### III SEMESTER

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Subject Code</th>
<th>Name of the Subject</th>
<th>No. of Hrs./Week</th>
<th>Duration of Exam in Hours</th>
<th>Marks for Total Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>10LEL31</td>
<td>10EC071</td>
<td>RF &amp; Microwave Circuit Design</td>
<td>4 - 2</td>
<td>3</td>
<td>50 100 150</td>
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<tr>
<td>10LEL32</td>
<td>10ECxxx</td>
<td>Elective-III (10LEL32x)</td>
<td>4 - 2</td>
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<tr>
<td>10LEL33</td>
<td>10ECxxx</td>
<td>Elective-IV (10LEL33x)</td>
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<tr>
<td>10LEL34</td>
<td>10EC931</td>
<td>Evaluation of Project Phase I</td>
<td>- - -</td>
<td>-</td>
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</tbody>
</table>

Project Phase I (6 week Duration) should start between II Semester and III Semester, after availing a vacation of 2 weeks. This will be evaluated during III semester.

Total | 12 | 00 | 06 | 09 | 200 | 300 | 500

### ELECTIVE – III

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<th>Course Code</th>
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<tbody>
<tr>
<td>10LEL321</td>
<td>10EC066</td>
<td>Process Control Instrumentation</td>
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<tr>
<td>10LEL322</td>
<td>10EC123</td>
<td>Modern DSP</td>
</tr>
<tr>
<td>10LEL323</td>
<td>10EC005</td>
<td>Advanced Control Systems</td>
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</table>

### ELECTIVE – IV

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<tr>
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<tbody>
<tr>
<td>10LEL331</td>
<td>10EC047</td>
<td>Low Power VLSI Design</td>
</tr>
<tr>
<td>10LEL332</td>
<td>10EC003</td>
<td>Advanced Computer Architecture</td>
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<tr>
<td>10LEL333</td>
<td>10EC043</td>
<td>Image &amp; Video Processing</td>
</tr>
</tbody>
</table>

### III – SEMESTER

**RF AND MICROWAVE CIRCUIT DESIGN**

Subject Code : 10EC071
No. of Lecture Hours /week : 04
Total no. of Lecture Hours : 52
IA Marks : 50
Exam Hours : 03
Exam Marks : 100

**Wave Propagation in Networks:** Introduction to RF/Microwave Concepts and applications; RF Electronics Concepts; Fundamental Concepts in Wave Propagation; Circuit Representations of two port RF/MW networks.

**Passive Circuit Design:** The Smith Chart, Application of the Smith Chart in Distributed and lumped element circuit applications, Design of Matching networks.

**Basic Considerations in Active Networks:** Stability Consideration in Active networks, Gain Considerations in Amplifiers, Noise Considerations in Active Networks.


**REFERENCE BOOKS:**

ELECTIVE - III
PROCESS CONTROL INSTRUMENTATION

Subject Code : 10EC066  IA Marks : 50
No. of Lecture Hours /week : 04  Exam Hours : 03
Total no. of Lecture Hours : 52  Exam Marks : 100

Introduction to Process Control, objects and benefits, mathematical modeling;

Principles, Modeling Analysis for Process Control: Dynamic behavior of typical process systems;

PID Controller tuning for dynamic performance, stability analysis and controller tuning;

Digital Implementation of process control;

Temperature Measurement using IC temperature sensor, thermocouple & RTD; Measurement of strain, force, displacement weight, flow and pressure;

Signal Conditioning & Transmission. 4-20mA current transmitter for LVDT, signal conditioning for low level DC & AC signals, concept of shielding, grounding & EMI

REFERENCE BOOKS:
2. Anvekar & Sonde, “Electronic Data Converters”, TMH

MODERN DSP

Subject Code : 10EC123  IA Marks : 50
No. of Lecture Hours /week : 04  Exam Hours : 03
Total no. of Lecture Hours : 52  Exam Marks : 100

Goal of the course – Advances in Digital Signal Processing involve variable sampling rates and thus the multirate signal processing and hence their applications in communication systems and signal processing. It is intended to introduce a basic course in multirate signal processing especially meant for students of branches eligible for M Tech courses in EC related disciplines.

