Autonomous Program Structure of
M.Tech. Signal Processing (Electronics & Telecommunication)

First Semester M.Tech. Signal Processing (Electronics & Telecommunication)											
Course Code	Course Title	Teaching Scheme			Examination Scheme					Marks	Credit
		Hours/Week			In Sem						
		Lecture	Tutorial	Practical	CA*	T1 + T2	End Sem	Oral	Practical		
ECSP1101	Image Processing and Analysis	3	0	0	0	50	50	0	0	100	3
ECSP1102	Advanced Digital Signal Processing	3	0	0	0	50	50	0	0	100	3
ECSP1103	Mathematics for Signal Processing	3	1	0	25	50	50	0	0	125	4
ECSP1104	Research Methodology	3	1	0	25	50	50	0	0	125	4
PEECSP1101	Elective I	3	0	0	0	50	50	0	0	100	3
ECSP1105	IPA Lab I	0	0	2	0	0	0	0	25	25	1
ECSP1106	ADSP Lab	0	0	2	0	25	0	0	0	25	1
ECSP1107	Elective I lab	0	0	2	0	0	0	25	0	25	1
Total		15	2	6	325		250	25	25	625	20
Grand Total		23			625						20

CA* - Continuous Assessment

Second Semester M.Tech. Signal Processing (Electronics & Telecommunication)										
Course Code	Course Title	Teaching Scheme			Examination Scheme				Marks	Credit
		Hours/Week								
		Lecture	Tutorial	Practical	In sem	End Sem	Oral	Practical		
ECSP1201	Speech Signal Processing	3	0	0	50	50	0	0	100	3
ECSP1202	Estimation and Detection Theory	3	0	0	50	50	0	0	100	3
ECSP1203	Statistical Signal Processing	3	0	0	50	50	0	0	100	3
PEECSP1202	Elective II	3	0	0	50	50	0	0	100	3
ECSP1204	SSP Lab	0	0	2	0	0	0	25	25	1
ECSP1205	Statistical SP Lab	0	0	2	25	0	0	0	25	1
ECSP1206	Elective II Lab	0	0	2	0	0	25	0	25	1
ECSP1207	Seminar I	0	2	0	0	0	50	0	50	2
AC1201	Non Credit*	0	0	2	0	0	0	0	0	No Credit
Total		12	2	8	225	200	75	25	525	17
Grand Total		22			525					17

*****Non Credit – Soft Skills and Business Communication / Entrepreneurship Development

Elective I:

PEECSP1101: Mixed Signal Processing System Design
PEECSP1101: Soft Computing
PEECSP1101: Satellite and Radar Signal Processing

Elective II:

PEECSP1202: Computer Vision
PEECSP1202: Advanced Wireless Communication Systems
PEECSP1202: Embedded Systems

Third Semester M.Tech. Signal Processing (Electronics & Telecommunication)											
Course Code	Course Title	Teaching Scheme			Examination Scheme					Marks	Credit
		Hours/Week			In Sem						
		Lecture	Tutorial	Practical	CA*	T1 + T2	End Sem	Oral	Practical		
ECSP2101	Multimedia Signal Compression Standards	3	0	0	0	50	50	0	0	100	3
HSEL2101	Elective III	3	1	0	25	50	50	0	0	125	4
OE2101	Elective IV	3	0	0	0	50	50	0	0	100	3
ECSP2102	Project Stage I	0	0	18	0	50	0	50	0	100	9
Total		9	1	18	225		150	50	0	425	19
Grand Total		28			425						19

Fourth Semester M.Tech. Signal Processing (Electronics & Telecommunication)										
Course Code	Course Title	Teaching Scheme			Examination Scheme				Marks	Credit
		Hours/Week								
		Lecture	Tutorial	Practical	In sem	End Sem	Oral	Practical		
ECSP2201	Project Stage II	0	0	28	150	0	100	0	250	14
Total		0	0	0	150	0	100	0	250	14
Grand Total		28			250				250	14

Elective III:

HSEL2101: Environmental Studies
HSEL2101: Economics for Engineers
HSEL2101: Fundamentals of Disaster Management

Elective IV:

OE2101: Architecture for Signal Processing Algorithms
OE2101: Biomedical Signal Processing
OE2101: Underwater Acoustics Signal Processing
OE2101: Data Analytics
OE2101: Cyber Security

ECSP1101 Image Processing & Analysis

Teaching Scheme:	**Examination Scheme:**
Lectures: 3 Hrs/Week	In-Semester: **50** Marks
	End-Semester: **50** Marks
	Credits: 3

Course Objectives:

1. To understand image fundamentals and mathematical transforms necessary for image processing.
2. To apply image enhancement techniques.
3. To segment and represent images.
4. To study image restoration techniques.
5. To apply DCT and other codes to images.
6. To understand image classification and recognition techniques

Course Outcomes:

1. Understand and apply fundamentals of image processing, digitization, enhancement, restoration and segmentation.
2. Apply image processing techniques both in spatial and frequency domain using different transforms.
3. Formulate solutions to image processing problems.
4. Pursue the research in image processing.

Unit – I: Digital image fundamentals **(08)**

Image Representation, Color models – CIE, RGB, CMY, YIQ, HSI, HSV, L*a*b, Image Enhancement: Spatial domain methods: point processing - intensity transformations, histogram processing, image subtraction, image averaging, image zooming, Spatial filtering - smoothing filter, sharpening filter. Frequency domain filtering: low pass filtering, high pass filtering, and Homomorphic filtering.

Unit – II: Image restoration **(08)**

Degradation model - Inverse filtering - Wiener filter - Constrained Least squares restoration, Image segmentation Detection of discontinuities - point, line and edge and combined detection, Edge linking Region oriented segmentation - basic formulation, region growing by pixel aggregation, region splitting and merging, thresholding.

Unit – III: Image compression **(06)**

Image compression using DCT, zig-zag scanning, still image compression standard - baseline JPEG.

Unit – IV: Region and boundary descriptors **(08)**

Hough transform, Fourier descriptors, chain code. Morphological image processing: Basics, SE, Erosion, Dilation, Opening, Closing, Hit-or-Miss Transform, Boundary Detection, Hole filling, Connected components, thinning, thickening, skeletons, pruning.

Unit – V: Classification and Recognition **(06)**

Feature extraction, Patterns and Pattern Classes, Representation of Pattern classes, Types of classification algorithms: Minimum distance classifier, Correlation based classifier, Bayes classifier.

Reference Books:

1. R.C. Gonzalez, R.E. Woods, **'Digital Image Processing'**, *Pearson Education*. (3rd Edition), (2014)
2. S. Jayaraman, S. Esakkirajan, T. Veerakumar **'Digital Image Processing'**, *McGraw-Hill,* (2009)
3. K. Jain, **'Fundamentals of Digital Image Processing'**, *Prentice Hall*, (3rd edition), (2004)
4. W.K. Pratt**, 'Digital Image Processing',** *John Wiley & sons***, (**3rd Edition), (2006)
5. R.O. Duda, P.E.Hart and D.G. Stork, **'Pattern Classification'**, *John Wiley,* (2nd edition), (2002).

ECSP1102 Advanced Digital Signal Processing

Teaching Scheme:	**Examination Scheme:**
Lectures: 3 Hrs/Week	In-Semester: **50** Marks
	End-Semester: **50** Marks
	Credits: 3

Course Objectives:

1. To design FIR, IIR digital filters and adaptive filters and understand its applications.
2. To learn the fundamentals of multirate signal processing to design multistage filters.
3. To provide an understanding of finite word length effects to perform DSP operations in practical DSP systems.
4. To understand DSP processor architecture and some programming issues for real-time implementation.

Course Outcomes:

1. Design and realize FIR, IIR and adaptive filters for developing various DSP applications.
2. Explain concepts of sampling rate conversion and design multirate DSP system.
3. Analyze finite word length effects in DSP algorithm implementation.
4. Implement basic digital signal processing operations and digital filters on DSP Processors.

Unit – I: Digital filter design **(10)**

FIR filter design using windowing, frequency sampling method, IIR filter design- impulse invariant method, Bilinear transformation method, Adaptive digital filters- concepts, basic Wiener filter theory, steepest descent method, least mean square algorithm, applications of adaptive filters.

Unit – II: Multirate DSP **(08)**

Decimation by a factor D, Interpolation by a factor I, Sampling rate conversion by a rational factor I/D, efficient implementation of decimator and interpolator, polyphase filter structure, multistage filter design, applications of multirate DSP.

Unit – III: Analysis of finite word length effects **(08)**

Fixed point and floating point number representations, ADC Quantization noise, Truncation and rounding errors, coefficient quantization error, Product quantization error , Overflow error, Roundoff noise power, limit cycle oscillations due to product round off and overflow errors, Principle of scaling.

Unit – IV: DSP processor Hardware **(09)**

DSP Architectures: von Neumann Architecture, Harvard Architecture, Super Harvard Architecture, VLIW Architecture, Multiple access memory, multiport memory, circular buffering, MAC unit,

Barrel shifter. (DSP Processor: Not specific to any Manufacture-should be generalized)

Reference Books:

1. J. G. Proakis, D. G. Manolakis, **'Digital Signal Processing-Principles, algorithms and applications'**, *PHI*, (1997).
2. E.C. Ifeachor and B.W. Jervis, **'Digital signal processing – A practical approach'**, *Pearson Edu.* (2nd edition), (2002).
3. S. K. Mitra, **'Digital Signal Processing- A Computer Based approach'**, *Tata McGraw Hill*, (1998).
4. A. Singh and S. Srinivasan, **'Digital Signal Processing. Digital Signal Processing Implementations: Using DSP Microprocessors with Examples from TMS320C54xx'**, *Thomson/Brooks/Cole*, (2004).
5. J. G. Proakis, C. M. Rader, F. Ling and C. L. Nikias, **'Advanced Digital Signal Processing'**, *Macmillan Publishing Company*, (1992).
6. P. P. Vaidyanathan, **'Multirate Systems and Filter Banks'**, *Prentice Hall*, (1993).
7. R. Chassaing and D. Reay, '**Digital Signal Processing and Applications with TMS 320C6713 and TMS 320C6416 DSK'**, *Wiley*, (2nd edition), (2013).

