SREE VIDYANIKETHAN ENGINEERING COLLEGE
(AUTONOMOUS)
Sree Sainath Nagar, Tirupati

Department of Electronics and Communication Engineering

Supporting Document for 1.1.2

Syllabus Revision carried out in 2016

Program: M.Tech.- Communication Systems

Regulations : SVEC-16

This document details the following:

1. Courses where syllabus has been changed 20% and more.
2. Course-wise revised syllabus with changes highlighted.

Note: *For SVEC-16 revised syllabus, SVEC-14 (previous syllabus) is the reference.*

List of Courses where syllabus content has been changed (20% and more)

S. No.	Course Code	Name of the course	Percentage of Content changed	Page Number in which Details are Highlighted
1.	16MT15706	Advanced Digital Signal Processing	20	3
2.	16MT13802	Digital Communication Techniques	20	7
3.	16MT13801	Computer Networks	30	11
4.	16MT16132	RF Circuits & Optical Communications lab	100	15
5.	16MT13808	Research Methodology	100	17
6.	16MT13804	Image & Video Processing	100	19
7.	16MT26102	Smart Antennas	100	21
8.	16MT23809	Speech Processing	100	23
9.	16MT26131	Communications Lab - II	40	25
10.	16MT13832	Image & Video Processing Lab	100	29
11.	16MT23810	Intellectual Property Rights	100	31
		Average %**(A)**	73.64	-
		Total No. of Courses in the Program **(T)**	28	
		No. of Courses where syllabus (more than 20% content) has been changed **(N)**	11	
		Percentage of syllabus content change in the courses **(C)=(A x N)/100**	8.1	
		Percentage of Syllabus Content changed in the Program (P)= C/T	**28.93**	

DEAN (Academics)

DEAN (Academic)
SREE VIDYANIKETHAN ENGINEERING COLLEGE
Sree Sainath Nagar, A. RANGAMPET
CHITTOOR (DT.)-517 102, A.P.

PRINCIPAL

PRINCIPAL
SREE VIDYANIKETHAN ENGINEERING COLLEGE
(AUTONOMOUS)
Sree Sainath Nagar, A. RANGAMPET
Chittoor (Dist.) - 517 102, A.P., INDIA.

I M. Tech. – I Semester
(16MT15706) ADVANCED DIGITAL SIGNAL PROCESSING
(Common to VLSI (PE – I) & CMS)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	4	-	-	4

PRE-REQUISITES: Courses on Digital Signal Processing at UG level

COURSE DESCRIPTION:
Digital filter banks; Parametric and Non-Parametric Power Spectrum Estimation methods; computationally efficient algorithms; Applications of DSP.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:
1. Gain in-depth knowledge in
   - Filter banks and Wavelets
   - Linear Prediction
   - Efficient power Spectral Estimation Techniques
   - Applications of Multirate signal processing
2. Analyze complex engineering problems critically in the field of Signal Processing.
3. Design optimum filters, multirate DSP systems and computationally efficient DSP algorithms for societal needs.
4. Solve engineering problems for feasible and optimal solutions in the field of digital signal processing.
5. Initiate research in advanced digital signal processing.
6. Learn and apply appropriate techniques, including prediction and modeling to complex engineering activities with an understanding of the limitations.
7. Contribute to scientific research in Radar signal processing ,Inter disciplinary areas like Speech and Image processing and Remote sensing with objectivity and rational analysis.

DETAILED SYLLABUS:

UNIT-I: MULTIRATE FILTER BANKS (Periods:12)
Decimation, Interpolation, Sampling rate conversion by a rational factor I/D, Multistage Implementation of sampling rate conversion. **Digital Filter Banks**: Two-Channel Quadrature-Mirror Filter Bank, Elimination of aliasing, condition for Perfect Reconstruction, Polyphase form of QMF bank, Linear phase FIR QMF bank, IIR QMF bank, Perfect Reconstruction Two-Channel FIR QMF Bank.

UNIT-II: POWER SPECTRAL ESTIMATIONS (Periods:12)
Estimation of spectra from finite duration observation of signals.

Non-Parametric Methods: Bartlett, Welch, Blackman & Tukey methods. Performance Characteristics of Non-parametric Power Spectrum Estimators, Computational Requirements of Non-parametric Power Spectrum Estimates.

Parametric Methods of Power Spectral Estimation:
Auto correlation & Its Properties, Relationship between auto correlation & model parameters, Yule-Walker & Burg Methods, MA & ARMA models for power spectrum estimation.

UNIT-III: LINEAR PREDICTION (Periods:10)

Forward and Backward Linear Prediction – Forward Linear Prediction, Backward Linear Prediction, Optimum reflection coefficients for the Lattice Forward and Backward Predictors. Solution of the Normal Equations: Levinson Durbin Algorithm, Schur Algorithm. Properties of Linear Prediction Filters.

UNIT-IV: DSP ALGORITHMS (Periods:10)

Fast DFT algorithms based on Index mapping, Sliding Discrete Fourier Transform, DFT Computation Over a narrow Frequency Band, Split Radix FFT, Linear filtering approach to Computation of DFT using Chirp Z-Transform.

UNIT-V: APPLICATIONS OF DIGITAL SIGNAL PROCESSING (Periods:11)

Digital cellular mobile telephony, Adaptive telephone echo cancellation, High quality A/D conversion for digital Audio, Efficient D/A conversion in compact hi-fi systems, Acquisition of high quality data, Multirate narrow band digital filtering, High resolution narrow band spectral analysis.

Total periods: 55

TEXT BOOKS:

1. John G. Proakis, Dimitris G. Manolakis, *Digital signal processing, principles, Algorithms and applications,* Prentice Hall, 4th edition, 2007.
2. Sanjit K Mitra, "*Digital signal processing, A computer base approach",* McGraw-Hill Higher Education, 4th edition, 2011.

REFERENCE BOOKS:

1. Emmanuel C Ifeacher Barrie. W. Jervis, "*DSP-A Practical Approach*", Pearson Education, 2nd edition, 2002.
2. A.V. Oppenheim and R.W. Schaffer, "*Discrete Time Signal Processing",* PHI, 2nd edition, 2006.

M. Tech. (VLSI) - I Semester (Elective-I)
M. Tech. (CMS) - I Semester

(14MT15706) ADVANCED DIGITAL SIGNAL PROCESSING

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	4	--	--	4

PRE-REQUISITES: Courses on Digital Signal Processing at UG level.

COURSE DESCRIPTION:
Design of digital filter banks; Power spectral estimation; Digital signal processing algorithms; DSP applications.

