M.Tech (Signal Processing)

Programme Syllabus

(From First Semester to Fourth Semester Effective from the Academic Year 2018-20)

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

SRI VENKATESWARA UNIVERSITY COLLEGE OF ENGINEERING

(AUTONOMUS)

SRI VENKATESWARA UNIVERSITY

TIRUPATI-517502 (A.P), INDIA.

Department of ECE M.Tech (Signal Processing)

DEPARTMENT of ECE

VISION

To be a lead department imparting quality and value embedded higher education and research emphasizing freedom of learning and practice**.**

MISSION

- Transforming students into full-fledged professionals and to become leaders in dynamic global environment.
- Augmenting knowledge and technologies in rapidly advancing fields of Electronics and Communication Engineering.
- Promoting in depth research and create Centre of excellence in thrust areas.

Programme Educational Objectives

1. To pursue advanced research in nationally reputed institutions.

2. To pursue career in Premier organizations, Public/Private Sectors in the domain of Communication Engineering.

Program Outcomes (POs)

a. Ability to apply the knowledge of science, mathematics, and engineering principles for developing problems solving attitude.
b. Ability to identify, formulate and solve engineering problems in the signal processing areas such as Developing robust and problem specific algorithms for acquisition, processing, analysis, synthesis of signals, to be applied in Signal Processing, Machine Vision and Communication Networks.
c. Ability to understand and use different software tools in the domain of signal processing. Analysis and Verification of algorithms, Functional and timing Simulation on platforms like MATLAB, code composer studio and assembly language.
d. Ability to design and conduct experiments, analyze and interpret data, imbibe programming skills for development of simulation experiments.
e. Ability to function as a member of a multidisciplinary team with sense of ethics, integrity and social responsibility.

Abstract about M.Tech syllabus in ECE

Department of Electronics and Communication Engineering is offering two MTech programmes, one in Communication systems and second in Signal Processing. The syllabus revision was carried out in 2018 as per AICTE model curriculum. A standard academic format common for all PG programmes describing numbers of credits, weightage for lecture, laboratories work and projects have been fixed considering the scope of study. The position and sequence of study of core courses and elective courses are made to ensure sequential and integral learning. The focus on advance study in core courses through theory and laboratories work supported by study on relevant programme specific electives are incorporated. The selection of unique courses in the basket of elective is a special feature of curricula ensuring flexibility and diversity. The emphasis on understanding advanced concepts of PG course is ensured through elaborate practical work conducted through actual and virtual laboratory experiments. The concept of designing experiments and developing concept application is made part of learning process. The PG course is spread over two years in four semesters and inclusion of mini project, audit courses, open electives and dissertation are the special features of the curriculum. The contents of course are unitized to facilitate its execution. The list of suggested reading is also made part of the curriculum. The students are asked to learn IPR/ research methodology to understand importance and process of creation of patents through research. The introduction of two Audit courses covering subjects of developing desired attitude among the learners is on the line of initiatives such as Unnat Bharat Abhiyan, Yoga, Value education, Disaster management, Sanskrit, Pedagogy, Constitution of India, Personality development through Indian culture etc. The introduction of mini projects ensures preparedness of students to undertake major projects/dissertation. The courses included under open electives are of importance in the context of special skill development and they are on Business analytics, industrial safety, operation research and cost management of engineering project. These courses shall make students capable to work in industrial environment. The dissertation/major project work of PG programme of one-year duration is given strong weightage in the curriculum. It is expected to undertake industrially relevant problem to develop an optimal solution through extensive research work. The students and faculty can design the research project in consultant with industry preferably in the region. The planning of laboratory work/ modelling/ computational work with execution schedule is suggested at the being of the programme to ensure expected outcome. This will lead to creation of patents from the result of the programme.

SRI VENKATESWARA UNIVERSITY COLLEGE OF ENGINEERING: TIRUPATI – 517 502

Department of Electronics and Communication Engineering-Scheme of Instruction- (CBCS) effective from the Academic Year 2018-19

M.Tech (PG) (Electronics and Communication Engineering)

Specialization: Signal Processing

I Semester

Course Code	Course Title	Scheme of Instruction (Hours/Week)				No. of Credits	Scheme of Evaluation		
		Lecture	Tutorial	Practical	Total		Sessional Marks	Semester End Examination Marks	Total
Program core									
SPPC 01	Advanced Digital Signal Processing	3			3	3	40	60	100
SPPC 02	Digital Image Video Processing	3			3	3	40	60	100
Program Elective- I (Any one of the following)		3			3	3	40	60	100

SPPE 11	DSP Architecture								
SPPE 12	Computer Vision								
SPPE 13	Artificial Intelligence								
Program Elective- II (Any one of the following)		3			3	3	40	60	100
SPPE 21	Joint time frequency analysis and multiresolution analysis(JTFA and MRA)								
SPPE 22	Voice and Data Networks								
SPPE 23	Audio Video Coding & Compression								
Program Practicals									
SPCP 01	Advanced Digital Signal Processing Lab			4	4	2	40	60	100
SPCP 02	Digital Image Video Processing Lab			4	4	2	40	60	100
Mandatory course									
PGMC 01	Research Methodology and IPR	2			2	2	40	60	100
Audit Course – I (Any one of the following)		2			2				
PGPA11	English and Research Paper Writing								
PGPA12	Disaster Management								
PGPA13	Sanskrit for Technical Knowledge								
PGPA14	Value Education								
Total		16	-	8	24	18	280	420	700

II Semester

Course Code	Course Title	Scheme of Instruction (Hours/Week)				No. of Credits	Scheme of Evaluation		
		Lecture	Tutorial	Practical	Total		Sessional Marks	Semester End Examination Marks	Total
Program core									
SPPC 03	Pattern Recognition and Machine Learning	3			3	3	40	60	100
SPPC 04	Detection and Estimation Theory	3			3	3	40	60	100

Program Elective- III (Any one of the following)		3			3	3	40	60	100
SPPE 31	Advanced Computer Architecture								
SPPE 32	IOT and Applications								
SPPE 33	Digital Design and Verification								
Program Elective- IV (Any one of the following)		3			3	3	40	60	100
SPPE 41	Multispectral Signal Analysis								
SPPE 42	Audio Processing								
SPPE 43	Biomedical Signal Processing								
Program practicals									
SPCP 03	Pattern Recognition and Machine Learning Lab			4	4	2	40	60	100
SPCP 04	Detection and Estimation Theory Lab			4	4	2	40	60	100
Program Audit Course – II (Any one of the following)		2			2				
PGPA21	Constitution of India								
PGPA22	Pedagogy Studies								
PGPA23	Stress Management by Yoga								
PGPA24	Personality Development through Life Enlightenment Skills								
SPMP 01	Mini Project with seminar			4	4	2	100		100
Total		14		12	26	18	340	360	700

III Semester

Course Code	Course Title	Scheme of Instruction (Hours/Week)				No. of Credits	Scheme of Evaluation		
		Lecture	Tutorial	Practical	Total		Sessional Marks	Semester End Examination Marks	Total