ECSP1103 Mathematics for Signal Processing	
Teaching Scheme:	**Examination Scheme:**
Lectures: 3 Hrs/Week	In-Semester: **75** Marks
Tutorial: 1 Hr/Week	End-Semester: **50** Marks
	Credits: 4

Course Objectives:

1. Familiarization with the fundamental concepts of Linear Algebra involving arrays and matrix in concrete setting of R^n
2. Understand and analyze methods of solving systems of linear equations.
3. Understand and analyze linear transformations of matrices.
4. Understand the use of determinants, eigen vectors and eigen values in DSP applications.
5. Familiarization with fundamental concepts of Vector spaces and subspaces.
6. Understand the importance of statistical methods to collect, analyze and test the data.

Course Outcomes:

1. Formulate mathematical model for any signal processing application.
2. Reveal probability axioms, rules and the moments of discrete and continuous random variables.
3. Algorithm development involving arrays and matrix operations.
4. Choose appropriate probabilistic models for a given problem, using information from observed data and knowledge of the physical system being studied.
5. Choose appropriate methods to solve mathematical models and obtain valid solutions.
6. Understand the balance between the complexity / accuracy of the mathematical / statistical models used and the timeliness of the delivery of the solution.

Unit – I: Matrices **(08)**

Rank of a matrix, use of echelon form and canonical form of a matrix to find rank, Inverse matrix to solve system of linear equations, Types of Matrices: Topelitz Matrices, Square Matrices, Symmetric, Asymmetric and Hermitian Matrices, idempotent matrices and unitary matrices classification of real and complex matrices, trace, quadratic form, matrix differentiation and matrix integration, LDU decomposition.

Unit – II: Vector Spaces **(10)**

Vector Space -Definition and properties of vector space, Definition and properties of vector sub-space, Algebra of subspaces; basis of a vector space, finite dimensional vector space, Linear dependence and independence of vectors, Orthogonal and Orthonormal vectors, Cayley-Hamilton theorem, Gram-Schmidt Orthogonalization, Diagonalization of matrix,

Singular value Decomposition.	
Unit – III: Random variables	**(09)**
Probability, relative frequency, Joint and conditional probability, Bayes' theorem, Independent events, permutations and combinations, Random variables, Probability density function, histogram, Cumulative distribution function, standard probability density functions, Gaussian variable, uniform exponential and Rayleigh distribution, Binomial and Poisson distribution, fitting a distribution function to a random variable, Chi square test, K_S test.	
Unit – IV: Random processes	**(09)**
Random processes, stationary and non stationary, wide sense and strict sense stationary, time averages and ensemble averages, ergodicity, autocorrelation and cross correlation, measurement of correlation functions, spectral characteristics of random processes, Power spectral density and its properties, relation between power spectral density and autocorrelation, Power spectra of discrete time processes.	
Reference Books:	

1. S.Andrilli, D.Hecker**, 'Elementary linear Algebra',** *Elsever Inc. (2003)*
2. A.Popoulis, Pillai, **'Probability Random Variables & stochastic processors'**, *TMH* (4^{th} Edition), (2004)
3. K.Hoffman, R.Kunze, **'Linear Algebra'**, *PHI*,(2^{nd} Edition),(1996)
4. E. Kreyszig, **'Advanced Engineering Mathematics'**, *Wiley India*. (9^{th} Edition), (2012)
5. K. S. Trivedi, **'Probability, Random Variables & Random processors'**, *Prentice hall.*
6. H. Taub, D. Schilling, **'Principals of Communication Systems'**, *TMH* (3rd edition), (1977)
7. Howard A, Chris R, **'Elementary Linear Algebra Applications Version',** *Wiley-Indai*, (9^{th} Edition)

ECSP1104 Research Methodology

Teaching Scheme:	**Examination Scheme:**
Lectures: 3 Hrs/Week	In-Semester: **75** Marks
Tutorial: 1 Hr/Week	End-Semester: **50** Marks
	Credits: 4

Course Objectives:

1. To understand basic concepts of research and research methodology
2. To understand principles behind Research problem formulation
3. To study Instrumentation schemes for Data collection
4. To understand Statistical methods for Data Analysis
5. To prepare a research/ project proposal

Course Outcomes:

1. Formulate Research Problems
2. Decide Instrumentation schemes for Data collection
3. Apply Statistical methods for Data Analysis
4. Write research proposals
5. Write and present Technical Papers

Unit – I: Research Problem	**(12)**

Research and research problem, sources of research problem, criteria / Characteristics of a good research problem, Literature Review, Scope and objectives of research problem. Hypothesis its importance and construction, Constructing research instrument, Selecting a sample.

Unit – II: Applied statistics	**(12)**

Regression analysis, Parameter estimation, Design and analysis of experiments, Multivariate statistics, Principal Component Analysis. Moments and response curve methods, Support vector machines, Uncertainty analysis

Unit – III: Instrumentation schemes	**(06)**

Static and dynamic characteristics of instruments used in experimental set up, Basic electrical measurements and sensing devices, flow measurement, Linear scaling for receiver and fidelity of instrument, Data acquisition and processing.

Unit – IV: Research Proposal	**(06)**

Developing a Research Proposal and writing a research report. Format of research proposal, Individual research proposal, Institutional proposal, Report writing, Technical Paper writing.

Reference Books:

1. S. Melville, W. Goddard, **'Research Methodology: An introduction for Science & Engineering students'**, *Juta and Company* (1996)
2. R. Kumar, **'Research Methodology: A Step by Step Guide for Beginners'**, *Pearson Education* (2nd Edition), (2005)
3. Dr. C. R. Kothari, **'Research Methodology: Methods and Techniques',** *New Age Publication*, (2nd edition**),** (2010)
4. R. Panneerselvam, **'Research Methodology'**, *PHI Learning* (2nd edition**),** (2014)
5. S. Gupta, **'Research Methodology and Statistical Techniques'**, *Deep and Deep* (2005)
6. N.J. Rajagopalan, **'Research Methodology'**, *Depiti Civil* (Rev. Edition),(1994)
7. D. Buchala, W. Mclachlan, **'Applied Electronic Instrumentation and Measurement'**, *PHI*, (1992)
8. J.P. Holman, **'Experimental Methods for Engineers'**, *McGraw Hill* (7th Edition), (2001)

PEECSP1101 Mixed Signal Processing System and Design

Teaching Scheme:	**Examination Scheme:**
Lectures: 3 Hrs/Week	In-Semester: **50**Marks
	End-Semester: **50** Marks
	Credits: 3

Course Objectives:

1. To understand the need of Mixed Signals processing and its design.
2. To understand the necessity of switched capacitor circuits and design concepts of them.
3. To understand designs of different types of DACs and ADCs and their performance parameters.
4. To understand and design the architecture of analog and digital frequency synthesizers.

Course Outcomes:

1. Reveal the need of mixed signal processing and switched capacitor circuits.
2. Design basic building blocks of mixed signal processing applications.
3. Compare and get knowledge of different types of DACs and ADCs.
4. Design DACs and ADCs according to specifications.
5. Analyze analog and digital frequency synthesizers.

Unit – I: Data converters **(15)**

Basics of data converters, types of data converters, Types of ADCs like Successive approximation, dual slope, Flash type, pipelined ADCs, hybrid ADCs, high resolution ADCs, parallel path ADCs like time-interleaved and multi-channel converters.

Types of DACs like Current scaling, Voltage scaling, Charge scaling, their architectures, Combination of differently scaled DAC Performance metrics of data converters, SNR, SFDR, SNDR.

Background and foreground techniques to improve performance of data converters.

Unit – II: Switched Capacitor filter **(15)**

Introduction to Analog and Discrete Time signal processing, Sampling theory, Nyquist and over sampling rates, Analog filters, analog amplifiers, analog integrated and discrete time switched capacitor filters, architectures for switched capacitor filters, their applications and design.

Non idealities in switched capacitor filters, Switched capacitor amplifiers.

Unit–III : Frequency synthesizers and synchronization **(08)**

Analog PLLs

Digital PLLs design and architectures, Delay locked loops design and architectures

Direct Digital Synthesis.

Reference Books	
1.	R. J. Baker, **'CMOS mixed signal circuit design',** *Prentice Hall, IEEE press,* (2nd edition), (2008)
2.	A. Handkiewicz, **'Mixed Signal System- a guide to CMOS circuit design',** *IEEE computer society press,*(2012)
3.	B. Giora, **'Digital Frequency Synthesis Demistified',** *Elsevier,*
4.	W. Kester, **'Mixed Signal and DSP design techniques',** *Engineering Analog Devices Inc published by Newnes.*

PEECSP1101 Soft Computing	
Teaching Scheme:	**Examination Scheme:**
Lectures: 3 Hrs/Week	In-Semester: **50** Marks
	End-Semester: **50** Marks
	Credits: 3

Course Objectives:

1. To introduce a relatively new computing paradigm for creating intelligent machines useful for solving complex real world problems.
2. To give an insight of the soft computing techniques: fuzzy logic, artificial neural networks and hybrid systems Techniques.
3. To create awareness of the application areas of soft computing technique.
4. To provide alternative solutions to the conventional problem solving techniques in image/signal processing, pattern recognition/classification, control system.