Review of Signals and Systems – Discrete time processing of continuous signals - Structure of a digital filter; Frequency domain analysis of a digital filter; Quantization error; Sigma and Sigma Delta Modulation. Fourier Analysis – DFT, DTFT, DFT as an estimate of the DTFT for Spectral estimation. DFT for convolution, DFT/DCT for compression, FFT. Ideal Vs non ideal filters, FIR and IIR Filters Digital Filter Implementation; Elementary Operations.

Digital Filters –, State Space realization, Robust implementation of Digital Filters, Robust implementation of equi – ripple FIR digital filters

Multirate Systems and Signal Processing. Fundamentals – Problems and definitions; Upsampling and downsampling; Sampling rate conversion by a rational factor;

Multistage implementation of digital filters; Efficient implementation of multirate systems.

Maximally Decimated Filter banks – Vector spaces, Two Channel Perfect Reconstruction conditions; Design of PR filters Lattice Implementations of Orthonormal Filter Banks, Applications of Maximally Decimated filter banks to an audio signal.

Introduction to Time Frequency Expansion; The STFT; The Gabor Transform, The Wavelet Transform; The Wavelet transform; Recursive Multiresolution Decomposition.

References:

ADVANCED CONTROL SYSTEMS

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<thead>
<tr>
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<tr>
<td>10EC005</td>
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<td>04</td>
<td>03</td>
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Digital Control Systems: Review of difference equations and Z — transforms, Z- transfer function (Pulse transfer function), Z-. Transforms analysis sampled data systems, Stability analysis (Jury’s Stability Test and Bilinear Transformation), Pulse transfer functions and different configurations for closed loop Discrete-time control systems

Modern Control Theory: I, State model for continuous time and discrete time systems, Solutions of state equations (for both continuous and discrete systems), Concepts of controllability and observability (For both continuous and discrete systems), Pole Placement by state feedback (for both continuous and discrete systems), Full order and reduced order observes (for both continuous and discrete systems). Dead beat control by state feedback, Optimal control problems using state variable approach, State Regulator and output regulator, Concepts of Model reference control systems, Adaptive Control systems and design

Non Linear Control Systems: Common nonlinearities, Singular Points, Stability of nonlinear systems - Phase plane analysis and describing function analysis, Liapunoy’s stability criterion, Popov’s criterion

REFERENCE BOOKS:
1. Ogata. K. “Modern Control Engineering”, PHI
2. Ogata K “Discrete time Control Systems”, Pearson Education

ELECTIVE – IV

LOW POWER VLSI DESIGN

<table>
<thead>
<tr>
<th>Subject Code</th>
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<tr>
<td>10EC047</td>
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**Introduction**: Need for low power VLSI chips, Sources of power dissipation on Digital Integrated circuits. Emerging Low power approaches, Physics of power dissipation in CMOS devices.

**Device & Technology Impact on Low Power**: Dynamic dissipation in CMOS, Transistor sizing & gate oxide thickness, Impact of technology Scaling, Technology & Device innovation

**Power estimation, Simulation Power analysis**: SPICE circuit simulators, gate level logic simulation, capacitive power estimation, static state power, gate level capacitance estimation, architecture level analysis, data correlation analysis in DSP systems, Monte Carlo simulation.

**Probabilistic power analysis**: Random logic signals, probability & frequency, probabilistic power analysis techniques, signal entropy.

**Low Power Design Circuit level**: Power consumption in circuits. Flip Flops & Latches design, high capacitance nodes, low power digital cells library

**Logic level**: Gate reorganization, signal gating, logic encoding, state machine encoding, pre-computation logic

**Low power Architecture & Systems**: Power & performance management, switching activity reduction, parallel architecture with voltage reduction, flow graph transformation, low power arithmetic components, low power memory design.