COURSE OBJECTIVES:

CEO1. To impart advanced knowledge in Digital Signal Processing and applications.
CEO2. To develop skills in design, analysis, problem solving and research in designing Multirate filter banks and power spectral estimation methods.
CEO3. To apply knowledge and skills for development of new algorithms in signal processing.

COURSE OUTCOMES:
On successful completion of this course the students will be able to

CO1. Gain advanced knowledge in
- Filter banks and Wavelets
- Efficient power Spectral Estimation Techniques.
- Adaptive filters.
- Applications of Multirate signal processing

CO2. Analyze complex engineering problems critically for conducting research in Adaptive filter design.

CO3. Solve engineering problems by designing computationally efficient DSP algorithms for feasible and optimal solutions in digital signal processing field.

CO4. Contribute to scientific research in signal processing and inter disciplinary areas like cellular mobile communications, multirate signal processing and spectral analysis.

DETAILED SYLLABUS:

UNIT I: MULTIRATE FILTER BANKS **(Periods:12)**

Decimation, Interpolation, Sampling rate conversion by a rational factor I/D, Multistage Implementation of sampling rate conversion. **Digital Filter Banks**: Two-Channel Quadrature-Mirror Filter Bank, Elimination of aliasing, condition for Perfect Reconstruction, Polyphase form of QMF bank, Linear phase FIR QMF bank, IIR QMF bank , Perfect Reconstruction Two-

Channel FIR QMF Bank .

UNIT II: POWER SPECTRAL ESTIMATIONS (Periods:11)

Estimation of spectra from finite duration observation of signals, **Non-Parametric Methods**: Bartlett, Welch, Blackmann & Tukey methods. Performance Characteristics of Nonparametric Power Spectrum Estimators, Computational Requirements of Nonparametric Power Spectrum Estimates.

UNIT III: PARAMETRIC METHODS OF POWER SPECTRAL ESTIMATION (Periods:11)

Autocorrelation & Its Properties, Relation between auto correlation & model parameters, Yule-Walker & Burg Methods, MA & ARMA models for power spectrum estimation.

UNIT IV: DSP ALGORITHMS (Periods:10)

Fast DFT algorithms based on Index mapping, Sliding Discrete Fourier Transform, DFT Computation Over a narrow Frequency Band, Split Radix FFT, Linear filtering approach to Computation of DFT using Chirp Z-Transform.

UNITV: APPLICATIONS OF DIGITAL SIGNAL PROCESSING (Periods:11)

Digital cellular mobile telephony, Adaptive telephone echo cancellation, High quality A/D conversion for digital Audio, Efficient D/A conversion in compact hi-fi systems, Acquisition of high quality data, Multirate narrow band digital filtering, High resolution narrowband spectral analysis.

Total periods: 55

TEXT BOOKS:

1. John G. Proakis, Dimitris G. Manolakis, *Digital signal processing, principles, Algorithms and applications,* Prentice Hall, 4th Edition, 2007.
2. Sanjit K Mitra, "*Digital signal processing, A computer base approach",* McGraw-Hill Higher Education, 4th Edition, 2011.

REFERENCE BOOKS:

3. Emmanuel C Ifeacher Barrie. W. Jervis, "*DSP-A Practical Approach*", Pearson Education, 2nd Edition, 2002.
4. A.V. Oppenheim and R.W. Schaffer, "*Discrete Time Signal Processing",* PHI, 2nd Edition, 2006.

I M. Tech. – I Semester
(16MT13802) DIGITAL COMMUNICATION TECHNIQUES
(Common to DECS & CMS)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	4	-	-	4

PRE-REQUISITES: --
Course on Digital Communications at UG Level**,** Review of random Variables and Processes

COURSE DESCRIPTION:
Characterization of Communication Signals and Systems; Digital Modulation Techniques; Optimum Receivers for the Additive Gaussian Noise Channel; Spread Spectrum Technique; Multichannel and Multicarrier Systems.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:
1. Demonstrate in-depth knowledge in
   - Characterization of communication signals and systems.
   - Digital modulation techniques
   - Communication over AWGN channels
   - Optimum receivers
   - Spread spectrum techniques
   - Multi-carrier communication system
2. Analyze numerical and analytical problems critically for conducting research in the field of Digital Communication Systems.
3. Solve engineering problems and arrive at optimal solutions pertaining to digital communications.
4. Apply appropriate techniques to complex engineering activities in the field of signal processing and communications.

DETAILED SYLLABUS:

UNIT I– CHARACTERIZATION OF COMMUNICATION SIGNALS AND SYSTEMS (10 periods)
Representation of Band Pass Signals and Systems–Representation of Band Pass Signals, Representation of Linear Band-Pass System, Response of a Band-Pass System to a Band-Pass Signal. Signal Space Representations – Vector Space Concepts, Signal Space Concepts, Orthogonal Expansion of Signals. Representation of Digitally Modulated Signals – Memory Less Modulation Methods – PAM Signals, Phase Modulated Signals, QAM Signals, Multidimensional Signals, Orthogonal Multidimensional Signals. Spectral Characteristics of Digitally Modulated Signals – Power Spectra of Linearly Modulated Signals.

UNIT II – DIGITAL MODULATION TECHNIQUES (11 periods)
Digital Modulation – Factors that Influence the Choice of Digital Modulation, Bandwidth and Power Spectral Density of Digital Signals. Linear Modulation Techniques – BPSK, DPSK, QPSK, OQPSK, Π/4 QPSK. Constant Envelope Modulation Techniques – MSK, GMSK, Combined Linear and Constant Envelope Modulation Techniques – M-ary PSK, M- ary QAM.

UNIT III – OPTIMUM RECEIVERS FOR THE ADDITIVE GAUSSIAN NOISE CHANNEL (10 periods)

Optimum Receiver for Signals corrupted by AWGN –Correlation demodulator, Matched Filter Demodulator, Optimum Detector. Performance of the Optimum Receiver for Memory Less Modulation – Probability of Error for Binary Modulation, M-ary Orthogonal Signals, M-ary PAM, M-ary PSK, QAM. Optimum Receiver for Signals with Random Phase in AWGN Channel – Optimum Receiver for Binary Signals, Optimum Receiver for M-ary Orthogonal Signals.

UNIT IV – SPREAD SPECTRUM TECHNIQUES (13 periods)

Introduction, Model of Spread Spectrum Digital Communication System, Direct Sequence Spread Spectrum Signals – Introduction, The Processing Gain and Jamming Margin. Applications of Direct Sequence Spread Spectrum Signals – Anti jamming Application, Low-Detectability Signal Transmission, Code Division Multiple Access. Generation of PN-Sequences, Frequency-Hopped Spread Spectrum Signals, Other Types of Spread Spectrum Signals. Detection of spread spectrum signals- Matched filter receiver, RAKE Receiver.

