GUJARAT TECHNOLOGICAL UNIVERSITY

M.E Semester-II

Signal Processing and Communication (w.e.f. 28/2/2012)

PROPOSED TEACHING SCHEME (SEMESTER-II)

SUBJECT CODE	Subject	Teaching Scheme(Hours)			Credits
		Theory	Tutorial	Practical	
1720001	Principle of management	3	0	0	3
1724101	RF and Microwave Circuits	4	0	2	5
1724102	Wireless Adhoc and Sensor Networks	4	0	2	5
	Major Elective - II	3	0	2	4
	Major Elective - III	3	0	2	4
	Inter Disciplinary Elective II	3	0	2	4
Total		**20**	**4**	**6**	**25**

Major Elective - II	
SUBJECT CODE	**Major Elective- II**
1724103	Error Control Coding Communication
1722605	Multirate Signal Processing
1710419	Antenna Engineering and Design
1724104	Digital Video Processing
Major Elective - III	
SUBJECT CODE	**Major Elective- III**
1724105	Speech Signal Processing and Applications
1724106	Image Matching and Registration
1724107	Bio - Medical Signal and Image Processing
Inter Disciplinary Elective - II	
SUBJECT CODE	**Inter Disciplinary Elective- II**
1724108	Digital Signal Processor Based Motion Control
1724109	Electronics System Design
1710410	Introduction to Artificial Intelligence

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Subject code: **1724101**

subject Name:- **RF and Microwave Circuits**

Sr.No.	Content
1	Introduction: Basics of Microwave propagation, propagation through transmission line, Transmission line analysis, Microstrip lines, Losseless transmission line, Loaded transmission line, Rectangular and circular waveguide analysis, Maxwells time varying equations applications, Poynting vector, Uniqueness theorems, Smith chart applications and examples of stub matching.
2	RF and Microwave Components and Analysis: Impedance and admittance matrix, scattering matrix and parameters, ABCD matrix, principle working and analysis of Ferrite materials and Faraday's rotation, Modal analysis, signal flow graph representation, Ferromagnetic material such as isolator, Gyrator and circulators.Passive comonents such as Microwave resonators,Hybrid junctions, power dividers and couplers.
3	RF and Microwave filters: Periodic structures, Basic resonator and Filter configurations, Filter design methods, Filter Transformations, Filter implementation, Filter examples, Filter using cavity resonators.
4	Microwave Circuits**:** MMIC Introduction, Types of MICs and their technology, Hybrid and Monolithic technolgy, MIC Lumped and distribution elements, Microwave solid state devices and circuits, various microwave oscillators circuits and Mixer circuits, Microwave Communication system

Reference Books:

1. David M Pozar, Microwave engineering, second edition, John Wiley and sons Publications
2. Robert E Collin, Foundations for Microwave Engineering second edition, Wiley India publication.
3. Annapurna Das and Shishir Das, Microwave Engineering, second edition, TMH publications.
4. K C Gupta and Amarjit Singh, Microwave Integrated Circuits, John Willey and sons Publications.

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Subject code: **1724102**

Subject Name:- Wireless Ad Hoc and Sensor Networks

Sr.No.	Content
1	Introduction to Wireless Ad Hoc Networks**:** Background of Ad hoc wireless networks, Architecture of Ad Hoc Networks, Application of Ad Hoc sensor networks, Protocols of Ad Hoc Networks, Issues in Ad Hoc wireless networks. Comparison between Wireless Ad Hoc and Sensor Networks
2	Basics of Wireless Sensor Network**:** Background of Sensor Network Technology, MANETs, Sensor Network Architectural Elements, Applications of Wireless Sensor Network , Technologies for Wireless Sensor Network
3	Wireless Sensors Networks Protocols**:** Medium Access Control Protocols, Routing Protocols, Transport Control Protocols, Dissemination protocol for Large sensor Networks, Reliable Transport for Sensor networks.
4	Localization and Management of Sensor Networks**:** Localization in Sensor networks,Network Management Requirements, Network Management Models, Design Issues, Energy Harvesting in Sensor Network
5	Control Aspect in Sensor Networks **:** Congestion control, Distributed Power Control, Admission Controller Design for High Speed Networks, Performance evaluation of the Architecture.
6	Security in WSN**:** Security Issues in WSN, Key Distribution Techniques in WSN, Watermarking techniques in Wireless Sensor Networks