Program Elective- V (Any one of the following)		3			3	3	40	60	100
SPPE 51	Remote Sensing								
SPPE 52	Optimization Techniques								
SPPE 53	Modelling and Simulation Techniques								
Open Elective- I (Any one of the following)		3			3	3	40	60	100
PGOE 11	Business Analytics								
PGOE 12	Industrial Safety								
PGOE 13	Operation Research								
PGOE 14	Cost Management of Engineering Projects								
PGOE 15	Composite Materials								
PGOE 16	Waste to Energy								
SPPD 01	Dissertation Phase-I			20	20	10	40	60	100
Total		6		20	26	16	120	180	300

IV Semester

Course Code	Course Title	Scheme of Instruction (Hours/Week)				No. of Credits	Scheme of Evaluation		
		Lecture	Tutorial	Practical	Total		Sessional Marks	Semester End Examination Marks	Total
SPPD 02	Dissertation Phase- II			32	32	16	40	60	100
Total				32	32	16	40	60	100

SPPC01 Advanced Digital Signal Processing

Teaching Scheme

Instruction Hours/week : 3(L) **Credits : 3**
Sessional Marks : 40 **Semester-end Examination : 60**

Course Objectives:

- To know the theory of different filters and algorithms
- To know the theory of multirate DSP, solve numerical problems and write algorithms
- To know the theory of prediction and solution of normal equations and DSP applications.

Syllabus Contents:

Unit 1

Multi rate DSP, Decimators and Interpolators, Sampling rate conversion, multistage decimator & interpolator, poly phase filters, QMF, digital filter banks, Applications in sub-band coding.

Unit 2

Linear prediction & optimum linear filters, stationary random process, forward-backward linear prediction filters, solution of normal equations, AR Lattice and ARMA Lattice-Ladder Filters, Wiener Filters for Filtering and Prediction.

Unit 3

Adaptive Filters, Applications, Gradient Adaptive Lattice, Minimum mean square criterion, LMS algorithm, Recursive Least Square algorithm

Unit 4

Estimation of Spectra from Finite-Duration Observations of Signals. Nonparametric Methods for Power Spectrum Estimation, Parametric Methods for Power Spectrum Estimation, Minimum-Variance Spectral Estimation, Eigenanalysis Algorithms for Spectrum Estimation.

Unit 5

Application of DSP & Multi rate DSP, Application to Radar, introduction to wavelets, application to image processing, design of phase shifters, DSP in speech processing & other applications

References:

1.J.G.Proakis and D.G.Manolakis"Digital signal processing: Principles, Algorithm and Applications", 4th Edition, Prentice Hall, 2007.
2.N. J. Fliege, "Multirate Digital Signal Processing: Multirate Systems -Filter Banks – Wavelets", 1st Edition, John Wiley and Sons Ltd, 1999.
3.Bruce W. Suter, "Multirate and Wavelet Signal Processing",1st Edition, Academic Press, 1997.
4.M. H. Hayes, "Statistical Digital Signal Processing and Modeling", John Wiley & SonsInc., 2002.
5.S.Haykin, "Adaptive Filter Theory", 4th Edition, Prentice Hall, 2001.
6.D.G.Manolakis, V.K. Ingle and S.M.Kogon, "Statistical and Adaptive Signal Processing", McGraw Hill, 2000.

Course Outcomes

COs	Description of CO's
CO1	To understand theory of different filters and algorithms
CO2	To understand theory of multirate DSP, solve numerical problems and write algorithms
CO3	To understand theory of prediction and solution of normal equations
CO4	To know applications of DSP at block level

CO-PO Mapping

POs / COs	POa	POb	POc	POd	POe

CO1	1	3	3	3	1
CO2	3	3	3	2	1
CO3	3	3	1	1	1
CO4	1	3	2	3	1

SPPC02 Digital Image and Video Processing

Teaching Scheme

Instruction Hours/week : 3(L) **Credits : 3**
Sessional Marks : 40 **Semester-end Examination : 60**

Course Outcomes:

At the end of this course, students will be able to

- Learn different techniques for image enhancement, video and image recovery
- Understand techniques for image and video segmentation
- Study techniques for image and video compression and objectrecognition

Syllabus Contents:

Unit 1

Digital Image and Video Fundamentals: Digital image and video fundamentals and formats, 2-D and 3-D sampling and aliasing, 2-D/3-D filtering, image decimation/interpolation, video sampling and interpolation, Basic image processing operations, Image Transforms,Need for image transforms, DFT, DCT, Walsh, Hadamard transform, Haar transform, Wavelet transform

Unit 2

Image and Video Enhancement and Restoration: Histogram, Point processing, filtering, image restoration, algorithms for 2-D motion estimation, change detection, motion-compensated filtering, frame rate conversion, deinterlacing, video resolution enhancement, Image and Video restoration (recovery).

Colour image Processing: Colour fundamentals, Colour models, Conversion of colour models, Pseudo colour image processing, Full colour processing

Unit 3

Image and Video Segmentation: Discontinuity based segmentation- Line detection, edge detection, thresholding, Region based segmentation, Scene Change Detection, Spatiotemporal Change Detection, Motion Segmentation, Simultaneous Motion Estimation and Segmentation Semantic Video Object Segmentation, Morphological image processing.

Unit 4

Image and Video Compression: Lossless image compression including entropy coding, lossy image compression, video compression techniques, and international standards for image and video compression (JPEG, JPEG 2000, MPEG-2/4, H.264, SVC), Video Quality Assessment

Unit 5

Object recognition: Image Feature representation and description-boundary representation, boundary descriptors, regional descriptors, feature selection techniques, introduction to classification, supervised and unsupervised learning, Template matching, Bayes classifier

References:

1.Ed. Al Bovik ,"Handbook of Image and Video Processing", 2nd Edition, Academic Press, 2000.

2.J. W. Woods, "Multidimensional Signal, Image and Video Processing and Coding", 2nd Edition, Academic Press, 2011.

3. Rafael C. Gonzalez and Richard E. Woods," Digital Image Processing", 3rd Edition, Prentice Hall, 2008.

4.M. Tekalp, "Digital Video Processing", 2nd Edition, Prentice Hall, 2015.

5.S. Shridhar, "Digital Image Processing", 2nd Edition, Oxford University Press, 2016.

Course Outcomes

COs	Description of CO's
CO1	Learn different techniques for image enhancement, video and image recovery
CO2	Understand techniques for image and video segmentation
CO3	Study techniques for image and video compression and objectrecognition

CO-PO Mapping

POs / COs	POa	POb	POc	POd	POe
CO1	3	3	3	3	1
CO2	3	3	3	3	1
CO3	3	3	3	3	1

SPPE11 DSP Architecture

Teaching Scheme

Instruction Hours/week : 3(L) **Credits : 3**
Sessional Marks : 40 **Semester-end Examination : 60**

Course Objectives:

- To identify and formalize architectural level characterization of P-DSP hardware

- To be able to design, programming (assembly and C), and testing code using Code Composer Studio environmentDSP hardware for Control, Audio and Video Signal processing applications

Syllabus Contents:

Unit 1
Programmable DSP Hardware: Processing Architectures (von Neumann, Harvard), DSP core algorithms (FIR, IIR, Convolution, Correlation, FFT), IEEE standard for Fixed and Floating Point Computations, Special Architectures Modules used in Digital Signal Processors (like MAC unit, Barrel shifters), On-Chip peripherals, DSP benchmarking.