UNIT V –MULTICHANNEL AND MULTICARRIER SYSTEMS (10periods)

Rayleigh and Rician channels, Multichannel Digital Communications in AWGN Channels; Binary Signals, M-ary Orthogonal Signals. Multicarrier Communications; Single Carrier verses Multicarrier Modulation, Capacity of a Non ideal Linear Filter Channel, OFDM, Modulation & Demodulation in an OFDM, An FFT Algorithm Implementation of an OFDM System. OFDMA.

Total Periods: 54

TEXT BOOKS:

1. John G. Proakis, "Digital Communications", McGraw-Hill, 4th edition, 2001.
2. Theodore S. Rappaport, "Wireless Communications", Pearson Education, 2nd edition, 2002.
3. George R. Cooper & Clare D. McGillem, "Modern Communication and Spread Spectrum", McGraw-Hill Book Company, 1986.

REFERENCE BOOKS:

1. Marvin K. Simon, Jim K Omura, Robert A. Scholtz& Barry K.Levit, "Spread Spectrum Communications", McGraw-Hill, 1st edition,1995.
2. J.Marvin, K.Simon, Sami. M.Hinedi and William C. Lindsey, "Digital Communication Techniques", PHI, 2009.

M. Tech. (CMS & DECS)-I Semester
(14MT13802) DIGITAL COMMUNICATION TECHNIQUES

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	4	-	-	4

PRE-REQUISITES:
A Course on Digital Communications at UG Level

COURSE DESCRIPTION:
Representation of band pass signals and systems; Digital modulation techniques; Design of optimum receivers; Generation and detection of spread spectrum signals.

COURSE OBJECTIVES:

CEO1. To provide advanced knowledge in digital communication over communication channels.

CEO2. To impart design and analytical skills in digital communication systems.

CEO3. To apply the knowledge and skills acquired to the real problems in the field of digital communications.

COURSE OUTCOMES: On successful completion of this course the students will be able to

CO1. Gain in-depth knowledge in

- Characterization of communication signals and systems.
- Digital modulation techniques
- Communication over AWGN channels
- Optimum receivers
- Spread spectrum techniques

CO2. Analyze numerical and analytical problems critically for conducting research in the field of Digital Communication Systems.

CO3. Solve engineering problems and arrive at optimal solutions pertaining to digital communications.

CO4. Apply appropriate techniques to complex engineering activities in the field of signal processing and communications.

DETAILED SYLLABUS

Review of random Variables and Processes

UNIT–I: CHARACTERIZATION OF COMMUNICATION SIGNALS AND SYSTEMS **[10 Periods]**

Representation of Band Pass Signals and Systems – Representation of Band-Pass Signals, Representation of Linear Band-Pass System, Response of a Band-Pass System to a Band-Pass Signal. Signal Space Representations – Vector Space Concepts, Signal Space Concepts, Orthogonal Expansion of Signals. Representation of Digitally Modulated Signals – Memory Less Modulation Methods – PAM Signals,

Phase Modulated Signals, QAM Signals, Multidimensional Signals, Orthogonal Multidimensional Signals. Spectral Characteristics of Digitally Modulated Signals – Power Spectra of Linearly Modulated Signals.

UNIT–II: DIGITAL MODULATION TECHNIQUES [11 Periods]

Digital Modulation – Factors that Influence the Choice of Digital Modulation, Bandwidth and Power Spectral Density of Digital Signals. Linear Modulation Techniques – BPSK, DPSK, QPSK, OQPSK, ∏/4 QPSK. Constant Envelope Modulation Techniques – MSK, GMSK, Combined Linear and Constant Envelope Modulation Techniques – M-ary PSK, M- ary QAM.

UNIT–III: OPTIMUM RECEIVERS FOR THE ADDITIVE GAUSSIAN NOISE CHANNEL [10 Periods]

Optimum Receiver for Signals Corrupted by AWGN – Correlation Demodulator, Matched Filter Demodulator, the Optimum Detector. Performance of the Optimum Receiver for Memory Less Modulation – Probability of Error for Binary Modulation, M-ary Orthogonal Signals, M-ary PAM, M-ary PSK, QAM. Optimum Receiver for Signals with Random Phase in AWGN Channel – Optimum Receiver for Binary Signals, Optimum Receiver for M-ary Orthogonal Signals.

UNIT–IV: SPREAD SPECTRUM TECHNIQUES [10 Periods]

Introduction, Model of Spread Spectrum Digital Communication System, Direct Sequence Spread Spectrum Signals – Introduction, The Processing Gain and Jamming Margin. Applications of Direct Sequence Spread Spectrum Signals – Anti-jamming Application, Low-Detectability Signal Transmission, Code Division Multiple Access. Generation of PN-Sequences, Frequency-Hopped Spread Spectrum Signals, Other Types of Spread Spectrum Signals.

UNIT–V: DETECTION OF SPREAD SPECTRUM SIGNALS [09 Periods]

Coherent Direct-Sequence Receivers, Coherent Carrier Tracking – Delay-Lock Loop Analysis, Tau-Dither Loop. Non Coherent Carrier Tracking, Non coherent Frequency-Hop Receiver, Acquisition of Spread-Spectrum Signals – Acquisition by Cell-By-Cell Searching. Reduction of Acquisition Time – Acquisition with Matched Filters, Matched filters for PN Sequences, Matched Filters for Frequency-Hopped Signals.

Total periods: 50

TEXT BOOKS:

1. John G. Proakis, "Digital Communications", McGraw Hill, 4th edition, 2001.
2. Theodore S. Rappaport, "Wireless Communications", Pearson Education, 2nd edition, 2002.
3. George R. Cooper & Clare D. McGillem, "Modern Communication and Spread Spectrum", McGraw-Hill Book Company, 1986.

REFERENCE BOOKS:

1. Marvin K. Simon, Jim K Omura, Robert A. Scholtz & Barry K.Levit, "Spread Spectrum Communications", Computer Science Press, 1995.
2. J.Marvin, K.Simon, Sami. M.Hinedi and William C. Lindsey, "Digital Communication Techniques", PHI, 2009.