Course Outcomes:

1. Describe the concepts of Artificial Neural Network, fuzzy logic, Genetic algorithms and the hybrid systems
2. Analyze the relative advantages and limitations of soft computing techniques
3. Formulate the mathematical model for the real world applications using the ANN and fuzzy logic techniques.
4. Implement and analyze the alternative solutions to the conventional problem solving methods using soft computing methods

Unit – I: Basics of soft computing, Genetic algorithms and ANN	**(10)**

Introduction to soft computing: Hard Computing versus soft computing. Soft computing techniques: artificial neural networks, fuzzy logic and fuzzy control, genetic algorithms, hybrid systems (ANFIS, CANFIS) (history and general applications areas).
Genetic algorithms: Concept of genetic evolution, parent, child, chromosome, mutation from biological perspective, Comparison of Biological and GA Terminology
Artificial neural networks I: Biological neuron, Artificial neuron model, concept of bias and threshold, McCulloch-Pits Neuron Model , implementation of logical AND, OR, XOR functions, Topologies of neural networks, learning paradigms: supervised, unsupervised, reinforcement, Linear neuron model : concept of error energy , gradient descent algorithm and application of linear neuron for linear regression, Activation functions : binary , bipolar (linear, signum, log sigmoid, tan-sigmoid), Learning mechanisms: Hebbian, Delta Rule, Perceptron and its limitations, Multilayer perceptron (MLP) and back propagation algorithm, Application of MLP for classification and regression.

Unit – II: Artificial neural networks II	**(12)**

Artificial neural networks II: Self-organizing Feature Maps, k-means clustering, Learning vector

quantization, Radial Basis Function networks: Cover's theorem, mapping functions(Gaussian, Multi-quadrics, Inverse multi-quadrics, Application of RBFN for classification and regression, Hopfield network, associative memories, Boltzmann machine.

Unit – III: Fuzzy logic **(14)**

Fuzzy logic: Concept of Fuzzy number, fuzzy set theory(continuous, discrete), Operations on fuzzy sets, Fuzzy member-ship functions , primary and composite linguistic terms, Concept of fuzzy relation, composition operation, Concept of fuzzy inference, Fuzzification and de-fuzzification, Mamdani inference rule, Sugeno inference rule, Simple example of fuzzy control in contrast with traditional PID control.

Reference Books:

1. J. M. Zurada , **'Introduction To Artificial Neural Systems',** *West publishing house*
2. S. N. Sivanandam, S. N. Deepa, **'Introduction to Genetic Algorithms'**, *Springer-Verlag Berlin Heidelberg*, (2008).
3. J.S. Jang, C.T. Sun, E. Mizutani, **'Neuro-Fuzzy and Soft Computing'**, *PHI Learning Private Limited*
4. S. Haykin, **'Neural Networks-A comprehensive foundation'**, *Prentice Hall International* Inc, (1999)
5. L. Fausett, **'Fundamentals of Neural Networks: Architectures, Algorithms and Applications',** *Pearson Education* (2008)
6. T. and T. Ross, **'Fuzzy Logic with Engineering Applications'**, John Wiley and Sons, (2010)
7. J. C. Principe, Neil R. Euliano, W. Curt Lefebvre, **'Neural and Adaptive Systems: Fundamentals through Simulations'**, *John-Wiley & Sons*, (2000)
8. V. Kecman, **'Learning and Soft Computing-Support Vector Machines, Neural Networks, and Fuzzy Logic Models'**, *MIT Press*, (2001)
9. P. E. Hart, D. G. Stork Richard O. Duda, **'Pattern Classification'**, (2^{nd} Edition), (2000)
10. S. Theodoridis , K. Koutroumbas, **'Pattern Recognition'**, Fourth Edition, *Academic Press,* (2008)

PEECSP110 Satellite and Radar Signal Processing

Teaching Scheme:	**Examination Scheme:**
Lectures: 3 Hrs/Week	In-Semester: **50**Marks
	End-Semester: **50** Marks
	Credits: 3

Course Objectives:

1. To analyze the various aspects of satellite communication link.
2. To design a satellite communication link.
3. To learn the principles of antennas and propagation as related to radars.
4. To understand principles of navigation.

Course Outcomes:

1.Design a geo-stationary satellite communication link taking into account the inter satellite interference aspects, frequency, Bandwidth, power & polarization considerations.

2. Design satellite communication link using the various aspects of establishment.

3. Understand basics of radar and GNSS.

4. Gain the knowledge of antenna types and principle of navigation.

Unit – I: Orbital Mechanics and Launchers **(09)**

Introduction to Satellite Communication, Orbital Mechanics, Look angle determination, Orbital perturbations, Orbital determination, Launchers and Launch Vehicles, Orbital effects in communication system performance.

Unit – II: Satellite Communication Link Design **(10)**

Basic transmission Theory, System Noise, Temperature and G/T Ratio, Design of Downlinks, Satellite Systems using Small Earth Stations, Uplink Design, Design for Specified C/N : Combining C/N and C/I values in Satellite Links, System Design Examples, Introduction to GNSS, Types and application of GNSS.

Unit – III: Introduction to Radar **(10)**

Radar Block Diagram, Range determination, Radar Frequencies, History of Radar, Types of Radar, Applications of Radar. The Radar Equation: The simple form of the Radar Equation, Radar performance, Transmitter Power, Pulse width, Pulse Repetition Frequency, Radar Receiver Noise and the Signal-to-Noise Ratio, Propagation effect, System losses, Radar antennas.

Unit – IV: Detection of Radar signals **(09)**

Detection of Signals in Noise, Matched Filter, correlation detector, Cross corelation detector, Detection Criteria, Detectors, Automatic Detection, Constant-False-Alarm Rate, Tracking with

Radar, Radar servo tracking system, Block diagram.

Moving target indicator (MTI) Radar, MTI moving platform, limitation of MTI performance.

Reference Books:

1. D. Roody, **'Satellite Communications'**, *McGraw Hill*, (4th edition).

2. M. I. Skolnik, **'Introduction to Radar Systems'**, *Tata McGraw-Hill*, (3rd Edition).

3. P. Z. Peebles, **'Radar Principles'**, *John Wiley*, (2004)

4. T. Pratt, C. Bostian, Jeremy Allnutt, **'Satellite Communications'**, *John Wiley & Sons.*

5. J.C Toomay, **'Principles of Radar'**, PHI, (2nd Edition), (2004).

ECSP1201 Speech Signal Processing

Teaching Scheme:	**Examination Scheme:**
Lectures: 3 Hrs/Week	In-Semester: **50** Marks
	End-Semester: **50** Marks
	Credits: 3

Course Objectives:

1. To characterize the speech signal as generated by a speech production model.
2. To understand the mechanism of speech perception
3. To understand the motivation of short-term analysis of speech signals.
4. To perform the analysis of speech signal using LPC

Course Outcomes:

1. Design and implement algorithms for processing speech signals.
2. Analyze speech signal to extract the characteristic of vocal tract (formants) and vocal cords (pitch).
3. Implement different speech modeling techniques.
4. Design and implement different applications in speech processing

Unit I: I Basics of Speech and Pre-processing Techniques **(06)**

Speech production system, speech perception, LTI model, LTV model, voiced and unvoiced speech, methods for its identification, types of speech, intelligibility and quality of speech and its measurement, sampling, quantization, PCM, parametric speech coding, transform domain coding, sub-band coding, voice activity detection, normalization, segmentation, windowing, filtering, speech prosody, cepstrum.

Unit - II: Features in Speech **(07)**

Pitch frequency, measurement using AMDF and autocorrelation, pitch period measurement using spectral domain and cepstral domain, formants, relation between formants and LPC, methods for formant extraction, spectrogram, homomorphic processing, mel scale, bark scale, MFCC block schematic and function of each block, PLP, LFPC, STFT, wavelet analysis of speech.

Module - III: Speech Processing and Evaluation Techniques **(06)**

Dynamic time warping, speech modelling using GMM and HMM, Vector quantization, Overlap add method, PSOLA, subjective and objective evaluation, MOS, Mel cepstral distance, bark spectral distortion, MSE, Euclidean distance, perceptual evaluation of speech quality, ITU standards, P.862

Unit - IV: Speech Processing Applications **(15)**

Speech recognition, speaker recognition and speaker verification, text-to-speech conversion

system, speech morphing and transformation, speech enhancement, echo cancellation, speech synthesis techniques, watermarking of speech

Reference Books:

1. R. Rabiner and S.W. Schafer, **'Digital Processing of Speech signals'**, *Pearson Education*, (2005).
2. Dr. S. Apte, **'Speech and Audio Processing'**, *Wiley India Publication*, (2013).
3. T. F. Quateri, **'Discrete Time Speech Signal Processing: Principles and Practice'**, *Prentice Hall Press*, (2001).
4. I. McLoughlin, **'Applied Speech and Audio Processing'**, *Cambridge Press*, (2009).
5. L.R Rabinar and B.H. Juang and Yegnanarayana, **'Fundamentals of Speech Recognition'**, *Pearson Publishers*, (2009).

ECSP1202 Estimation and Detection Theory

Teaching Scheme:	**Examination Scheme:**
Lectures: 3 Hrs/Week	In-Semester: **50** Marks
	End-Semester: **50** Marks
	Credits: 3

Course Objectives:

1. To study estimation techniques.
2. To study detection techniques.
3. To estimate parameters for given application
4. To apply detection techniques for a given application

Course Outcomes:

1. Apply detection techniques in complex problem
2. Estimate parameters for given application
3. Design optimum filters for the given application
4. Understand and apply techniques of detection and estimation to future communication systems.

Unit – I: Fundamentals of Estimation Theory **(09)**

Role of Estimation in Signal Processing, Unbiased Estimation, Minimum variance unbiased(MVU) estimators, Finding MVU Estimators, Maximum likelihood estimation, Cramer - Rao Lower Bound, Bayes estimator (MMSE), Linear Modeling – Examples.