REFERENCE BOOKS

1. Title**:** Wireless Sensor Networks: Technology, Protocols, and Applications
   Author(s): Kazem Sohraby, Daniel Minoli, Taieb Znati
   Publisher: Wiley Student Edition
2. Title**:** Wireless Sensor Networks
   Author(s): C.S. Raghavendra, Krishna M. Sivalingam and Taieb Znati
   Publisher: Springer International Edition
3. Title: Adhoc Wireless Sensor Networks: Architecture and Protocols
   Author(s): C.Sivaramamurthy and B.S.Manoj
   Publishers: Pearson Education
4. Title: Wireless Ad Hoc and Sensor Networks Protocols,Perfomances and Control
   Author(s): Jagannathan Sarangapani, "
   Publisher: CRC Press

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Subject code: **1724103**

Subject Name: **Error Control Coding in Communication (Major Elective II)**

Sr.No.	Content
1	**Introduction:** Types of codes, Modulation and Demodulation, Maximum Likelihood Decoding, Types of Errors, Problems
2	**Linear block codes:** Introduction to linear block codes, Syndrome and Error detection, Minimum Distance of Block Codes, Error Detecting and Error Correcting Capabilities of Block code, Syndrome Decoding, Hamming Codes, Problems
3	**Cyclic Codes:** Description of cyclic codes, Generator and Parity Matrix of Cyclic Codes, Encoding of Cyclic Codes, Syndrome Computation and Error detection, Decoding of Cyclic Codes, Cyclic Hamming Codes, Shortened Cyclic Codes, Problems, Error Trapping Decoding for Cyclic Codes
4	**BCH Codes and Burst Error Correcting Codes:** Description of BCH Codes, Decoding of BCH Codes, Implementation of Error Detection, Non Binary BCH Codes and Reed-Solomon Codes, Weight Distribution and Error Detection of Binary BCH Codes, Problems, Single Burst Error Correcting Codes, Interleaved Codes.
5	**Convolution Codes:** Encoding of Convolutional Codes, Encoding of Convolutional Codes Using Time-Domain Approach, Encoding of Convolutional Codes Using Transform-Domain Approach, State Diagrams and Code Tree of Convolution Codes, Trellis Diagram, Problems.
6	**Modern Coding:** **Turbo Coding**: Introduction, Distance Properties, Performance Analysis, Design, Iterative Decoding. **Low Density Parity Check Code**: Introduction, Tanner Graph for Linear Block Code, a geometric construction of LDPC code, EG-LDPC code, PG-LDPC code, Decoding of LDPC Code.

REFERENCE BOOKS:

1. Title: Error Control Coding: Fundamentals and Applications
   Authors: Shu Lin and Daniel J.Costello
   Publishers: Prentice Hall Series

2. Title: Digital Communications Fundamentals and Applications
   Authors: Bernard Skalar
   Publishers: Prentice Hall

3. Title: Introduction to Error Control Codes
   Authors: Salvatore Gravans
   Publishers: Oxford University Press

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Suject code: **1724104**
Subject Name:- **Digital Video Processing (Major Elective II)**

Sr.No.	Content
1	Introduction: Analog Video and Digital Video, Standards, Three Dimensional Motion Models, Geaometric Image Formation, Photometric Image Formation.
2	Spatial Temporal Sampling: Sampling for Analog and Digital Video, Rectangular Sampling and Periodic Sampling, Sampling and 3-D Structure, Reconstruction from Samples, Sampling Structure Conversion.
3	Motion Estimation and Segmentation: Optical Flow Methods, Block Based Methods, PEL –Recursive Methods, Bayesian Methods, Direct Methods for Segmentation
4	Motion Tracking: Motion and Structure from Stereo, 2-D Motion Tracking, 3-D Rigid Motion Tracking.
5	Video Filtering: Spatial Temporal Fourier Spectrum, Sub Nyquist Spatial Temporal Filtering, Filtering Along Motion Trajectories.