M. Tech. - I Semester
(16MT13801) COMPUTER NETWORKS
(Common to DECS & CMS (PE-I))

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	4	-	-	4

PRE-REQUISITES: --
A Course on Computer Networks and Wireless Communication and Networks at UG Level

COURSE DESCRIPTION:
Advanced computer networks and its architectures; Protocols & Network security; Mobile adhoc networks.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:
1. Demonstrate in-depth knowledge on
   - Architectures and functioning of advanced computer networks like Ethernet, SONET/SDH, Wi-Fi, Frame Relay, ATM networks etc.
   - Protocols like IPv6, MPLS, RSVP, VoIP associated with advanced computer networks.
   - Security features associated with advanced computer networks.
2. Analyze various design issues for conducting research related to the Internet protocol (IP), Wireless LANs and ATM network technologies prominent in high performance scenario.
3. Design and develop techniques for solutions pertaining to the advanced networking technologies.
4. Formulate solutions for engineering problems pertaining to the advanced networking technologies.
5. Initiate research in advanced computer networks.
6. Apply appropriate techniques and tools to complex engineering activities in the field of advanced computer networks.
7. Contribute positively to multidisciplinary scientific research in design and development of Protocols for adhoc network architectures.

DETAILED SYLLABUS

UNIT- I: WIRED AND WIRELESS NETWORKS (10 Periods)
Introduction, Reference models- OSI, TCP/IP; Data Link Control Protocols - HDLC, Point to Point Protocol (PPP); Ethernet- Fast Ethernet, Gigabit Ethernet; Wireless LANS – Merits, topologies, Architecture – Physical Layer, MAC Layer, Frame structure, Applications; Virtual LANs.

UNIT- II: ADVANCED NETWORK ARCHITECTURES (13 Periods)
Circuit switching network - SONET/SDH; Virtual Circuit Networks – Frame Relay, ATM - Protocol Architecture, Logical Connections, ATM Cells, Transmission of ATM Cells, ATM Service Categories; Signaling Protocols - MPLS, RSVP; VPN architectures.

UNIT- III: INTERNET TRANSPORT AND APPLICATION PROTOCOLS

(11 Periods)

Internet protocol - IPv6, Transport protocols – Connection Oriented protocol TCP, Connectionless protocol UDP; Congestion control in TCP, Domain Name System, Simple Mail Transfer Protocol, WWW and HTTP, Multimedia Applications – RTP, Voice Over IP.

UNIT- IV: SECURITY IN ADVANCED NETWORKS (10 Periods)

Network security, Cryptography - Symmetric Key Cryptography, Public Key Cryptography, Simple Network Management Protocol, Firewalls - Packet filtering, Digital Signature, IP Security.

UNIT- V: MOBILE AD-HOC NETWORKS (11 Periods)

Overview of Wireless Ad-Hoc Networks, Routing in Ad-Hoc Networks, Routing Protocols for Ad-Hoc Networks; Wireless Sensor Networks: Sensor Networks and Protocol Structures, Communication Energy Model, Clustering Protocols, Routing Protocols.

Total Periods: 55

TEXT BOOKS:

1. Behrouz A. Forouzan, "Data Communications and Networking", Tata McGraw-Hill, New Delhi, 4th edition, 2006
2. Nader F. Mir, Computer and Communication Networks, Pearson Education, 4th edition, 2007.
3. William Stallings, "Data and Computer Communication", Prentice hall, 9th edition, 2010

REFERENCE BOOKS:

1. Jim Kurose, Keith Ross, "Computer Networking: A Top Down Approach", Addison Wesley, 4th edition, July 2007.
2. Andrew S. Tanenbaum "Computer Networks", Pearson Education, 4th edition, 2008.

M. Tech. (CMS) – I Semester
M. Tech. (DECS) – I Semester (Elective-I)
(14MT13805) COMPUTER NETWORKS

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	4	--	--	4

PRE-REQUISITES:
A Course on Computer Networks at UG Level

COURSE DESCRIPTION:
Protocols & standards of computer and wireless networks; Advanced network architectures; Upper layers protocols; Network security.

COURSE OBJECTIVES:
CEO 1. To impart comprehensive knowledge in understanding the concepts of Networking technologies.

CEO 2. To induce analytical problem solving skills in networking issues.

CEO 3. To apply the knowledge and skills to develop various routing protocols for high speed wired and wireless LAN and WAN technologies that drive towards the development of new applications.

COURSE OUTCOMES: After completion of the course, students should be able to:

CO 1. Acquire in-depth knowledge on
   a. Architectures and functioning of Advanced Wireless LAN and WAN technologies such as Wi-Fi, Wi-Max, Frame Relay, ATM networks etc.
   b. Protocols like MPLS, RSVP, VOIP associated with modern computer network systems.
   c. Know the security features associated with modern computer network systems.

CO 2. Analyze various design issues for conducting research related to the Internet protocol (IP), Wireless LANs and ATM network technologies prominent in high performance scenario.

CO 3. Formulate solutions for engineering problems pertaining to the advanced networking technologies.

CO 4. Apply appropriate techniques and tools to complex engineering activities in the field of computer networks.

DETAILED SYLLABUS

UNIT- I: INTRODUCTION TO COMPUTER NETWORKS (11 Periods)

Data communications & Networking for Today's Enterprise, Data Communications, Network Edge, Network core, Internet, OSI, TCP/IP models, Data Link Control Protocols - HDLC, Point to Point Protocol (PPP);

UNIT- II: WIRELESS NETWORKS (12 Periods)

Ethernet, Fast Ethernet, Gigabit Ethernet, WLANS – Merits and topologies, IEEE 802.11 WLAN Standard – Physical Layer, MAC Layer, Frame structure, IEEE 802.11 a, b, g, e and n standards, Applications; Bluetooth & WiMax- features, standards, protocols and utility; Virtual LANs

UNIT- III: ADVANCED NETWORK ARCHITECTURES (13 Periods)

Circuit switching network - SONET/SDH; Virtual Circuit Networks – Frame Relay, ATM - Protocol Architecture, Logical Connections, ATM Cells, Transmission of ATM Cells, ATM Service Categories; Signaling Protocols - MPLS, RSVP; VPN architectures, IP over ATM, Connecting Devices: Repeaters, Bridges, Routers, Gateways.

UNIT- IV: INTERNET TRANSPORT AND APPLICATION PROTOCOLS (12 Periods)

Internet protocol - IPv6, Transport protocols – Connection Oriented protocol TCP, Connectionless protocol UDP; Congestion control in TCP, Socket interface, Domain Name System, Simple Mail Transfer Protocol, WWW and HTTP, Multimedia Applications – RTP, Voice Over IP.

UNIT- V: SECURITY IN COMPUTER NETWORKS (8 Periods)

Simple Network Management Protocol, Network security, Cryptography - Symmetric Key Cryptography, Public Key Cryptography, Firewalls - Packet filtering, Application Gateway, Digital Signature, IP Sec.

Total Periods: 56

TEXT BOOKS:

4. William Stallings, "Data and Computer Communication", 9th edition, Prentice hall, 2010
5. Behrouz A. Forouzan, "Data Communications and Networking", 4th Ed, Tata McGraw-Hill, New Delhi, 2006
6. Jim Kurose, Keith Ross, "Computer Networking: A Top Down Approach", 4th edition, Addison Wesley, July 2007.

