine, PAC System.

Therapeutic Equipments (Principles And Types Only) – Cardiac Pacemakers, Electrosurgical Instruments, Ventilators, Automated Drug Delivery System.

12 Hours

Books:

1. L. Cromwell, F.J. Weibell, Eapfeiffer, Biomedical Instrumentation And Measurements, Phi Publication, 3rd Edition, 2011.
2. R. S. Khandpur, Handbook Of Biomedical Instrumentation, Mcgrawhill Publications, 3rd Edition, 2016.
3. Arumugam.M. “Biomedical Instrumentation", Anuradha Agencies Publishers, Kumbakonam, 2006.

ELE 459 - INTRODUCTION TO MUSIC TECHNOLOGY

Course Outcomes:

1. To appreciate Science and Mathematics behind music theory like tone, semitone, octaves etc.
2. To appreciate the signal processing aspects of music and related technology.
3. To understand the methods and means to tune different musical instruments to the required key.
4. To appreciate the different file formats used to communicate the music files.

UNIT I

Fundamentals of music signal: Definition of music as an organized sound on time axis, sinusoidal signal, definitions of octave, cent, tone, semitone, frequency(shruthi) intervals, pitch, loudness, decibel, logarithmic behavior of human auditory system, Fourier analysis of signals, periodic and aperiodic signals, fundamental frequency, harmonics, beating phenomenon, names and frequencies of twelve notes of piano and electronic keyboard, concept of melody and harmony, circle of fifth, Pythagorean comma, concept of time keeping in music- tala and beats. Concept of That, melakartha ragas, ragas and janya ragas in Indian music, scales, modes and chord sequences in western music. Reading music notations in western and Indian music systems, musical note synthesis using MATLAB, the process of music composition, list and classification of popular musical instruments, tuning of guitar and violin, voice culture.

16 Hours

UNIT II

Music Signal : Analog signal, digital signal, analog to digital conversion(ADC), sampling theorem, Nyquist rate, oversampling, under-sampling, aliasing, digital to analog conversion(DAC), sound cards in a computer, frequency ranges of different musical instruments and human voice. Concept of bandwidth: signal spectrum, communication channel, FM radio station. Noise in audio range-their sources, power noise, filters(analog and digital), notch filter, Dolby system, digital audio effects, surround sound.

10 Hours

UNIT III

Music Signal Recording and Reproduction : Microphones , different classes of microphones and their classifications based on bandwidth, fidelity, noise performance, angle and range of reception, sensitivity, mono versus stereo music, Digital audio workstations, signal mixing, audio amplifiers, speakers – classifications, power output, definition of PMPO, spectral equalizers, tracks and multitracks, Bass versus treble, Musical Interface Digital Interface(MIDI)

10 Hours

Books:

1. “The structure of music in RAGA and western systems”- Padma Vibhushan Dr. Raja Ramanna, Bharatiya Vidya Bhavan, 1993
2. “Speech and Audio Processing” - Dr. Shaila D. Apte, Wiley Precise textbook, Wiley India edition, 2013

3. “The Rags of North Indian Music” - N.A. Jairazbhoy, Popular Prakashana, 1995
4. “NAD – Understanding Raga Music”- Sandeep Bagchee, Eeshwar publisher, 1998
5. “Shyam Rao Gharana – Redefining Hindustani Music- Vols 1 and 2”- SvaraSagara Pt. Shyamrao Kulkarni, Prism Books, 2011
6. “Introduction to Music Theory”- Catherine Scmidt Jones, Russell Jones, CONNEXIONS, Rice University, Houston, Texas-2010
7. “The Science of Indian Music” – Nookala Chinna Satyanaraya, Sri Dattasai Graphics, Hyderabad, 2005
8. “The Structure of Music”-R.O. Morris, University Press, Oxford, 1985
9. “History and Evolution of Indian Music”- Khushboo Kulshreshtha, Shree Natraj Prakashan, Delhi,2010
10. “Indian Music” - Swami Rama, The Himalayan International Institute of Yoga science and Philosophy of U.S.A, Honesdale, Pennsylvania
11. Digital signal processing – Principles Algorithms & Applications, Proakis & Monalakis, Pearson education, 4th Edition, New Delhi, 2007.