Unit 2
Structural and Architectural Considerations: Parallelism in DSP processing, Texas Instruments
TMS320 Digital Signal Processor Families, Fixed Point TI DSP Processors: TMS320C1X and TMS320C2X Family,TMS320C25 –Internal Architecture, Arithmetic and Logic Unit, Auxiliary Registers, Addressing Modes (Immediate, Direct and Indirect, Bit-reverse Addressing), Basics of TMS320C54x and C55x Families in respect of Architecture improvements and new applications fields, TMS320C5416 DSP Architecture, Memory Map, Interrupt System, Peripheral Devices, Illustrative Examples for assembly coding.

Unit 3
VLIW Architecture: Current DSP Architectures, GPUs as an alternative to DSP Processors, TMS320C6X Family, Addressing Modes, Replacement of MAC unit by ILP, Detailed study of ISA, Assembly Language Programming, Code Composer Studio, Mixed Cand Assembly Language programming, On-chip peripherals, Simple applications developments as an embedded environment.

Unit 4
Multi-core DSPs: Introduction to Multi-core computing and applicability for DSP hardware, Concept of threads, introduction to P-thread, mutex and similar concepts, heterogeneous and homogenous multi-core systems, Shared Memory parallel programming –OpenMP approach of parallel programming, PRAGMA directives, OpenMP Constructs for work sharing like for loop, sections, TI TMS320C6678 (Eight Core subsystem).

Unit 5
FPGA based DSP Systems: Limitations of P-DSPs, Requirements of Signal processing for Cognitive Radio (SDR), FPGA based signal processing design-case study of a complete design of DSP processor,High Performance Computing using P-DSP: Preliminaries of HPC, MPI, OpenMP, multicore DSP as HPC infrastructure.

References:

1.M. Sasikumar, D. Shikhare, Ravi Prakash, "Introduction to Parallel Processing", 1st Edition, PHI, 2006.

2.FayezGebali, "Algorithms and Parallel Computing",1st Edition, John Wiley & Sons, 2011

3.Rohit Chandra, Ramesh Menon, Leo Dagum, David Kohr, DrorMaydan, Jeff McDonald,"Parallel Programming in OpenMP", 1st Edition, Morgan Kaufman,2000.

4.AnnMelnichuk,Long Talk, "Multicore Embedded systems", 1st Edition, CRC Press,2010.

5.Wayne Wolf, "High Performance Embedded Computing: Architectures, Applications and Methodologies", 1st Edition, Morgan Kaufman, 2006.

6.E.S.Gopi, "Algorithmic Collections for Digital Signal Processing Applications Using MATLAB", 1st Edition, Springer Netherlands,2007.

Course Outcomes

COs	Description of CO's
CO1	Identify and formalize architectural level characterization of P-DSP hardware
CO2	Ability to design, programming (assembly and C), and testing code using Code Composer Studio environment
CO3	Deployment of DSP hardware for Control, Audio and Video Signal processing applications
CO4	Understanding of major areas and challenges in DSP based embedded systems

CO-PO Mapping

POs / COs	POa	POb	POc	POd	POe
CO1	3	3	3	3	2
CO2	3	3	3	3	2

CO3	3	3	3	3	2
CO4	3	3	3	3	2

SPPE12 Computer Vision

Teaching Scheme

Instruction Hours/week : 3(L) **Credits : 3**
Sessional Marks : 40 **Semester-end Examination : 60**

Course Outcomes:

At the end of this course, students will be able to

- Study the image formation models and feature extraction for computer vision
- Identify the segmentation and motion detection and estimation techniques
- Develop small applications and detect the objects in various applications

Syllabus Contents:

Unit 1

Image Formation Models: Monocular imaging system • Orthographic & Perspective Projection • Camera model and Camera calibration • Binocular imaging systems, Perspective, Binocular Stereopsis: Camera and Epipolar Geometry; Homography, Rectification, DLT, RANSAC, 3-D reconstruction framework; Auto-calibration. Apparel, Binocular Stereopsis: Camera and Epipolar Geometry; Homography, Rectification, DLT, RANSAC, 3-D reconstruction framework; Auto-calibration. Apparel, Stereo vision

Unit 2

Feature Extraction

Image representations (continuous and discrete) • Edge detection, Edge linking, corner detection, texture, binary shape analysis, boundary pattern analysis, circle and ellipse detection, Light at Surfaces; Phong Model; Reflectance Map; Albedo estimation; Photometric Stereo; Use of Surface Smoothness Constraint; Shape from Texture, color, motion and edges.

Unit 3

Shape Representation and Segmentation • Deformable curves and surfaces • Snakes and activecontours • Level set representations • Fourier and wavelet descriptors • Medial representations • Multi-resolution analysis, Region Growing, Edge Based approaches to segmentation, Graph-Cut, Mean-Shift, MRFs, Texture Segmentation

Unit 4

Motion Detection and Estimation • Regularization theory • Optical computation • Stereo Vision

Motion estimation, Background Subtraction and Modelling, Optical Flow, KLT, Spatio-Temporal Analysis, Dynamic Stereo; Motion parameter estimation • Structure from motion, Motion Tracking in Video

Unit 5

Object recognition • Hough transforms and other simple object recognition methods, Shape correspondence and shape matching, Principal component analysis, Shape priors for recognition.

Applications of Computer Vision: Automated Visual Inspection, Inspection of Cereal Grains, Surveillance, In-Vehicle Vision Systems, CBIR, CBVR, Activity Recognition, computational photography, Biometrics, stitching and document processing

References:

1.D. Forsyth and J. Ponce,"Computer Vision - A modern approach", 2nd Edition, Pearson Prentice Hall, 2012

2.Szeliski, Richard, "Computer Vision: Algorithms and Applications", 1st Edition, Springer-Verlag London Limited, 2011.

3.Richard Hartley and Andrew Zisserman, "Multiple View Geometry in Computer Vision", 2nd Edition, Cambridge University Press, 2004.

4.K. Fukunaga,"Introduction to Statistical Pattern Recognition",2nd Edition, Morgan Kaufmann, 1990.

5.Rafael C. Gonzalez and Richard E. Woods," Digital Image Processing", 3rd Edition, Prentice Hall, 2008.

6.B. K. P. Horn, “Robot Vision”, 1st Edition, McGraw-Hill, 1986.
7.E. R. Davies“Computer and Machine Vision: Theory, Algorithms, Practicalities”, 4th Edition, Elsevier Inc,2012.