REFERENCE BOOKS:

3. Andrew S. Tanenbaum "Computer Networks", 4th Edition, Pearson Education, 2008
4. LEON-GARCIA, INDRA WIDJAJA, "Communication Networks – Fundamental concepts and Key architectures", TMH, 2000

M. Tech. - I SEMESTER
(16MT16132) RF CIRCUITS & OPTICAL COMMUNICATIONS LAB

Int. Marks	Ext. Marks	Max. Marks	L	T	P	C
50	50	100	-	-	4	2

PRE- REQUISITES:
Antennas, Microwaves and Optical Communication lab at UG level

COURSE DESCRIPTION:
Design and simulation of Various antennas; Measurement of various parameters; characteristics of couplers; non-ideal behaviour of lumped circuit components; characteristics of microwave passive components; Measurement of 4 channel CWDM using modulation; PC to PC communication; Characterization of Optial circulator and Bragg-grating.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:

1. Demonstrate advanced knowledge required in
   - Measurement of Impedance, Coupling and cross talk in 3 wire pickup.
   - Design and simulation of different antennas.
   - Design and measurement of PC to PC communication.
   - Characterization of branch line directional copupler, capacitive coupling and inductive coupling.
   - Study of non ideal behaviour of lumped circuit components, 3 dB power divider and filters.
   - Designing WDM system and measurement of 4 channel CWDM by internal and external modulation.
   - Wavelength division multiplexing & de-multiplexing of analog/digital signals over 1310 nm and 1550 nm wavelengths.
2. Analyse of engineering problems for feasible and optimal solutions in the core area of RF, Microwave and Optical Communications.
3. Use RF Spice Pro Software to complex engineering activities in the domain of RF, Microwave and Optical communications.
4. Demonstrate Knowledge and understanding of Engineering Principles to execute the Projects effectively in the field of RF, Microwave and Optical communications.
5. Understand ethical responsibility towards environment & society in the field of communications.
6. Communicate effectively in verbal & written forms in the core area of RF, Microwave and Optical communications

LIST OF EXERCISES:

1 Measurement of Frequency, Wavelength and Impedance.
2 Characteristics of branch line directional coupler.
3 Measurement of coupling & cross talk in 3 wire pick up.
4 Characterization of current probe with capacitive coupling or inductive coupling.
5 Study of non-ideal behaviour of lumped circuit components.
6 Measure characteristics of passive components such as attenuator, isolator, coupler and WDM.
7 Characterization of Optial circulator and Bragg-grating.
8 Measurement of 4 channel CWDM by internal & external modulation.

9 Wavelength division multiplexing & de-multiplexing of analog/digital signals over 1310 nm and 1550 nm wavelengths.
10 Design and Simulate any patch antenna given by the faculty in the lab.

Total Time slots : 10

TOOLS REQUIRED:

RF Spice Pro simulation software, MIC System, Motorized microstrip transmission line trainer, advanced fiber optic lab with Fiber optic laser source, passive component, cable dispersion, DWDM and bragg grating modules.

REFERENCE BOOKS:

1. RF Circuit & Optical Communications lab-II manual of the department.
2. RF Spice Pro User Manual
3. Devendra K. Misra, "Radio Frequency and Microwave Communication Circuits Analysis and Design", Wiley Student Edition, John Wiley & Sons, 2nd edition, July 2004.
4. S.E.Miller, A.G.Chynoweth, *Optical Fiber Telecommunication,* 1979.

M. Tech. – I Semester
(16MT13808) RESEARCH METHODOLOGY
(Common to all M. Tech. Programs)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
-	-	-	-	2	-	-

PREREQUISITES: --

COURSE DESCRIPTION:

Overview of Research, research problem and design, various research designs, data collection methods, statistical methods for research, importance of research reports and its types.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:

1. Acquire in-depth knowledge on
   - Research design and conducting research
   - Various data collection methods
   - Statistical methods in research
   - Report writing techniques.
2. Analyze various research design issues for conducting research in core or allied areas.
3. Formulate solutions for engineering problems by conducting research effectively in the core or allied areas.
4. Carryout literature survey and apply research methodologies for the development of scientific/technological knowledge in one or more domains of engineering.
5. Select and Apply appropriate techniques and tools to complex engineering activities in their respective fields.
6. Write effective research reports.
7. Develop attitude for lifelong learning to do research.
8. Develop professional code of conduct and ethics of research.

DETAILED SYLLABUS:

Unit-I: Introduction to Research Methodology (Periods: 5)
Objectives and Motivation of Research, Types of Research, Research Approaches, Research Process, Criteria of good Research, Defining and Formulating the Research Problem, Problem Selection, Necessity of Defining the Problem, Techniques involved in Defining a Problem.

Unit-II: Research Problem Design and Data Collection Methods (Periods: 7)
Features of Good Design, Research Design Concepts, Different Research Designs, Different Methods of Data Collection, Data preparation: Processing Operations, Types of Analysis.

Unit-III: Statistics in Research (Periods: 6)
Review of Statistical Techniques - Mean, Median, Mode, Geometric and Harmonic Mean, Standard Deviation, Measure of Asymmetry, ANOVA, Regression analysis.

Unit-IV: Hypothesis Testing (Periods: 7)

Normal Distribution, Properties of Normal Distribution, Basic Concepts of Testing of Hypothesis, Hypothesis Testing Procedure, Hypothesis Testing: t-Distribution, Chi-Square Test as a Test of Goodness of Fit.

Unit-V: Interpretation and Report Writing (Periods: 3)

Interpretation – Techniques and Precautions, Report Writing – Significance, Stages, Layout, Types of reports, Precautions in Writing Reports.

Total Periods: 28

TEXT BOOK:

1. C.R. Kothari, "*Research Methodology: Methods and Techniques*," New Age International Publishers, New Delhi, 2nd Revised Edition, 2004.

REFERENCE BOOKS:

1. Ranjit Kumar, "*Research Methodology: A step-by-step guide for beginners*," Sage South Asia, 3rd ed., 2011.
2. R. Panneerselvam, "Research Methodology," PHI learning Pvt. Ltd., 2009

M. Tech. - I Semester
(16MT13804) IMAGE & VIDEO PROCESSING

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	4	-	-	4

PRE-REQUISITES:
A Course on Digital Communications & Digital Signal Processing at UG Level

COURSE DESCRIPTION:
Image Fundamentals and its transforms; image enhancement techniques; Image compression, Image Restoration & Image Segmentation; Video Processing basics like Representation, Sampling, Motion estimation, Filtering and Compression.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:

1. Gain in-depth knowledge in
   - Image Transforms
   - Image Enhancement & Restoration Techniques
   - Image Segmentation & Compression Techniques
   - Video Processing
2. Analyze complex engineering problems critically in the domain of Image Processing for conducting research.
3. Solve engineering problems for feasible and optimal solutions in the core area of Image Processing.
4. Initiate research in image and video processing.
5. Apply appropriate tools and techniques to complex engineering activities in the field of Image Processing.
6. Contribute positively to multidisciplinary scientific research in Image Processing.