ELE 460 - ELECTRONIC COMMUNICATION

Course Outcomes:

1. To understand the basics of the electronic communication systems.
2. To describe the principles and working of amplitude and frequency modulation.
3. To study the basic working of high frequency transmission lines, antennas and waveguides.
4. Discuss the fundamentals of the data communication, modems and communication networks.

Unit I

Introduction to Electronic communication systems, electromagnetic spectrum, noise analysis. Principles of AM modulator circuits, AM transmitter, AM receivers, SSB communication systems. Principles of FM, FM transmitter, FM receiver.

12hours

Unit II

Transmission lines: Transverse electromagnetic waves, Types of transmission lines, equivalent circuit, wave propagation

Antennas and waveguides: Antenna terminology, basic antennas, antenna loading, antenna arrays, special purpose antennas, UHF and microwave antenna, waveguides

12 hours

Unit III

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 for mobile communication, Introduction to satellite communication

12 hours

Books:

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
3. "Electronic Communication Systems" by Kennedy and Davis, Tata McGraw-Hill Edition,4th ed.
4. "Electronic Communication" by Roddy and Coolen, Pearson Education publication, 4th ed.

III SEMESTER

ELH 501 - DIGITAL IMAGE PROCESSING

Course Outcomes:

1. Fundamentals of digital image acquisition and processing to compare with human visual system.
2. Study on image as spatial domain as well as frequency domain signal using transformation functions.
3. Application of 2-D DFT for image enhancement and demising process.
4. Study on mathematical modeling of noise functions and corresponding filter design
5. Study on the Morphological Operations and Segmentation used in digital image processing.
6. Basics of color image processing and various color models for image representation

Unit I

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: Some basic intensity Transformation Functions, Histogram Processing, Fundamentals of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters, Combining Spatial Enhancement Methods.

16 hours

Unit II

Filtering in Frequency Domain: Preliminary concepts, Sampling, Fourier Transform of sampled Functions, DFT 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.
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.

16 hours

Unit III

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,

16 hours

Books:

1. “Digital Image Processing”, Rafael Gonzalez and Richard Woods, PHI.2nd Edition.
2. “Fundamentals of Digital Image Processing”, A. K. Jain, Prentice Hall of India, 1989.
3. “Digital Image Processing”, W. K. Pratt, Prentice Hall, 1989.

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ELH 502 - LOW POWER VLSI CIRCUIT DESIGN

Course Outcomes:

1. To appreciate the requirements and compulsions leading to the power aware VLSI design.
2. To identify the source of power dissipation and the ways to minimize the same.
3. To understand the tradeoff between different design parameters power dissipation and speed of operation.
4. To understand the ways to tradeoff power dissipation and performance at various levels of design highearly.

Unit-I

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.
Power Estimation: Modeling of signals, signal probability calculation, probability technique for signal activity estimation, statistical techniques, estimation of glitching power

. **12 Hours**

Unit-II

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

12 Hours

Unit-III

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.

12 Hours

Book:

1. "Low-power CMOS VLSI circuit design" by Kaushik Roy and Shart C. Prasad, Wiley - Interscience publication, 2000.
2. "Practical Low Power Digital VLSI design", Gary Yeap (Motorola), Springer Science + Business Media, LLC, 1998
3. "CMOS Low Power Digital Design," A. Chandrakasan & R. Brodersen, Kluwer Academic Pubs. 1995.
4. "Low Power Design Methodologies," J. Rabaey & M. Pedram (Editors), Kluwer Academic Pubs. 1996.
5. "Low Power Digital VLSI Design – Circuits and Systems", Abdellatif Bellaouar, Mohamed I. Elmasry, S. Ramamurthy, Springer Science + Business Media, LLC, 1995.