Unit – II: Estimation Techniques **(09)**

Deterministic Parameter Estimation: Least Squares Estimation-Batch Processing, Recursive Least Squares Estimation, Best Linear Unbiased Estimation, Likelihood and Maximum Likelihood Estimation, estimation efficiency, weighted least squares, best linear unbiased estimation. Random Parameter Estimation: Bayesian Philosophy, Selection of a Prior PDF, Bayesian linear model, Minimum Mean Square Error Estimator, Maximum a Posteriori Estimation.

Unit – III: State Estimation **(06)**

Prediction, Single and Multistage Predictors

Unit – IV: Fundamentals of Detection Theory **(12)**

Bayes' Detection, MAP Detection, ML Detection, Minimum Probability of Error Criterion, Min-Max Criterion, Neyman-Pearson Criterion, Multiple Hypothesis, Composite Hypothesis Testing: Generalized likelihood ratio test (GLRT), Receiver Operating Characteristic Curves. Detection of Signals in White Gaussian Noise (WGN), Binary Detection of Known Signals in WGN, M-ary Detection of Known Signals in WGN, Matched Filter Approach, Detection of signals with Random

Parameters

Applications of detection and estimation: Applications in communications, system identification, pattern recognition, speech processing, and image processing.

Reference Books:

1. J. M. Mendel, **'Lessons in Estimation Theory for Signal Processing, Communication and Control',** *Prentice Hall Inc*, (1995)
2. M. H. Hayes, **'Statistical Digital Signal Processing and Modelling',** *John Wiley & Sons Inc*, (1996)
3. M. Barkat, **'Signal Detection and Estimation',** *Artech House* (2nd Edition), (2005).
4. S.M. Kay, **'Fundamentals of Statistical Signal Processing: Detection Theory',** *Prentice Hall*, (1998)
5. S.M. Kay, **'Fundamentals of Statistical Signal Processing: Estimation Theory',** *Prentice Hall*, (1993)

ECSP1203 Statistical Signal Processing

Teaching Scheme:	**Examination Scheme:**
Lectures: 3 Hrs/Week	In-Semester: **50** Marks
	End-Semester: **50** Marks
	Credits: 3

Course Objectives:

1. To introduce Concepts of Statistical Signal Processing that has been used in many applications fields such as Communications Speech Signal Processing, Image Processing, etc
2. Importance of Signal Modelling methods in signal processing.
3. Importance of Parametric and Non-Parametric Spectral Estimation methods.
4. Necessity of Linear Prediction and Optimum Filters for noise filtering.
5. To introduce Concepts of Adaptive filters and algorithms for real time noise filtering.

Course Outcomes:

1. Explain and demonstrate the role of signal analysis and modeling play in developing algorithms which are extensively used in speech and image processing applications.
2. Formulate mathematical models to estimate desire signal for signal processing application such as speech processing and/or image processing.
3. Choose appropriate spectral estimation methods for the Analysis of real world signals.
4. Describe importance of linear prediction and Optimum filters for prediction and filtering of real world signals.
5. Apply basic concepts of adaptive filters for denoising and echo cancellations in the signal.

Unit – I: Signal Modeling	**(10)**

Introduction, Least Square methods for signal modeling and its disadvantages. Pade, Prony's and Shank's Methods for signal Modeling, FIR least square inverse filter, Stochastic Models: AR(p),MA(q) and ARMA(p,q) modelling

Unit – II: Linear Prediction and Optimum Filter	**(10)**

Forward and Backward Predictions, Yule-walker equation, Linear Prediction of Signals, Levinson Durbin Algorithm, Lattice filters realization, Wiener filter, noise cancellation using FIR wiener filter.

Unit – III: Spectral Estimation	**(08)**

Introduction to need of Spectral estimation, Spectral estimation methods: Periodogram, Bartlett method, Welch method, Blckman-Tukey method, non-parametric Power spectrum estimation using AR model.

Unit – IV: Adaptive Filters:	**(08)**
Need of adaptive filters, steepest descent method, LMS algorithm, convergence, application using LMS algorithms, Normalize LMS. RLS algorithm, tracking performance of LMS and RLS Algorithms in non- stationary environment.	
Reference Books:	
1. M. H. Hayes, **'Statistical Digital Signal Processing and Modelling'**, *Wiley*, (1996). 2. J. G. Proakis, Dimitris G. Manolakis, **'Digital Signal Processing principles, Algorithms, and Applications'**, *Pearson Prentice Hall* (4^{th} edition), (2013). 3. S. M. Kay, **'Modern Spectral Estimation: Theory and Application'**, *Prentice Hall* (1988). 4. D. G. Manolakis, V. K. Ingle, S. M. Kogon, **'Statistical and Adaptive Signal Processing'**, *McGraw-Hill*.	

PEECSP1202 Computer Vision

Teaching Scheme:	**Examination Scheme:**
Lectures: 3 Hrs/Week	In-Semester: **50**Marks
	End-Semester: **50** Marks
	Credits: 3

Course Objectives:

1. To understand Image acquisition concepts.
2. To understand mapping from 3D word to 2D word.
3. Hands on Camera calibration techniques and basics of stereo imaging.
4. Feature analysis and extraction techniques such as Corner detector, Scale Invariant Feature Transform.
5. Understand and compare different object tracking algorithms such as Optical flow, Kalman filter, Mean Shift etc.
6. Applications of Computer Vision such as Surveillance system, Tomography, Tomography, Surveillance, Industrial robot vision, 3D Reconstruction, etc.

Course Outcomes:

1. Understand and analyze image formation and working of camera as image sensor.
2. Analyze procedure of camera calibration.
3. Analyze of stereo imaging formation and its applications and challenges.
4. Apply computer vision algorithms for motion tracking.
5. Express the basic concept of infrared imaging
6. Development of different video and computer vision based applications.

Unit – I: Image Formation	**(08)**

Introduction: Purpose, state of the art

Image Formation: CMOS CCD image sensors, projection, color image camera.

Unit – II: Camera Calibration and Stereo Imaging	**(08)**

Camera calibration: camera parameters, camera calibration.

Stereo imaging: Epipolar geometry, rectification, correspondence, triangulation, RANSAC algorithm, Dynamic programming.

Unit – III: Feature detection and tracking	**(14)**

Corner detector, Edge Detector, Histogram of Gradient, Scale Invariant Feature Transform, Background Subtraction Techniques, Optical flow, mean shift tracking, Kalman filter, Object Tracking, Condensation.

Unit – V: Applications	**(06)**
Non-visible-light Imagery: infrared and thermal imaging, applications, **Applications of computer vision:** Tomography, Surveillance, Industrial robot vision, 3D reconstruction.	
Reference Books :	

1. D. A. Forsyth, J. Ponce, **'Computer Vision, A Modern Approach'**, *Prentice Hall*, (2003).
2. R. Szeliski, **'Computer vision algorithms and applications',** *Springer-Verlag*, (2010)
3. M. Shah, **'Fundamentals of Computer Vision',** *Online book* (1997)
4. L. G. Shapiro, George C. Stockman, **'Computer Vision'**, *Prentice Hall* (2001).
5. E. Trucco, A. Verri, **'Introductory Techniques for 3-D Computer Vision'** *Prentice Hall* (1998)
6. D. H. Ballard, C. M. Brown, **'Computer Vision',** *Prentice Hall* (1982)
7. M. Sonka, V. Hlavac, R. Boyle, **'Image Processing, Analysis, and Machine Vision'** *Thomson* (2011).

PEECSP1202 Advanced Wireless Communication Systems

Teaching Scheme:	**Examination Scheme:**
Lectures: 3 Hrs/Week	In-Semester: **50** Marks
	End-Semester: **50** Marks
	Credits: 3

Course Objectives:

1. To understand the fundamentals of wireless communication
2. To model Wireless channel (large scale and small scale)
3. To understand Equalization and Diversity techniques
4. To analyze the performance of digital modulation techniques over fading channels

Course Outcomes:

1. Fundamentals and advancement in wireless communication systems.
2. Simulate and model (large scale and small scale) wireless Channel.
3. Problems of multipath fading and techniques used to mitigate the same.
4. Evaluate the performance of digital modulation techniques in wireless environment.

Unit – I: Overview of Wireless Communications **(08)**

History of mobile communication systems, need of LTE, UMTS to LTE, LTE advanced, Broadband Wireless access, Satellite Networks, Ultra-wideband, Spectrum Allocations for Systems, and Challenges in the design of modern wireless networks, Introduction to SDR and Cognitive networks.

Unit – II: Large Scale and Small Scale Fading Model **(12)**

Radio Wave Propagation, Free-Space Path Loss, Ray Tracing, Two-Ray Model, Empirical Path Loss Models, Okumura Model, Hata Model, Indoor Attenuation, Combined Path Loss and Shadowing, Outage Probability, Cell Coverage Area. Time-Varying Channel Impulse Response, Power Delay Profile, Coherence Bandwidth, Doppler and Channel Coherence Time, Level Crossing Rate and Average Fade Duration.

Unit – III: Equalization and Diversity techniques **(08)**

Need of equalization technique, linear and nonlinear equalizers, Adaptive equalizers, Types of Diversity techniques, performance of diversity techniques in multipath environments, factors affecting performance of diversity techniques, transmitter and Receiver Diversity, System Model, Combining techniques, Moment Generating Functions in Diversity Analysis for MRC, EGC, SC of Non-coherent and Differentially Coherent Modulation.

