VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS)

IBRAHIMBAGH, HYDERABAD - 500031.

Approved by A.I.C.T.E., New Delhi and

Affiliated to Osmania University, Hyderabad-07

Sponsored by

VASAVI ACADEMY OF EDUCATION

Hyderabad

SCHEME OF INSTRUCTION AND SYLLABI UNDER CBCS FOR

M.E. (ECE) Communication Engineering and Signal Processing

With effect from 2018-2019

(For the batch admitted in 2018-19)

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Phones: +91-40-23146040, 23146041

Fax: +91-40-23146090

DEPARTMENTOF ELECTRONICS AND COMMUNICATIONS ENGINEERING
SCHEME OF INSTRUCTION AND EXAMINATION FOR
M.E (ECE) Communication Engineering and Signal Processing
I-SEMESTER w.e.f. 2018-19 under CBCS

S.No.	Category	Course code	Course Title	Scheme of Instruction			Scheme of Examination			Total	Credits
				L	T	P	Duration of SEE in Hrs	CIE	SEE		
Theory											
1.	AC	PI18AC110EH	Audit course-I: English for Research Paper Writing	2	-	-	3	40	60	100	-
2.	PC	PII18PC110EC	**Core – I:** Advanced Digital Signal Processing	3	-	-	3	40	60	100	3
3.	PC	PII18PC120EC	**Core – II:** Advanced Digital Modulation Techniques	3	-	-	3	40	60	100	3
4.	PC	PII18PC130EC	**Core – III:** Image and Video Processing	3	-	-	3	40	60	100	3
5.	PE	PII18PE1X0EC	Professional Elective - I	3	-	-	3	40	60	100	3
6.	PE	PII18PE1X0EC	Professional Elective - II	3	-	-	3	40	60	100	3
7.	PE	PII18PE1X0EC	Professional Elective - III	3	-	-	3	40	60	100	3
Laboratory											
8.	PC	PII18PC111EC	Advanced Signal Processing Laboratory	-	-	3	-	50	-	50	1.5
9.	PC	PII18PC121EC	Embedded Systems Laboratory	-	-	3	-	50	-	50	1.5
10.	PC	PII18PC118EC	Seminar – I	-	-	2	-	50	-	50	1
				20	**-**	**8**	**-**	**430**	**420**	**850**	**22**

***Note*: AC** - Audit Course, **PC** - Program Core, **PE** - Professional Elective, **HS** - Humanities & Social Sciences, **PW** - Project Work, **OE** - Open Elective

S.No.	Course Code	Course	Hours per week
Professional Core Courses			
1	PI18PC240ME	Research Methodology and IPR	2
2	PII18PC110EC	**Core – I:** Advanced Digital Signal Processing	3
3	PII18PC120EC	**Core – II:** Advanced Digital Modulation Techniques	3
4	PII18PC130EC	**Core – III:** Image and Video Processing	3
5	PII18PC210EC	**Core – IV:** Coding Theory and Techniques	3
6	PII18PC220EC	**Core – V:** Wireless Communications and Networking	3
7	PII18PC230EC	**Core – VI:** Microcontrollers and DSP Processors – Architecture	3
8	PII18PC111EC	Advanced Signal Processing Laboratory	3
9	PII18PC121EC	Embedded Systems Laboratory	3
10	PII18PC211EC	Communication Systems Simulation Laboratory	3
11	PII18PC212EC	DSP Processors Applications Laboratory	3
12	PII18PW219EC	Mini Project	2
13	PI18HS200EH	Skill Development Course	2
14	PII18PC118EC	Seminar – I	2
15	PII18PC218EC	Seminar – II	2
16	PII18PW319EC	Dissertation-Phase-I / Internship	8
17	PII18PW419EC	Dissertation-Phase-II / Internship	24
Professional Electives			
Elective – I			
18	PII18PE110EC	Network Security and Cryptography	3
	PII18PE120EC	Data and Computer Communication Networks	3
	PII18PE130EC	Soft Computing Techniques	3
Elective – II			
19	PII18PE140EC	Audio and Speech Signal Processing	3
	PII18PE150EC	Bio-Medical Signal Processing	3
	PII18PE160EC	Wavelets & Applications	3
Elective – III			
20	PII18PE170EC	Adaptive Signal Processing	3
	PII18PE180EC	Array Signal Processing	3
	PII18PE190EC	Radar Signal Processing	3
Elective – IV			
21	PII18PE210EC	Data Compression Methods	3
	PII18PE220EC	CODECS for Multimedia Applications	3
	PII18PE230EC	Advanced Optical Communication	3
Elective – V			
22	PII18PE240EC	Global Navigational Satellite Systems	3
	PII18PE250EC	Advanced Wireless Communication	3
	PII18PE260EC	Smart Antennas for Mobile Communications	3
Elective – VI			
23	PII18PE310EC	MIMO Communication Systems	3
	PII18PE320EC	Spread Spectrum and CDMA Systems	3
	PII18PE330EC	Software Defined and Cognitive Radio	3
Audit Course – I			
24	PI18AC110EH	English for Research Paper Writing	2
	PI18AC120XX	Value Education	2
	PI18AC130XX	Stress Management by Yoga	2
	PI18AC140XX	Sanskrit for Technical Knowledge	2
Audit Course –II			
25	PI18AC210EH	Pedagogy Studies	2
	PI18AC220XX	Personality Development through Life Enlightenment Skills.	2
	PI18AC230XX	Constitution of India	2
	PI18AC240XX	Disaster Management	2
Open Electives			
26	PI18OE310XX	Business Analytics	3
	PI18OE320XX	Industrial Safety	3
	PI18OE330XX	Operations Research	3
	PI18OE340XX	Cost Management of Engineering Projects	3
	PI18OE350XX	Composite Materials	3
	PI18OE360XX	Waste to Energy	3

DEPARTMENT OF HUMANITIES AND SOCIAL SCIENCES
SYLLABUS FOR M.E. (ECE) – I SEMESTER
ENGLISH FOR RESEARCH PAPER WRITING

Instruction: 2 Hours**/** week	**Semester End Exam Marks: 60**	**Course Code: PI18AC110EH**
Credits: NIL	CIE Marks : 40	Duration of SEE: 3 Hours

Course Objectives	Course Outcomes
Students Should be able to	At the end of the course, students will be able to
• Understand that how to improve your writing skills and level of readability • Learn about what to write in each section • Understand the skills needed when writing a Title	• write research papers • write citations as per the MLA style sheet and APA format • write concisely and clearly following the rules of simple grammar, diction and coherence.

Unit-I: Planning and Preparation, Word Order, Breaking up long sentences. Structuring Paragraphs and Sentences, Being concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

Unit-II: Clarifying Who Did What, Highlighting your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts, Introduction

Unit-III: Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.

Unit-IV: Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature, useful phrases, how to ensure paper is as good as it could possibly be the first-time submission.

Unit-V: Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions.

LEARNING RESOURCES :

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM Highman's book.
4. Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011

DEPARTMENTOF ELECTRONICS AND COMMUNICATIONS ENGINEERING
SYLLABUS FOR M.E. (ECE - CE&SP) – I SEMESTER

Advanced Digital Signal Processing

Course Code : **PII18PC110EC**	Instruction : 3 Hrs/week	CIE – Marks : 40
SEE – Marks : 60	SEE - Duration : 3 Hours	Credits: 3

Course Objectives	Course Outcomes
1. Review of discrete time signals and systems 2. Design of optimal FIR filters, and IIR filters 3. Multirate Signal Processing fundamentals and design of practical sampling rate converters, and applications 4. Analysis of multirate filter banks and their applications 5. wavelet transforms and digital filter implementation of wavelets and applications 6. Adaptive Filters, LMS and RLS algorithms and Linear Prediction Filters. 7. Different Methods for power Spectrum estimation of signals.	**At the end of the course, students will be able to:** 1. design FIR and IIR filters 2. understand theory of multirate DSP, and wavelets and capable of designing wavelet filters 3. design adaptive filters 4. design prediction filters and understand solution of normal equations 5. estimate power spectrum of signals using different methods 6. know applications of DSP

UNIT – I

Review of discrete time signals and systems: LTI systems, Discrete convolution, DFT computation using the Goertzel Algorithm, Z-transform, Rational transfer function, Frequency response from poles and zeros of the transfer function.

Digital filters design: Design of Optimal FIR filters, IIR Filters Design using bilinear transformation method, Cascaded and lattice structures of FIR and IIR filters, Finite word length effects in IIR filter, Application examples.

UNIT – II

Multirate DSP: Down sampling, Up sampling, Relation between the Fourier transform of the input and output of the down sampling and up sampling, Representation of decimator and interpolator, Changing the sampling rate by noninteger factor, Multistage approach to sampling rate conversion, Design of practical sampling rate converters, Polyphase decomposition of decimator and interpolator, Oversampling ADC analysis, Two channel QMF bank structure, Analysis of Two-Channel QMF Bank. Design of perfect reconstruction M-channel filter banks, Tree structured filter banks, Application examples.

UNIT – III

Wavelet transforms: Time frequency representation of signals, short-time Fourier transform (STFT), Scaling functions and wavelets, Discrete wavelet transform (DWT), Multi-resolution analysis (MRA), Wavelet reconstruction, design of decomposition and reconstruction filters for Haar, Daubechies and biorthogonal wavelets, Digital filter implementation of wavelets, Application examples.

UNIT – IV

Adaptive Digital Filters: Adaptive Filter Structures, Minimum mean square criterion, LMS algorithm, Recursive Least Square algorithm, Application Examples.

Linear Prediction & Optimum Linear Filters: Linear prediction, forward-backward linear prediction filters, solution of normal equations, Wiener Filters.

UNIT – V

Power Spectrum Estimation: Nonparametric Methods and parametric Methods for Power Spectrum Estimation, Minimum-variance spectral estimation, Eigen analysis Algorithms for Spectrum Estimation.

Suggested Reading:

1. K. Deergha Rao and MNS Swamy, "Digital Signal Processing Theory and Practice", Springer, 2018.
2. Sanjit K. Mitra, "Digital Signal Processing", 3/e, Tata McGraw-Hill Edition, 2006.
3. J.G.Proakis and D.G. Manolakis," Digital signal processing: Principles, Algorithm and Applications", 4th Edition, Prentice Hall, 2007..
4. S.Haykin, "Adaptive Filter Theory", 4th Edition, Prentice Hall, 2001.

Steven M Kay, "Modern Spectral Estimation Theory and Application", Prentice Hall,1988.

DEPARTMENTOF ELECTRONICS AND COMMUNICATIONS ENGINEERING
SYLLABUS FOR M.E. (ECE - CE&SP) – I SEMESTER

Advanced Digital Modulation Techniques

Course Code : **PII18PC120EC**	Instruction : 3 Hrs/week	CIE – Marks : 40
SEE – Marks : 60	SEE - Duration : 3 Hours	Credits: 3

Course Objectives	Course Outcomes
1. Analyze the properties of basic Modulation techniques and apply them to Digital Communication. 2. Apply different types of coding techniques to design the optimum receiver for channels with ISI and AWGN. 3. Design and develop the different types of modulation techniques, equalizer to improve the performance under fading channels for various applications. 4. Understand and appreciate the need of various modulations and spread spectrum techniques. 5. Analyze the performance of spread spectrum systems in the presence of interference.	**At the end of the course, students will be able to:** 1. Explain merits and demerits of different modulation techniques & coding techniques, spread spectrum signals and channel behaviors. 2. Analyze various modulation, equalization, diversity and coding techniques for communication systems. 3. Compare performance of different types of modulation on different wireless application fading channels. 4. Design and demonstrate various modulation/coding equalization techniques and measure their performance. 5. Apply spread spectrum techniques to the baseband signal in the presence of interference to reduce the occurrence of error.

UNIT – I

Review of fundamental concepts and parameters in Digital Communication. Digital modulation schemes, Power spectra of digital modulation signals.

UNIT – II

Performance of carrier modulation schemes : Performance of BPSK and QPSK in AWGN Channel, Performance of Binary FSIC in M-ary PSK in AWGN Channel, Minimum Shift keying (MSK) Modulation, GMSK continuous phase modulation(CPM) schemes.

UNIT – III

Channel characterization and modeling: Optimum receivers for AWGN Channels, Equalization techniques, Orthogonal Frequency Division Multiplexing (OFDM). Carrier Synchronization, Timing synchronization.

UNIT – IV

Introduction to spread spectrum modulation, Direct Sequence modulation, spreading codes, Advantage of CDMA for wireless, Code Synchronization, Code Acquisition and tracking. Channel estimation, Power control, the near-far problem, FEC coding and CDMA, Frequency Hopping spread spectrum, Complex baseband representation of FHSS, slow and fast frequency hopping, Processing gain.

UNIT – V

Spread spectrum as a Multiple access technique: Multi channel and Multi carrier systems; Digital Communication through fading multipath channels; Multi user communications. 'Space diversity on Receiver' technique, MIMO antenna systems, Space time codes for MIMO wireless Communication, Differential space time block codes, SDMA, Smart antennas.

Suggested Reading:

1. John G. Proakis and Masoud Salehi, "Digital Communications," McGraw Hill, 5/e, 2008.
2. Stephen G. Wilson, "Digital Modulation and coding," Pearson Education, 2010.
3. Simon Haykin and Michael Moher, "Modern Wireless Communications," Pearson Education, 2005.
4. Marvin K. Simon, Sami M. Hinedi and W. C. Lindsay, "Digital Communication Techniques," Eastern Economy Edition, 2010.
5. Andrew J Viterbi, "CDMA principles spread spectrum communications," Adison Wesley, 1995.

DEPARTMENTOF ELECTRONICS AND COMMUNICATIONS ENGINEERING
SYLLABUS FOR M.E. (ECE - CE&SP) – I SEMESTER

Image and Video Processing

Course Code : **PII18PC130EC**	Instruction : 3 Hrs/week	CIE – Marks : 40
SEE – Marks : 60	SEE - Duration : 3 Hours	Credits: 3

Course Objectives	Course Outcomes
1. Understand the basics of image processing system and the concepts of image transforms. 2. Gain knowledge in applying image processing algorithms to enhance images. 3. Gain complete knowledge about image compression and segmentation used in digital image processing 4. Understand representation of digital video in the spatial domain and knowledge about time varying image formation models. 5. Understand principles and methods of 2-D motion estimation for digital video	**At the end of the course, students will be able to:** 1. Analyze relationship between pixels in images and able to apply proper image transform on digital images for the intended application. 2. Apply filtering operations to remove noise in images and to segment the digital images. 3. Apply proper compression techniques on images to save storage space and to reduce transmission time. 4. Analyze video signals and time-varying image formation models. 5. Analyze 2-D motion estimation of video and video filtering operations.