DETAILED SYLLABUS

UNIT I: FUNDAMENTALS OF IMAGE PROCESSING AND IMAGE TRANSFORMS: (10 Periods)
Fundamental steps in Image Processing, Gray scale and color Images, image sampling and quantization, **2-D Transforms:** DFT, Walsh, Hadamard, Haar, KLT, DCT.

UNIT II: IMAGE ENHANCEMENT & RESTORATION: (10 Periods)
Enhancement: Intensity transformation functions, Filters in spatial and frequency domains, histogram processing, homomorphic filtering.
Restoration: Image Degradation Model, Restoration in presence of noise only- spatial filtering, inverse filtering, Wiener filtering and Constrained least squares filtering.

UNIT III: IMAGE COMPRESSION & IMAGE SEGMENTATION: (13 Periods)
Image compression fundamentals -Redundancies, Compression models: Lossy & Lossless, Arithmetic coding, Bit plane coding, Run length coding, symbol based coding, Transform coding, fidelity criteria.
Segmentation: Fundamentals, Point, line and edge detection, Thresholding, Region based segmentation.

UNIT IV: VIDEO PROCESSING - I (11 Periods)

Analog Video, Digital Video. Time-Varying Image Formation models: Three-Dimensional Motion Models, Geometric Image Formation, Photometric Image Formation, Sampling for Analog and Digital Video, Two-Dimensional Rectangular Sampling, Two-Dimensional Periodic Sampling, Sampling on 3-D Structures, Reconstruction from Samples.

UNIT V: VIDEO PROCESSING -II (10 Periods)

Motion Estimation: 2-D Motion vs. Apparent Motion, 2-D Motion Estimation, Methods Using the Optical Flow Equation. Video filtering: motion compensated filtering, noise filtering, restoration, video compression standards.

Total periods: 54

TEXT BOOKS:

1. Rafael C. Gonzalez, Richard E. Woods, Digital Image Processing, Pearson Education, 3rd edition, 2008.
2. A. Murat Tekalp, Digital Video Processing, Prentice-Hall, 1995.

REFERENCE BOOKS:

1. R. C. Gonzalez, R. E. Woods, Digital Image Processing, Pearson Education, 2nd edition, 2002.
2. Anil K. Jain, 'Fundamentals of Digital Image Processing', Pearson Education, Inc., 2002.

M. Tech. - I Semester
(16MT26102) SMART ANTENNAS

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	4	-	-	4

PRE-REQUISITES: --
A Course on Antennas and Wave Propagation at UG Level

COURSE DESCRIPTION:
Smart antenna configurations and architecture; Beam forming methods; Direction of Arrival (DOA) estimating methods, simulation of smart antennas and space time processing.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:
1. Demonstrate in-depth knowledge on
   - Smart antenna architecture and configurations
   - Methods of estimating DOA
   - Beam forming techniques
   - Design and simulation of smart antennas
   - Space time processing
2. Analyze various design issues for conducting research related to smart antennas.
3. Design and develop smart antennas for wireless applications.
4. Formulate solutions for engineering problems pertaining to smart antennas in the field of communication.
5. Apply appropriate techniques to complex engineering activities in the field of Smart antennas.

DETAILED SYLLABUS

UNIT -I: SMART ANTENNAS (Periods: 10)
Introduction, Need for Smart Antennas, Overview, Smart Antenna Configurations- Switched Beam Antennas, Adaptive Antenna Approach. Space Division Multiple Access (SDMA), Architecture of a Smart Antenna System- Receiver, Transmitter. Benefits and Drawbacks, Basic Principles, Mutual Coupling Effects.

UNIT -II: DOA ESTIMATION FUNDAMENTALS (Periods: 12)
Introduction, Array Response Vector, Received Signal Model, Subspace-Based Data Model, Signal Autocovariance matrices, Conventional DOA Estimation Methods- Conventional Beamforming Method, Capon's Minimum Variance Method. Subspace Approach to DOA Estimation- MUSIC Algorithm, ESPRIT Algorithm. Uniqueness of DOA Estimates.

UNIT -III: BEAM FORMING FUNDAMENTALS (Periods: 10)
Classical Beam former, Statistically Optimum Beamforming Weight Vectors- Maximum SNR Beam former, Multiple Sidelobe Canceller and Maximum, SINR Beam former, Minimum Mean Square Error (MMSE), Direct Matrix Inversion (DMI), Linearly Constrained Minimum Variance (LCMV). Adaptive Algorithms for Beamforming

UNIT -IV: INTEGRATION AND SIMULATION OF SMART ANTENNAS

(Periods: 11)

Overview, Antenna Design, Mutual Coupling, Adaptive Signal Processing Algorithms- DOA, Adaptive Beam forming, Beam forming and Diversity Combining for Rayleigh-Fading Channel. Trellis-Coded Modulation (TCM) for Adaptive Arrays, Smart Antenna Systems for Mobile Ad Hoc Networks (MANETs)- Protocol, Simulations. Discussion.

UNIT -V: SPACE–TIME PROCESSING (Periods: 12)

Introduction, Discrete Space–Time Channel and Signal Models, Space–Time Beamforming, Intersymbol and Co-Channel Suppression, Space–Time Processing for DS-CDMA, Capacity and Data Rates in MIMO Systems, Discussion.

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Total Periods: 55

TEXT BOOKS:

1. Constantine A. Balanis & Panayiotis I. Ioannides, "*Introduction to Smart Antennas*", Morgan & Claypool Publishers, 2007.
2. Joseph C. Liberti Jr., Theodore S Rappaport , "*Smart Antennas for Wireless Communications :IS-95 and Third Generation CDMA Applications*", Prentice Hall PTR, 1999

REFERENCE BOOKS:

1. T.S Rappaport ,"*Smart Antennas: Adaptive Arrays, Algorithms, & Wireless Position Locations*", IEEE press, 1998.
2. Lal Chand Godara, " *Smart Antennas*", CRC Press LLC, 2004.