**Low power Clock Distribution**: Power dissipation in clock distribution, single driver Vs distributed buffers, Zero skew Vs tolerable skew, chip & package co design of clock network


**REFERENCE BOOKS**:


**ADVANCED COMPUTER ARCHITECTURE**

<table>
<thead>
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<tbody>
<tr>
<td>10EC003</td>
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**Parallel Computer Models**: The state of computing, Classification of parallel computers, Multiprocessors and multicomputers, Multivector and SIMD computers.

**Program and Network Properties**: Conditions of parallelism, Data and resource Dependences, Hardware and software parallelism, Program partitioning and scheduling, Grain Size and latency, Program flow mechanisms, Control flow versus data flow, Data flow Architecture, Demand driven mechanisms, Comparisons of flow mechanisms

**Principles of Scalable Performance**: Performance Metrics and Mesaures, Parallel Processing Applications, Speedup Performance Laws, Scalability Analysis and Approches.

**Advanced Processors**: Advanced processor technology, Instruction-set Architectures, CISC Scalar Processors, RISC Scalar Processors, Superscalar Processors, VLIW Architectures, Vector and Symbolic processors
Pipelining: Linear pipeline processor, nonlinear pipeline processor, Instruction pipeline Design, Mechanisms for instruction pipelining, Dynamic instruction scheduling, Branch Handling techniques, branch prediction, Arithmetic Pipeline Design, Computer arithmetic principles, Static Arithmetic pipeline, Multifunctional arithmetic pipelines

Memory Hierarchy Design: Cache basics & cache performance, reducing miss rate and miss penalty, multilevel cache hierarchies, main memory organizations, design of memory hierarchies.

Multiprocessor Architectures: Symmetric shared memory architectures, distributed shared memory architectures, models of memory consistency, cache coherence protocols (MSI, MESI, MOESI), scalable cache coherence, overview of directory based approaches, design challenges of directory protocols, memory based directory protocols, cache based directory protocols, protocol design tradeoffs, synchronization.

Multithread and Dataflow Architecture: Principles of Multithreading, Scalable and Multithreaded Architecture, Dataflow Architecture

REFERENCE BOOKS:
1. Kai Hwang, “Advanced computer architecture”; TMH.

IMAGE AND VIDEO PROCESSING

Subject Code : 10EC043
IA Marks = 50
No. of Lecture Hours /week = 04
Exam Hours = 03
Total no. of Lecture Hours = 52
Exam Marks = 100


Image Perception: Light, Luminance, Brightness, Contrast, MTF of the visual system, Visibility function, Monochrome vision models, Fidelity criteria, Color representation, Chromaticity diagram, Color coordinate systems, Color difference measures, Color vision model, Temporal properties of vision.

Image Sampling and Quantization: Introduction, 2D sampling theory, Limitations in sampling & reconstruction, Quantization, Optimal quantizer, Compander, Visual quantization.


Image Representation by Stochastic Models: Introduction, one-dimensional Causal models, AR models, Non-causal representations, linear prediction in two dimensions.

Image Enhancement: Point operations, Histogram modeling, spatial operations, Transform operations, Multispectral image enhancement, false color and Pseudo-color, Color Image enhancement.


Image Analysis & Computer Vision: Spatial feature extraction, Transform features, Edge detection, Boundary Extraction, Boundary representation, Region representation, Moment representation, Structure, Shape features, Texture, Scene matching & detection, Image segmentation, Classification Techniques.
**Image Reconstruction from Projections:** Introduction, Radon Transform, Back projection operator, Projection theorem, Inverse Radon transform, Fourier reconstruction, Fan beam reconstruction, 3D tomography.

**Image Data Compression:** Introduction, Pixel coding, Predictive techniques, Transform coding, Inter-frame coding, coding of two tone images, Image compression standards.

**Video Processing:** Fundamental Concepts in Video – Types of video signals, Analog video, Digital video, Color models in video, Video Compression Techniques – Motion compensation, Search for motion vectors, H.261, H.263, MPEG I, MPEG 2, MPEG 4, MPEG 7 and beyond, Content based video indexing.

**REFERENCE BOOKS:**