ELH 503 - Wireless Communication Systems

Course Outcomes:

1. To discuss the various wireless communication systems
2. To study and discuss the 2G, 3G, 4G and 5G network features and architectures
3. To study the cellular frequency assignment strategy and channel planning for wireless systems
4. Device level discussion on multiple access wireless communication techniques and wireless networking

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), 4G architecture & Features, 5G Mobile communication networks-Features, Architecture. Architectural shift from 4G to 5G.

16 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.

18 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, Code division 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.

16 hours

Books:

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

ELS 504 -NANO ELECTRONICS

Course Outcomes:

1. The overview and importance of nanotechnology in the technological era.
2. Study the different fabrication techniques.
3. Discuss the types of characterization and applications of nano layers.
4. Study on innovative electronic devices based on nanostructure.

Unit I

Nanoscience and Nanoelectronics: Introduction to Nanoscience and Nanoelectronics, Nanostructure in nature, Bright future of Nanoelectronics.

Nanolayers: The top down and bottom up approach, Fabrication of nanoparticles: Working Principle of High energy ball mill and Sol Gel Process. Production of Nanolayers, Types and working of PVD (Physical Vapour Deposition), Types and working of CVD (Chemical Vapour Deposition).

12 Hours

Unit II

Characterization of Nanolayers: Characterization of Nanolayers, Thickness, Roughness, Crystallinity, Chemical Composition, Optical properties, Application of Nanolayers.

Extension of conventional devices by Nanotechniques: MOS Transistors, Structure and Technology, Electrical Characteristics of MOS Transistors, Limitations of Minimum Applicable Channels length, Low Temperature Behavior, Evaluation and Future prospects, Bipolar Transistors, Structure and technology.

12 Hours

Unit III

Innovative Electronic Devices Based on Nanostructures: General Properties, Resonant Tunneling Diode, Operating Principle and Technology. Quantum cascade Laser, operating principle and structure, Single Electron Transistor, Operating Principle and Technology, Applications, Carbon Nanotube Devices, Structure and Technology, Carbon Nanotube Transistors, Applications.

12 Hours

Books:

1) Nanotechnology and Nanoelectronics: Materials, Devices, Measurement Techniques by W.R Fahrner (Editor).
2) Nanotechnology-Nanomaterials and Nano Devices by G Mohan Kumar, Narosa Publishing House, New Delhi 2016.
3) Principles of Nanoscience and Nanotechnology by M.A Shah and Tokeer Ahmad Narosa Publishing House, New Delhi
4) Nano: The Essential understanding, Nanoscience and Nanotechnology by T Pradeep
5) Introduction to Nanotechnology, Charles P Poole Jr and Frank J Ownes, John Wiley Sons, Inc (2003)

ELS 505 - MICROWAVE DEVICES AND CIRCUITS

Course Outcomes:

1. Study on high frequency microwave devices for satellite and RADAR communication.
2. Describe the working and construction of metal oxide, metal semiconductor and transferred electron devices.
3. Study the fundamentals of working and construction of RADAR system.
4. Study the block diagram, basic laws and working principles of satellite communication

Unit I

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, Transferred Electron Devices, Gunn effect, principle of operations, mode of operation , IMPATT, TRAPATT diodes.

12 Hours

Unit II

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

12 Hours

Unit III

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

12 Hours

Books:

1. S Y Liao: Microwave devices and circuits, PHI 1980
2. M I Skolik: Introduction to radar system, 2/c McGraw 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.

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ELS 506 - SPEECH AND AUDIO PROCESSING

Course Outcomes:

1. Understanding the speech production mechanism in humans and studying using LTI model
2. Study and evaluation of speech parameters
3. Study on speech prediction techniques
4. Study techniques related to automatic speech and speaker recognition, echo concealment.
5. Introduction to musical instruments and music synthesis

UNIT I

Fundamentals of Speech: The Human speech production mechanism, LTI model for speech production, Nature of speech signal, Linear time varying model, Phonetics, Types of speech, voiced and unvoiced decision making. **Parameters of Speech:** Fundamental frequency, pitch period measurement using spectral domain, cepstral domain, formants and different methods of evaluating formants.