UNIT – I

Fundamentals of Image Processing and Image Transforms: Basic steps of Image Processing System, Sampling and Quantization of an image, relationship between pixels. Image Transforms: 2 D- Discrete Fourier Transform, Discrete Cosine Transform (DCT), Wavelet Transforms: Continuous Wavelet Transform, Discrete Wavelet Transforms.

UNIT – II

Image Processing Techniques: Image Enhancement: Spatial domain methods: Histogram processing, Fundamentals of Spatial filtering, Smoothing spatial filters, Sharpening spatial filters. Frequency domain methods: Basics of filtering in frequency domain, image smoothing, image sharpening, Selective filtering. Image Segmentation: Segmentation concepts, Point, Line and Edge Detection. Thresholding, Region Based segmentation.

UNIT – III

Image Compression: Image compression fundamentals - Coding Redundancy, Spatial and Temporal redundancy, Compression models: Lossy & Lossless, Huffman coding, Arithmetic coding, LZW coding, Run length coding, Bit plane coding, Transform coding, Predictive coding, Wavelet coding, JPEG Standards.

UNIT – IV

Basic concepts of Video Processing: Analog Video, Digital Video. Time-Varying Image Formation models: Three-Dimensional Motion Models, Geometric Image Formation, Photometric Image Formation, Sampling of Video signals, Filtering operations.

UNIT – V

2-D Motion Estimation**:** Optical flow, General Methodologies, Pixel Based Motion Estimation, Block- Matching Algorithm, Mesh based Motion Estimation, Global Motion Estimation, Region based Motion Estimation, Multi resolution motion estimation, Waveform based coding, Block based transform coding, Predictive coding, Application of motion estimation in Video coding.

Suggested Reading:

1. Gonzaleze and Woods, Digital Image Processing , 3rd ed., Pearson.
2. Yao Wang, Joem Ostermann and Ya–quin Zhang,Video processing and communication, 1st Ed., PH Int.
3. M. Tekalp, Digital Video Processing, Prentice Hall International.

DEPARTMENTOF ELECTRONICS AND COMMUNICATIONS ENGINEERING
SYLLABUS FOR M.E. (ECE - CE&SP) – I SEMESTER

Network Security and Cryptography

Course Code : **PII18PE110EC**	Instruction : 3 Hrs/week	CIE – Marks : 40
SEE – Marks : 60	SEE - Duration : 3 Hours	Credits: 3

Course Objectives	Course Outcomes
1. To understand the fundamentals of Cryptography 2. To acquire knowledge on standard algorithms used to provide confidentiality, integrity and authenticity. 3. To understand the various key distribution and management schemes. 4. To understand how to deploy encryption techniques to secure data in transit across data networks	**At the end of the course, students will be able to:** 1. Analyze the vulnerabilities in any computing system and hence be able to design a security solution 2. Identify the security issues in the network and resolve it. 3. Evaluate security mechanisms using rigorous approaches 4. Compare and Contrast different IEEE standards and electronic mail security

UNIT- I

Introduction : Attacks, Services and Mechanisms, Security attacks, Security services, A Model for Internetwork security, Classical Techniques: Conventional Encryption model, Steganography, Classical Encryption Techniques. Modern Techniques : Simplified DES, Block Cipher Principles, Data Encryption standard, Strength of DES, Block Cipher Design Principles.

UNIT- II

Encryption : Triple DES, International Data Encryption algorithm, Blowfish, RC5, Characteristics of Advanced Symmetric block cifers. Conventional Encryption: Placement of Encryption function, Traffic confidentiality, Key distribution, Random Number Generation.

UNIT – III

Public Key Cryptography: Principles, RSA Algorithm, Key Management, Diffie-Hellman Key exchange, Elliptic Curve Cryptograpy. Number Theory: Prime and Relatively prime numbers, Modular arithmetic, Fermat's and Euler's theorems, Testing for primality, Euclid's Algorithm, the Chinese remainder theorem, Discrete logarithms.

UNIT- IV:

Message Authentication and Hash Functions: Authentication requirements and functions, Message Authentication, Hash functions, Security of Hash functions and MACs. Hash and Mac Algorithms: MD File, Message digest Algorithm, Secure Hash Algorithm. Digital signatures and Authentication protocols: Digital signatures, Authentication Protocols, Digital signature standards. Authentication Applications: Kerberos, Electronic Mail Security: Pretty Good Privacy, S/MIME.

UNIT – V:

IP Security : Overview, Architecture, Authentication, Encapsulating Security Payload, Key Management. Web Security: Web Security requirements, Secure sockets layer and Transport layer security, Secure Electronic Transaction. Intruders, Viruses and Worms: Intruders, Viruses and Related threats. Fire Walls: Fire wall Design Principles, Trusted systems.

Suggested Reading:

1. Cryptography and Network Security: Principles and Practice - William Stallings, Pearson Education.
2. Network Security Essentials (Applications and Standards) by William Stallings Pearson Education.
3. Fundamentals of Network Security by Eric Maiwald (Dreamtech press)
4. Principles of Information Security, Whitman, Thomson.
5. Introduction to Cryptography, Buchmann, Springer.

DEPARTMENTOF ELECTRONICS AND COMMUNICATIONS ENGINEERING
SYLLABUS FOR M.E. (ECE - CE&SP) – I SEMESTER

Data and Computer Communication Networks

Course Code : **PII18PE120EC**	Instruction : 3 Hrs/week	CIE – Marks : 40
SEE – Marks : 60	SEE - Duration : 3 Hours	Credits: 3

Course Objectives	Course Outcomes
1. Analyze the services and features of the various layers of data networks. . 2. Familiarize the student with the basic taxonomy and terminology of the computer networking area. 3. Identify the different types of network topologies and protocols. 4. To understand the evolution of the WAN industry, wireless home networking IEEE 802.11 the PHY layer.	**At the end of the course, students will be able to:** 1. Enumerate the layers of the OSI and TCP/IP models 2. Illustrate how communication works in data networks and the Internet. 3. Understand and build the skills of subnetting and routing mechanisms. 4. Able to understand the Historical overviews of the land industry, evolution of the wan industry, wireless home networking IEEE 802.11 the physical layer, MAC , wireless ATM 5. Analyze the features and operations of various application layer protocols such as SNMP, SIP, and H.323 and security in internet.

UNIT – I

Data Communications and Networks Overview: Data Communications Model Communication Tasks, Basic concepts of Networking and Switching, Networking configurations, Protocols and Architecture, Key Elements of a Protocol, Protocols in Simplified Architecture, Protocol Data Units (PDU), Operation of a Protocol Architecture, Operation of a Protocol Architecture, Standardized Protocol Architectures, OSI and TCP/IP Architectures, Comparisons between OSI and TCP/IP, TCP/IP Addressing Concepts, concepts of Frequency, Spectrum and Bandwidth, Modem, Codec and Shannon Capacity.

UNIT – II

Line Configuration, Interfacing, Characteristics of Physical Layer Interface, Flow Control, Sliding Window Flow Control, Error control, CRC, ARQ Protocols, Data Link Control, Bit stuffing, HDLC Operation; Hierarchy of FDM schemes, WDM Operation, TDM Link Control, Hierarchy of TDM, DS-1 Transmission Format, SONET/SDH Frame Formats. Asymmetrical Digital Subscriber Line, xDSL.

UNIT – III

Circuit Switching and Packet Switching: Circuit Switching concepts, Circuit Switching applications, Circuit Switch Elements, Three Stage Space Division Switch, Blocking and Non-blocking switching, Time Division Switching, Control Signaling Functions, In Channel Signaling, Common Channel Signaling, Introduction to Signaling System Number 7 (SS7), Packet Switching Principles, Datagram and Virtual Circuit switching, Effects of variable packet size, X.25, X.25 Protocol Control Information. Routing: Routing in Circuit Switched Network, Routing in Packet Switched Network, Routing Strategies, Least Cost Algorithms, Bellman-Ford Algorithm.

UNIT – IV

LAN Architecture. Topologies, Choice of Topology, Ring and Star Usage, MAC and LLC, Generic MAC Frame Format, Bridge, Bridge Operation, Bridges and LANs with Alternative Routes, Spanning Tree, Loop resolution in bridges, Hubs, Two Level Star Topology, Layer 2 Switches, Wireless LAN, Multi cell Wireless LANs, IEEE 802.11 Architecture, IEEE 802.11 Medium Access Control logic.

UNIT – V

ATM, Architecture of ATM, Congestion Control and Quality of Service in ATM, Internetworking, IPv4, IPv6 comparison , Transport layer protocols, UDP Operation, TCP features, Flow Control, Error Control, Congestion Control, Network Management System, SNMP, SIP, and H.323 architectures, *Security in the Internet,* IP Security, Firewalls.

Suggested Reading:

1. William Stallings, "Data and Computer Communications", Eigth Edition, Pearson Prentice Hall, 2007.
2. Behrouz A. Forouzan, "Data Communications and Networking", Fourth Edition, Tata Mc Graw Hill, 2007.

DEPARTMENTOF ELECTRONICS AND COMMUNICATIONS ENGINEERING
SYLLABUS FOR M.E. (ECE - CE&SP) – I SEMESTER

Soft Computing Techniques

Course Code : **PII18PE130EC**	Instruction : 3 Hrs/week	CIE – Marks : 40
SEE – Marks : 60	SEE - Duration : 3 Hours	Credits: 3

Course Objectives	Course Outcomes
1. Introduce students to soft computing concepts and techniques and encourage their abilities in designing and implementing soft computing based solutions for real world and engineering problems. 2. Introduce the ideas of fuzzy sets, fuzzy logic and fuzzy inference systems.	**At the end of the course, students will be able to:** 1. Identify and describe soft computing techniques and their roles in building intelligent machines. 2. Apply neural networks to pattern classification and image processing problems. 3. Apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems. 4. Analyze the genetic algorithms and their applications.

UNIT – I

Fundamentals of Neural Networks & Feed Forward Networks: Basic Concept of Neural Networks, Human Brain, Models of an Artificial Neuron, Learning Methods, Neural Networks Architectures, Single Layer Feed Forward Neural Network :The Perceptron Model, Multilayer Feed Forward Neural Network :Architecture of a Back Propagation Network(BPN), The Solution, Backpropagation Learning, Selection of various Parameters in BPN. Application of Back propagation Networks in Pattern Recognition & Image Processing.

UNIT – II

Associative Memories & ART Neural Networks: Basic concepts of Linear Associator, Basic concepts of Dynamical systems, Mathematical Foundation of Discrete-Time Hop field Networks(HPF), Mathematical Foundation of Gradient-Type Hopfield Networks, Transient response of Continuous Time Networks, Applications of HPF in Solution of Optimization Problem: Minimization of the Traveling salesman tour length, Summing networks with digital outputs, Solving Simultaneous Linear Equations, Bidirectional Associative Memory Networks; Cluster Structure, Vector Quantization, Classical ART Networks, Simplified ART Architecture.

UNIT – III

Fuzzy Logic & Systems: Fuzzy sets, Crisp Relations, Fuzzy Relations, Crisp Logic, Predicate Logic, Fuzzy Logic, Fuzzy Rule based system, Defuzzification Methods, Applications: Greg Viot's Fuzzy Cruise Controller, Air Conditioner Controller.

UNIT – IV

Genetic Algorithms: Basic Concepts of Genetic Algorithms (GA), Biological background, Creation of Offsprings, Working Principle, Encoding, Fitness Function, Reproduction, Inheritance Operators, Cross Over, Inversion and Deletion, Mutation Operator, Bit-wise Operators used in GA, Generational Cycle, Convergence of Genetic Algorithm.

UNIT – V

Hybrid Systems: Types of Hybrid Systems, Neural Networks, Fuzzy Logic, and Genetic Algorithms Hybrid, Genetic Algorithm based BPN: GA Based weight Determination, Fuzzy Back Propagation Networks: LR-type fuzzy numbers, Fuzzy Neuron, Fuzzy BP Architecture, Learning in Fuzzy BPN, Inference by fuzzy BPN.

Suggested Reading:

1. Neural Networks, Fuzzy Logic & Genetic Algorithms: Synthesis & Applications -S.Rajasekaran, G.A. Vijayalakshmi Pai, July 2011, PHI, New Delhi.
2. Genetic Algorithms by David E. Gold Berg, Pearson Education India, 2006.
3. Neural Networks & Fuzzy Sytems- Kosko.B., PHI, Delhi, 1994.
4. Artificial Neural Networks - Dr. B. Yagananarayana, 1999, PHI, New Delhi.
5. An introduction to Genetic Algorithms - Mitchell Melanie, MIT Press, 1998.

DEPARTMENTOF ELECTRONICS AND COMMUNICATIONS ENGINEERING
SYLLABUS FOR M.E. (ECE - CE&SP) – I SEMESTER

Audio and Speech Signal Processing

Course Code : **PII18PE140EC**	Instruction : 3 Hrs/week	CIE – Marks : 40
SEE – Marks : 60	SEE - Duration : 3 Hours	Credits: 3

Course Objectives	Course Outcomes
1. Understand the anatomy and physiology of acoustic production and perception model. 2. To analyze the speech in time domain and extract various parameters. 3. To study the concept of Homomorphic system and analyze various audio coding techniques with applications.	**At the end of the course, students will be able to:** 1. Model an electrical equivalent of Speech Production System. 2. Extract the LPC coefficients that can be used to synthesize or compress the speech. 3. Design a homomorphic vocoder for coding and decoding of speech. 4. Extract the features for automatic speaker recognition systems 5. Design basic audio coding methods.

UNIT – I

Fundamentals of Digital Speech Processing: Anatomy & Physiology of Speech Organs, The Process of Speech Production, The Acoustic theory of speech production- Uniform lossless tube model, effect of losses in vocal tract, effect of radiation at lips, Digital models for speech signals.

Perception : Anatomical pathways from the Ear to the Perception of Sound, The Peripheral Auditory system, Hair Cell and Auditory Nerve Functions, Properties of the Auditory Nerve. Block schematics of the Peripheral Auditory system.

UNIT – II

Time Domain models for Speech Processing: Introduction – Window considerations, Short time energy, average magnitude, average zero crossing rate, Speech vs Silence discrimination using energy and zero crossing, pitch period estimation using a parallel processing approach, the short time autocorrelation function, average magnitude difference function, pitch period estimation using the autocorrelation function. Linear Predictive Coding (LPC) Analysis : Basic principles of Linear Predictive Analysis : The Autocorrelation Method, The Covariance method, Solution of LPC Equations : Cholesky Decomposition Solution for Covariance Method, Durbin's Recursive Solution for the Autocorrelation Equations, comparison between the methods of solution of the LPC Analysis Equations, Applications of LPC Parameters : Pitch Detection using LPC Parameters, Formant Analysis using LPC Parameters.