Unit – IV: Multicarrier Modulation	**(08)**
Data Transmission using Multiple Carriers, Overlapping Sub channels, Mitigation of Sub Carrier Fading, Discrete Implementation of Multi-carrier, Cyclic Prefix, OFDM, Matrix Representation of OFDM, Vector Coding, Challenges in multicarrier systems- PAPR and frequency and timing offset, performance of MCM in fading environment, applications of OFDM, Case study of IEEE 802.11a wireless LAN Standard.	
Reference Books:	
1. G. Andrea, **'Wireless Communications'**, *Cambridge University Press*, (2005). 2. T.S. Rappaport, **'Wireless Communications'**, *Pearson Education*, (2^{nd} edition), (2007). 3. T. David and P. Viswanath, **'Fundamentals of Wireless Communication'**, *Cambridge University Press*, (2^{nd} edition), (2006). 4. C. Cox, **'An introduction to LTE'**, *Wiley publication*, (2012)	

PEECSP1202 Embedded Systems

Teaching Scheme:	**Examination Scheme:**
Lectures: 3 Hrs/Week	In-Semester: **50** Marks
	End-Semester: **50** Marks
	Credits: 3

Course Objectives:

1. To understand the Embedded system design issues.
2. To learn real time operating system concepts.
3. To learn ARM and cortex series processor
4. To learn Embedded in instrumentation, network, automobile, communication.

Course Outcomes:

1. Apply design metrics while designing embedded system for real time applications.
2. Choose Real time operating system for development of product
3. Apply hardware – software co design issues
4. Explore that embedded system makes signal analysis - a portable solution

Unit – I: Introduction to Embedded Systems **(08)**

Introduction to Embedded Systems, Architecture, Classification and Characteristics of Embedded System, Design Process, Design Metrics and optimization of various parameters of embedded system. Embedded processor technology, IC technology, Design technology. Software development life cycle. Various models like waterfall, spiral, V , Rapid Prototyping models and Comparison

Unit – II: Real Time Systems Concepts **(09)**

Foreground/ Background systems, Critical section of code, Resource, Shared resource, multitasking, Task, Context switch, Kernel, Scheduler, Non-Preemptive Kernel , Preemptive Kernel, Re-entrancy, Round robin scheduling, Task Priorities, Static & Dynamic Priority, Priority Inversion, Assigning task priorities, Mutual Exclusion, Deadlock, Clock Tick, Memory requirements, Advantages & disadvantages of real time kernels.

Unit – III: ARM9 and cortex architecture **(09)**

Introduction to ARM processors and its versions, ARM7, ARM9 & ARM11 features, advantages & suitability in embedded application.ARM Based Microcontroller LPC1768: Features, Architecture (Block Diagram and Its Description), System Control Block (PLL and VPB divider),Memory Map, GPIO, Pin Connect Block, timer.

Unit – IV: Embedded System Applications **(12)**

Case Studies :

1. Washing machine [Fuzzy based]
2. Micowave oven
3. Router
4. Face recognition using Raspberry Pi and open CV
5. ECU [electronic control Module for diesel generator]
6. ECG machine
7. Digital camera
8. Mobile
9. Automobile embedded system
    a. MPFI

b. Window control
c. Digital dash board [speed / fuel level / KM / clock]
d. GPS
e. ABS

Reference Books:

1. A. Kamal, **'Embedded Systems – Architecture, Programming and Design'**, *Mc Graw Hill* (2nd edition).
2. F. Vahid and T. Givargis, **'Embedded System Design – A Unified hardware/ Software introduction',** *Wiley*, (3rd edition)
3. J. Labrosse, **'MicroCOS II, The Real-Time Kernel'**, *CMP Books*, (2nd edition),

AC1201 Soft Skills and Business Communication

Teaching Scheme:	**Examination Scheme:**
Practical: 2 Hrs/Week	In-Semester: --
	End-Semester: --
	Credits: NIL

Course Objectives:

1. To help the students to develop as team member, leader and all round professional in the long run.
2. This course would focus on over all personality development.
3. Have right attitudinal and behavioral aspects, and build the same through activities.
4. Possess right professional and social ethical values.
5. To make student confident in communicating in Business environment.
6. Improve their fluency in English language.

Course Outcomes:

1. To communicate, interact and present his ideas to the other professionals.
2. Understand and aware of importance, role and contents of soft skills through instructions, knowledge acquisition, demonstration and practice.
3. Have right attitudinal and behavioural aspects, and build the same through activities.
4. Possess right professional and social ethical values.
5. The student will overcome apprehension of communicating in professional environment.
6. Language proficiency will enable student present ideas, applications and reports effectively in oral and written communication.

Unit – I: Self-Awareness & self-Development **(03)**

a) Self Assessment, Self Appraisal, SWOT, Goal setting -Personal &career-Self-Assessment, Self-Awareness, Perceptions and Attitudes, Positive Attitude, Values and Belief Systems, Self-Esteem, Self appraisal, Personal Goal setting.

b) Career Planning, Personal success factors, Handling failure, Depression and Habit, relating SWOT analysis & goal setting, prioritization.

Unit – II: Communication Skill **(06)**

a) Importance of communication, types, barriers of communication, effective communication.

b) Speaking Skills– Public Speaking, Presentation skills, Group discussion- Importance of speaking effectively, speech process, message, audience, speech style, feedback, conversation and oral skills, fluency and self expression, body language phonetics and spoken English, speaking techniques,

word stress, correct stress patterns, voice quality, correct tone, types of tones, positive image projection techniques.

c) Listening Skills: Law of nature- you have 2 ears and 1 tongue so listen twice and speak once is the best policy, Empathic listening, Avoid selective listening.

d) Group Discussion- characteristics, subject knowledge, oral and leadership skills, team management, strategies and individual contribution and consistency.

e) Presentation skills- planning, preparation, organization, delivery.

f) Written Skills– Formal & Informal letter writing, Report writing, Resume writing- Sentence structure, sentence coherence, emphasis. Paragraph writing, Letter writing skills-form and structure, style and tone. Inquiry letters, Instruction letters, complaint letters, Routine business letters, Sales Letters etc.

Unit – III: Corporate/ Business Etiquettes.	**(02)**

Corporate grooming & dressing, Email & telephone etiquettes, etiquettes in social & office setting- Understand the importance of professional behavior at the workplace, Understand and Implement etiquettes in workplace, presenting oneself with finesse and making others comfortable in a business setting. Importance of first impression, Grooming, Wardrobe, Body language, Meeting etiquettes (targeted at young professionals who are just entering business environment), Introduction to Ethics in engineering and ethical reasoning, rights and responsibilities.

Unit – IV: Interpersonal relationship	**(03)**

Team work, Team effectiveness, Group discussion, Decision making - Team Communication Team, Conflict Resolution, Team Goal Setting, Team Motivation Understanding Team Development, Team Problem Solving, Building the team dynamics. Multicultural team activity

Unit – V: Leadership skills	**(01)**

Leaders' role, responsibilities and skill required- Understanding good Leadership behaviours, Learning the difference between Leadership and Management, Gaining insight into your Patterns, Beliefs and Rules, Defining Qualities and Strengths of leadership, Determining how well you perceive what's going on around you, interpersonal Skills and Communication Skills, Learning about Commitment and How to Move Things Forward, Making Key Decisions, Handling Your and Other People's Stress, Empowering, Motivating and Inspiring Others, Leading by example, effective feedback

Unit – VI: Other skill	**(03)**

a) Time management-The Time management matrix, apply the Pareto Principle (80/20Rule) to time management issues, to prioritise using decision matrices, to beat the most common time wasters, how to plan ahead, how to handle interruptions, to maximize your personal effectiveness,

how to say “no” to time wasters, develop your own individual plan of action.

b) Stress management- understanding the stress & its impact, techniques of handling stress

c) Problem solving skill, Confidence building Problem solving skill, Confidence building.

Reference Books:

1. S. Kumar, S. Pushpalata, **‘Communication Skills’**, *Oxford University Press.* (2011)
2. K. Mohan, M. Banerji , **‘Developing Communication Skill’ ,** *McMillan India Ltd.* (2011)
3. S. Sweeney, **‘English for Business Communication’** *Cambridge UniversityPress.* (2013)
4. B. K. Mitra, **‘Personality Development and Group Discussions’,** *Oxford University Press*
5. S. Napoleon Hill **‘Think and Grow Rich’**, *Ebury Publishing*, (1937)

AC1201 Entrepreneurship Development

Teaching Scheme:	**Examination Scheme:**
Practical: 2 Hrs/Week	In-Semester: --
	End-Semester: --
	Credits: NIL

Course Objectives:

1. An understanding of the scope of Entrepreneurship Development
2. To make them understand key areas of Business development
3. Understand different sources of finance, project preparation and legal requirements for Business.
4. Understand the significance of Entrepreneurship and economic growth
5. Application of engineering skills in entrepreneurial activities etc.

Course Outcomes:

1. Develop an entrepreneur attitude.
2. Analyze business opportunity and will be ready with business plan
3. Take decisions related to procurement and application of funds.
4. Students are better prepared to become effective team members and can better support their employers as innovators.

Unit – I: Modern Small Business Enterprises **(06)**

Role of Small- scale Industries

Concepts and definitions of SSI

Government Policy and Development of the Small-scale sector in India

1. Growth and performance of small scale Industries in India
2. Small and Medium Enterprises in other countries
3. Problems for Small-scale Industries in a free Economy

Institutions supporting small Business Enterprises: Central Level, State Level, Other agencies and Industry Associations.