Course Outcomes

COs	Description of CO’s
CO1	Study the image formation models and feature extraction for computer vision
CO2	Identify the segmentation and motion detection and estimation techniques
CO3	Develop small applications and detect the objects in various applications

CO-PO Mapping

POs / COs	POa	POb	POc	POd	POe
CO1	3	2	3	3	1
CO2	3	2	2	2	1
CO3	2	2	2	2	1

SPPE13 Artificial Intelligence

Teaching Scheme

Instruction Hours/week : 3(L) **Credits : 3**

Sessional Marks : 40 **Semester-end Examination : 60**

Course Outcomes:

Syllabus Contents:

Unit 1

What is AI (Artificial Intelligence)? : The AI Problems, The Underlying Assumption, What are AI Techniques, The Level Of The Model, Criteria For Success, Some General References, One Final WordProblems, State Space Search & Heuristic Search Techniques: Defining The Problems As A State Space Search, Production Systems, Production Characteristics, Production System Characteristics, And Issues In The Design Of Search Programs, Additional Problems. Generate-And-Test, Hill Climbing, Best-First Search, Problem Reduction, Constraint Satisfaction, Means-Ends Analysis.

Unit 2

Knowledge Representation Issues: Representations And Mappings, Approaches To Knowledge
Representation. Using Predicate Logic: Representation Simple Facts In Logic, Representing Instance And Isa Relationships, Computable Functions And Predicates, Resolution. Representing Knowledge Using Rules: Procedural Versus Declarative Knowledge, Logic Programming, Forward Versus Backward Reasoning.

Unit 3

Symbolic Reasoning Under Uncertainty: Introduction To No monotonic Reasoning, Logics For Non-monotonic Reasoning. Statistical Reasoning: Probability And Bays' Theorem, Certainty.Factors And Rule-Base Systems, Bayesian Networks, Dempster Shafer Theory.
Fuzzy Logic. Weak Slot-and-Filler Structures: Semantic Nets, Frames. Strong Slot-and-Filler
Structures: Conceptual Dependency, Scripts, CYC

Unit 4

Game Playing: Overview, And Example Domain: Overview, MiniMax, Alpha-Beta Cut-off, Refinements, Iterative deepening, The Blocks World, Components Of A Planning System, Goal Stack Planning, Nonlinear Planning Using Constraint Posting, Hierarchical Planning, Reactive Systems, Other Planning Techniques. Understanding: What is understanding? What makes it hard? As constraint satisfaction

Unit 5

Natural Language Processing: Introduction, Syntactic Processing, Semantic Analysis, Semantic Analysis, Discourse And Pragmatic Processing, Spell Checking Connectionist Models: Introduction: Hopfield Network, Learning In Neural Network, Application of Neural Networks, Recurrent Networks, Distributed Representations, Connectionist AI And Symbolic AI.

References:

1.Elaine Rich and Kevin Knight "Artificial Intelligence", 2nd Edition, Tata Mcgraw-Hill, 2005.
2.StuartRussel and Peter Norvig, "Artificial Intelligence: A Modern Approach", 3rd Edition, Prentice Hall, 2009.

SPPE21 Joint Time Frequency Analysis & Multi Resolution Analysis

Teaching Scheme

Instruction Hours/week : 3(L) **Credits : 3**
Sessional Marks : 40 **Semester-end Examination : 60**

Course Outcomes:

At the end of this course, students will be able to

- Introduction to Transforms in signal processing
- To understand Time -Frequency Analysis & Multiresolution
- Analysis Study of Wavelets and its Applications

Syllabus Contents:

Unit 1

Introduction Review of Fourier Transform, Parseval Theorem and need for joint time-frequency Analysis. Concept of non-stationary signals, Short-time Fourier transforms (STFT), Uncertainty Principle, and Localization/Isolation in time and frequency, Hilbert Spaces, Banach Spaces, and Fundamentals of Hilbert Transform.

Unit 2

Bases for Time-Frequency Analysis: Wavelet Bases and filter Banks, Tilings of Wavelet Packet and Local Cosine Bases, Wavelet Transform, Real Wavelets, Analytic Wavelets, Discrete Wavelets, Instantaneous Frequency, Quadratic time-frequency energy, Wavelet Frames, Dyadic wavelet Transform, Construction of Haar and Roof scaling function using dilation equation and graphical method.

Unit 3

Multiresolution Analysis: Haar Multiresolution Analysis, MRA Axioms, Spanning Linear Subspaces, nested subspaces, Orthogonal Wavelets Bases, Scaling Functions, Conjugate Mirror Filters, Haar 2-band filter Banks, Study of up samplers and down samplers, Conditions for alias cancellation and perfect reconstruction, Discrete wavelet transform and relationship with filter Banks, Frequency analysis of Haar 2-band filter banks, scaling and wavelet dilation equations in time and frequency domains, case study of decomposition and reconstruction of given signal using orthogonal framework of Haar 2band filter bank.

Unit 4

Wavelets: Daubechies Wavelet Bases, Daubechies compactly supported family of wavelets; Daubechies filter coefficient calculations, Case study of Daub-4 filter design, Connection between Haar and Daub-4, Concept of Regularity, Vanishing moments. Other classes of wavelets like Shannon, Meyer, and Battle-Lamarie.

Unit 5

Bi-orthogonal wavelets and Applications: Construction and design. Case studies of biorthogonal 5/3 tap design and its use in JPEG 2000. Wavelet Packet Trees, Time-frequency localization, compactly supported wavelet packets, case study of Walsh wavelet packet bases generated using Haar conjugate mirror filters till depth level 3. Lifting schemes for generating orthogonal bases of second generation wavelets.
JTFA Applications: Riesz Bases, Scalograms, Time-Frequency distributions: fundamental
ideas, Applications: Speech,audio, image and video compression; signal denoising, feature extraction, inverse problem.

References:

1.S. Mallat, "A Wavelet Tour of Signal Processing," 2nd Edition, Academic Press, 1999.

2.L. Cohen, “Time-frequency analysis”, 1st Edition, Prentice Hall, 1995.
3.G.Strang and T. Q. Nguyen, “Wavelets and Filter Banks",2nd Edition, Wellesley Cambridge Press, 1998.
4.Daubechies, "Ten Lectures on Wavelets", SIAM, 1992.
5.P. P. Vaidyanathan, "Multirate Systems and Filter Banks", Prentice Hall, 1993.
6.M. Vetterli and J. Kovacevic, "Wavelets and Subband Coding", Prentice Hall, 1995

Course Outcomes

COs	Description of CO’s
CO1	Introduction to Transforms in signal processing
CO2	To understand Time -Frequency Analysis & Multiresolution
CO3	Analysis Study of Wavelets and its Applications

3.CO-PO Mapping

POs / COs	POa	POb	POc	POd	POe
CO1	3	3	3	3	1
CO2	3	2	2	3	1
CO3	2	2	2	2	1

SPE22 Voice and Data Networks

Teaching Scheme

Instruction Hours/week : 3(L) **Credits : 3**
Sessional Marks : 40 **Semester-end Examination : 60**

Course Objectives:

- To understand the Protocol, algorithms, trade-offs rationale,Routing, transport, DNS resolutions
- To gain knowledge in Network extensions and next generation architectures.