UNIT – III

Homomorphic Speech Processing: Introduction , Homomorphic Systems for Convolution : Properties of the Complex Cepstrum, Computational Considerations , The Complex Cepstrum of Speech, Pitch Detection , Formant Estimation, The Homomorphic Vocoder. Speech Enhancement: Speech enhancement techniques : Single Microphone Approach, Spectral Subtraction, Enhancement by re-synthesis, Comb filter, Wiener filter, Multi Microphone Approach.

UNIT – IV

Automatic Speech Recognition: Basic pattern recognition approaches, parametric representation of Speech, Evaluating the similarity of Speech patterns, Isolated digit Recognition System, Continuous word Recognition system. Elements of HMM, Training & Testing of Speech using HMM. Automatic Speaker Recognition: Recognition techniques, Features that distinguish speakers, MFCC, delta MFCC, Speaker Recognition Systems: Speaker Verification System , Speaker Identification System, Performance Metrics.

UNIT – V

Audio Coding : Lossless Audio Coding, Lossy Audio coding, Psychoacoustics , ISO-MPEG-1 Audio coding , MPEG - 2 Audio coding, MPEG - 2 Advanced Audio Coding, MPEG - 4 Audio Coding.

Suggested Reading:

1. Digital Processing of Speech Signals - L.R. Rabiner and S. W. Schafer. Pearson Education.
2. Digital Audio Signal Processing – Udo Zolzer, 2nd Edition, Wiley.
3. Speech & Audio Signal Processing- Ben Gold & Nelson Morgan, 1st Ed., Wiley
4. Discrete Time Speech Signal Processing: Principles and Practice - Thomas F. Quateri, 1st Ed., PE.
5. Digital Processing of Speech Signals. L.R Rabinar and R W Jhaung, 1978, PHI.

DEPARTMENTOF ELECTRONICS AND COMMUNICATIONS ENGINEERING
SYLLABUS FOR M.E. (ECE - CE&SP) – I SEMESTER

Bio-Medical Signal Processing

Course Code : **PII18PE150EC**	Instruction : 3 Hrs/week	CIE – Marks : 40
SEE – Marks : 60	SEE - Duration : 3 Hours	Credits: 3

Course Objectives	Course Outcomes
1. To introduce students the basic signal processing techniques in analyzing biological signals. 2. To develop the students mathematical, scientific & computational skills related to the field of biomedical signal processing 3. To enhance the ability in formulating problems & designing analysis tools for biological signals.	**At the end of the course, students will be able to:** 1. Knowledgeable of the basic signal processing techniques in analyzing biological signals. 2. To possess the basic mathematical & computational skills necessary to analyse biomedical signals. 3. Formulate and solve basic problems in biomedical signal analysis is enhanced 4. Aware of the complexity of biological signal and the impact, promise of biomedical engineering in understanding these signals. 5. Demonstrate to effectively communicate their ideas in terms of biomedical signal parameters.

UNIT –I

Random Processes: Stationary random process, Ergodicity, Power spectral density and autocorrelation function of random processes. Noise power spectral density analysis, Noise bandwidth and noise figure of systems.

UNIT –II

Data Compression Techniques: Lossy and Lossless data reduction Algorithms. ECG data compression using Turning point, AZTEC, CORTES, Huffman coding, vector quantisation, DICOM Standards

UNIT –III

Cardiological Signal Processing: Pre-processing, QRS Detection Methods, Rhythm analysis, Arrhythmia Detection Algorithms, Automated ECG Analysis, ECG Pattern Recognition. Adaptive Noise Cancelling: Principles of Adaptive Noise Cancelling, Adaptive Noise Cancelling with the LMS Adaptation Algorithm, Noise Cancelling Method to Enhance ECG Monitoring, Fetal ECG Monitoring.

UNIT -IV

Signal Averaging, Polishing: Mean and trend removal, Prony's method, Prony's Method based on the Least Squares Estimate, Linear prediction, Yule – Walker (Y –W) equations, Analysis of Evoked Potentials.

UNIT –V

Neurological Signal Processing: Modelling of EEG Signals, Detection of spikes and spindles Detection of Alpha, Beta and Gamma Waves. Auto Regressive (A.R.) modelling of seizure EEG. Sleep Stage analysis, Inverse Filtering, Least squares and polynomial modelling.

Suggested Reading:

1. Probability, Random Variables & Random Signal Principles – Peyton Z. Peebles, 4th Ed., 2009, TMH.
2. Biomedical Signal Processing- Principles and Techniques - D. C. Reddy, 2005, TMH.
3. Digital Bio Dignal Processing - Weitkunat R, 1991, Elsevier.
4. Biomedical Signal Processing - Akay M , IEEE Press.
5. Biomedical Signal Processing -Vol. I Time & Frequency Analysis - Cohen.A, 1986, CRC Press.

DEPARTMENTOF ELECTRONICS AND COMMUNICATIONS ENGINEERING
SYLLABUS FOR M.E. (ECE - CE&SP) – I SEMESTER

Wavelets & Applications

Course Code : **PII18PE160EC**	Instruction : 3 Hrs/week	CIE – Marks : 40
SEE – Marks : 60	SEE - Duration : 3 Hours	Credits: 3

Course Objectives	Course Outcomes
1. To establish the theory necessary to understand & use wavelets and related constructions. 2. Describe various continuous & discrete wavelet transform. 3. Understand the multi resolution analysis and its various applications.	**At the end of the course, students will be able to:** 1. Understand the terminology that are used in the wavelets literature. 2. Explain the concepts, theory of algorithms behind wavelets from an inter disciplinary perspective that unities harmonic analysis, filter banks & multi resolution analysis 3. Understand how to use the modern signal processing tools using signal spaces, bases, operators & series expansions. 4. Apply wavelets, filter banks and multi resolution techniques to a problem at hand & justify why wavelets provide the right tool. 5. Think critically ask question & apply problem solving techniques.

UNIT – I

Introduction: Stationary and non-stationary signals, Signal representation using basis and frames, Brief introduction to Fourier transform and Short time Fourier transform, Time-frequency analysis, Bases of time frequency: orthogonal, Filter banks, Multi resolution formulation: Wavelets from filters, Classes of wavelets: Haar, Daubechies, bi-orthogonal.

UNIT – II

Continuous Wavelet Transform: Continuous wavelet transform (CWT), Time and frequency resolution of the continuous wavelet transform, Construction of continuous wavelets: Spline, orthonormal, bi-orthonormal, Inverse continuous wavelet transform, Redundancy of CWT, Zoom property of the continuous wavelet transform, Filtering in continuous wavelet transform domain.

UNIT – III

Discrete Wavelet Transform And Filterbanks: Orthogonal and bi-orthogonal two-channel filter banks, Design of two-channel filter banks, Tree-structured filter banks, Discrete wavelet transform, Non-linear approximation in the Wavelet domain, multi resolution analysis, Construction and Computation of the discrete wavelet transform, the redundant discrete wavelet transform.

UNIT – IV

Multi Resolution Analysis: Multirate discrete time systems, Parameterization of discrete wavelets, Bi-orthogonal wavelet bases, Two dimensional, wavelet transforms and Extensions to higher dimensions, wave packets

UNIT – V

Applications: Signal and Image compression, Detection of signal changes, analysis and classification of audio signals using CWT, Wavelet based signal de-noising and energy compaction, Wavelets in adaptive filtering, Adaptive wavelet techniques in signal acquisition, coding and lossy transmission, Digital Communication and Multicarrier Modulation, Trans multiplexers , Image fusion, Edge Detection and object isolation.

Suggested Reading:

1. A Wavelet Tour of Signal Processing, 2nd edition, S. Mallat, Academic Press, 1999.
2. Wavelet transforms: Introduction, Theory and applications, Raghuveer rao and Ajit S.Bopardikar, Pearson Education Asia, 2000.
3. Fundamentals of Wavelets: Theory, Algorithms, and Applications, J.C. Goswami and A.K. Chan, 2nd ed., Wiley, 2011.
4. Wavelets and their Applications, Michel Misiti, Yves Misiti, Georges Oppenheim, Jean-Michel Poggi, John Wiley & Sons, 2010 .
5. Multirate Systems and Filter Banks, P. P. Vaidyanathan, Pearson Education, 2004.

DEPARTMENTOF ELECTRONICS AND COMMUNICATIONS ENGINEERING
SYLLABUS FOR M.E. (ECE - CE&SP) – I SEMESTER

Adaptive Signal Processing

Course Code : **PII18PE170EC**	Instruction : 3 Hrs/week	CIE – Marks : 40
SEE – Marks : 60	SEE - Duration : 3 Hours	Credits: 3

Course Objectives	Course Outcomes
1. To introduce some practical aspects of signal processing, and in particular adaptive systems 2. The basic principles of adaptation which cover various adaptive signal processing algorithms (e.g., the LMS algorithm) and its applications, such as adaptive noise cancellation, interference canceling, system identification.	**At the end of the course, students will be able to:** 1. Understand basic concepts of adaptive signal processing. 2. Derive & apply the principle of orthogonality 3. Understand the convergence issues, computational complexities and optimality of Weiner & scalar & vector Kalman filters. 4. Derive the Least Means Squares (LMS) & Recursive Least Square (RLS) adaptive filter algorithms & apply them to problems in system identification & linear prediction. 5. Develop adaptive systems for various applications.

UNIT – I

Approaches to the development *of* adaptive filter theory. Introduction to filtering, smoothing and prediction. Wiener filter theory, introduction; Error performance surface; Normal equation; Principle of orthogonality; Minimum mean squared error; example.

UNIT – II

Gradient algorithms; Learning curves; LMS gradient algorithm; LMS stochastic gradient algorithms; convergence of LMS algorithms.

UNIT – III

Applications of adaptive filter to adaptive noise canceling, Echo cancellation in telephone circuits and adaptive beam forming.

UNIT – IV

Kalman Filter theory; Introduction; recursive minimum mean square estimation for scalar random variables; statement of the Kalman filtering problem: the innovations process; Estimation of state using the innovations process; Filtering examples.

UNIT – V

Vector Kalman filter formulation. Examples. Application of Kalman filter to target tracking.

Suggested Reading:

1. Sophoclas, *J.* Orphanidies, "Optimum signal processing an introduction", McMillan, 1985.
2. Simon Haykins, "Adaptive signal processing", PHI, 1986.
3. Bernard Widrow, "Adaptive signal processing", PHI,1986.
4. Bozic. SM., Digital and kalman Filtering.

DEPARTMENTOF ELECTRONICS AND COMMUNICATIONS ENGINEERING
SYLLABUS FOR M.E. (ECE - CE&SP) – I SEMESTER

Array Signal Processing

Course Code : **PII18PE180EC**	Instruction : 3 Hrs/week	CIE – Marks : 40
SEE – Marks : 60	SEE - Duration : 3 Hours	Credits: 3

Course Objectives	Course Outcomes
1. To understand fundamentals of arrays and representation of signals is space and time and wave field signals. 2. To understand spatial simples and concepts of sensor arrays and different arrays. 3. To get acquainted with spatial frequency transform and spatial domain filters and applications. 4. To study how to develop beam forming techniques with their application of DOA estimation 5. To get acquainted with different subspace methods and algorithms to develop high resolution DOA estimation techniques.	**At the end of the course, students will be able to:** 1. Students will be able to represent propagating signals in space and time and wave field generation. 2. Students will be in a position to understand spatial sampling of wave fields. Study and understanding the concepts of sensor arrays. 3. Students will be in a position to write spatial frequency transform for different signals and concept of spatial domain filtering and applications. 4. Students will be in a position to develop. Beam Forming circuit and apply to DOA estimation. 5. Students will be in a position to develop high resolution DOA techniques and their simulations.

UNIT – I

Spatial Signals: Array fundamentals. Signals in space and time. Signal models. Spatial frequency, Propagation Signal Direction Vs Spatial Frequency. Wave fields. Far field and Near field signals.

UNIT – II

Sensor Arrays: Spatial sampling, Spatial sampling theorem. Aliasing in spatial frequency domain. Sensor arrays. Uniform Linear Arrays (ULA) basic idea of Direction of Arrival using Uniform Linear Array. Array transfer (steering) vector. Array steering vector for ULA. Planar and Random Arrays. Broadband arrays.

UNIT – III

Spatial Frequency: Spatial Frequency Transform, Spatio-Temporal Filter. Spatial spectrum. Spatial Domain Filtering, Spatial smoothing, Smoothing filters, Sharpening filters. Spatially white signal.

UNIT – IV

Direction of Arrival Estimation: Conventional Beam Forming, Tapered and optimum Beam Forming, Eigen analysis, Interference cancellation, Side lobe canceller. Non parametric methods - Beam Forming and Capon methods. Resolution of Beam Forming.

UNIT – V

Subspace methods: Maximum likely hood estimation, Pisaranko's method, MUSIC, Minimum Norm and ESPRIT techniques and algorithms.

Suggested Reading:

1. Don H. Johnson and Dan E. Dugeon, "Array Signal Processing: Concepts and Techniques," PHI, 2010.
2. Prabhakar S. Naidu, "Sensor Array Signal Processing," 2/e, CRC Press, 2009.
3. Simon Haykin, "Array Signal Processing," PHI, 1984.
4. Petre Stoica and Randolph L. Moses, "Spectral Analysis of Signals," PHI, 2005.

DEPARTMENTOF ELECTRONICS AND COMMUNICATIONS ENGINEERING
SYLLABUS FOR M.E. (ECE - CE&SP) – I SEMESTER

Radar Signal Processing

Course Code : **PII18PE190EC**	Instruction : 3 Hrs/week	CIE – Marks : 40
SEE – Marks : 60	SEE - Duration : 3 Hours	Credits: 3

Course Outcomes
At the end of the course, students will be able to:
1. Understand operating principles of basic radar systems their main design parameters and components
2. Apply detection and estimation theory to radar.
3. Apply target and noise models and Doppler processing.
4. Compare passive and active processing.
5. Analyze array beam forming.
6. Discuss problems and design challenges in radar signalling and waveforms
7. Describe signals and waveforms used in radar systems
8. Apply various tools (or simulators) for signal and system level simulations in radar systems

UNIT-I

Introduction: Classification of Radars based on functions, principles of operation etc., performance measures and interplay between Radar parameters, Target parameters and Environment parameters. Classical Detection and Estimation Theory, Binary Hypotheses Testing, Likely hood Ratio Test, Neymon square, MAP, Maximum Likelihood Estimation of parameters, Cramer-Rao Bounds, Chemo of Bounds.

UNIT – II

Representation of Signals, K-L expansion, Equivalent Low-pass representation of Band pass signals and noise. Detection of Slowly Fluctuating point Targets in white noise and coloured noise. Swerling Target models. Optimum receivers. Correlator and Band pass Matched Filter Receivers. PD – PF performance; Coherent and non-coherent Integration sub-optimum Reception. Radar Power – Aperture product.