Unit – II: Entrepreneurship and Emerging areas **(10)**

Importance of Entrepreneurship

Concepts of Entrepreneurship and corporate Entrepreneurship

Characteristics of a successful Entrepreneurship

Classification of Entrepreneurship

Myths of Entrepreneurship

Emerging areas in Entrepreneurship: Women Entrepreneurship: Types, Challenges, Opportunities,

Achievements,, Problems, Remedial Measures & supporting Institutions and Role Models of Woman Entrepreneurs in India, Self Help Group Rural Entrepreneurship: meaning, need, Problems, Development, Role of NGO's, Entrepreneurship in agriculture, TRYSEM Social Entrepreneurship: Genesis & Characteristic International Entrepreneurship E-Entrepreneurship: Concept, Purpose and Essence Profiles of successful Entrepreneurs of each emerging field	
Unit – III: Setting Up a Small Business Enterprise	**(10)**
Identifying the Business Opportunity, assessment of viability, formulation, evaluation, financing, field-study and collection of information, preparation of project report, Business opportunities in various sectors Formalities for Setting Up of a Small Business Enterprises Environment Pollution Related Clearances.	
Unit - IV: Financial Management in small Business	**(10)**
Importance of Financial Management, Accountancy, Preparation of balance sheets and assessment of economic viability, Capital structure, Cost of capital, Sources of Finance, Working capital Management, Capital Budgeting decisions: Pay-back period, discounted cash flow, internal rate of return and net present value methods. Taxation – Direct, Indirect Taxes.	
Unit – V: Production Management in small Business	**(05)**
Production Management, Materials Management, inventory control, Productivity, Break Even Analysis Total quality management Environmental Management System.	
Unit – VI: Legal Requirements	**(04)**
Laws concerning entrepreneur viz, partnership laws, business ownership, sales and income taxes Industrial Relations Laws: workman compensation act, Labour Laws, Environment and Pollution Control laws.	
Reference Books:	

1. P. M. Charantimath, **'Entrepreneurship Development and Small Business Enterprises'**, *Pearson Education India* (2nd edition),(2005)
2. V. Desai, **'Dynamics of Entrepreneurial Development and Management'** , *Himalaya Publishing House*, (4th edition),(2007)
3. J. Forbat, **'Entrepreneurship'**, *New Age International Pvt Limited*, (2008)
4. J. L. Massod, **'Essential of Management'**, *Prentice Hall of India*, (4th edition), (1986)
5. M. Lall, S. Sahai, **'Entrepreneurship'**, *Excel Books*, (2nd edition), (2008)
6. N. Baporikar**, 'Entrepreneurship Development and Project Management',** *Himalaya Publishing House*, (2nd edition),(2013)
7. Gupta, Srinivasan, **'Entrepreneurship Development in India'**, *Sultan Chand & Sons*, (new edition),*(2013)*

ECSP2101 Multimedia Signal Compression Standards

Teaching Scheme:	**Examination Scheme:**
Lectures: 3 Hrs/Week	In-Semester: **50** Marks
	End-Semester: **50** Marks
	Credits: 3

Course Objectives:

1. To study JPEG 2000 Standard
2. To study audio standards
3. To understand the basic principles of Video Compression
4. To understand MPEG1 , MPEG2 and MPEG4 Standard
5. To Study H.263 standard

Course Outcomes:

1. Appreciate the need of standards
2. Analyze problems based on DCT and Wavelet transform
3. Compare and Select appropriate Standard as per application(TV, Internet, Video conferencing, Mobile Networks)
4. Participate in future developments in this field
5. Compare and Select appropriate Standard as per application(TV, Internet, Video conferencing,

Unit–I: Still Picture Compression standard JPEG 2000	**(08)**

Wavelets- Basics, Wavelet Based Image Compression 'Embedded Zero Wavelet EZW, SPIHT, EBCOT, Rate control, Pre-processor, Core Encoder, Post-processing, ROI, Encoding, Scalability.

Unit – II: Basics of Video Compression	**(10)**

Analog Video (Comparison of NTSC, PAL, SECAM), Digital Video, Temporal Redundancy, Motion Estimation.

Unit – III: Video and Audio Compression Standards	**(10)**

MPEG 1- Video structures, Picture slice, group of pictures, macro-block, coding of pictures, video buffers and decoders MPEG - 2, H-263, Audio Standards like MP3.

Unit – III: Advanced Compression Techniques	**(10)**

MPEG-4, MPEG-7.

Reference Books:

1. M. Ghanbhari, **'Standard Codecs: Image Compression to Advanced Video Coding'**, *IET Publication*, (2003)
2. E. G. Richardson, **'H.264 and MPEG-4 Video Compression'**, *John Wiley And Sons*, (2nd

Edition), (2010)

3. K. Sayood, **'Introduction to Data Compression'**, *The Morgan Kaufmann Series in Multimedia Information and Systems, Series Editor, Edward A. Fox, Virginia Polytechnic University*, (3rd Edition), (2011)

HSEL2101 Environmental Studies

Teaching Scheme:	**Examination Scheme:**
Lectures: 3 Hrs/Week	In-Semester: **75** Marks
Tutorial: 1 Hr/Week	End-Semester: **50** Marks
	Credits: 4

Course Objectives:

1. To understand the environment and its effects
2. Apply reasoning skills to environmental problems including basic calculations related to energy.
3. To understand the importance of ecological balance for sustainable development. Understand the relevance and importance of natural resources in the sustenance of life on earth and living standard.

Course Outcomes:

1. Understand that life in a viable ecosystem should be the most desirable goal and not wealth or consumption of resources
2. Enhance and strengthen the natural resources base so that need of all is fulfilled today and in future.
3. Create awareness about sustainable development.
4. Identify different types of environmental pollution and control measures.

Unit – I: Multidisciplinary nature of environmental studies	**(06)**

Definition of Environment, multidisciplinary nature of Environmental Studies, scope, importance of Environment, Public awareness for Environment Concept, Ecosystem characteristics:-Biotic abiotic, functional attributes, Energy flow in ecosystem: - Universal and single channel energy flow model, Nutrient Cycling:- Nitrogen cycle, carbon cycle, phosphorus cycle, Biodiversity and its conservation- Definition- Genetic, Species and ecosystem diversity, Value of biodiversity: - food, drugs, medicine, fuel, social, ethical, aesthetic and ecosystem service value

Unit – II: Natural resources- Utilization and conservation	**(06)**

Renewable and Non-renewable resources, Energy resources: - Growing energy needs, use of alternate energy resources, case studies. Limitations of Renewable and Non-renewable resources, Lack of sustainability of modern society, towards sustainable development

Unit – III: Environmental Pollution	**(06)**

Introduction, Classification of pollution - Air, water, soil, marine, noise, thermal and nuclear hazards. – sources , causes, effects & remedial measures ,Solid waste generation, Collection of solid wastes, processing techniques, E- waste generation and methods of disposal ,Role of an individual in prevention of pollution.

Unit – IV: Disaster Management	**(05)**

Types and classification of Disaster – Earthquakes, floods, Tsunami, cyclones, landslides, drought, volcanoes , forest fires, avalanches, soil erosion, Disaster Management- meaning, Concept, approaches, principles, Resettlement and rehabilitation of the victims of the disaster

Unit – V: Social Issues and Environment	**(06)**

- Urban problems related to energy, Climate change, global warming, acid rain, ozone layer depletion ,Water conservation and Rain water harvesting ,Human health and environment, Introduction to Environmental Impact Assessment - Definition, introduction of methods with the help of a case study, Environment Protection Act, Forest Conservation Act, Air (prevention and control of pollution) Act, Water (prevention and control of pollution) Act , Wild life protection Act, Public awareness

Unit – VI: Sustainable Development	**(05)**

Emergence of Global Concern for Environment and Development, Management strategies of sustainable development, Smart City**,** Concept and features of smart city, challenges of urbanization, selection process, strategy

Reference Books:

1. D.L. Manjunath, **'Environmental Studies'**, *Pearson Education*, (2007)
2. E. Bharucha, **'Text Book of Environmental Studies**', *UGC, Universities Press,* (2005)
3. D.K. Asthana ,Meera Asthana,**'A Text Book Of Environmental Studies',** *S.Chand,*(3rd edition), (2009)
4. Dr. J.P. Sharma, **'Environmental Studies',** *University Science Press,* (3rd edition), (2013)
5. Dr. S. K. Dhameja, **'Environmental Studies'**, *S.K.Kataria & Sons,* (4th edition), (2012)
6. A. Kaushik, C.P.Kaushik, **'Perspectives in Environmental Studies',** *New Age International Publisher*, (2014).
7. Shah, Kale, Patki, **'Building planning and Built environment'**,*Tata McGraw Hill,* (4th edition), (2002)
8. R. Bukhootsow, **'Energy policy and planning',** *B- Prentice Hall of India New Delhi,* (2003)

HSEL2101 Economics for Engineers	
Teaching Scheme:	**Examination Scheme:**
Lectures: 3 Hrs/Week	In-Semester: **75** Marks
Tutorial: 1 Hr/Week	End-Semester: **50** Marks
	Credits: 4

Course Objectives:

1. The objective of this course is to familiarize the prospective engineers with elementary principles of economics.
2. It also deals with acquainting the students with standard concepts and tools that they are likely to find useful in their profession when employed in the firm/industry/corporation in public or private sector.
3. It also seeks to create awareness about the status of the current economic parameters /indicators/ policy debates.
4. All of this is a part of the quest to help the students imbibe soft skills that will enhance their employability.

Course Outcomes:

1. Awareness of the economic side of the state of affairs of a country.
2. Apply economic tools at work place.
3. Know the various sources of Finance.
4. Understand Government policies and their impact on economy.
5. Get an international perspective to business and economy.

Unit – I: Basic Principles and Methodology of Economics.	**(10)**

Demand/Supply – elasticity – Government Policies and Application. Theory of the Firm and Market Structure. Basic Macro-economic Concepts (including GDP/GNP/NI/Disposable Income) and Identities for both closed and open economies. Aggregate demand and Supply (IS/LM). Price Indices (WPI/CPI), Interest rates, Direct and Indirect Taxes

Unit – II: Public Sector Economics	**(10)**

Welfare, Externalities, Labour Market. Components of Monetary and Financial System, Central Bank –Monetary Aggregates; Commercial Banks & their functions; Capital and Debt Markets. Monetary and Fiscal Policy Tools & their impact on the economy – Inflation and Phillips Curve.