Syllabus Contents:

Unit 1

Network Design Issues, Network Performance Issues, Network Terminology, centralized and distributed approaches for networks design, Issues in design of voice and data networks.

Unit 2

Layered and Layer less Communication, Cross layer design of Networks, Voice Networks (wired and wireless) and Switching, Circuit Switching and Packet Switching, Statistical Multiplexing.

Unit 3

Data Networks and their Design, Link layer design- Link adaptation, Link Layer Protocols, Retransmission.Mechanisms (ARQ), Hybrid ARQ (HARQ), Go Back N, Selective Repeat protocols and their analysis.

Unit 4

Queuing Models of Networks , Traffic Models , Little's Theorem, Markov chains, M/M/1 and other Markov systems, Multiple Access Protocols , Aloha System , Carrier Sensing , Examples of Local area networks,

Unit 5

Inter-networking, Bridging, Global Internet, IP protocol and addressing , Sub netting , Classless Inter domain Routing (CIDR) , IP address lookup , Routing in Internet. End to End Protocols, TCP and UDP. Congestion Control, Additive Increase/Multiplicative Decrease, Slow Start, Fast Retransmit/ Fast Recovery,

Congestion avoidance, RED TCP Throughput Analysis, Quality of Service in Packet Networks,Network Calculus, Packet Scheduling Algorithms.

References:

1.D. Bertsekas and R. Gallager, “Data Networks”, 2nd Edition, Prentice Hall, 1992.

2.L. Peterson and B. S. Davie, “Computer Networks: A Systems Approach”,5th Edition, Morgan Kaufman, 2011.

3.Kumar, D. Manjunath and J. Kuri, “Communication Networking: An analytical approach”, 1st Edition, Morgan Kaufman, 2004.

4.Walrand,“Communications Network: A First Course”, 2nd Edition, McGraw Hill, 2002.

5.LeonardKleinrock, “QueueingSystems,Volume I: Theory”, 1st Edition, John Wiley and Sons, 1975.

6.Aaron Kershenbaum, “Telecommunication Network Design Algorithms”, McGraw Hill, 1993.

7.VijayAhuja, “Design and Analysis of Computer Communication Networks”, McGraw Hill, 1987

Course Outcomes

COs	Description of CO’s
CO1	Protocol, algorithms, trade-offs rationale
CO2	Routing, transport, DNS resolutions
CO3	Network extensions and next generation architectures.

3.CO-PO Mapping

POs / COs	POa	POb	POc	POd	POe
CO1	**3**	**2**	**3**	**3**	**1**
CO2	**2**	**2**	**2**	**2**	**1**

CO3	2	2	2	2	2

SPPE23 Audio Video Coding &Compression

Teaching Scheme

Instruction Hours/week : 3(L) **Credits : 3**
Sessional Marks : 40 **Semester-end Examination : 60**

Course Outcomes:

At the end of this course, students will be able to

- Familiarity to lossy and lossless compression systems.
- Study of Video coding techniques and standards.
- Understand audio coding and multimedia synchronization techniques.

Syllabus Contents:

Unit 1

Introduction to Multimedia Systems and Processing, Lossless Image Compression Systems Image Compression Systems, Huffman Coding, Arithmetic and Lempel-Ziv Coding, Other Coding Techniques

Unit 2

Lossy Image Compression Systems, Theory of Quantization, Delta Modulation and DPCM, Transform Coding & K-L Transforms, Discrete Cosine Transforms, Multi-Resolution Analysis, Theory of Wavelets, Discrete Wavelet Transforms, Still Image Compression Standards: JBIG and JPEG

Unit 3

Video Coding and Motion Estimation: Basic Building Blocks & Temporal Redundancy, Block based motion estimation algorithms, Other fast search motion estimation algorithms

Video Coding Standards MPEG-1 standards, MPEG-2 Standard, MPEG-4 Standard, H.261, H.263 Standards, H.264 standard

Unit 4

Audio Coding, Basic of Audio Coding, Audio Coding, Transform and Filter banks, Polyphase filter implementation, Audio Coding, Format and encoding, Psychoacoustic Models

Unit 5

Multimedia Synchronization, Basic definitions and requirements, References Model and Specification, Time stamping and pack architecture, Packet architectures and audio-video interleaving, Multimedia Synchronization, Playback continuity, Video Indexing And Retrieval: Basics of content based image retrieval, Video Content Representation, Video Sequence Query Processing

References:

1.Iain E.G. Richardson, "H.264 and MPEG-4 Video Compression", Wiley, 2003.
2.KhalidSayood, "Introduction to Data Compression", 4th Edition, Morgan Kaufmann, 2012
3.MohammedGhanbari, "Standard Codecs: Image Compression to Advanced Video Coding", 3rd Edition, The Institution of Engineering and Technology, 2011.
4.Julius O. Smith III, "Spectral Audio Signal Processing", W3K Publishing, 2011.
5.Nicolas Moreau, "Tools for Signal Compression: Applications to Speech and Audio Coding", Wiley, 2011.

Course Outcomes

COs	Description of CO's
CO1	Familiarity to lossy and lossless compression systems.
CO2	Study of Video coding techniques and standards.
CO3	Understand audio coding and multimedia synchronization techniques.

3.CO-PO Mapping

POs / COs	POa	POb	POc	POd	POe
CO1	3	3	3	3	1

CO2	3	3	3	2	1
CO3	3	3	2	2	1

SPCP01 Advanced Digital Signal Processing lab

Teaching Scheme

Instruction Hours/week : 4(P) **Credits : 2**
Sessional Marks : 40 **Semester-end Examination : 60**

Course Objectives:

- To design different digital filters in software and Apply various transforms in time and frequency
- To perform decimation and interpolation

List of Assignments:

1. Basic Signal Representation
2. Correlation Auto And Cross
3. Stability Using Hurwitz Routh Criteria
4. Sampling FFT Of Input Sequence
5. Butterworth Low pass And High pass Filter Design
6. Chebychev Type I,II Filter
7. State Space Matrix from Differential Equation
8. Normal Equation Using Levinson Durbin
9. ecimation And Interpolation Using Rationale Factors
10. Maximally Decimated Analysis DFT Filter
11. Cascade Digital IIR Filter Realization
12. Convolution And M Fold Decimation &PSD Estimator

13. Estimation Of PSD
14. Inverse Z Transform
15. Group Delay Calculation
16. Separation Of T/F
17. Parallel Realization of IIR filter

Course Outcomes

COs	Description of CO's
CO1	Design different digital filters in software
CO2	Apply various transforms in time and frequency
CO3	Perform decimation and interpolation

3.CO-PO Mapping

POs / COs	POa	POb	POc	POd	POe
CO1	**3**	**3**	**3**	**3**	**2**
CO2	**3**	**3**	**3**	**3**	**1**
CO3	**3**	**3**	**2**	**3**	**1**