UNIT – III

Range and Doppler Resolution : Ambiguity function and its properties. Local and Global Accuracy. Signal Design. LFM. Polyphase coded signals Detection of a Doppler shifted slowly fluctuating point target return in a discrete scatterer environment.

UNIT – IV

Dobly dipersive Fading Target and Clutter models-Scattering function description. Land clutter-pulse length limited and Beam width limited clutter. Sea clutter.

UNIT – V

Optimum / Sub optimum reception of Range Spread / Doppler Spread / Doubly spread targets in the presence of noise and clutter. Introduction to Adaptive Detection and CFAR Techniques.

Suggested Reading:

1. Di Franco. JV and Rubin, WL., "Radar Detection", Artech House, 1980.
2. Gaspare Galati (Ed), "Advanced Radar Techniques and Systems", Peter Perigrinus Ltd., 1993.

Ramon Nitzberg, "Radar Signal Processing and Adaptive Systems", Artech House, 1999. August. W Rihaczek, "Principles of High Resolution Radar", Artech House, 1996.

DEPARTMENTOF ELECTRONICS AND COMMUNICATIONS ENGINEERING
SYLLABUS FOR M.E. (ECE - CE&SP) – I SEMESTER

Advanced Signal Processing Laboratory

Course Code : **PII18PC111EC**	Instruction : 3 Hrs/week	CIE – Marks : 50
SEE – Marks : -	SEE - Duration : 3 Hours	Credits: 1.5

Course Objectives	Course Outcomes
1. To perform basic signal operations using simulink. 2. To d sign a digital filter. 3. Perform MAC operations using DSP processors.	**At the end of the course, students will be able to:** 1. Develop Matlab files for the verification of system response and design digital filters using various methods. 2. Generate various musical effects with digital filter. 3. Work with simulink environment. 4. Perform various signal operations using DSP kit. 5. Interfacing the DSP processor in real time.

Section - 1:

1. Generating basic waveforms (impulse, step, ramp, exponential, sin, …)
2. Digital FIR Filter implementation and realizations: with and without windows.
3. Design of IIR filters (Butterworth, Chebychev, IIR, …).
4. Generation of musical effects using digital filters.
5. Using the Simulink generate the basic waveforms (impulse, step, ramp, exponential, sin, …) observe the waveforms on the CRO.
6. Using Simulink generate the modulated waveforms.
7. Study and implementation of sigma - delta modulator/ Transmultiplexer.

Section – 2:

1. Declaring and initializing the variables and moving the data to and from
   Memory (register to memory, memory to register).
2. Setting up Circular buffering , hardwared loops:
   a. Adding the 10 consecutive numbers
   b. Splitting he numbers
   c. Bit level operations.
3. Underatsatding the DSP MAC capabilities.
   a. Windowing, Convolution, FIR filtering
4. Underatsatding the DSP parallel instruction optimisation.
   a. FFT without parallel instructions
   b. FFT with parallel instructions
5. Creation of periodic waveforms and noise sequences using the DSP kit.
6. Interfacing the DSP processor in real time.
7. Initialization of Audio codec.

Note: The experiments will be decided and modified if necessary and conducted by the lecturer concerned.

DEPARTMENTOF ELECTRONICS AND COMMUNICATIONS ENGINEERING
SYLLABUS FOR M.E. (ECE - CE&SP) – I SEMESTER

Embedded Systems Laboratory

Course Code : **PII18PC121EC**	Instruction : 3 Hrs/week	CIE – Marks : 50
SEE – Marks : -	SEE - Duration : 3 Hours	Credits: 1.5

Course Objectives	Course Outcomes
1. Compare different cross compilers and install Keil v5 µVision IDE in x86 Windows 7 & above or Linux 2.6 (Ubuntu 16.04 LTS) & above host. 2. Develop programming constructs in embedded C for C51 targets to configure built-in peripherals. 3. Simulate actual hardware environment by designing hardware in Proteus7.x & above. 4. Implement Device Drivers for off-chip I/O & memories with C51 MCU. 5. Adopt debugging policies for validating the designed firmware.	**At the end of the course, students will be able to:** 1. Implement embedded C constructs to configure built-in registers of C51 target. 2. Demonstrate the hardware emulation of the design on Proteus 7.x IDE. 3. Design & Implement off-chip OS-less device drivers for C51 in Keil v5 µVision IDE 4. Demonstrate efficient Interrupt Service Routine coding principles in C/C++. 5. Analyze & suggest debugging methods for any given specifications with C51 target.

List of Experiments using Embedded C/Embedded C++:

1. To toggle LEDs connected to GPIOs of AT89S52 with some intentional Delay.
2. To design & implement 4x3 matrix Keypad Device Driver for ASCII mapping.
3. To design & implement 2x16 LCD Device Driver for displaying below text:

   Line-1: "**Welcome@ESD Lab!**"

   Line-2:"**Enter to Proceed**"
4. To Configure Timer0 and Timer1 for intended delay without interrupts.
5. To design & demonstrate the UART drivers for data transmission and data reception at 9600bps full duplex baud.
6. To design & implement the concept of writing Interrupt Service Routine (ISR) for external interrupt INT0, INT1.
7. To design & implement the concept of mixing of external ISRs with Internal ISRs and understanding the ISR handling process.
8. To design & implement LED Seven Segment driver with adjustable delay.
9. To design & implement User Centric template Menu designs in Embedded C
10. To design and implement embedded C/C++ constructs for programming LPC2148 ARM powered MCU.

Suggested tools for use:

1. Hardware Target CPU – AT89S52 ; LPC2148 (ARM7 TDMI-S)
2. Embedded Software Development – Keil µVision5 IDE
3. Embedded Debugger – Keil µVision5 Debugger
4. Hardware Simulator – Proteus

DEPARTMENTOF ELECTRONICS AND COMMUNICATIONS ENGINEERING
SYLLABUS FOR M.E. (ECE - CE&SP) – I SEMESTER

Seminar – I

Course Code : **PII18PC118EC**	Instruction : 2 Hrs/week	CIE – Marks : 50
SEE – Marks : -	SEE - Duration : 3 Hours	Credits: 1

Course Objectives	Course Outcomes
1. Prepare the student for a systematic and independent study of the state of the art topics in a broad area of his / her specialization.	**At the end of the course, students will be able to:** 1. Selection of a suitable topic / problem for investigation and presentation. 2. Carryout literature survey and prepare the presentation. 3. Formulating the problem, identify tools and techniques for solving the problems. 4. Clear communication and presentation of the seminar topic. 5. Apply ethical principles in preparation of seminar report.

Oral presentation and technical report writing are two important aspect of engineering education. The objective of the seminar is to prepare the student for a systematic and independent study of the state of the art topics in the advanced fields of Communication Engineering and related topics.

Seminar topics may be chosen by the students with advice from the faculty members. Students are to be exposed to the following aspects for a seminar presentation.

- Literature survey
- Organization of the material
- Presentation of OHP slides / LCD presentation
- Technical writing

Each student required to:

1. Submit a one page synopsis before the seminar talk for display on the notice board.
2. Give a 20 minutes time for presentation following by a 10 minutes discussion.
3. Submit a detailed technical report on the seminar topic with list of references and slides used.

Seminars are to be scheduled from the 3rd week to the last week of the semester and any change in schedule shall not be entertained.

For award of sessional marks, students are to be judged by at least two faculty members on the basis of an oral and technical report preparation as well as their involvement in the discussions.

DEPARTMENTOF ELECTRONICS AND COMMUNICATIONS ENGINEERING
SCHEME OF INSTRUCTION AND EXAMINATION FOR
M.E (ECE) Communication Engineering and Signal Processing
II-SEMESTER w.e.f. 2018-19 under CBCS

S.No.	Category	Course code	Course Title	Scheme of Instruction			Scheme of Examination			Total	Credits
				L	T	P	Duration of SEE in Hrs	CIE	SEE		
Theory											
1.	AC	PI18AC210EH	Audit course-II: : Pedagogy Studies	2	-	-	3	40	60	100	-
2.	PC	PI18PC240ME	Research Methodology and IPR	2	-	-	3	40	60	100	2
3.	HS	PI18HS200EH	Skill Development Course	2	-	-	3	40	60	100	2
4.	PC	PII18PC210EC	**Core–IV:** Coding Theory and Techniques	3	-	-	3	40	60	100	3
5.	PC	PII18PC220EC	**Core–V:** Wireless Communications and Networking	3	-	-	3	40	60	100	3
6.	PC	PII18PC230EC	**Core–VI:** Microcontrollers and DSP Processors - Architecture	3	-	-	3	40	60	100	3
7.	PE	PII18PE2X0EC	Professional Elective – IV	3	-	-	3	40	60	100	3
8.	PE	PII18PE2X0EC	Professional Elective – V	3	-	-	3	40	60	100	3
Laboratory											
9.	PC	PII18PC211EC	Communication Systems Simulation Laboratory	-	-	3	-	50	-	50	1.5
10.	PC	PII18PC212EC	DSP Processors Applications Laboratory	-	-	3	-	50	-	50	1.5
11.	PW	PII18PW219EC	Mini Project	-	-	2	-	50	-	50	1
12.	PC	PII18PC218EC	Seminar – II	-	-	2	-	50	-	50	1
				21	**-**	**10**	**-**	**520**	**480**	**1000**	**24**

DEAPRTMENT OF HUMANITIES AND SOCIAL SCIENCES
SYLLABUS FOR M.E. (ECE - CE&SP) – II SEMESTER
PEDAGOGY STUDIES
VASAVI COLLEGE OF ENGINEERING(AUTONOMOUS)

Instruction: 2 Hours/ week	Semester End Exam Marks: 60	Course Code: PI18PC210EH
Credits: 0	CIE marks: 40	Duration of SEE: 3 hrs.

Course Objectives	Course Outcomes
Students will be able to: 1. Review existing evidence on the review topic to inform programme design and policy making undertaken by the DfID, other agencies and researchers. 2. Identify critical evidence gaps to guide the development.	**Students will be able to understand:** 1. What pedagogical practices are being used by teachers in formal and informal classrooms in developing countries? 2. What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners? 3. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?

Unit-I **Introduction and Methodology :**
- Aims and rationale, Policy background, Conceptual framework and terminology
- Theories of learning, Curriculum, Teacher education.
- Conceptual framework, Research questions.
- Overview of methodology and Searching.

Unit-II
- **Thematic overview:**
  - Pedagogical practices that are being used by teachers
  - in formal and informal classrooms in developing countries.
  - Curriculum, Teacher education.

Unit-III
- **Evidence on the effectiveness of pedagogical practices**
  - Methodology for the in depth stage: quality assessment of included studies.
  - How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?
  - Theory of change.
  - Strength and nature of the body of evidence for effective pedagogical practices.
  - Pedagogic theory and pedagogical approaches.
  - Teachers' attitudes and beliefs and Pedagogic strategies.

Unit-IV
- **Professional development: alignment with classroom practices and follow-up support**
  - Peer support
  - Support from the head teacher and the community.
  - Curriculum and assessment
  - Barriers to learning: limited resources and large class sizes

Unit-V
- **Research gaps and future directions**
  - Research design
  - Contexts
  - Pedagogy
  - Teacher education
  - Curriculum and assessment
  - Dissemination and research impact.

Suggested reading

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2):245-261.
2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.
3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.
4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.
5. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.
6. Chavan M (2003) Read India: A mass scale, rapid, 'learning to read' campaign.
7. www.pratham.org/images/resource%20working%20paper%202.pdf.

DEPARTMENT OF MECHANICAL ENGINEERING
SYLLABUS FOR M.E (ECE - CE&SP) II-SEMESTER
RESEARCH METHODOLOGY AND IPR

Instruction: 2 Hours/ week	Semester End Exam Marks: 60	Course Code: PI18PC240ME
Credits: 2	Sessional Marks: 40	Duration of Semester End Exam: 3 hrs.

Course Outcomes

At the end of the course, Students will be able to

- Understand research problem formulation.
- Analyze research related information and follow research ethics
- Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
- Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.
- Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

UNIT-I

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

UNIT-II

Effective literature studies approaches, analysis Plagiarism, Research ethics,

Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

UNIT-III

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

UNIT-IV

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

UNIT-V

New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

References:

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students'"
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"
3. Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners"
4. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd,2007.
5. Mayall, "Industrial Design", McGraw Hill, 1992.

DEPARTMENT OF HUMANITIES AND SOCIAL SCIENCES
SYLLABUS FOR M.E. (ECE- CE&SP) – II SEMESTER
SKILL DEVELOPMENT COURSE

Instruction: 2 Hours/ week	Semester End Exam Marks: 60	Course Code: PI18HS200EH
Credits: 2	CIE Marks : 40	Duration of SEE: 3 Hours

Course Objectives	Course Outcomes
Students Should be able to: The four major skills of language learning, listening, speaking, reading and writing provide the right key to success. The main objective of the Skill Development Course curriculum is to involve content for all the above mentioned four skills in teaching English and to get students proficient in both receptive and productive skills.	At the end of the course, students will be able to • Better Comprehension and Presentation Skills • Exposure to Versant, AMCAT and better strike rate during placement • Better Interview Performance

Unit I: **Remedial English: Delightful Descriptions**:
Describing Past, Present and Future Events.

Unit II: **Developing Conversational Skills –** Exchange of pleasantries, Exchange facts and opinions, Using relevant vocabulary.

UNIT III: **Contextual Conversations:** Ask for Information, Give Information, Convey bad news, show appreciation

UNIT IV: **Business English**: **Professional Communication**:
Concise Cogent Communication, Active Listening, Interact, Interpret and Respond. **Expositions and Discussions:** Organization, Key Points, Differing Opinions, Logical conclusions. **Effective Writing Skills:** Structure, Rough Draft, Improvisations and Final Draft for Emails, paragraphs and Essays. **High Impact Presentations:** Structure, Content, Review, Delivery

Unit V: **Industry Orientation and Interview Preparation**
Interview Preparation– Fundamental Principles of Interviewing, Resume Preparation, Types of Interviews, General Preparations for an Interview. **Corporate Survival skills**: Personal accountability, Goal Setting, Business Etiquette, Team Work

Suggested Readings:

1. Business Communication, by Hory Shankar Mukerjee, Oxford/2013
2. Managing Soft Skills for Personality Development by B.N.Gosh, Tata McGraw-Hill/ 2012
3. Personality Development & Soft Skills by Barun K Mitra, Oxford/2011
4. Murphy, Herta A., Hildebrandt, Herbert W., & Thomas, Jane P., (2008) "Effective Business Communication", Seventh Edition, Tata McGraw Hill, New Delhi
5. Locker, Kitty O., Kaczmarek, Stephen Kyo, (2007), "Business Communication – Building Critical Skills", Tata McGraw Hill, New Delhi
6. Lesikar, Raymond V., &Flatley, Marie E., (2005)"Basic Business Communication – Skills for Empowering the Internet Generation", Tenth Edition, Tata McGraw Hill, New Delhi
7. Raman M., & Singh, P., (2006) "Business Communication", Oxford University Press, New Delhi.