12 Hours

UNIT II

Spectral parameters of speech: Homomorphic processing, ceptral coefficients, Mel Frequency Ceptral Coefficients (MFCC), Short Time Fourier Transform (STFT). **Linear Prediction of speech:** Lattice Structure Realization, Forward linear prediction, autocorrelation method, covariance methods, lattice methods.

12 Hours

UNIT III

Speech quantization and coding: Automatic Speech Recognition and Speaker recognition systems, speech enhancement and echo cancellation. **Basics of musical instruments and music synthesis:** Indian and western musical Instruments, Features used for classification, music synthesis, Musical Instrument Digital Interface (MIDI), Streaming audio, piano note synthesis using LPC.

12 Hours

Books:

(1). Speech and Audio processing – Shaila D. Apte, Wiley Precise Textbook-Wiley India Edition, 2013

(2). “Discrete- Time Speech Signal Processing”- Thomas F. Quatieri, prentice hall signal processing series, 2002

(3). “Introduction to Digital Speech Processing”- Lawrence R. Rabiner, Ronald W. Schafer, Foundations and Trends ® in Signal Processing, 2007

(4).“Applied Speech and Audio Processing With MATLAB Examples” - Ian Mcloughlin, Cambridge university press, 2009

(5). “Digital Speech Processing Using Matlab”- E. S. Gopi, Springer India, 2014

ELS 507 - PIC Microcontroller

Course Outcomes:

1. Describes detailed architecture of the PIC microcontroller and detailed classification of the PIC family.
2. Makes aware of interrupts and describing about I/O ports to handle external signal.
3. Programing aspects to handle interfacing device such as Display system, DAC and ADC.
4. Analyze various examples of PIC microcontroller.
5. Ability to develop application based projects

Unit-I

PIC18FXX Microcontrollers, PIC architecture & Assembly Language Programming, Branch, Call and Time Delay Loop, PIC I/O port programming, Arithmetic Logic Instructions and Programs.

12 Hours

Unit-II

Bank Switching, Table processing, Macros and Modules, PIC Programming In C, PIC Timer Programming, and Serial Port Programming.

12 Hours

Unit-III

Interrupt Programming, ADC, DAC and Sensor Interfacing, Using Flash and EEPROM Memory for Data Storage, CCP and ECCP Programing, SPI Protocol and DS 1306 RTC Interfacing.

12 Hours

Books:

1. Muhammad Ali Mazidi, "Pic Microcontroller and Embedded Systems: Using Assembly And C For Pic 18" Pearson Education
2. Tim Wilmshurst, "Designing Embedded Systems using PIC microcontrollers Principles and Applications". Second Edition, Elesevier, 2010
3. Ajay V deshmukh, "Microcontrollers: Theory and Applications", Tata McGraw-Hill Education.
4. J. B. Preatman, "Design with PIC Microcontrollers"1st Ed, Prentice Hall
5. Bohdan Borowik, "Interfacing PIC Microcontrollers to Peripheral Devices". Springer, 2011

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ELS 508 - ARM processor

Course Outcomes:

1. To develop background knowledge and core expertise microprocessor and to know the design aspects of microprocessors.
2. To write programs for various applications.
3. To describe the architecture of the ARM7 microcontroller.
4. Interface various peripheral devices to the microcontrollers.
5. Design microcontroller based system for various applications

Unit I

An Introduction to Processor Design-Processor architecture and organization, Abstraction in hardware design The ARM Architecture-The Acorn RISC Machine, Architectural inheritance, The ARM programmer's model, ARM 3 stage pipelining organization, The ARM Instruction Set (excluding coprocessor instructions).