SPCP02 Digital Image and Video Processing lab

Teaching Scheme

Instruction Hours/week : 4(P) **Credits : 2**

Sessional Marks : 40 **Semester-end Examination : 60**

Course Outcomes:

At the end of this course, students will be able to

- Perform image and video enhancement.
- Perform image and video segmentation
- Detect an object in an image/video

List of Assignments:

1. Perform basic operations on images like addition, subtraction etc.
2. Plot the histogram of an image and perform histogram equalization
3. Implement segmentation algorithms
4. Perform video enhancement
5. Perform video segmentation
6. Perform image compression using lossy technique
7. Perform image compression using lossless technique
8. Perform image restoration
9. Convert a colour model into another
10. Calculate boundary features of an image
11. Calculate regional features of an image
12. Detect an object in an image/video using template matching/Bayes classifier

Course Outcomes

COs	Description of CO's
CO1	Perform image and video enhancement
CO2	Perform image and video segmentation
CO3	Detect an object in an image/video

3.CO-PO Mapping

POs / COs	POa	POb	POc	POd	POe
CO1	3	3	2	3	2
CO2	3	3	3	3	1
CO3	3	3	3	3	1

PGPC 01 Research Methodology and IPR

Instruction Hours/week : 2(L) **Credits : 2**
Sessional Marks : 40 **Semester-end Examination : 60**

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

UNIT III

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 IV

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. 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.

6.Niebel , "Product Design", McGraw Hill, 1974.

7.Asimov , "Introduction to Design", Prentice Hall, 1962.

8.Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in New

Technological Age", 2016.
9.T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008

Course Outcomes:

At the end of this course, students will be able to

1. Understand research problem formulation.
2. analyze research related information
3. follow research ethics
4. Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
5. Understand 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.
6. understand that IPR protection provides an incentive to inventors for further research work andinvestment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

PGPA11 ENGLISH FOR RESEARCH PAPER WRITING

Instruction Hours/week : 2(L) **Credits : 2**
Sessional Marks : 100 **Semester-end Examination : -**

Course objectives:

Students will be able to

1. Understand that how to improve your writing skills and level of readability
2. Learn about what to write in each section
3. Understand the skills needed when writing a Title Ensure the good quality of paper at very first-time submission

UNIT I

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction

UNIT II

Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.

UNIT III

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

UNIT IV

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

UNIT V

Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission

References :

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'sbook .
4. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011

PGPA12 DISASTER MANAGEMENT

Instruction Hours/week : 2(L) **Credits : 2**
Sessional Marks : 100 **Semester-end Examination : -**

Course Objectives:

Students will be able to:

1. Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
2. Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
3. Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
4. Critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in

UNIT I

Introduction

Disaster: Definition, Factors And Significance; Difference Between Hazard And Disaster; natural and Manmade Disasters: Difference, Nature, Types And Magnitude.

UNIT II

Repercussions Of Disasters And Hazards

Economic Damage, Loss Of Human And Animal Life, Destruction Of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Manmade disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.

UNIT III

Disaster Preparedness And Management Preparedness

Monitoring Of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk: Application Of Remote Sensing, Data from Meteorological And Other Agencies, Media Reports: Governmental And Community Preparedness.

UNIT IV

Risk Assessment Disaster Risk
Concept And Elements, Disaster Risk Reduction, Global And National Disaster Risk Situation. Techniques Of Risk Assessment, Global Co-Operation In Risk Assessment And Warning, People's Participation In Risk Assessment. Strategies for Survival.

UNIT V

Disaster Mitigation Meaning
Concept And Strategies Of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation And Non-Structural Mitigation, Programs Of Disaster Mitigation In India.

References:

1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'New Royal book Company.
2. Sahni, PardeepEt.Al. (Eds.)," Disaster Mitigation Experiences And Reflections", Prentice Hall Of India, New Delhi.
3. Goel S. L. , Disaster Administration And Management Text And Case Studies" ,Deep &Deep Publication Pvt. Ltd., New Delhi.

PGPA 13 SANSKRIT FOR TECHNICAL KNOWLEDGE

Instruction Hours/week : 2(L) **Credits : 2**
Sessional Marks : 100 **Semester-end Examination : -**

Course Objectives

1. To get a working knowledge in illustrious Sanskrit, the scientific language in the world
2. Learning of Sanskrit to improve brain functioning
3. Learning of Sanskrit to develop the logic in mathematics, science & other subjects enhancing the memory power
4. The engineering scholars equipped with Sanskrit will be able to explore the huge knowledge from ancient literature

UNIT I

Alphabets in Sanskrit, Past/Present/Future Tense

UNIT II

Simple Sentences Order

UNIT III

Introduction of roots

UNIT IV

Technical information about Sanskrit Literature

UNIT V

Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics

References:

1. "Abhyaspustakam" – Dr.Vishwas, Samskrita-Bharti Publication, New Delhi
2. "Teach Yourself Sanskrit" PrathamaDeeksha-VempatiKutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication
3. "India's Glorious Scientific Tradition" Suresh Soni, Ocean books (P) Ltd., New Delhi.

Course Outcomes:

Students will be able to
1. Understanding basic Sanskrit language
2. Ancient Sanskrit literature about science & technology can be understood

3. Being a logical language will help to develop logic in students

PGPA14 VALUE EDUCATION

Instruction Hours/week : 2(L) **Credits : 2**
Sessional Marks : 100 **Semester-end Examination : -**

Course Objectives:
Students will be able to

1.understand value of education and self- development
2. imbibe good values in students
3. know about the importance of character

UNIT I

values and self-development –Social values and individual attitudes. Work ethics, Indian vision of humanism.Moral and non- moral valuation.Standards and principles. Value judgements

UNIT II

Importance of cultivation of values.Sense of duty.Devotion, Self-reliance.Confidence, Concentration.Truthfulness, Cleanliness.Honesty, Humanity.Power of faith, National Unity.
Patriotism. Love for nature ,Discipline

UNIT III

Personality - Soul and Scientific attitude. Positive Thinking.Integrity and discipline. Punctuality, Love and Kindness, Avoid fault Thinking. Free from anger, Dignity of labour.

UNIT IV

Behavior Development, Universal brotherhood and religious tolerance.True friendship. Happiness Vs suffering, love for truth. Aware of self-destructive habits.Association and Cooperation. Doing best for saving nature

UNIT V

Character and Competence, Holy books vs Blind faith.Self-management and Good health.Science of reincarnation. Equality, Nonviolence ,Humility, Role of Women. All religions and same message. Mind your Mind, Self-control. Honesty, Studying effectively

References:

1 Chakroborty, S.K. “Values and Ethics for organizations Theory and practice”, Oxford University Press, New Delhi

Course outcomes:

Students will be able to

1.Knowledge of self-development

2.Learn the importance of Human values

3.Developing the overall personality

Semester - II

SPPC03 Pattern Recognition and Machine Learning

Teaching Scheme

Instruction Hours/week : 3(L) **Credits : 3**
Sessional Marks : 40 **Semester-end Examination : 60**

Course Objectives:

- To study the parametric and linear models for classification and design neural network and SVM for classification
- To develop machine independent and unsupervised learning techniques.

