SCHEME OF TEACHING AND EXAMINATION
M.TECH. - SIGNAL PROCESSING

II SEMESTER

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Subject Code</th>
<th>Name of the Subject</th>
<th>Teaching hours/week</th>
<th>Duration of Exam in Hours</th>
<th>Marks for</th>
<th>Total Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Lecture</td>
<td>Practical</td>
<td>Tutorial</td>
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<tr>
<td>10LSP21</td>
<td>10EC030</td>
<td>Digital Signal Compression</td>
<td>4</td>
<td>-</td>
<td>2</td>
<td>3</td>
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<tr>
<td>10LSP22</td>
<td>10EC123</td>
<td>Modern Digital Signal Processing</td>
<td>4</td>
<td>2</td>
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<tr>
<td>10LSP23</td>
<td>10EC093</td>
<td>Modern Spectral Analysis &amp; Estimation</td>
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<td>10LSP24</td>
<td>10EC069</td>
<td>Real Time Digital Signal Processors</td>
<td>4</td>
<td>2</td>
<td>-</td>
<td>3</td>
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<td>10LSP25</td>
<td>10ECxxx</td>
<td>Elective-II (10LSP25x)</td>
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<td>10LSP26</td>
<td>10EC921</td>
<td>Mini-Projects</td>
<td>--</td>
<td>3</td>
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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 | 20 | 07 | 06 | 15 | 300 | 500 | 800

* Practical will be evaluated 25 marks and internal assessment for 25 marks. Lab journals should be maintained.
‡ Assignments/seminar will be evaluated for 25 marks and internal assessment for 25 marks. Record of Assignments/seminar should be maintained.
§ Mini projet should be done individually and is assessed for 25 marks. Seminar on Miniproject will be assessed for 25 marks

ELECTIVE – II

<table>
<thead>
<tr>
<th>Course Code</th>
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<tbody>
<tr>
<td>10LSP251</td>
<td>10EC028</td>
<td>Detection &amp; Estimation</td>
</tr>
<tr>
<td>10LSP252</td>
<td>10EC086</td>
<td>Wireless Communication</td>
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</table>

10LSP253 | 10EC048 | Medical Imaging

II - SEMESTER

DIGITAL SIGNAL COMPRESSION

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>No. of Lecture Hours /week</th>
<th>Total no. of Lecture Hours</th>
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<tbody>
<tr>
<td>10EC030</td>
<td>04</td>
<td>52</td>
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</table>

IA Marks : 50
Exam Hours : 03
Exam Marks : 100

Introduction: Compression techniques, Modeling & coding, Distortion criteria, Differential Entropy, Rate Distortion Theory, Vector Spaces, Information theory, Models for sources, Coding – uniquely decodable codes, Prefix codes, Kraft McMillan Inequality

Quantization: Quantization problem, Uniform Quantizer, Adaptive Quantization, Non-uniform Quantization; Entropy coded Quantization, Vector Quantization, LBG algorithm, Tree structured VQ, Structured VQ, Variations of VQ – Gain shape VQ, Mean removed VQ, Classified VQ, Multistage VQ, Adaptive VQ, Trellis coded quantization


Transform Coding: Transforms – KLT, DCT, DST, DWHT; Quantization and coding of transform coefficients, Application to Image compression – JPEG, Application to audio compression.


REFERENCE BOOKS:


Modern Digital Signal Processing

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<tr>
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<th>50</th>
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<tr>
<td>No. of Lecture Hours/Week</td>
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<td>03</td>
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<tr>
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<td>Exam Hours</td>
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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:

MODERN SPECTRAL ANALYSIS & ESTIMATION

<table>
<thead>
<tr>
<th>Subject Code</th>
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<tbody>
<tr>
<td>10EC093</td>
<td>50</td>
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<td>No. of Lecture Hours /week</td>
<td>Exam Hours</td>
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<tr>
<td>04</td>
<td>03</td>
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Spectrum Estimation: Introduction, Correlogram method, Periodogram Computation Via FFT, properties of Periodogram method such as bias analysis, window design considerations. Signals with Rational spectra. ARMA state – space Equation, sub space Parameter Estimation.


REFERENCE BOOKS:

REAL TIME DIGITAL SIGNAL PROCESSING

<table>
<thead>
<tr>
<th>Subject Code</th>
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<tr>
<td>10EC069</td>
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<td>No. of Lecture Hours /week</td>
<td>Exam Hours</td>
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<tr>
<td>04</td>
<td>03</td>
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</table>
Digital Signal Processing Fundamentals:

Review of DSP Fundamentals; FIR filter design by windowing;

Adaptive filtering techniques; Fourier analysis of signal using FFT;

Introduction to Real time DSP and Moronic DS5630X, Architecture.; Instruction set; Addressing modes; Simple 5630X program;

Real time digital FIR filter; Real time LMS adaptive filters; Real time frequency domain processing

REFERENCE BOOKS:


ELECTIVE II

DETECTION AND ESTIMATION

Subject Code : 10EC028
IA Marks : 50
No. of Lecture Hours /week : 04
Exam Hours : 03
Total no. of Lecture Hours : 52
Exam Marks : 100


Estimation of Continuous Waveforms: Introduction, derivation of estimator equations, a lower bound on the mean-square estimation error, multidimensional waveform estimation, nonrandom waveform estimation.


REFERENCE BOOKS:

Radio Propagation: Free space propagation model, Relating power to electric field, reflection, ground reflection, diffraction, scattering, practical link budget design using path loss models, outdoor propagation models, indoor propagation models, signal penetration into buildings, ray tracking and site specific modeling, small scale multi-path propagation, impulse response model of a multi-path channel, small scale multi-path measurements, parameters of mobile multi-path channels, types of small scale fading, Rayleigh and Ricean distributions, statistical models for multi-path fading channels.

Diversity Techniques: Concepts of Diversity branch and signal paths, Combining and switching methods, C/N, C/I performance improvements, Average P_e performance improvement, RAKE receiver.

Cellular Concept: Frequency reuse, channel assignment strategies, handoff strategies; interference and system capacity, trunking and grade of service, improving coverage and capacity in cellular systems. FDMA, TDMA, spread spectrum multiple access, SDMA, packet Radio, capacity of cellular systems.

Personal Mobile Satellite Communications: Integration of GEO, LEO, and MEO Satellite and Terrestrial mobile systems, personal satellite Communications programs.


REFERENCE BOOKS:

**Computed Tomography:** Basic principles, system components and truncations of scanning systems, Medical applications and safety precautions, Discussion on reconstruction algorithms

**Ultrasound:** Functional block diagram of basic pulse echo system for diagnostic purposes, A mode, B mode and M mode principles of echocardiography

**Magnetic Resonance Imaging:** Basic principles, Signals excitation and detection, Schematic functional diagram of MRI scanner with its sub systems, Magnet gradient systems, RF transmitter- receiver system, medical applications, safety precautions.

**Radio Nuclide Imaging:** Principles, schematic functional diagram and components of gamma, Medical applications, safety precautions.

**Medical Thermography:** Basic principles, functional diagram of thermo graphic equipment PET Principles Medical applications of microwaves

**REFERENCE BOOKS:**

5. G.T. Herman, “*Imaging reconstruction from projections — Implementation and applications*”, Topics in applied physics vol.32 Springer Verlag’ 1979.