M. Tech. - II Semester
(16MT23809) SPEECH PROCESSING
(Common to DECS & CMS)
(PE-II)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	4	-	-	4

PRE-REQUISITES: Courses on Signals & Systems and Digital Signal Processing in UG

COURSE DESCRIPTION:
Acoustic theory of speech production; Models for speech signals and speech processing systems; Mathematical analysis of speech signals - homomorphic and LPC models; Speech and speaker recognition systems.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:
1. Demonstrate in-depth knowledge in
   - Digital model representation of speech signal
   - LPC analysis
   - Homomorphic models
2. Analyze complex engineering problems critically for conducting research in speech signal processing.
3. Solve engineering problems using efficient algorithms for feasible and optimal solutions in Speech signal processing field.
4. Initiate research in speech signal processing.
5. Apply speech and speaker verification techniques to complex engineering activities in the field of speech processing.
6. Contribute to scientific research in Speech and speaker identification and verification systems with objectivity and rational analysis.

DETAILED SYLLABUS:

UNIT-I: DIGITAL MODEL FOR THE SPEECH SIGNAL (Periods:13)
The process of speech production - the mechanism of speech production, acoustic phonetics. The Acoustic theory of speech production- sound propagation, uniform lossless tubes, Effect of losses in the vocal tract, Effect of radiation at the lips, Vocal tract transfer functions for vowels, the effect of nasal coupling, Excitation of sound in the vocal tract. Digital model for speech signals.

UNIT - II : TIME DOMAIN MODELS FOR SPEECH PROCESSING (Periods:10)
Introduction, Window considerations, Short time energy and average magnitude, Short time average zero crossing rate, Speech vs silence discrimination using Average energy and zero crossing, Pitch period estimation using parallel processing approach, The short time autocorrelation function, The short time average magnitude difference function, Pitch period estimation using the autocorrelation function.

UNIT-III: HOMOMORPHIC SPEECH PROCESSING (Periods:09)
Homomorphic systems for convolution – properties of the complex Cepstrum, computational considerations. The complex Cepstrum of speech, pitch detection, formant estimation, Homomorphic vocoder.

UNIT-IV : LINEAR PREDICTIVE CODING OF SPEECH (Periods:12)

Basic principles of linear predictive analysis – Auto correlation method, The covariance method. Computation of the gain for the model, solution of LPC Equations – Cholesky Decomposition solution for the covariance method. Durbin's Recursive solution for the autocorrelation equations. Comparison between methods of solutions of LPC analysis equations. Applications of LPC parameters – Pitch detection using LPC parameters, Formant analysis using LPC parameters.

UNIT-V: SPEECH AND SPEAKER RECOGNITION SYSTEMS (Periods:08)

Speaker recognition system-speaker verification system, speaker identification systems. Speech recognition system- isolated digit recognition system, continuous digit recognition system, LPC distance measure.

Total periods: 52

TEXT BOOKS:

1. L R Rabiner and SW Schafer, "*Digital processing of speech signals*", Pearson Education, 2006.
2. LR Rabiner, BH Juang, B Yegnanarayana, "*Fundamentals of Speech Recognition*", Pearson Education, 1993.

REFERENCE BOOKS:

1. Thomas F Quateri, "*Discrete time speech signal processing*", Pearson edition, 2006.
2. Ben Gold & Nelson Morgan, "*Speech & audio signal processing*", wiley, 2006.
3. Douglas O Shaughnessy, "*Speech Communications*", Oxford university press, 2nd edition, 2000.

M. Tech. - II SEMESTER
(16MT26131) COMMUNICATIONS LAB-II

Int. Marks	Ext. Marks	Max. Marks	L	T	P	C
50	50	100	-	-	4	2

PRE- REQUISITES: Simulation lab at UG level

COURSE DESCRIPTION:

Simulation of communication systems over communication channels with and without line coding; Design and simulation of Bussgang Blind channel; Minimum Mean Square Error and zero force equalizer; Adaptive equalizers using LMS and RLS algorithms.

COURSE OUTCOMES:

After successful completion of the course, students will be able to:

1. Demonstarte in-depth knowledge in
   - Design of CDMA communication system and evluate its performance over a Gaussian and multipath Rayleigh fading channel.
   - Design and simulation of an adaptive equalizer using LMS and RLS algorithms.
   - Design and simulation of M-ary QAM system over an AWGN fading channel and evaluate its performance.
   - Simulating communication system using convolutional codes & Viterbi Decoding.
   - BER evaluation for BPSK modulation system with Minimum Mean Square Error (MMSE) equalization and Zero force Equalization in 3 tap ISI channel.
2. Analyze engineering problems for feasible and optimal solutions in the core area of advanced Communications.
3. Design of various components of communication systems.
4. Use MATLAB Toolboxes to solve complex engineering activities in the domain of advanced communications.
5. Understand ethical responsibility towards environment & society in the field of communications.
6. Communicate effectively in verbal & written forms.

LIST OF EXERCISES:

1. Design and simulation of M-ary QAM system with AWGN fading channel.
2. Simulation of Rayleigh fading channel in the mobile environment.
3. Design and performance evaluation of CDMA communication system over a Gaussian channel.
4. Design and performance evaluation of CDMA communication system over a multipath Rayleigh fading channel.
5. Simulation of communication system using convolutional codes & Viterbi Decoding.
6. Design and simulation of an adaptive equalizer using LMS algorithm.
7. Design and simulation of an adaptive equalizer using RLS algorithm.
8. Design and simulation of communication system using Bussgang Blind channel equalizer.
9. BER evaluation for BPSK modulation system with Minimum Mean Square Error (MMSE) equalization in 3 tap ISI channel.

10. BER evaluation for BPSK modulation system with Zero force Equalization in 3 tap ISI channel.

Total Time Slots : 10

TOOLS REQUIRED:
MATLAB with communication and Signal Processing tool boxes.

REFERENCE BOOKS:

1. Advanced communication lab-II manual of the department.
2. W.H. Tranter, K. Sam Shanmugham, T.S. Rappaport, and K.L. Kosbar, "*Principles of Communication System Simulation with Wireless Applications",* Prentice Hall Professional Technical Reference,2004.
3. J.G. Proakis, and M. Salehi, "*Contemporary Communication Systems using MATLAB",* cengage learning, *2nd edition,* 2004.

M. Tech. (CMS) - II SEMESTER
(14MT26121) COMMUNICATIONS LAB - II

Int. Marks	Ext. Marks	Max. Marks	L	T	P	C
25	50	75	-	-	4	2

PRE- REQUISITES: Simulation lab at UG level

COURSE DESCRIPTION:

Simulation of communication systems over communication channels with and without line coding; Design and simulation of Bussgang Blind channel equalizer; Adaptive equalizers using LMS and RLS algorithms; Image processing techniques; Design and simulation of WDM systems.