Syllabus Contents:

Unit 1

Introduction to Pattern Recognition: Problems, applications, design cycle, learning andadaptation, examples, Probability Distributions, Parametric Learning - Maximum likelihood and Bayesian Decision Theory- Bayes rule, discriminant functions, loss functions and Bayesian error analysis

Unit 2

Linear models: Linear Models for Regression, linear regression, logistic regression LinearModels for Classification

Unit 3

Neural Network: perceptron, multi-layer perceptron, back propagation algorithm, error surfaces,practical techniques for improving back propagation, additional networks and training methods, Adaboost, Deep Learning

Unit 4

Linear discriminant functions - decision surfaces, two-category, multi-category, minimum-squared error procedures, the Ho-Kashyap procedures, linear programming algorithms, Support vector machine

Unit 5

Algorithm independent machine learning – lack of inherent superiority of any classifier, biasand variance, re-sampling for classifier design, combining classifiers

Unsupervised learning and clustering – k-means clustering, fuzzy k-means clustering,hierarchical clustering

References:

1.Richard O. Duda, Peter E. Hart, David G. Stork, "Pattern Classification", 2nd Edition John Wiley & Sons, 2001.
2.Trevor Hastie, Robert Tibshirani, Jerome H. Friedman, "The Elements of Statistical Learning", 2nd Edition, Springer, 2009.
3.C. Bishop, "Pattern Recognition and Machine Learning", Springer, 2006.

Course Outcomes

COs	Description of CO's
CO1	Study the parametric and linear models for classification
CO2	Design neural network and SVM for classification
CO3	Develop machine independent and unsupervised learning techniques.

3.CO-PO Mapping

POs / COs	POa	POb	POc	POd	POe
CO1	3	3	3	3	2
CO2	3	3	3	3	1
CO3	3	2	2	3	1

SPPC04 Detection and Estimation Theory

Teaching Scheme

Instruction Hours/week : 3(L) **Credits : 3**
Sessional Marks : 40 **Semester-end Examination : 60**

Course Outcomes:

At the end of this course, students will be able to

- Understand the mathematical background of signal detection and estimation
- Use classical and Bayesian approaches to formulate and solve problems for signal detection and parameter estimation from noisy signals.
- Derive and apply filtering methods for parameter estimation.

Syllabus Contents:

Unit I

Review of Vector Spaces: Vectors and matrices: notation andproperties, orthogonality and linear independence, bases, distance properties, matrix operations, Eigen values and eigenvectors.

Properties of Symmetric Matrices: Diagonalizationof symmetric matrices, symmetric positive, definite and semi definite matrices, principal component analysis (PCA), singular valuedecomposition.

Unit II

Review of Gaussian variables and processes; problem formulation and objective of signal detection and signal parameter estimation in discrete-time domain.

Unit III

Statistical Decision Theory:

Bayesian, minimax, and Neyman-Pearson decision rules, likelihood ratio, receiver operating characteristics, composite hypothesis testing, locally optimum tests, detector comparison techniques, asymptotic relative efficiency.

Unit IV

Detection of Random Signals:

Estimator-correlator, linear model, general Gaussian detection, detection of Gaussian random signal with unknown parameters, weak signal detection.

Unit V

Estimation of Signal Parameters:

Minimum variance unbiased estimation, Fisher information matrix, Cramer-Rao bound, sufficient statistics, minimum statistics, complete statistics; linear models; best linear unbiased estimation; maximum likelihood estimation, invariance principle; estimation efficiency; Bayesian estimation: philosophy, nuisance parameters, risk functions, minimum mean square error estimation, maximum a posteriori estimation.

References:

1.H. L. Van Trees, "Detection, Estimation and Modulation Theory: Part I, II, and III", John Wiley, NY, 1968.

2.H. V. Poor, "An Introduction to Signal Detection and Estimation", Springer, 2/e, 1998.

3.Steven M. Kay, “Fundamentals of Statistical Signal Processing, Volume I: Estimation Theory”,Prentice Hall, 1993

4.Steven M. Kay, “Fundamentals of Statistical Signal Processing, Volume II: Detection Theory”, 1st Edition, Prentice Hall, 1998

5.ThomasKailath, BabakHassibi, Ali H. Sayed, “Linear Estimation”, Prentice Hall, 2000.

6.H. Vincent Poor, “An Introduction to Signal Detection and Estimation”, 2nd Edition, Springer, 1998.

Course Outcomes

COs	Description of CO’s
CO1	Understand the mathematical background of signal detection and estimation
CO2	Use classical and Bayesian approaches to formulate and solve problems for signal detection and parameter estimation from noisy signals.

CO3	Derive and apply filtering methods for parameter estimation.

3.CO-PO Mapping

POs / COs	POa	POb	POc	POd	POe
CO1	3	3	2	3	2
CO2	3	2	3	3	1
CO3	3	3	2	3	1

SPPE31 Advanced Computer Architecture

Teaching Scheme

Instruction Hours/week : 3(L) **Credits : 3**
Sessional Marks : 40 **Semester-end Examination : 60**

Course Outcomes:

At the end of this course, students will be able to

- Understand parallelism and pipelining concepts, the design aspects and challenges.
- Evaluate the issues in vector and array processors.
- Study and analyze the high performance scalable multithreaded and multiprocessor systems.
-

Syllabus Contents:

Unit 1

Parallel Processing and Pipelining Processing- Architectural Classification, Applications ofparallel processing, Instruction level Parallelism and Thread Level Parallelism, Explicitly Parallel Instruction Computing (EPIC) Architecture

Unit 2

Pipeline Architecture-Principles and implementation of Pipelining, Classification of pipeliningprocessors, Design aspect of Arithmetic and Instruction pipelining, Pipelining hazards and resolving techniques, Data buffering techniques, Advanced pipelining techniques, Software pipelining, VLIW (Very Long Instruction Word) processor.

Unit 3

Vector and Array Processor- Issues in Vector Processing, Vector performance modeling, SIMD Computer Organization, Static Vs Dynamic network, Parallel Algorithms for Array Processors: Matrix Multiplication.

Unit 4

Multiprocessor Architecture - Loosely and Tightly coupled multiprocessors, Inter Processorcommunication network, Time shared bus, Multiport Memory Model, Memory contention and arbitration techniques, Cache coherency and bus snooping, Massively Parallel Processors (MPP).

Unit 5

Multithreaded Architecture- Multithreaded processors, Latency hiding techniques, Principles ofmultithreading, Issues and solutions, Parallel Programming Techniques: Message passing program development.

Parallel algorithms for multiprocessors- Classification and performance of parallel algorithms,operating systems for multiprocessors systems, Message passing libraries for parallel programming interface, PVM (in distributed memory system), Message Passing Interfaces (MPI).