Reference Books:

1. Title: Digital Video Processing
   Author: A. Murat Tekalp
   Publishers: Pearson Education

2. Title: Video Compression
   Author: Peter D. Symes
   Publishers: Mc Graw Hill Publishers

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Subject Code: **1724105**

Subject Name:- **Speech Signal Processing and Applications**

(Major Elective III)

Sr. No.	Content
1	Speech Communication**:** Introduction, discrete-time speech signal processing, speech communication, review of signals and linear systems
2	Speech production and acoustic phonetics**:** Anatomy and physiology of speech organs, speech sounds and classification, International Phonetic Alphabet (IPA), Articulatory Phonetics: Manner of articulation and place of articulation, vowel triangle, Acoustic Phonetics: spectrograms, wide-band and narrow-band spectrograms, acoustic characteristics of speech sounds, coarticulation and prosody
3	Time-domain models for speech processing**:** Introduction to short-time speech analysis, windowing, short-time energy and average magnitude, short-time Zero-Crossing Rate (ZCR), speech vs. silence discrimination using energy and zero crossings, short-time autocorrelation function, short-time Average Magnitude Difference Function (AMDF)
4	Short-time Fourier analysis**:** Short-time Fourier transform (STFT), spectral displays, time-frequency resolution tradeoffs, Linear filtering interpretation, short-time synthesis, filter bank summation method
5	Linear Predictive Coding of Speech**:** Basic principles of Linear predictive analysis, autocorrelation method and covariance method, computation of gain for the model, prediction error signal, frequency domain interpretation of LP analysis, frequency domain interpretation of mean-squared prediction error, applications of LPC parameters
6	Homomorphic Signal Processing**:** Concept of Homomorphic processing, Homomorphic systems for convolution, properties of complex cepstrum, Homomorphic filtering, complex cepstrum of voiced speech, complex cepstrum of unvoiced speech, Mel-scale cepstrum
7	Applications**:** Pitch detection, Isolated Digit Recognition, Speaker Recognition, speech enhancement, speech coding

REFERENCE BOOKS

1. Title: Speech Communication: Human and machine
   Author(s):D. O'Shaughnessy
   Publisher: Uniiversity Press
2. Title:Digital Processing of Speech Signals
   Author(s):L. Rabiner and R. Schafer
   Publisher:Pearson Education
3. Title:Discrete-time Speech Signal Processing
   Author(s):T. Quatieri
   Publisher:Pearson Education

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Signal Processing and Communications

Subject Code : **1724106**

Subject Name:- **Image Matching and Registration (Major Elective III)**

Sr.No.	Content
1	Introduction, Computer Vision, Classification of Existing Vision Systems, Acquisition Systems, Multisensor, Multiview, Multi temporal and Multi-resolution Registration.
2	Fundamental of Stereo Vision, Transform Based Techniques, Symbolic Feature Based Techniques, Hybrid Techniques, Matching Constraints and Diagnosis.
3	Feature Correspondence, Point Pattern Matching, Line Matching, Region Matching, chamfer matching, template matching, performance evaluation
4	Image Registration, Affine Transformations, Projective Transformation, Applications of Transforms to Images, Similarity Transformation, Thin-Plate Spline, Multiquadratic,Weighted Mean , Resampling Issues.
5	Area Based and Feature based Methods for Registration, Time and Frequency Based Methods for Registration, Model-Based Registration, Adaptive Registration.
6	Applications to Medical Images, License Plate Images and Satellite Images

Reference Books:

1. Title: Digital Image Processing Using MATLAB
   Authors: Rafael C. Gonzalez, Richard E. Woods and Steven L. Eddins
   Publishers: TMH
2. Title: Object Recognition – Fundamentals and Case Studies
   Authors: M. Bennamoun and G.J. Mamic
   Publishers: Springer Publications
3. Title: 2D and 3D Image Registration for Medical , Remote Sensing and Industrial Applications
   Author(s): A. Ardeshir Goshtasby
   Publishers: John Wiley and Sons Inc
4. Title: Image Registration: Principals, Tools and Methods
   Author(s): A. Ardeshir Goshtasby
   Publications: Springer Publications
5. Title: Medical Image Registration
   Author(s): Joseph V. Hajmal, Derek L.G. Hill and David J.Hawks
   Publications: Publications: CRC Press
6. Selected Papers from Research Journals and Transactions.