Journals / Magazines:

1. Journal of Business Communication, Sage publications
2. Management Education, Mumbai

Websites:

www.mindtools.com
www.bcr.com

DEPARTMENTOF ELECTRONICS AND COMMUNICATIONS ENGINEERING
SYLLABUS FOR M.E. (ECE- CE&SP) – II SEMESTER

Coding Theory and Techniques

Course Code : **PII18PC210EC**	Instruction : 3 Hrs/week	CIE – Marks : 40
SEE – Marks : 60	SEE - Duration : 3 Hours	Credits: 3

Course Objectives	Course Outcomes
1. To study performance of different communication techniques in fading channels. 2. To study theory of Galois fields and design of block codes such as BCH, RS, LDPC and polar codes. 3. To get acquainted with the design of both convolution and turbo encoders and decoders. 4. To study space time coding for MIMO systems. 5. To get acquainted with applications of channel coding.	**At the end of the course, students will be able to:** 1. understand different communication techniques and their performance in fading 2. understand theory of block codes such as BCH,RS,LDPC, and polar codes 3. design encoders and decoders for BCH,RS,LDPC ,and polar codes 4. understand theory of convolutional codes and turbo codes and their encoders and decoders design 5. understand space time coding for MIMO systems 6. know applications of channel coding

UNIT – I

Introduction: Digital communication system, Wireless channel statistical models, BER performance in AWGN and fading channels for different modulation schemes, BER performance of CDMA, FH – CDMA in AWGN and fading channels, capacity of fading channels with CSI, Diversity reception, channel coding Theorem, Channel coding gain.

UNIT – II

Block Coding: Galois fields, polynomials over Galois fields, BCH codes,CRC codes, RS codes, Decoding Techniques for RS codes, LDPC encoder and decoder, Performance analysis of RS and LDPC codes.
Polar Codes :polar encoder and decoder, performance analysis of polar codes

UNIT – III

Convolution codes: Linear convolution encoders, Structural properties of Convolution codes, Viterbi decoding technique for convolution codes – Soft / Hard decision, concatenation of block codes and convolutional codes, performance analysis, concept of Trellis coded modulation.

UNIT – IV

Turbo Codes: Parallel concatenation, Turbo encoder, Iterative decoding using BCJR algorithm, Performance analysis.

UNIT – V

Space – Time Coding: MIMO systems, MIMO fading channels, rate gain & diversity gain, transmit diversity, Alamouti scheme, OSTBC codes, Linear space – time codes, trellis space – time codes, Space – time codes with no CSI

Suggested Reading:

1. K. Deergha Rao, Channel Coding Techniques for Wireless Communications, Springer, 2015.
2. E. Biglieri, Coding for Wireless Channels, Springer, 2007.
3. S.B. Wicker, Error control systems for Digital communication and Storage, Prentice Hall, 1995.
4. K.L.Du & M.N.S.Swamy, Wireless Communication: From RF to 4G Enabling Technologies, Cambridge, 2010.
5. J.G. Proakis & M. Salehi, Digital Communications, Mc Graw-Hill, 2008.

DEPARTMENTOF ELECTRONICS AND COMMUNICATIONS ENGINEERING
SYLLABUS FOR M.E. (ECE- CE&SP) – II SEMESTER

Wireless Communications and Networking

Course Code : **PII18PC220EC**	Instruction : 3 Hrs/week	CIE – Marks : 40
SEE – Marks : 60	SEE - Duration : 3 Hours	Credits: 3

Course Objectives	Course Outcomes
6. To analysis wireless and mobile network architectures technologies, 7. To analysis performance analysis of link and transport layer protocols. 8. To design various wireless networks and perform mini project in recent technologies. 9. To design mobile adhoc networks.	**At the end of the course, students will be able to:** 1. Understand basic propagation of radio signals. 2. Understand propagation characteristics of wireless channels, attenuation and to combat fading. 3. Understand diversity, interleaving, link technologies for wireless communication networks. 4. Apply analytical and empirical models in design of wireless links 5. Understand various channel allocation scheme. 6. Understand wireless data network and performance analysis of link and transport layer protocols. 7. Compare different types of mobile and wireless networks. 8. Able to design mobile and wireless applications and design mini projects in OFDM. 9. Able to analysis and synthesize characteristics of different multiple techniques and channel coding techniques.

UNIT - I
Radio Propagation Characteristics: Models for path loss, shadowing and multipath fading (delay spread, coherence band width, coherence time, Doppler spread), Jakes channel model, Digital modulation for mobile radio, analysis under fading channels:

UNIT – II
Wireless Communication Techniques: Diversity techniques and RAKE demodulator, channel coding techniques, multiple access techniques used in wireless mobile communications. Space time propagation, wireless channel, channel as a space time random field, space time channel and signal models, capacity of space time channels, spatial diversity, space time receivers, space time coding with channel knowledge, space time OFDM.

UNIT – III
Wireless networks: WLAN, Bluetooth. Suitable mini-projects in the areas of Space-Time codes and OFDM. The cellular concept: Frequency reuse: The basic theory of hexagonal cell layout: Spectrum efficiency, FDM / TDM cellular systems: Channel allocation schemes, Handover analysis, Erlang capacity comparison of FDM / TDM systems and cellular CDMA. GSM and CDMA cellular standards.

UNIT – IV
Signaling and call control: Mobility management, location tracking. Wireless data networking, packet error modeling on fading channels, performance analysis of link and transport layer protocols over wireless channels.

UNIT – V
Wireless/Wireline interworking: Mobile IP, WAP, Mobile ad-hoc networks. Wireless data in GSM, IS – 95 and GPRS. Space time Wireless Communications.

Suggested Reading:

1. Theodore S. Rappaport, "Wireless Communications: Principles and Practice," Pearson Education, 2011.
2. John G. Proakis and Masoud Salehi, "Digital Communications," McGraw Hill, 5/e, 2008.
3. William Stallings, "Wireless Communications and Networking," PHI, 2006.
4. C Sivarama Murthy and B S Manoj, "Ad-Hoc Wireless Networks: Architectures and Protocols," Pearson Education, 2011.
5. Jon W. Mark and Weihua Zhuang, "Wireless Communications and Networking," PHI, 2005.
6. Vijay K. Garg, "Wireless Communications and Networking," Elsevier, 2011.

DEPARTMENTOF ELECTRONICS AND COMMUNICATIONS ENGINEERING
SYLLABUS FOR M.E. (ECE- CE&SP) – II SEMESTER

Microcontrollers and DSP Processors – Architecture

Course Code : **PII18PC230EC**	Instruction : 3 Hrs/week	CIE – Marks : 40
SEE – Marks : 60	SEE - Duration : 3 Hours	Credits: 3

Course Objectives	Course Outcomes
1. Different between general purpose processor and DSP processor 2. Interface DSP processor with external devices 3. Develop a prototype around TMs320C54XX using devices	**At the end of the course, students will be able to:** 1. Program 8051 architecture using embedded C 2. Interface 8051μC with external world 3. Understand the concepts of fixed point DSP processor 4. Apply the knowledge of programmable concepts on DSP TMS320C54XX processor 5. Develop applications based on TMS320C54XX processor

UNIT – I

C51 Architecture, Instruction set, Addressing modes, Programming on-chip peripherals: Timers and counters, serial communication, Interrupt programming in Embedded- C.

UNIT – II

C51 interfacing with External Memory, Expansion of I/O ports with PPI (8255), C51 real world interfacing using Embedded C: ADC 0804, DAC, LCD, Keyboard, Stepper motor.

UNIT – III

Architectural features of programmable Digital signal processing Devices: Introduction, Basic Architectural features, DSP computational building blocks-Multipliers, shifter, MAC, ALU, Bus architecture and memory-on-chip memory, organization of on-chip memory, Data addressing capabilities, Address generation unit, Programmability and program execution, Speed issues, Q-notation.

UNIT – IV

Programmable Digital signal processors: Introduction, Commercial Digital Signal Processing Devices, Data addressing modes of TMS320C54XX processors, Memory space of TMS320C54XX processors, Program Control, TMS320C54XX Instructions and programming.

UNIT – V

Programmable Digital Signal processors on-chip peripherals, Interrupts of TMS320C54XX processors, pipeline operation of TMS320C54XX processors.
Applications using DSPs: FIR, IIR filter Design.

Suggested Reading:

1. Mazidi M.A and Mazidi J.G,"The 8051 Microcontroller and Embedded Systems", Pearson 2007.
2. Avtar Singh, S. Srinivasan "Digital Signal Processing Implementations: Using DSP Microprocessors--With Examples from TMS320C54xx", Cengage Learning (2004)
3. Kenneth Ayala,"The 8051 Microcontroller" 3rd Edition, Cengage Learning (2004).
4. B. Venkataramani, M. Bhaskar, "Digital Signal Processors, Architecture Programming and Applications", Tata Mc Graw Hill,2002.

DEPARTMENTOF ELECTRONICS AND COMMUNICATIONS ENGINEERING
SYLLABUS FOR M.E. (ECE- CE&SP) – II SEMESTER

Data Compression Methods

Course Code : **PII18PE210EC**	Instruction : 3 Hrs/week	CIE – Marks : 40
SEE – Marks : 60	SEE - Duration : 3 Hours	Credits: 3

Course Objectives	Course Outcomes
1. To provide students with contemporary knowledge in Data Compression 2. To equip students with skills to analyze and evaluate different mathematical aspects required for lossy and lossless Compression methods. 3. To study methods for compression of symbolic data as well as audio and video data, and to gain an appreciation of the ubiquity and importance of compression technologies.	**At the end of the course, students will be able to:** 1. Solve the problems associated different source coding techniques. 2. Understand the operation of scalar and vector quantizer. 3. Implement the compression techniques to compress the different raw data. 4. Summarize the concepts associated textual, image and video compression. 5. understand the most common file formats for textual, audio and video.

UNIT – I

Review of Information Theory, The discrete memory less information source - Kraft inequality; optimal codes Source coding theorem. Compression Techniques - Lossless and Lossy Compression - Mathematical Preliminaries for Lossless Compression -Huffman Coding - Optimality of Huffman codes - Extended Huffman Coding – Adaptive Huffman Coding - Arithmetic Coding - Adaptive Arithmetic coding, Run Length Coding, Dictionary Techniques - Lempel-Ziv coding, Applications - Predictive Coding - Prediction with Partial Match – Burrows Wheeler Transform, Dynamic Markov Compression.

UNIT – II

Rate distortion theory: Rate distortion function R(D),Properties of R(D); Calculation of R(D) for the binary source and the Gaussian source, Rate distortion theorem, Converse of the Rate distortion theorem, Quantization - Uniform & Non-uniform - optimal and adaptive quantization, vector quantization and structures for VQ, Optimality conditions for VQ, Predictive Coding - Differential Encoding Schemes.

UNIT – III

Mathematical Preliminaries for Transforms, Sub-bands and Wavelets, Karhunen Loeve Transform, Discrete Cosine and Sine Transforms, Discrete Walsh Hadamard Transform.

UNIT – IV

Transform coding – Sub-band coding – Wavelet transform based Compression.

UNIT – V

Basics of Compression standards: Audio Compression standards: MPEG, Dolby AC3; and Video Compression Standards: MPEG, H.261, H.263 and H.264.

Suggested Reading:

1. Khalid Sayood, "Introduction to Data Compression," Morgan Kaufmann Publishers., 3/e, 2011.
2. David Salomon, "Data Compression: The Complete Reference," Springer Publications, 4/e, 2006.
3. Toby Berger, "Rate Distortion Theory: A Mathematical Basis for Data Compression," PHI, 1971.
4. S. Mallat, A wavelet Tour of Signal Processing, 2/e, Academic Press, 1999.
5. Martin Vetterli and Jelena Kovacevic, "Wavelets and Subband Coding," PHI, 1995.

DEPARTMENTOF ELECTRONICS AND COMMUNICATIONS ENGINEERING
SYLLABUS FOR M.E. (ECE- CE&SP) – II SEMESTER

CODECS for Multimedia Applications

Course Code : **PII18PE220EC**	Instruction : 3 Hrs/week	CIE – Marks : 40
SEE – Marks : 60	SEE - Duration : 3 Hours	Credits: 3

Course Objectives	Course Outcomes
1. To get acquainted with components of multimedia and understand fundamental concepts in video and basics of digital audio 2. To study digital audio compression techniques and different CODECS. 3. To understand image transforms and different image compression standards 4. To study video compression techniques and standards 5. To get acquainted with current trends in digital signal processing.	**At the end of the course, students will be able to:** 1. Get familiarity with multimedia components and software tools and understand fundamental of multimedia. 2. Compress digital audio using different techniques and compress speech signal using different CODECS 3. Compress images using different standards such as JPEG, JPEG 2000 and SPIHT and EZW codes 4. Compress video signals using standards H261, H263 and MPEG4 and H264 CODECS 5. Have knowledge on the current trends in digital signal processing.

UNIT – I

Introduction to multimedia: components of multimedia; overview of multimedia software tools;
Graphics and Image Data Representations: Graphics/image data types, popular file formats;
Fundamental Concepts in Video: analog and digital video.
Basics of Digital Audio – Storage requirements for multimedia applications; Need for Compression - Taxonomy of compression techniques

UNIT – II

Digital audio: audio compression techniques; μ-Law and A-Law, companding, ADPCM.
Speech compression: waveform codecs; source codecs; hybrid codecs; Shorten: lossless speech compressor, MPEG-1 audio layers

UNIT – III

Image Transforms – orthogonal transforms- DCT, JPEG, progressive image compression- JBIG, JBIG2 standards , Vector quantization, Differential lossless compression –DPCM Wavelet based
compression- Filter banks, DWT, Multiresolution decomposition, SPIHT and EZW Coders, JPEG 2000 standard

UNIT – IV

Video signal components - Video compression techniques – MPEG Video Coding– Motion
Compensation – H.261 , H.263 Standard , .MPEG4 and H.264 codecs.

UNIT – V

PLL, Image Processing, FSK modems, Voice detection and reverse play back, multi-rate filters, Current trends in digital signal processors.