COURSE OBJECTIVES:

CEO1. To design, develop and simulate various components of communication system.

CEO2. To apply Knowledge and Skills to implement engineering Principles in the field of Communications.

COURSE OUTCOMES: At the end of the course, students will be able to

CO1. Gain skills in

- Simulation of Rayleigh fading channel in the mobile environment.
- Design and simulation of an adaptive equalizer using LMS and RLS algorithms.
- Designing communication system over a Gaussian channel and evaluate its performance.
- Simulating communication system using convolutional codes & Viterbi Decoding.
- Developing Color image in various color models.
- Performing image smoothening and sharpening.
- Designing WDM system.

CO2. Solve engineering problems for feasible and optimal solutions in the core area of Communications.

CO3. Use MATLAB Toolboxes to complex engineering activities in the domain of communications.

CO4. Demonstrate Knowledge and understanding of Engineering Principles in the field of communications.

List of experiments:

1. Simulation of Rayleigh fading channel in the mobile environment. (2 time slots)
2. Design and performance evaluation of CDMA communication system over a Gaussian channel. (2 time slots)
3. Simulation of communication system using convolutional codes & Viterbi Decoding.
   i. (2 time slots)
4. Design and simulation of an adaptive equalizer using LMS algorithm. (1 time slot)

5. Design and simulation of an adaptive equalizer using RLS algorithm. (1 time slot)

6. Design and simulation of communication system using Bussgang Blind channel equalizer. (2 time slots)

7. Smoothening and Sharpening of a given image. (1 time slot)

8. Color image in various color models. (1 time slot)

9. Design of WDM system. (2 time slots)

Tools required:

MATLAB with communication & image processing tool boxes and OptSim and ModeSYS software.

REFERENCE BOOKS:

1. Advanced communication lab-II manual of the department.

2. W.H. Tranter, K. Sam Shanmugham, T.S. Rappaport, and K.L. Kosbar, *Principles of Communication System Simulation with Wireless Applications,* Pearson, 2004.

3. J.G. Proakis, and M. Salehi, *Contemporary Communication Systems using MATLAB,* cengage learning, *2nd Edition,* 2004.

4. *R. C. Gonzalez, R. E. Woods, Steven L. Eddins, Digital Image Processing using MATLAB, Gatesmark publishing,2nd Edition, 2009.*

5. OptSim and ModeSYS user manual.

M.Tech. – I Semester
(16MT13832) IMAGE & VIDEO PROCESSING LAB

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	4	2

PREREQUISITE:
A course on Image & Video Processing

COURSE DESCRIPTION: Fundamentals of images, image transforms, enhancement, restoration, image compression and coding and video processing.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:

1. Demonstrate knowledge in
   - Image Transforms
   - Image Enhancement & Restoration Techniques
   - Image Segmentation & Compression Techniques
   - Video Processing
2. Understand various applications of image processing in industry, Medicine, and defense.
3. Solve engineering problems for feasible and optimal solutions in the core area of Image and video Processing.
4. Initiate research in image and video processing.
5. Acquire an appreciation for the Image and video processing issues and techniques and be able to apply these techniques to real world problems.
6. Contribute positively to multidisciplinary scientific research in Image and video Processing.
7. Communicate effectively in verbal and written forms.

List of Exercises

1. Point processing in spatial domain
   a. Negation of an image
   b. Thresholding of an image
   c. Contrast Stretching of an image
2. Geometric transformations.
   a. Image rotation
   b. Scaling
   c. Translation
3. Logical operations on Digital Image
   a. AND
   b. NAND
   c. OR
   d. NOR
   e. NOT
4. Histogram Equalization and Specification
5. Filtering in spatial domain
   a. smoothing
   b. sharpening
6. Filtering in frequency domain
   a. Low pass filter
   b. High pass filter

7. Edge Detection using derivative filter mask
    a. Prewitt
    b. Sobel
    c. Laplacian
8. Image compression using transform techniques.
9. Zooming and shrinking operations on images
10. Morphological operations on images
11. Representation of Digital video: Read, Write, View Videos and conversion of videos in different formats.
12. Video to frame and frame to Video conversion.

Total Time Slots: 12

Required Software Tools:

1. MATLAB with image processing and computer vision tool box

REFERENCE BOOKS:

1. Rafael C. Gonzalez, Richard E. Woods, Digital Image Processing, 3rd edition, Pearson Education, 2008.
2. A. Murat Tekalp, Digital Video Processing, Prentice-Hall, 1995.

M. Tech. – II Semester
(16MT23810) INTELLECTUAL PROPERTY RIGHTS
(Common to all M. Tech. Programs)
(Audit Course)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
-	-	-	-	2	-	-

PRE-REQUISITES: --

COURSE DESCRIPTION:

Introduction to Intellectual Property; Trade Marks; Law of Copy Rights; Law of Patents; Trade Secrets; Unfair Competition; New Development of Intellectual Property.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:
1. Demonstrate in-depth knowledge on
   - Intellectual Property
   - Trade Marks & Secrets
   - Law of Copy Rights, Patents
   - New development of Intellectual Property
2. Analyze the different forms of infringement of intellectual property rights.
3. Solve problems pertaining to Intellectual Property Rights.
4. Stimulate research zeal for patenting of an idea or product.
5. Write effective reports required for filing patents.
6. Develop life-long learning capabilities.
7. Develop awareness of the relevance and impact of IP Law on their academic and professional lives.
8. Develop attitude for reflective learning.

DETAILED SYLLABUS:

UNIT - I: Introduction to Intellectual property (Periods:5)
Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights.

UNIT - II: Trade Marks: (Periods:5)
Purpose and function of trademarks, acquisition of trade mark rights, protectable matter, selecting and evaluating trade mark, trade mark registration processes.

UNIT - III: Law of copy rights: (Periods:6)
Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law.
Law of patents: Foundation of patent law, patent searching process, ownership rights and transfer

UNIT - IV: Trade Secrets: (Periods:6)
Trade secrete law, determination of trade secrete status, liability for misappropriations of trade secrets, protection for submission, trade secrete litigation.
Unfair competition: Misappropriation right of publicity, False advertising.

UNIT - V: New development of intellectual property: (Periods:6)

New developments in trade mark law; copy right law, patent law, intellectual property audits.

International overview on intellectual property, international - trade mark law, copy right law, international patent law, international development in trade secrets law.

Total Periods: 28

REFERENCE BOOKS:

1. Deborah, E. Bouchoux, *Intellectual property right*, Cengage learning.
2. Prabuddha ganguli, *Intellectual property right - Unleashing the knowledge economy*, Tata Mc Graw Hill Publishing Company Ltd.