12 Hours

Unit II

The Thumb Instruction Set, Architectural Support for System Development, ARM7TDMI, Memory Hierarchy

12 Hours

Unit III

Architectural Support for Operating Systems, ARM CPU Cores-The ARM710T, ARM720T and ARM740T, Embedded ARM applications. Introduction to ARM Cortex M3, Architecture of ARM Cortex M3, Programming the ARM Cortex M3

12 Hours

Books:

1) “ARM system on chip architecture” bySteve Furber, Pearson addition.
2)“Definitive Guide to the Arm Cortex M3”,Joseph Yiu, Newness, 2008
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ELE 509 - CONSUMER ELECTRONICS (Open Elective)

Course Outcomes:

1. Study the working principles of different microphones and diss the merits and demerits.
2. Study the construction and working of different types of loudspeakers.
3. Elementary level study of television (TV) system, principles of color TV, LED and LCD TV.
4. Principle and working of Microwave Oven, automatic washing machine, photostat machine, digital camera and smartphones

Unit I

Audio Systems: Microphones and Loudspeakers: Carbon, Moving Coil, Cordless microphone, Direct radiating and horn loudspeaker, Multi-speaker System
Sound Recording: Magnetic Recording, Digital Recording, optical Recording (CD system and DVD)

12 Hours

Unit II

Television Technology: principles of Monochrome TV: Elements of TV Communication System, Scanning and its need, Need of Synchronizing and blanking pulses, VSB, Picture Tube, principles of Colour Television: Primary, Secondary colours, Concept of Mixing, Colour Triangle, NTSC, PAL, SECAM
LCD and LED Television: Basic Principle and working of LCD & LED TV
Cable Television: Working of Cable TV, DTH

12 Hours

Unit III

Consumer Appliances (principle and working) : Microwave Oven, Automatic Washing Machine, Photostat machine, Digital Camera, Smart Phone.

12 Hours

Books:

1) Audio and Vedio Systems by R G Gupta, tata McGraw Hill Education Pvt. Ltd, New Delhi
2) Consumer Electronics by Deepak Arora, Eagle Prakashan, Jalandhar.

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ELS 513 - DESIGN AND ANALYSIS OF ALGORITHMS

Course Outcomes:

1. To appreciate the need for the analysis of the usage of computing resources by an algorithm.
2. To appreciate the difference between feasible and infeasible problems.
3. To understand the usage of big oh notation to capture the computational and space complexities.
4. To understand the components of standard tool kit of an algorithm designer, like divide-and-cangue approach, greedy approval, dynamic programming, linear programming etc.
5. To appreciate the definition of NP-completeness and the reduction process.
6. To appreciate the importance of PVS NP problem as the control problem in theoretical Computer Science.

Unit – I

Introduction: Books and algorithms, Fibonacci numbers, Big-O notation, **Algorithms with numbers:** Basic arithmetic, Modular arithmetic, Primality testing, Cryptography, Universal hashing, Randomized algorithms**, Divide-and-conquer algorithms:** Multiplication, Recurrence relations, Mergesort , Medians, Matrix multiplication, Fast Fourier transform, **Decompositions of graphs:** The need of graphs, Depth-first search in undirected graphs, Depth-first search in directed graphs, Strongly connected components.

(18 hours)

Unit – II

Paths in graphs: Distances, Breadth-first search, Lengths on edges, Dijkstra's algorithm , Priority queue implementations, Shortest paths in the presence of negative edges, Shortest paths in dags, **Greedy algorithms:** Minimum spanning trees, Huffman encoding, Horn formulas, Set cover**, Dynamic programming:** Shortest paths in dags, revisited, Longest increasing subsequences, Edit distance, Knapsack, Chain matrix multiplication, Shortest paths, Independent sets in trees.

(18 hours)

Unit – III

Linear programming and reductions: An introduction to linear programming, Flows in networks, Bipartite matching, Duality, Zero-sum games, The simplex algorithm, Postscript: circuit evaluation, **NP-complete problems:** Search problems, NP-complete problems, The reductions, **Coping with NP-completeness:** Intelligent exhaustive search, Approximation algorithms, Local search heuristics

(18 hours)

Books:

(1) Algorithms – Sanjoy Dasgupta, Christos Papadimitriou and Umesh Vazirani, TMH-2008
(2) Introduction to Algorithms – Thomas H. Cormen, Charles E. Leiserson, Ronald L Rivest, Clifford Stein, 3rd edition, The MIT Press, 2009
(3) Combinatorial Optimization: Algorithms and Complexity, Christos H. Papadimitriou, Kenneth Steiglitz