Unit – III: Elements of Business/Managerial Economics	**(10)**

Forms of organizations. Cost & Cost Control –Techniques, Types of Costs, Budgets, Break even Analysis, Capital Budgeting, Application of Linear Programming. Investment Analysis – NPV,

ROI, IRR, Payback Period, Depreciation, Time value of money. Business Forecasting – Elementary techniques. Statements – Cash flow, Financial. Case Study Method.

Unit – IV: Indian economy **(10)**

Brief overview of post independence period – plans. Post reform Growth, Structure of productive activity. Issues of Inclusion – Sectors, States/Regions, Groups of people (M/F), Urbanization. Employment–Informal, Organized, Unorganized, Public, Private. Challenges and Policy Debates in Monetary, Fiscal, Social, External sectors. International Economy, WTO.

Reference Books:

1. M. Gregory N, **'Principles of Economics'**, *Thompson Asia*, (2nd edition), (2002)
2. V. Mote, S. Paul, G. Gupta, **'Managerial Economics'**, *Tata McGraw Hill*, (2004)
3. S.K Misra, Puri, **'Indian Economy'**, *Himalaya*, (2009)
4. P. Saroj, **'Textbook of Business Economics'**, *Sunrise Publishers*, (2003)
5. Krugman, **'International Economics'**, *Pearson Education*, (2nd edition), (2009)
6. Prakash, **'The Indian Economy'**, *Pearson Education*, (2009)
7. T. Gerald, **'Engineering Economics'**, *Prentice Hall*, (9th edition), (2008)
8. **'Industrial Organisation and Engineering Economics'**, *Khanna Publishers*, (24th edition), (2009)

HSEL2101 Fundamentals of Disaster Management	
Teaching Scheme:	
Lectures: 3 Hrs/Week	In-Semester: **75**Marks
Tutorial: 1 Hr/Week	End-Semester: **50** Marks
	Credits: 4

Course Objectives:

1.To increase the knowledge and understanding of the disaster phenomenon, its different contextual aspects, impacts and public health consequences

2. To increase the knowledge and understanding of the International Strategy for Disaster reduction and to increase skills and abilities for implementing the Disaster Risk Reduction Strategy.

3. To ensure skills and ability to design, implement and evaluate research on disasters.

Course Outcomes:

1. Integrate knowledge and to analyse, evaluate and manage the different public health aspects of disaster events at a local and global levels, even when limited information is available.
2. Describe, analyse and evaluate the environmental, social, cultural, economic, legal and organizational aspects influencing vulnerabilities and capacities to face disasters.
3. Work theoretically and practically in the processes of disaster management (disaster risk reduction, response, and recovery) and relate their interconnections, particularly in the field of the Public Health aspects of the disasters.
4. Manage the Public Health aspects of the disasters.
5. Obtain, analyze, and communicate information on risks, relief needs and lessons learned from earlier disasters in order to formulate strategies for mitigation in future scenarios with the ability to clearly present and discuss their conclusions and the knowledge and arguments behind them

Unit – I: Introduction :Concepts and definitions	**(06)**

Disaster, hazard, vulnerability, risk, capacity, impact, prevention, mitigation).Disasters classification; natural disasters (floods, draught, cyclones, volcanoes, earthquakes, tsunami, landslides, coastal erosion, soil erosion, forest fires etc.); manmade disasters (industrial pollution, artificial flooding in urban areas, nuclear radiation, chemical spills etc); hazard and vulnerability profile of India, mountain and coastal areas, ecological fragility Authority.

Unit-II: Disaster Impacts	**06)**

Disaster impacts (environmental, physical, social, ecological, economical, political, etc.); health, psychosocial issues; demographic aspects (gender, age, special needs); hazard locations; global and

national disaster trends; climate change and urban disasters.

Unit-III : Disaster Risk Reduction (DRR)	**(06)**

Disaster management cycle its phases; prevention, mitigation, preparedness, relief and recovery; structural and non-structural measures; risk analysis, vulnerability and capacity assessment; early warning systems, Post disaster environmental response (water, sanitation, food safety, waste management, disease control); Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders; Policies and legislation for disaster risk reduction, DRR programmes in India and the activities of National Disaster Management

Reference Books:

1. http://ndma.gov.in/ (Home page of National Disaster Management Authority).
2. http://www.ndmindia.nic.in/ (National Disaster management in India, Ministry of Home Affairs).
3. P. Sahni, **'Disaster Risk Reduction in South Asia',** *Prentice Hall.* (2004)
4. B. K. Singh, **'Handbook of Disaster Management: techniques & Guidelines',** *Rajat Publication,* (2008)
5. G. K. Ghosh**, 'Disaster Management'**, *APH Publishing Corporation,* (2006)

OE2101 Architecture for Signal Processing Algorithms

Teaching Scheme:	**Examination Scheme:**
Lectures: 3 Hrs/Week	In-Semester: **50** Marks
	End-Semester: **50** Marks
	Credits: 3

Course Objectives:

1. To understand the methodologies needed to design custom or semi-custom VLSI circuits for DSP applications.
2. To design efficient architectures, algorithms and circuits which can be operated with low power or high speed with low area utilization.
3. To compute iteration bound using efficient algorithms.
4. To understand the concepts of retiming, unfolding, systolic architecture and its methodology.

Course Outcomes:

1. Represent DSP algorithms in graphical forms.
2. Design power and area efficient architectures for DSP algorithms using pipelining and parallel processing approaches.
3. Identify the techniques, to be applied to optimize the implementations for speed, power and area.
4. Make use of retiming techniques, folding and register minimization path problems.

Unit – I: Review of DSP algorithms	**(08)**

Discrete Fourier Transform, Decimation in time and decimation in frequency FFT, Representation of DSP algorithms: Block Diagram, signal flow graph, data flow graph, dependence graph, Challenges in designing architectures for DSP algorithms, DSP application demands and CMOS technologies.

Unit – II: Iteration Bound	**(08)**

Data flow graph representations, loop bound and iteration bound, algorithms for computing iteration bound, iteration bound of Multirate data flow graphs.

Unit – III: Architecture Design	**(09)**

Pipelining and parallel processing of FIR digital filters, combined pipelining and parallel processing, Fast Convolution- Cook-Toom algorithm, Algorithm-Architecture transformation.

Unit – IV: Retiming, Unfolding and Folding	**(10)**

Retiming techniques; algorithm for unfolding, Folding transformation, systolic architecture design, systolic array design methodology.

Reference Books:

1. K. K. Parhi, **'VLSI Digital Signal Processing Systems, Design and Implementation'**, *John-Wiley and sons*, (2008)
2. U. Meyer-Baese, **'Digital Signal Processing with Field Programmable Gate Arrays'**, *Springer*, (2nd edition), (2004)
3. J. G. Proakis, Dimitris G. Manolakis, **'Digital Signal Processing-Principles, algorithms and applications'**, *PHI*, (1997)
4. M. S. Moonen, Francky Catthoo, **'Algorithms and Parallel VLSI architectures'**, *Elsevier*, (1995)
5. K. J. Ray Liu, **'High Performance VLSI-signal Processing: Algorithms, architectures and applications'**, *IEEE Press*, (1998)

OE2101 Biomedical Signal Processing

Teaching Scheme:	**Examination Scheme:**
Lectures: 3Hrs/Week	In-Semester: **50** Marks
	End-Semester: **50** Marks
	Credits: 3

Course Objectives:

1. To understand the basic bio-signals.
2. To study origins and characteristics of some of the most commonly used biomedical signals, especially ECG, EEG, and EMG.
3. To understand sources and characteristics of noise and artifacts in bio signals.
4. To understand use of bio signals in diagnosis, patient monitoring and physiological investigations.
5. To explore research domain in biomedical signal processing.
6. To explore applications of established engineering solutions to complex biomedical signal problems.

Course Outcomes:

1. Apply various methods of acquiring bio signals.
2. Reveal various sources of bio signal distortions and its remedial techniques.
3. Analyze ECG and EEG signal with characteristic feature points.
4. Apply various Image processing techniques for biomedical image analysis.

Unit – I : Introduction to bio-medical signals and their acquisition:	**(6)**

Origin of bio-signal, action potential, nerve and muscle cells and their electrical activity, electrical activity of the heart, genesis of ECG, ECG lead systems, electrical activity of the brain, EEG signal and its acquisition, EMG signals and its acquisition. Sources of contamination and variation of bio-signals.

Unit – II: Analog signal processing of bio-signals:	**(7)**

Biomedical instrumentation systems, biomedical transducers, electrodes and their characteristics, instrumentation amplifier, isolation amplifier, active filters(commonly used topologies), ADC, aliasing effect, anti-aliasing filters, grounding, shielding, bonding and EMI filters: Principles and types of grounding, shielding and bonding with reference to Biomedical equipment.

Unit – III: Digital Signal processing of bio-signals	**(13)**

Review of FIR, IIR Filters, Weiner filters, adaptive filters. Model-based spectral analysis, AR, Eigen analysis spectral analysis, Time-frequency methods: Spectrogram, Wigner-Ville and other methods, Principal Component Analysis, Independent Component Analysis, Continuous Wavelet Transform, and Discrete Wavelet transform, Electrocardiogram: Signal analysis of event related potentials, morphological analysis of ECG waves, Envelope extraction and analysis of activity, application- Normal and Ectopic ECG beats, Phonocardiography

Unit – IV: Diagnostic Biomedical Imaging:	**(10)**

Types of Medical Images, CT, PET, and SPECT, MRI, Functional MRI, ultrasonic diagnostic imaging. Feature extraction, analysis and classification. Introduction to soft computing approaches for biomedical signal and image diagnostics: Artificial Neural networks, (Multilayer perceptron, Radial basis function networks) as classifiers.