Suggested Reading:

1. David Salomon, "Data Compression – The Complete Reference," Springer Verlag New York Inc.,3rd Edition, 2008.
2. L. Hanzo, P. J. Cherriman and J. Streit, "Video Compression and Communications From Basics toH.261, H.263, H.264,MPEG4 for DVB and HSDPA-Style Adaptive Turbo Transceivers," Second Edition, IEEE Communications Society, John Wiley & Sons Ltd, 2007.
3. Peter Symes, "Digital Video Compression," McGraw Hill Pub., 2004.

DEPARTMENTOF ELECTRONICS AND COMMUNICATIONS ENGINEERING
SYLLABUS FOR M.E. (ECE- CE&SP) – II SEMESTER

Advanced Optical Communication

Course Code : **PII18PE230EC**	Instruction : 3 Hrs/week	CIE – Marks : 40
SEE – Marks : 60	SEE - Duration : 3 Hours	Credits: 3

Course Objectives	Course Outcomes
1. To understand properties of different types of fibers, attenuation and dispersion mechanisms in them 2. To study physical construction and principle of operation of different types of optical sources and detectors 3. To understand the application of different modulation techniques to coherent systems 4. To study the effect of noise on the performance of optical communication systems 5. To understand the working principle of optical amplifiers	**At the end of the course, students will be able to:** 1. To distinguish between the various modes of operation of optical fibers, to explain the attenuation and dispersion mechanisms in fibers 2. To employ optical sources and detectors in different applications according to their specifications. 3. To classify coherent systems using different modulation techniques 4. To analyze the effects of noise and performance degradation induced by nonlinear effects in fiber propagation. 5. To employ optical amplifiers in appropriate applications

UNIT – I

Solution to Maxwell's equation in a circularly symmetric step index optical fiber, linearly polarized modes, single mode and multimode fibers, concept of V number, graded index fibers, total number of guided modes (no derivation), attenuation mechanisms in fibers, dispersion in single mode and multimode fibers, dispersion shifted and dispersion flattened fibers, attenuation and dispersion limits in fibers, Kerr nonlinearity, self phase modulation, combined effect of dispersion and self phase modulation.

UNIT – II

Optical sources - LED and laser diode - Principles of operation, concepts of line width, phase noise, switching and modulation characteristics. Optical detectors - PN detector, pin detector, avalanche photodiode - Principles of operation, concepts of responsivity, sensitivity and quantum efficiency, noise in detection, typical receiver configurations (high impedance and trans-impedance receivers).

UNIT – III

Coherent systems - Homodyne and heterodyne systems, coherent systems using PSK, FSK, ASK and DPSK modulations.

UNIT – IV

Noise Effects in coherent systems: Related noise effects, performance degradation induced by laser phase and intensity noise, degradation due to fiber dispersion, degradation induced by nonlinear effects in fiber propagation.

UNIT – V

Optical amplifiers - semiconductor amplifier, rare earth doped fiber amplifier (with special reference to erbium doped fibers), Raman amplifier, Brillouin amplifier - principles of operation, amplifier noise, signal to noise ratio, gain, gain bandwidth, gain and noise dependencies, inter modulation effects, saturation induced crosstalk, wavelength range of operation.

Suggested Reading:

1. John Senior, "Optical Fiber Communications: Principles and Practice," 3/e, Pearson, 2010.
2. Govind P. Agrawal, "Fiber-Optic Communication Systems," 3/e, John Wiley & Sons, 2002.
3. Gerd Keiser, "Optical Fibre Communications," 3/e, McGraw Hill, 2000.
4. John Gowar, "Optical Communication Systems," 2/e, PHI, 1993.

DEPARTMENTOF ELECTRONICS AND COMMUNICATIONS ENGINEERING
SYLLABUS FOR M.E. (ECE- CE&SP) – II SEMESTER

Global Navigational Satellite Systems

Course Code : **PII18PE240EC**	Instruction : 3 Hrs/week	CIE – Marks : 40
SEE – Marks : 60	SEE - Duration : 3 Hours	Credits: 3

Course Objectives	Course Outcomes
1. To demonstrate different positioning systems 2. To explain GPS operation, architecture operating frequencies and orbits. 3. To differentiate between GPS and UTC time. 4. To explain the GPS signal structure 5. To differentiate between various coordinate system 6. To estimate link budget 7. To demonstrate different GPS errors 8. To estimate total electron content (TEC) and VERE 9. To compare different DOPS (Dilution of precision) 10. To demonstrate integration of GPS with other systems 11. To demonstrate GPS data formats. 12. To estimation user position. 13. To demonstrate DGPS principle and errors 14. To understand local and global satellite constellation 15. To differentiate between various augmentation systems.	**At the end of the course, students will be able to:** 1. Demonstrate the different positioning systems 2. Explain GPS operation architecture operating frequencies and orbits. 3. Differentiate between GPS and UTL time. 4. Explain the GPS signal structure 5. Differential between various co-ordinate systems 6. Estimation of Link budget. 7. Demonstrate the different GPS errors. 8. Estimation of total electron content (TEC) and UERE 9. Comparison of different DOPS (Dilution of Precision) 10. Demonstration of GPS integration with other systems 11. Demonstration of GPS data formats 12. Estimation of user position 13. Demonstration of DGPS principles & errors 14. Understanding the local and global satellite constellation 15. Differentiate between various augmentation systems.

UNIT – I

GPS fundamentals: INS, Trilaiteration, Hyperbolic navigation, Transit, GPS principle of operation, architecture, operating frequencies, orbits, Keplerian elements.Solar and Siderial days, GPS and UTC Time

UNIT – II

GPS Signals: Signal structure, C/A and P-Code, ECEF and ECI coordinate systems and WGS 84 and Indian datums, Important components of receiver and specifications, link budget.

UNIT – III

GPS Error Models: Ionospheric error, Tropospheric error, Ephemeris error, Clock errors, Satellite and receiver instrumental biases, Antenna Phase center variation, multipath; estimation of Total Electron Content (TEC) using dual frequency measurements, Various DOPs, UERE. Spoofing and Anti-spoofing. : Future GPS satellites, new signals and their benefits GPS integration – GPS/GIS, GPS/INS, GPS/pseudolite, GPS/cellular.

UNIT – IV

GPS data processing, DGPS and Applications: RINEX Navigation and Observation formats, Code and carrier phase observables, linear combination and derived observables, Ambiguity resolution, cycle slips, Position estimation. principle of operation of DGPS, architecture and errors,

UNIT – V

Other Constellations and Augmentation systems Other satellite navigation constellations GLONASS and Galileo IRNS System. : Relative advantages of SBAS and GBAS, Wide area augmentation system (WAAS) architecture, GAGAN, EGNOS and MSAS. Local area augmentation system (LAAS) concept.

Suggested Reading:

1. B. Hofmann Wollenhof, H. Lichtenegger, and J.Collins, "GPS Theory and Practice", Springer Wien, new York, 2000.
2. Pratap Misra and Per Enge, "Global Positioning System Signals, Measurements, and Performance," Ganga-Jamuna Press, Massachusetts, 2001.
3. Ahmed El-Rabbany, "Introduction to GPS," Artech House, Boston, 2002.
4. Bradford W. Parkinson and James J. Spilker, "Global Positioning System: Theory and Applications," Volume II, American Institute of Aeronautics and Astronautics, Inc., Washington, 1996.

DEPARTMENTOF ELECTRONICS AND COMMUNICATIONS ENGINEERING
SYLLABUS FOR M.E. (ECE- CE&SP) – II SEMESTER

Advanced Wireless Communication

Course Code : **PII18PE250EC**	Instruction : 3 Hrs/week	CIE – Marks : 40
SEE – Marks : 60	SEE - Duration : 3 Hours	Credits: 3

Course Objectives	Course Outcomes
1. Understand the techniques of radio spectrum allocation in multi-user systems and their impact on networks capacity 2. To understand the various terminology, principles, devices, schemes, concepts, algorithms and different methodologies used in Wireless Communication Networks. 3. To appreciate the contribution of Wireless Communication networks to overall technological growth. 4. Understand the techniques of radio spectrum allocation in multi-user systems and their impact on networks capacity 5. Understand how the various signal processing and coding techniques combat channel uncertainties	**At the end of the course, students will be able to:** 1. To understand how the OFDM receiver performs synchronization and the adverse effects of synchronization. 2. To understand MIMO channel models and space-time coding. 3. To understand the concept and methods of diversity reception 4. Analyze Multiuser Systems, CDMA, WCDMA network planning and OFDM Concepts. 5. Illustrate the problem of PAPR and methods to reduce the PAPR.

UNIT – I

Mathematical preliminaries: Review of probability theory, Essentials of (convex) optimization theory, Essentials of information theory,

UNIT – II

Wireless channel models and latest multiple access technologies, Introduction to various channel models (namely frequency flat, frequency selective, Rayleigh and Ricean fading models), Introduction to CDMA and associated standards, Introduction to OFDM.

UNIT - III

Capacity of scalar wireless channels, Introduction to the notion of channel capacity, Capacity of time invariant channels, Capacity of time varying (or fading) channels, Capacity of vector (MISO, SIMO, MIMO) channels and spatial multiplexing, Capacity of MISO and SIMO channels for both time varying and time invariant cases, Capacity of MIMO systems, V-BLAST and D-BLAST, STBC and STTC.

UNIT – IV

Multiuser detection (MUD), Introduction to MUD, Linear decorrelator, MMSE MUD, Adaptive MUD.

UNIT - V

Application of convex optimization to wireless design, Minimizing PAPR in OFDM systems via convex optimization, Applications of convex optimization to MAC and flow control problems.

Suggested Reading:

1. Fundamentals of wireless communications by David Tse and Pramod Viswanath.
2. Convex optimization by Steven Boyd and L. Vandenberge.
3. Wireless Communications by Andrea Goldsmith.
4. Introduction to space-time wireless communications by Arogyaswami Paulraj, Rohit Nabar and Dhananjay Gore.
5. Multiuser detection by S. Verdu.

DEPARTMENTOF ELECTRONICS AND COMMUNICATIONS ENGINEERING
SYLLABUS FOR M.E. (ECE- CE&SP) – II SEMESTER

Smart Antennas for Mobile Communications

Course Code : **PII18PE260EC**	Instruction : 3 Hrs/week	CIE – Marks : 40
SEE – Marks : 60	SEE - Duration : 3 Hours	Credits: 3

Course Outcomes
At the end of the course, students will be able to:
1. Demonstration of various cellular CDMAs
2. Estimation of CDMA – 2000
3. Explain the various beam forming networks and systems
4. Demonstration of array calculations for digital radio receivers techniques.
5. Explanation of smart antenna techniques for non-coherent and coherent CDMA\
6. Demonstration of radio link beam forming, range improvement and various filtering algorithms.

UNIT – I

Cellular Radio concepts – Spread Spectrum CDMA – Antenna Systems – Radio wave propagation – fading – Cellular CDMA – IS-95 CDMA system work – Reverse Traffic Transmission – Forward Channel Signal – Evaluation of CDMA 2000.

UNIT – II

Introduction to Smart Antennas – Spatial processing for wireless systems – Fixed beam forming networks – Switched beam systems – Adaptive Antenna Systems – Wide band Smart Antennas – Digital Radio Receiver techniques - Array calibrations.

UNIT – III

Smart Antennas Techniques for CDMA: Non Coherent CDMA – Coherent CDMA –Multi user spatial processing – Re sectoring using Smart Antennas – Down link beam forming for CDMA.

UNIT – IV

CDMA System Range and Improvements using Spatial Filtering – Range extensions in CDMA – Spatial filtering at IS-95 base station – Reverse channel performance – Spatial filtering at WLL subscriber unit – Range and Capacity Analysis.

UNIT – V

Optimal Spatial Filtering and Adaptive Algorithms – Array performance in Multipath – under loaded , over loaded adaptive arrays – Adaptive algorithms for CDMA – Multi Target Decision Directed Algorithms – Estimation Algorithms – RF position location systems.

Suggested Reading:

1. Joseph C. Liberti Jr., Theodore S Rappaport, "Smart Antennas for wireless communications IS-95 and third generation CDMA applications", PTR – PH publishers, 1st edition, 1989.
2. T.S Rappaport, "Smart Antennas Adaptive arrays algorithms and wireless position location", IEEE press 1998, PTR – PH publishers 1999.
3. Garg, "IS-95 CDMA and CDMA 2000, "Cellular / PCs systems implementation", Pearson Education, 2002.

DEPARTMENTOF ELECTRONICS AND COMMUNICATIONS ENGINEERING
SYLLABUS FOR M.E. (ECE- CE&SP) – II SEMESTER

Communication Systems Simulation Laboratory

Course Code : **PII18PC211EC**	Instruction : 3 Hrs/week	CIE – Marks : 50
SEE – Marks : -	SEE - Duration : 3 Hours	Credits: 1.5

Course Objectives	Course Outcomes
1. This lab course complements EE341 as students conduct experiments with signals, systems, and communication systems. Systems are built with discrete components and also verified through matlab and analytically	**At the end of the course, students will be able to:** 1. Study signal and linear time invariant system properties. 2. Study, design, and build amplitude modulation systems examining tradeoffs in different communication systems. 3. Study, design, and build angle modulation systems examining tradeoffs in different communication systems. 4. Perform experiments in converting analog information into digital data via sampling, quantization, and coding.

Section - 1:

1. Simulation study of wavelength division multiplexing and de-multiplexing.
2. Study of digital modulation schemes using Spectrum analyzer.
3. Study and implementation of different simulation techniques.
4. Error detection codes in data communications.
5. Analysis of error coding, parity check and hamming check.
6. Simulation of a communication channel using convolutional encoding and Viterbi decoding using MATLAB.
7. Simulation of Channel coding / decoding using MATLAB and SIMULINK.

Section – 2:

1. Study of wireless LAN
2. Using Wireless digital communication trainer, study of:
   a) Baseband digital communication link
   b) Quadrature modulation schemes
   c) Adaptive equalization techniques
   d) GSM and Basics of DS-CDMA
   f) Basics of OFDM.
3. Implementation of DPSK modulators and demodulators using MATLAB.
4. Simulation of software radio system using MATLAB.
5. Simulation study of collaborative transmission schemes for Multiuser wireless systems using MATLAB.

Note: The experiments will be decided and modified if necessary and conducted by the lecturer concerned.

DEPARTMENTOF ELECTRONICS AND COMMUNICATIONS ENGINEERING
SYLLABUS FOR M.E. (ECE- CE&SP) – II SEMESTER

DSP Processors Applications Laboratory

Course Code : **PII18PC212EC**	Instruction : 3 Hrs/week	CIE – Marks : 50
SEE – Marks : -	SEE - Duration : 3 Hours	Credits: 1.5

Course Objectives	Course Outcomes
1. To understand the architecture of a digital signal processor and programming issues in fixed-point digital signal processor. 2. To learn to design a real-time signal processing algorithms using the fixed-point processor. 3. To implement signal processing projects on the processor.	**At the end of the course, students will be able to:** 1. Develop and Implement DSP algorithms in CCS software using a computer language such as C with TMS320C6711 floating point Processor. 2. Analyze and observe the magnitude and phase characteristics of digital IIR Butterworth, Chebyshev filters. 3. Analyze and Observe Magnitude and phase characteristics of digital FIR filters using window techniques. 4. Implement C code for fast fourier transform on fixed point processor.