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Subject Code : **1724107**

Subject Name: **Biomedical Signal and Image Processing (Major Elective III)**

Sr. No.	Content
1	Introduction to Human Physiological system, Sources of Bioelectric potentials, Types of Biomedical signals: ECG, EEG, EMG, EOG, ERG etc.
2	Function and Structure of the Heart, Electrocardiogram: Signal of the Cardiovascular System, Noise and artifacts, Cardiovascular Diseases and the ECG, ECG signal processing: ECG filtering, baseline wander, power line interference, QRS detection, Wave Delineation, Data compression.
3	The Brain and Its Functions, Electroencephalogram: Signal of the Brain, Evoked Potentials, Diseases of the Central Nervous System and the EEG, Artifacts in the EEG, Modeling the EEG signal, Autoregressive (AR) Model.
4	The nature of biomedical image, Medical Imaging Modalities: X-Ray Imaging, Magnetic Resonance Imaging, Computed Tomography, PET and Ultrasound Imaging.
5	Biomedical Image coding and compression: Fundamentals, some basic compression methods: Huffman coding, Arithmetic coding, LZW coding, Run length coding, Bit plane coding, Block transform coding, Predictive coding and Wavelet coding, Digital image watermarking.
6	Medical image registration: methodology, Rigid and non-rigid transformations, objective functions: feature based and intensity based, Joint entropy, mutual information, optimization methods and applications of image registration

REFERENCE BOOKS:

1. Title: Bioelectrical Signal Processing in Cardiac and Neurological applications
   Author(s): Leif Sornmo and Pablo Laguna
   Publishers: Elsevier Academic press.

2. Title: Biomedical Signal and Image Processing
   Author(s): Kayvan Najarian and Robert Splinter
   Publisher: CRC press, Taylor & Francis Inc.

3. Title: Digital image processing
   Author(s): Gonzalez and Woods
   Publisher: Pearson Education

4. Title: Medical Image Analysis,
   Author(s): Atam P. Dhawan
   Publishers: IEEE Press series in Biomedical Engineering, Wiley Publication.

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Subject Code : **1724108**

Subject Name:- Digital Signal Processor in Motion Control
(Interdisciplinary Elective II)

Sr.No.	Content
1	Review of Signal Processor Architecture, Concepts in motion control, Review of power electronics, DSP architecture for Motion Control, Introduction to LF2407 and its variants.
2	Peripheral and Core of LF2407, Instruction Set and Programming C2xx DSP. General purpose I/O functionality and Interrupts.
3	Analog to Digital Converters and Event Managers, PWM generation
4	DSP based implementation of DC-DC Buck Boost Converter, DSP implementation of Stepper Motors and DSP Based Implementation of PMDC Motors.

Reference Books:

1. Title : DSP Based Electromechanical Motion Control
   Author: Hamid A. Toliyat and Steven G.Campbell
   Publishers: CRC Press

2. Title: The Stepper Motors and Their Microprocessor Control
   Author: Takashi Kenjo and Suguwara
   Publishers: Oxford Press

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Subject Code : **1724109**

Subject Name:- Electronic System Design (Interdiciplinary Elective II)

Sr.No.	Content
1	Introduction and Review of Analog Electronic Circuits, Digital Electronic Circuits
2	Sensors and Transducers with Signal Conditioning Circuits. Simulation and Design Using Software Tools.
3	Controller Architectures of 8, 16 bit and 32 bit. System on Chip Architectures Case Studies of ARM 7 and its variants, Mixed Signal Processor and Devices,. Programming Issues. Interrupt Structures, Real Time System, Applications.
4	Field Programmable Gate Arrays and Complex Programmable Logic Devices based System Design, Applications

Reference Books:

1 .Title: Electronics Circuits, Handbook for Design and Applications
Author : U.Tietze, Ch. Schenk
Publisher: Springer Publication

2. Title: Transducer and Instrumentation
Author : D.S.Murthy
Publisher: PHI

3. Title: ARM System-on-chip Architecture
Author : Steve Furber
Publisher: Pearson Education

4. Datasheet and References of related controllers.