Reference Books:

1. J. Malmivuo & Robert Plonsey, **'Bioelectromagnetism - Principles and Applications of Bioelectric and Biomagnetic Fields'**, *Oxford University Press, New York,* (1995).
2. J. L. Semmlow, **'Signals and Systems for Bioengineers: A MATLAB-Based Introduction'**, *Academic Press,* (2nd Edition), (2011)
3. J. L. Semmlow, **'Biosignal and Biomedical Image Processing MATLAB-Based Applications'**, *Marcel Dekker,* (2nd Edition), (2008)
4. W. J. Tompkins, **'Biomedical Signal Processing'**, *ED, Prentice – Hall*, (1993).
5. E. N. Bruce, **'Biomedical Signal Processing and Signal Modelling'**, *John Wiley & Sons,* (2000).
6. R. M. Rangayyan, **'Biomedical Signal Analysis A case study approach'**, *John Wiley & Sons*, (2002).
7. R. M. Rangayyan, **'Biomedical Image Analysis'**, *CRC Press*, (2005).

OE2101 Underwater Acoustic Signal Processing

Teaching Scheme:	**Examination Scheme:**
Lectures: 3 Hrs/Week	In-Semester: **50** Marks
	End-Semester: **50** Marks
	Credits: 3

Course Objectives:

1. To study fundamentals of underwater acoustics
2. To recognize importance of ambient noise in the sea
3. To understand characteristics of sonar systems
3. To understand characteristics of sonar systems

Course Outcomes:

1. Explain fundamentals of underwater acoustics.
2. Analyze ambient noise in the sea
3. Design and analyze sonar systems
4. Explain acoustics imaging, beamforming
5. Apply acoustic imaging techniques to design systems

Unit – I: Fundamentals Of Underwater Acoustics **(09)**

The Ocean acoustic environment, measuring sound level, Sources and receivers, relevant units, sound velocity in sea water, typical vertical profiles of sound velocity, Sound propagation in the Ocean- characteristic sound propagation paths-deep water and shallow water, Range dependent environment. Sound attenuation in sea water, Bottom Loss, Surface bottom and volume scattering, Snell's law for range dependent ocean.

Unit – II: Ambient Noise In The Sea **(09)**

Sources of ambient noise-introduction, different frequency bands of ambient noise, process of surface noise generation, shallow water, variability of ambient noise, spatial coherence of ambient noise, directional characteristics of ambient noise, intermittent sources of noise-biological & non biological (rain, earthquakes, explosions and volcanoes).

Unit – III: Characteristics Of Sonar Systems **(09)**

Sonar systems, active and passive sonar equations, transducers and their directivities, Sensor array characteristics-array gain, receiving directivity index, beam patterns, shading and super directivity, adaptive beam forming

Unit – IV: Acoustics Imaging **(09)**

Theory and Applications: Introduction of the basic formation of acoustic imaging systems, in

two parts: systems analysis and electronics systems architecture, transmitter design; digital signal processing techniques; digital beam forming; digital beam forming architectures; image formation, manipulation, and display

Reference Books:

1. R. J. Urick, **'Principles of Underwater Sound'** ,*McGraw-Hill Companies*, (3rd Edition), (2013)
2. R. J. Urick , **'Ambient noise in the sea'**, *Peninsula Publishing*, (1986)
3. C. S. Clay, H. Medwin, **'Acoustical Oceanography : Principles and Applications'**, *John Wiley & Sons*, (1997)
4. L.M. Brekhovskikh, Y.P. Lysanov, **'Fundamental of ocean acoustics',** *Springer*, (2003)

OE2101 Data Analytics

Teaching Scheme:	**Examination Scheme:**
Lectures: 3 Hrs/Week	In-Semester: **50** Marks
	End-Semester: **50** Marks
	Credits: 3

Course Objectives:

1. To introduce the basics concept of data analytics in context of business and society
2. To use data analytics to explore and gain a broad understanding of a dataset
3. To understand the scope and limitations of several state-of-the-art data analytics methods
4. To understand the use of data analytics methods to make predictions for a dataset

Course Outcomes:

1. Explain the basics of statistical methods for identifying patterns in data and making inferences;
2. Identify and apply appropriate techniques (such as ML) and tools to solve actual data problems
3. Identify and apply the data analytics techniques real world problems
4. Know, understand and analyze the big data concept

Unit – I: Basics of statistics **(10)**

Descriptive Statistics : Basics of data analytics, Descriptive Statistics , Probability Distributions
Inferential Statistics : Inferential Statistics through hypothesis tests
Regression & ANOVA :Regression, ANOVA(Analysis of Variance)

Unit – II: Machine learning, Regression and classification **(12)**

Machine Learning: Introduction and Concepts :
Differentiating algorithmic and model based frameworks
Regression : Ordinary Least Squares, Ridge Regression, Lasso Regression,
K Nearest Neighbours Regression & Classification
Supervised Learning with Regression and Classification techniques -1
Bias-Variance Dichotomy, Model Validation Approaches, Logistic Regression, Linear Discriminant Analysis Quadratic Discriminant Analysis, Regression and Classification Trees
Support Vector Machines

Unit – III: Supervised and unsupervised learning **(08)**

Supervised Learning with Regression and Classification techniques -2
Ensemble Methods: Random Forest, Neural Networks Deep learning
Unsupervised Learning and Challenges for Big Data Analytics
Clustering , Associative Rule Mining , Challenges for big data analytics

Unit – IV: Prescriptive Analytics **(06)**

Prescriptive analytics
Creating data for analytics through designed experiments
Creating data for analytics through Active learning

Creating data for analytics through Reinforcement learning
Reference Books:
1. H. Trevor, **'The elements of statistical learning'**, *Springer*, (2nd edition), (2009). 2. S. Montgomery, Douglas C., G. C. Runger, **'Applied statistics and probability for engineers'**, *John Wiley & Sons*, (6th edition), (2014) 3. J. Han, Micheline Kamber, **'Data mining: concepts and techniques'**, *Morgan Kaufmann Publisher*, (3rd edition), (2011) 4. P. Kulkarni, **'Reinforcement and systemic machine learning for decision making'**, *Wiley*, (2012) 5. R. Sharda, D. Delen, & E. Turban, **'Business Intelligence and Analytics. Systems for Decision Support'**, *Pearson/Prentice Hall*, (10th Edition), (2015).

OE2101 Cyber Security

Teaching Scheme:	**Examination Scheme:**
Lectures: 3 Hrs/Week	In-Semester: **50** Marks
	End-Semester: **50** Marks
	Credits: 3

Course Objectives:

1.To know the basics of network models and the protocols

2.To understand threats to data and ways to secure the data

3.To understand the threats to the network and the ways to secure the network

4.To understand the importance of IPR, security audits

Course Outcomes:

1.Recognizing the need of security for data and network

2.Understanding of threats for the data and network

3. Knowing different ways to secure data , wired and wireless network

4.Understand and analyze cyber crimes, cyber laws, IPR, Security audits

Unit – I: Network Basics, attacks and security concepts, cryptography **(14)**

Different Network Topologies, Types of Networks , OSI and TCP/IP model, functions of each layer with the protocols

Information Security Concepts: Information Security Overview: Background and Current Scenario, Types of Attacks, Goals for Security, E-commerce Security, Computer Forensics, steganography

Security Threats and Vulnerabilities: Overview of Security threats, Weak / Strong Passwords and Password Cracking, Insecure Network connections, Malicious Code , Programming Bugs

Cryptography / Encryption: Introduction to Cryptography / Encryption, Digital Signatures , Public Key infrastructure, Applications of Cryptography, Tools and techniques of Cryptography

Unit – II: Security management, laws and standards **(06)**

Security Management:

Security Management Practices: Overview of Security Management, Information Classification Process , Security Policy, Risk Management, Security Procedures and Guidelines , Business Continuity and Disaster Recovery, Ethics and Best Practices, Security Laws and Standards

Security Laws and Standards : Security Assurance, Security Laws, IPR, International Standards, Security Audit ,SSE-CMM / COBIT etc

Unit – III: Information and Network Security **(08)**

Access Control and Intrusion Detection : Overview of Identification and Authorization, Overview

of IDS, Intrusion Detection Systems and Intrusion Prevention Systems Server Management and Firewalls : User Management, Overview of Firewalls, Types of Firewalls

DMZ and firewall features Security for VPN and Next Generation Technologies: VPN Security, Security in Multimedia, networks , Various Computing Platforms: HPC, Cluster and Computing Grids, Virtualization and Cloud Technology and Security

Unit – IV: System and application security	**(08)**

System and Application Security : Security Architectures and Models: Security Architectures and Models: Designing Secure Operating Systems, Controls to enforce security services, Information Security Models System Security : Desktop Security, email security: PGP and SMIME , Web Security: web authentication, SSL and SET, Database Security OS Security Vulnerabilities, updates and patches, OS integrity checks, Anti-virus software , Configuring the OS for security, OS Security Vulnerabilities, updates and patches, Components of wireless networks , Security issues in wireless

Text Books:

1. D. Stinson, **'Cryptography – Theory and Practice'**, *CRC Press*, (3rd edition), (2006).
2. C. P. Pfleeger, S. L. Pfleeger, **'Analysing Computer security: A Threat/vulnerability/countermeasure approach'**, *Pearson Publication*, (2012)
3. M. T. Britz, **'Computer Forensics And Cyber Crime: An Introduction'**, *Prentice Hall* , (3rd edition), (2013)
4. N. Godbole , S. Belapure, **'Cyber Security: Understanding Cyber Crimes, Computer Forensics And Legal Perspectives'**, *Wiley India*, (2011)
5. K. K., **'Cyber Laws: Intellectual Property And E-Commerce Security'**, *Dominant Pub*, (2010).