List of Experiments:

1. Introduction and Preview: Digital Signal Processing and Digital Signal Processors
2. Design space exploration: How many DSP processors and which types? How much on-chip/off-chip memory? What type of bus and other hardware components, etc. Consider timing, power, area and cost.
3. DSP Algorithms, TMS320C6000 Family
4. Code Composer Studio and the DSK
5. Architectural features of DSP processors (arithmetic, memory organization, pipe lining, and use of special on-chip hardware)
6. Amplitude quantization effects (in A/D and D/A conversion, waveform generation and digital filter implementation)
7. Special on-chip hardware (serial ports, host ports, and timers)
8. Programming of DSP processors
9. Optimal code generation: the most time and power efficient codes for DSP processors.
10. Design and implementation of FIR and IIR filters
11. Realization of an FIR filter (any type) to meet given specification. The input can be a signal from function generator/speech signal.
12. FFT usage
13. Impulse response of a given system of first and second order.
14. Real-time concepts (interrupts, critical sections, threads of execution, etc.).
15. Data Transfers from/to Codec
16. Noise removal: Add noise above 3 kHz and then remove; Interference suppression using 400 Hz tone.

Note: The experiments will be decided and modified if necessary and conducted by the lecturer concerned.

Suggested Reading:

1. Dahnoun, D. Digital Signal Processors TMS320C6000. Collection of the PowerPoint Shows. Bristol : University of Bristol, 2002, Copyrighted by the Texas Instruments, Inc.
2. Chassaing, R. DSP Applications Using C and the TMS320C6x. First Edition. New York : John Wiley & Sons, Inc., 2002.
3. Porat, B. A Course in Digital Signal Processing. New York : John Wiley & Sons, Inc., 1997

DEPARTMENTOF ELECTRONICS AND COMMUNICATIONS ENGINEERING
SYLLABUS FOR M.E. (ECE - CE&SP) – II SEMESTER

Mini Project

Course Code : **PII18PW219EC**	Instruction : 2 Hrs/week	CIE – Marks : 50
SEE – Marks : -	SEE - Duration : 3 Hours	Credits: 1

Course Outcomes
At the end of the course, students will be able to:
1. Understand of contemporary / emerging technology for various processes and systems.
2. Share knowledge effectively in oral and written form and formulate documents.

The introduction of mini projects ensures preparedness of students to undertake major projects/dissertation.

The students are required to search / gather the material / information on a specific a topic comprehend it and present / discuss in the class.

DEPARTMENTOF ELECTRONICS AND COMMUNICATIONS ENGINEERING
SYLLABUS FOR M.E. (ECE- CE&SP) – II SEMESTER

Seminar – II

Course Code : **PII18PC218EC**	Instruction : 2 Hrs/week	CIE – Marks : 50
SEE – Marks : -	SEE - Duration : 3 Hours	Credits: 1

Course Objectives	Course Outcomes
1. Prepare the student for a systematic and independent study of the state of the art topics in a broad area of his / her specialization.	**At the end of the course, students will be able to:** 1. Selection of a suitable topic / problem for investigation and presentation. 2. Carryout literature survey and prepare the presentation. 3. Formulating the problem, identify tools and techniques for solving the problems. 4. Clear communication and presentation of the seminar topic. 5. Apply ethical principles in preparation of project seminar report.

Oral presentation and technical report writing are two important aspect of engineering education. The objective of the seminar is to prepare the student for a systematic and independent study of the state of the art topics in the advanced fields of Communication Engineering and related topics.

Seminar topics may be chosen by the students with advice from the faculty members. Students are to be exposed to the following aspects for a seminar presentation.

- Literature survey
- Organization of the material
- Presentation of OHP slides / LCD presentation
- Technical writing

Each student required to:

1. Submit a one page synopsis before the seminar talk for display on the notice board.
2. Give a 20 minutes time for presentation following by a 10 minutes discussion.
3. Submit a detailed technical report on the seminar topic with list of references and slides used.

Seminars are to be scheduled from the 3rd week to the last week of the semester and any change in schedule shall not be entertained.

For award of sessional marks, students are to be judged by at least two faculty members on the basis of an oral and technical report preparation as well as their involvement in the discussions.

DEPARTMENTOF ELECTRONICS AND COMMUNICATIONS ENGINEERING
SCHEME OF INSTRUCTION AND EXAMINATION FOR
M.E (ECE) Communication Engineering and Signal Processing
III and IV-SEMESTER w.e.f. 2018-19 under CBCS

III – SEMESTER											
1.	OE	PII18OE3XXXX	Open Elective	3	-	-	3	40	60	100	3
2.	PE	PII18PE3X0EC	Professional Elective – VI	3	-	-	3	40	60	100	3
3.	PW	PII18PW319EC	Dissertation-Phase-I / Internship	-	-	8	-	100	-	100	4
				6	**-**	**8**	**-**	**180**	**120**	**300**	**10**
IV - SEMESTER											
1.	PW	PII18PW419EC	Dissertation-Phase-II / Internship	-	-	24	-	Viva-voce (Grade)			**12**

DEPARTMENTOF ELECTRONICS AND COMMUNICATIONS ENGINEERING
SYLLABUS FOR M.E. (ECE- CE&SP) – III SEMESTER

Business Analytics

Course Code : **PI18OE310XX**	Instruction : 2 Hrs/week	CIE – Marks : 40
SEE – Marks : 60	SEE - Duration : 3 Hours	Credits: -

Course Objectives	Course Outcomes
1. Understand the role of business analytics within an organization. 2. Analyze data using statistical and data mining techniques and understand relationships between the underlying business processes of an organization. 3. To gain an understanding of how managers use business analytics to formulate and solve business problems and to support managerial decision making. 4. To become familiar with processes needed to develop, report, and analyze business data. 5. Use decision-making tools/Operations research techniques. 6. Mange business process using analytical and management tools. 7. Analyze and solve problems from different industries such as manufacturing, service, retail, software, banking and finance, sports, pharmaceutical, aerospace etc.	**At the end of the course, students will be able to:** 1. Students will demonstrate knowledge of data analytics. 2. Students will demonstrate the ability of think critically in making decisions based on data and deep analytics. 3. Students will demonstrate the ability to use technical skills in predicative and prescriptive modeling to support business decision-making. 4. Students will demonstrate the ability to translate data into clear, actionable insights

UNIT -I

Business analytics: Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organisation, competitive advantages of Business Analytics. Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modelling, sampling and estimation methods overview.

UNIT - II

Trendiness and Regression Analysis: Modelling Relationships and Trends in Data, simple Linear Regression. Important Resources, Business Analytics Personnel, Data and models for Business analytics, problem solving, Visualizing and Exploring Data, Business Analytics Technology.

UNIT – III

Organization Structures of Business analytics, Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, Measuring contribution of Business analytics, Managing Changes. Descriptive Analytics, predictive analytics, predicative Modelling, Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modelling, nonlinear Optimization

UNIT – IV

Forecasting Techniques: Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series with Seasonality, Regression Forecasting with Casual Variables, Selecting Appropriate Forecasting Models. Monte Carlo Simulation and Risk Analysis: Monte Carle Simulation Using Analytic Solver Platform, New-Product Development Model, Newsvendor Model, Overbooking Model, Cash Budget Model.

UNIT – V

Decision Analysis: Formulating Decision Problems, Decision Strategies with the without Outcome Probabilities, Decision Trees, The Value of Information, Utility and Decision Making.

UNIT – VI

Recent Trends in: Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data journalism.

Suggested Reading:

1. Business analytics Principles, Concepts, and Applications by Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, Pearson FT Press.
2. Business Analytics by James Evans, persons Education.

DEPARTMENTOF ELECTRONICS AND COMMUNICATIONS ENGINEERING
SYLLABUS FOR M.E. (ECE- CE&SP) – III SEMESTER

Industrial Safety

Course Code : **PI18OE320XX**	Instruction : 2 Hrs/week	CIE – Marks : 40
SEE – Marks : 60	SEE - Duration : 3 Hours	Credits: -

UNIT – I

Industrial safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.

UNIT-II

Fundamentals of maintenance engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment. Model Curriculum of Engineering & Technology PG Courses [Volume -II] 295

UNIT-III

Wear and Corrosion and their prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

UNIT-IV

Fault tracing: Fault tracing-concept and importance, decision treeconcept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic,automotive, thermal and electrical equipment's like, I. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes.

UNIT-V

Periodic and preventive maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance

Suggested Reading:

1. Maintenance Engineering Handbook, Higgins & Morrow, Da Information Services.
2. Maintenance Engineering, H. P. Garg, S. Chand and Company.
3. Pump-hydraulic Compressors, Audels, Mcgrew Hill Publication.
4. Foundation Engineering Handbook, Winterkorn, Hans, Chapman & Hall London.

DEPARTMENTOF ELECTRONICS AND COMMUNICATIONS ENGINEERING
SYLLABUS FOR M.E. (ECE- CE&SP) – III SEMESTER

Operations Research

Course Code : **PI18OE330XX**	Instruction : 2 Hrs/week	CIE – Marks : 40
SEE – Marks : 60	SEE - Duration : 3 Hours	Credits: -

Course Outcomes
At the end of the course, students will be able to:
1. Students should able to apply the dynamic programming to solve problems of discreet and continuous variables.
2. Students should able to apply the concept of non-linear programming
3. Students should able to carry out sensitivity analysis
4. Student should able to model the real world problem and simulate it.

UNIT - I

Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models

UNIT - II

Formulation of a LPP - Graphical solution revised simplex method - duality theory - dual simplex method - sensitivity analysis - parametric programming

UNIT - III

Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem - max flow problem - CPM/PERT

UNIT - IV

Scheduling and sequencing - single server and multiple server models - deterministic inventory models - Probabilistic inventory control models - Geometric Programming.

UNIT - V

Competitive Models, Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Game Theory Simulation

Suggested Reading:

1. H.A. Taha, Operations Research, An Introduction, PHI, 2008
2. H.M. Wagner, Principles of Operations Research, PHI, Delhi, 1982.
3. J.C. Pant, Introduction to Optimisation: Operations Research, Jain Brothers, Delhi, 2008
5. Hitler Libermann Operations Research: McGraw Hill Pub. 2009
6. Pannerselvam, Operations Research: Prentice Hall of India 2010
7. Harvey M Wagner, Principles of Operations Research: Prentice Hall of India 2010

DEPARTMENTOF ELECTRONICS AND COMMUNICATIONS ENGINEERING
SYLLABUS FOR M.E. (ECE- CE&SP) – III SEMESTER

Cost Management of Engineering Projects

Course Code : **PI18OE340XX**	Instruction : 2 Hrs/week	CIE – Marks : 40
SEE – Marks : 60	SEE - Duration : 3 Hours	Credits: -

Introduction and Overview of the Strategic Cost Management Process Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making.

Project: meaning, Different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and nontechnical activities. Detailed Engineering activities. Pre project execution main clearances and documents Project team: Role of each member. Importance Project site: Data required with significance. Project contracts. Types and contents. Project execution Project cost control. Bar charts and Network diagram. Project commissioning: mechanical and process

Cost Behavior and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making problems. Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector. Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning, Total Quality Management and Theory of constraints. Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis. Budgetary Control; Flexible Budgets; Performance budgets; Zero-based budgets. Measurement of Divisional profitability pricing decisions including transfer pricing.

Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory.

Suggested Reading:

1. Cost Accounting A Managerial Emphasis, Prentice Hall of India, New Delhi
2. Charles T. Horngren and George Foster, Advanced Management Accounting
3. Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting
4. Ashish K. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheeler publisher
5. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd.

DEPARTMENTOF ELECTRONICS AND COMMUNICATIONS ENGINEERING
SYLLABUS FOR M.E. (ECE- CE&SP) – III SEMESTER

Composite Materials

Course Code : **PI18OE350XX**	Instruction : 2 Hrs/week	CIE – Marks : 40
SEE – Marks : 60	SEE - Duration : 3 Hours	Credits: -

UNIT–I

INTRODUCTION: Definition – Classification and characteristics of Composite materials. Advantages and application of composites. Functional requirements of reinforcement and matrix. Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.

UNIT – II

REINFORCEMENTS: Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures. Isostrain and Isostress conditions.

UNIT – III

Manufacturing of Metal Matrix Composites: Casting – Solid State diffusion technique, Cladding – Hot isostatic pressing. Properties and applications. Manufacturing of Ceramic Matrix Composites: Liquid Metal Infiltration – Liquid phase sintering. Manufacturing of Carbon – Carbon composites: Knitting, Braiding, Weaving. Properties and applications.

UNIT–IV

Manufacturing of Polymer Matrix Composites: Preparation of Moulding compounds and prepregs – hand layup method – Autoclave method – Filament winding method – Compression moulding – Reaction injection moulding. Properties and applications.

UNIT – V

Strength: Laminar Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygrothermal failure. Laminate first play failure-insight strength; Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations.

TEXT BOOKS:

1. Material Science and Technology – Vol 13 – Composites by R.W.Cahn – VCH, West Germany.
2. Materials Science and Engineering, An introduction. WD Callister, Jr., Adapted by R. Balasubramaniam, John Wiley & Sons, NY, Indian edition, 2007.

Suggested Reading:

1. Hand Book of Composite Materials-ed-Lubin.
2. Composite Materials – K.K.Chawla.
3. Composite Materials Science and Applications – Deborah D.L. Chung.
4. Composite Materials Design and Applications – Danial Gay, Suong V. Hoa, and Stephen W. Tasi.

DEPARTMENTOF ELECTRONICS AND COMMUNICATIONS ENGINEERING
SYLLABUS FOR M.E. (ECE- CE&SP) – III SEMESTER

Waste to Energy

Course Code : **PI18OE360XX**	Instruction : 2 Hrs/week	CIE – Marks : 40
SEE – Marks : 60	SEE - Duration : 3 Hours	Credits: -

UNIT-I

Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors

UNIT - II

Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods - Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

UNIT – III

Biomass Gasification: Gasifiers – Fixed bed system – Downdraft and updraft gasifiers – Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for Model Curriculum of Engineering & Technology PG Courses [Volume -II] 299 thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.

UNIT - IV

Biomass Combustion: Biomass stoves – Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

UNIT – V

Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion - Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India.

Suggested Reading:

1. Non Conventional Energy, Desai, Ashok V., Wiley Eastern Ltd., 1990.
2. Biogas Technology - A Practical Hand Book - Khandelwal, K. C. and Mahdi, S. S., Vol. I & II, Tata McGraw Hill Publishing Co. Ltd., 1983.
3. Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd., 1991.
4. Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons, 1996.

DEPARTMENTOF ELECTRONICS AND COMMUNICATIONS ENGINEERING
SYLLABUS FOR M.E. (ECE- CE&SP) – III SEMESTER

MIMO Communication Systems

Course Code : **PII18PE310EC**	Instruction : 3 Hrs/week	CIE – Marks : 40
SEE – Marks : 60	SEE - Duration : 3 Hours	Credits: 3

Course Objectives	Course Outcomes
1. To learn about the MIMO communication system and modeling the MIMO channel and evaluation of MIMO system capacity and receiver designs for MIMO spatial multiplexing. 2. To know the significance of the diversity scheme in improving the communication link reliability and to learn about different diversity techniques with the usage of multiple antennas at transmitter and/or receivers. 3. To study the STBC designs, which provides transmitter diversity, and code design criteria for orthogonal designs for full rate (r=1) and for rate less than unity (r<1). 4. To study about the STTC designs and code construction and their performance.	**At the end of the course, students will be able to:** 1. to differentiate the typical SISO system and MIMO system (for SM), between two users, in terms of their capacities and receiver complexities and link error performance. 2. to justify the importance of diversity scheme, to alleviate the wireless channel fading effects and get the knowledge of different diversity techniques , which uses multiple antennas at transmitter and/or receivers. 3. to design ST Block Codes by ensuring the code design criteria of orthogonal designs for full rate (r=1) and for rate less than unity (r<1). 4. to construct ST Trellis Codes by using STTC encoder. 5. to think/do research on: new capacity improving (in turn spectral efficiency) techniques , low complex receiver designs for MIMO with better link performance.

UNIT – I

Information theoretic aspects of MIMO: Review of SISO communication - MIMO channel models - Classical i.i.d. and extended channels – Frequency selective and correlated channel models - Capacity of MIMO channels - Ergodic and Outage Capacity - Capacity bounds - Influence of channel properties on capacity.

UNIT – II

MIMO Diversity and Spatial Multiplexing: Space Time Diversity Aspects - Sources and types of diversity - analysis under Rayleigh fading – Diversity and Channel knowledge - MIMO Spatial multiplexing - Space Time receivers - ML - MMSE - ZF – Sphere decoding - BLAST receivers - DMG tradeoff in MIMO systems.

UNIT – III

Space Time Block Codes: Alamouti's code for two transmit antennas - Comparison with dual-branch receive diversity STBC based on real/complex orthogonal designs - Code Design Criteria for quasi-static Channels (Rank, Determinant and Euclidean Distance).

UNIT – IV

Orthogonal Designs: Generalized Orthogonal Designs - Quasi-Orthogonal Designs - Performance Analysis. Representation of STTC- shift register, generator matrix, state-transition diagram, trellis

UNIT – V

Space Time Trellis Codes: Diagram - Code construction. Delay diversity as a special case of STTC- Performance Analysis.

Suggested Reading:

1. Paulraj R. Nabar and D. Gore, "Introduction to Space Time Wireless Communications," Cambridge University Press, 2003.
2. B.Vucetic and J. Yuan, "Space-Time Coding," John Wiley, 2003.
3. E.G. Larsson and P. Stoica, "Space-Time Block Coding for Wireless Communications," Cambridge University press.
4. H. Jafarkhani, "Space-Time Coding: Theory and Practice," Cambridge University Press.
5. D. Tse and P. Viswanath, "Fundamentals of Wireless Communication," Cambridge University Press.

DEPARTMENTOF ELECTRONICS AND COMMUNICATIONS ENGINEERING
SYLLABUS FOR M.E. (ECE- CE&SP) – III SEMESTER

Spread Spectrum and CDMA Systems

Course Code : **PII18PE320EC**	Instruction : 3 Hrs/week	CIE – Marks : 40
SEE – Marks : 60	SEE - Duration : 3 Hours	Credits: 3

Course Objectives	Course Outcomes
1. Understand the concept of Spread Spectrum and study various types of Spread spectrum sequences and their generation. 2. Understand the principles of Code Division Multiple Access (CDMA) and use of Spread spectrum concept in CDMA 3. Understand the procedure for synchronization of receiver for receiving the Spread spectrum signal. 4. Study the performance of spread spectrum systems in Jamming environment, systems with Forward Error Correction and Multiuser detection in CDMA cellular radio.	**At the end of the course, students will be able to:** 1. Generate various types of Spread spectrum sequences and can simulate CDMA system (Both Transmitter & Receiver). 2. Analyze the performance of spread spectrum signals in the presence of multiple access interference (CDMA context). 3. Illustrate techniques for reducing the impact of interference on spread spectrum signals 4. Implement the features of CDMA and IS-95 systems and its evolution to 3rd generation system 5. Describe techniques for reducing the impact of interference on spread spectrum signals.

UNIT – I

Fundamentals of Spread Spectrum: Introduction to spread spectrum communication, pulse noise jamming, low probability of detection, direct sequence spread spectrum, frequency-hopping and time-hopping spread spectrum systems , correlation functions, spreading sequences- maximal-length sequences, gold codes, Walsh orthogonal codes- properties and generation of sequences Synchronization and Tracking: delay lock and tau-dither loops, coarse synchronization- principles of serial search and match filter techniques.

UNIT – II

Performance Analysis of SS system: Performance of spread spectrum system under AWGN, multi-user Interference, jamming and narrow band interferences

Low probability of intercept methods, optimum intercept receiver for direct sequence spread spectrum, Error probability of DS-CDMA system under AWGN and fading channels, RAKE receiver

UNIT – III

Capacity & Coverage of Spread Spectrum Multiple Access Networks: Basics of spread spectrum multiple access in cellular environments, reverse Link power control, multiple cell pilot tracking, soft and hard handoffs, cell coverage issues with hard and soft handoff, spread spectrum.

UNIT – IV

Control of Spread Spectrum Multiple Access Networks: Multiple access outage, outage with imperfect power control, Erlang capacity of forward and reverse links. Multi-user Detection -MF detector, decorrelating detector, MMSE detector. Interference Cancellation: successive, Parallel Interference Cancellation, performance analysis of multiuser detectors and interference cancellers.

UNIT – V

CDMA Systems: General aspects of CDMA cellular systems, IS-95 standard, Downlink and uplink, Evolution to Third Generation systems, WCDMA and CDMA-2000 standards, Principles of Multicarrier communication, MCCDMA and MC-DS-CDMA.

Suggested Reading:

1. R. L. Peterson, R. Ziemer and D. Borth, "Introduction to Spread Spectrum Communications," PHI, 1995.
2. J. Viterbi, "CDMA - Principles of Spread Spectrum Communications," Addison-Wesley, 1997.
3. Vijay K. Garg, Kenneth Smolik, and Joseph E. Wilkes, "Applications of CDMA in Wireless/Personal Communications," PHI, 1995.
4. S. Verdu, " Multiuser Detection," Cambridge University Press, 1998
5. M. K. Simon, J. K. Omura, R. A. Scholts and B. K. Levitt, " Spread Spectrum Communications Handbook," McGraw- Hill, 1994.
6. G. R. Cooper and C. D. McGillem, "Modern Communications and Spread Spectrum," McGraw- Hill,1985.

DEPARTMENTOF ELECTRONICS AND COMMUNICATIONS ENGINEERING
SYLLABUS FOR M.E. (ECE- CE&SP) – III SEMESTER

Software Defined and Cognitive Radio

Course Code : **PII18PE330EC**	Instruction : 3 Hrs/week	CIE – Marks : 40
SEE – Marks : 60	SEE - Duration : 3 Hours	Credits: 3

Course Objectives	Course Outcomes
1. To understand basic architecture of software defined radio 2. To study signal processing devices and architectures 3. To describe spectrum sensing techniques of cognitive radio	**At the end of the course, students will be able to:** 1. Gain knowledge on software defined radio and cognitive radio. 2. Describe about signal processing devices and architectures 3. Discuss on software and hardware architecture of Software Defined and Cognitive Radio. 4. Analyze spectrum sensing methods 5. Implement CR and SDR applications on to FPGA and ASICS.

UNIT – I

Introduction to SDR: What is Software-Defined Radio, The Requirement for Software-Defined Radio, Legacy Systems, The Benefits of Multi-standard Terminals, Economies of Scale, Global Roaming, Service Upgrading, Adaptive Modulation and Coding, Operational Requirements, Key Requirements, Reconfiguration Mechanisms, , Handset Model, New Base-Station and Network, Architectures, Separation of Digital and RF, Tower-Top Mounting, BTS Hoteling, Smart Antenna Systems, Smart Antenna System Architectures, Power Consumption Issues, Calibration Issues, Projects and Sources of Information on Software Defined Radio,

UNIT – II

Basic Architecture of a Software Defined Radio: Software Defined Radio Architectures, Ideal Software Defined Radio Architecture, Required Hardware Specifications, Digital Aspects of a Software Defined Radio, Digital Hardware, Alternative Digital Processing Options for BTS Applications, Alternative Digital Processing Options for Handset Applications, Current Technology Limitations, A/D Signal-to-Noise Ratio and Power Consumption, Derivation of Minimum Power Consumption, Power Consumption Examples, ADC Performance Trends, Impact of Superconducting Technologies on Future SDR Systems.

UNIT – III

Signal Processing Devices and Architectures: General Purpose Processors, Digital Signal Processors, Field Programmable Gate Arrays, Specialized Processing Units, Tilera Tile Processor, Application-Specific Integrated Circuits, Hybrid Solutions, Choosing a DSP Solution. GPP-Based SDR, Non real time Radios, High-Throughput GPP-Based SDR, FPGA-Based SDR, Separate Configurations, Multi-Waveform Configuration, Partial Reconfiguration, Host Interface, Memory-Mapped Interface to Hardware, Packet Interface, Architecture for FPGA- Based SDR, Configuration, Data Flow, Advanced Bus Architectures, Parallelizing for Higher Throughput, Hybrid and Multi-FPGA Architectures, Hardware Acceleration, Software Considerations, Multiple HA and Resource Sharing, Multi-Channel SDR.

UNIT – IV

Cognitive Radio : Techniques and signal processing History and background, Communication policy and Spectrum Management, Cognitive radio cycle, Cognitive radio architecture, SDR architecture for cognitive radio, Spectrum sensing Single node sensing: energy detection, cyclostationary and wavelet based sensing-problem formulation and performance analysis based on probability of detection Vs SNR. Cooperative sensing: different fusion rules, wideband spectrum sensing- problem formulation and performance analysis based on probability of detection Vs SNR.

UNIT V

Cognitive Radio: Hardware and applications: Spectrum allocation models. Spectrum handoff, Cognitive radio performance analysis. Hardware platforms for Cognitive radio (USRP, WARP), details of USRP board, Applications of Cognitive radio

Suggested Reading:

1. "RF and Baseband Techniques for Software Defined Radio" Peter B. Kenington, ARTECH HOUSE, INC, 2005.
2. "Implementing Software Defined Radio", Eugene Grayver, Springer, New York Heidelberg Dordrecht London, ISBN 978-1-4419-9332-8 (eBook) 2013.
3. "Cognitive Radio Technology", by Bruce A. Fette, Elsevier, ISBN 10: 0-7506-7952-2, 2006.
4. "Cognitive Radio, Software Defined Radio and Adaptive Wireless Systems", Hüseyin Arslan, Springer, ISBN 978-1-4020-5541-6 (HB), 2007.

DEPARTMENTOF ELECTRONICS AND COMMUNICATIONS ENGINEERING
SYLLABUS FOR M.E. (ECE- CE&SP) – III SEMESTER

Dissertation-Phase-I / Internship

Course Code : **PII18PW319EC**	Instruction : 8 Hrs/week	CIE – Marks : 100
SEE – Marks : -	SEE - Duration : 3 Hours	Credits: 4

Course Objectives	Course Outcomes
1. Selection of a suitable for investigation for the project 2. Literature survey 3. Carrying out investigation / experiments including the selection of approaches to be adopted 4. Analysis of the results in interaction with the project guides. 5. Preparation of presentations and technical report.	**At the end of the course, students will be able to:** 1. Students go through the foundation needed for carrying out new investigations 2. Students would be ready with the problem to be investigated in phase II 3. They also get the training needed for presentations of their work.

The students must be given clear guidelines to execute and complete the project on which they have delivered a seminar in the 3rd semester of the course.

All projects will be monitored at least twice in a semester through student's presentation. Sessional marks should be based on the grades/marks, awarded by a monitoring committee of faculty members as also marks given by the supervisor.

Efforts be made that some of the projects are carries out in industries with the help of industry coordinates.

Common norms will be established for documentation of the project report by the respective department.

The final project reports must be submitted two weeks before the last working day of the semester.
The project works must be evaluated by an external examiner and based on his comments a viva voice will be conducted by the departmental committee containing of HOD, two senior faculty and supervisor.

+ Excellent /Very Good / Good/Satisfactory / Unsatisfactory

DEPARTMENTOF ELECTRONICS AND COMMUNICATIONS ENGINEERING
SYLLABUS FOR M.E. (ECE- CE&SP) – IV SEMESTER

Dissertation-Phase-II / Internship

Course Code : **PII18PW419EC**	Instruction : 24 Hrs/week	CIE – Marks : Viva-Voce (Grade)
SEE – Marks : -	SEE - Duration : 3 Hours	Credits: 12

Course Objectives	Course Outcomes
1. Carrying out further literature survey related to the topic already selected. 2. Carrying out investigation experiments, simulation in relation to the problem. 3. Problem analysis and solution finding for problems encountered 4. Organization of results 5. Thesis preparation, presentation and defence.	**At the end of the course, students will be able to:** 1. Students will be able to face any new problem and find a sensible solution 2. Students would be trained to investigate a given problem in a systematic way 3. They would be ready to take up work which may be needed by the industry.

The students must be given clear guidelines to execute and complete the project on which they have delivered a seminar in the 3rd semester of the course.

All projects will be monitored at least twice in a semester through student's presentation. Sessional marks should be based on the grades/marks, awarded by a monitoring committee of faculty members as also marks given by the supervisor.

Efforts be made that some of the projects are carries out in industries with the help of industry coordinates.

Common norms will be established for documentation of the project report by the respective department.

The final project reports must be submitted two weeks before the last working day of the semester.
The project works must be evaluated by an external examiner and based on his comments a viva voice will be conducted by the departmental committee containing of HOD, two senior faculty and supervisor.

+ Excellent /Very Good / Good/Satisfactory / Unsatisfactory