References:

1.Kai Hwang, Faye A. Briggs, “Computer Architecture and ParallelProcessing” McGraw Hill Education, 2012.
2.Kai Hwang, “Advanced Computer Architecture”, McGraw Hill Education, 1993.
3.William Stallings, “Computer Organization and Architecture, Designing for Performance” Prentice Hall, 6th edition, 2006.
4.Kai Hwang, “ScalableParallelComputing”, McGraw Hill Education, 1998.
5.Harold S. Stone “High-Performance Computer Architecture”, Addison-Wesley, 1993.

Course Outcomes

COs	Description of CO's
CO1	Understand parallelism and pipelining concepts, the design aspects and challenges.
CO2	Evaluate the issues in vector and array processors.
CO3	Study and analyze the high performance scalable multithreaded and multiprocessor systems.

3.CO-PO Mapping

POs / COs	POa	POb	POc	POd	POe
CO1	3	3	3	3	2
CO2	3	3	3	3	2
CO3	3	3	2	3	2

SPPE32 IOT and Applications

Teaching Scheme

Instruction Hours/week : 3(L) **Credits : 3**

Sessional Marks : 40 **Semester-end Examination : 60**

Course Objectives:

- To understand the concept of IOT and M2M and
- To know IOT architecture and applications in various fields and the security and privacy issues in IOT.

Syllabus Contents:

Unit 1

IoT& Web Technology The Internet of Things Today, Time for Convergence, Towards the IoT Universe, Internet of Things Vision, IoT Strategic Research and Innovation Directions, IoT Applications, Future Internet Technologies, Infrastructure, Networks and Communication, Processes, Data Management, Security, Privacy & Trust, Device Level Energy Issues, IoT Related Standardization, Recommendations on Research Topics.

Unit 2

M2M to IoT – A Basic Perspective– Introduction, Some Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT, The international driven global valuechain and global information monopolies. M2M to IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations.

Unit 3

IoT Architecture -State of the Art – Introduction, State of the art, Architecture Reference Model-Introduction, Reference Model and architecture, IoT reference Model, IoT Reference Architecture- Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views.

Unit 4

IoT Applications for Value Creations Introduction, IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications, Four Aspects in your Business to Master IoT, Value Creation from Big Data and Serialization, IoT for Retailing Industry, IoT For Oil and Gas Industry, Opinions on IoT Application and Value for Industry, Home Management, eHealth.

Unit 5

Internet of Things Privacy, Security and Governance Introduction, Overview of Governance, Privacy and Security Issues, Contribution from FP7 Projects, Security, Privacy and Trust in IoT-Data-Platforms for Smart Cities, First Steps Towards a Secure Platform, Smartie Approach. Data Aggregation for the IoT in Smart Cities, Security

References:

1.VijayMadisetti and ArshdeepBahga, “Internet of Things (A Hands-on-Approach)”, 1st Edition, VPT, 2014.
2.FrancisdaCosta, “Rethinking the Internet of Things: A Scalable Approach to Connecting Everything”, 1stEdition, Apress Publications, 2013.
3.CunoPfister, “Getting Started with the Internet of Things”, O Reilly Media, 2011.

Course Outcomes

COs	Description of CO’s
CO1	Understand the concept of IOT and M2M
CO2	Study IOT architecture and applications in various fields
CO3	Study the security and privacy issues in IOT.

3.CO-PO Mapping

POs / COs	POa	POb	POc	POd	POe
CO1	3	3	3	3	2
CO2	3	2	3	2	2
CO3	2	2	3	2	2

SPPE33 Digital Design and Verification

Teaching Scheme

Instruction Hours/week : 3(L) **Credits : 3**
Sessional Marks : 40 **Semester-end Examination : 60**

Course Outcomes:

At the end of this course, students will be able to

- Familiarity of Front end design and verification techniques and create reusable test environments.
- Verify increasingly complex designs more efficiently and effectively.
- Use EDA tools like Cadence, Mentor Graphics.

Syllabus Contents:

Unit 1

Revision of basic Digital systems: Combinational Circuits, Sequential Circuits, Logic families, Synchronous FSM and asynchronous design, Metastability, Clock distribution and issues, basic building blocks like PWM module, pre-fetch unit, programmable counter, FIFO, Booth's multiplier, ALU, Barrel shifter etc.

Unit 2

Verilog/VHDL Comparisons and Guidelines, Verilog: HDL fundamentals, simulation, and test-bench design, Examples of Verilog codes for combinational and sequential logic, Verilog AMS

Unit 3

System Verilog and Verification: Verification guidelines, Data types, procedural statements and routines, connecting the test bench and design, Assertions, Basic OOP concepts, Randomization, Introduction to basic scripting language: Perl, Tcl/Tk

Unit 4

Current challenges in physical design: Roots of challenges, Delays: Wire load models Generic PD flow, Challenges in PD flow at different steps, SI Challenge - Noise & Crosstalk, IR Drop, Process effects: Process Antenna Effect &Electromigration

Unit 5

Programmable Logic Devices: Introduction, Evolution: PROM, PLA, PAL, Architecture of PAL's,

Applications, Programming PLD's, FPGA with technology: Antifuse, SRAM, EPROM, MUX, FPGA structures, and ASIC Design Flows, Programmable Interconnections, Coarse grained reconfigurable devices

IP and Prototyping: IP in various forms: RTL Source code, Encrypted Source code, Soft IP, Netlist, Physical IP, and Use of external hard IP during prototyping, Case studies, and Speed issues. Testing of logic circuits: Fault models, BIST, JTAG interface

References:

1.Douglas Smith, "HDL Chip Design: A Practical Guide for Designing, Synthesizing & Simulating ASICs & FPGAs Using VHDL or Verilog", Doone publications, 1998.
2.SamirPalnitkar, "Verilog HDL: A guide to Digital Design and Synthesis", Prentice Hall, 2nd Edition, 2003.
3.Doug Amos, Austin Lesea, Rene Richter, "FPGA based Prototyping Methodology Manual", Synopsys Press, 2011.
4.ChristopheBobda, "Introduction to Reconfigurable Computing, Architectures, Algorithms and Applications", Springer, 2007.
5.Janick Bergeron, "Writing Testbenches: Functional Verification of HDL Models", Second Edition, Springer, 2003.

Course Outcomes

COs	Description of CO's
CO1	Familiarity of Front end design and verification techniques and create reusable test environments.
CO2	Verify increasingly complex designs more efficiently and effectively.

CO3	Use EDA tools like Cadence, Mentor Graphics.

3.CO-PO Mapping

POs / COs	POa	POb	POc	POd	POe
CO1	**3**	**2**	**2**	**3**	**1**
CO2	**3**	**2**	**2**	**3**	**1**
CO3	**3**	**3**	**2**	**3**	**1**

SPPE41 Multispectral Signal Analysis

Teaching Scheme

Instruction Hours/week : 3(L) **Credits : 3**
Sessional Marks : 40 **Semester-end Examination : 60**

Course Outcomes:

At the end of this course, students will be able to

- Select appropriate hyperspectral data for a particular application.
- Understand basic concepts of data acquisition and image processing tasks required for multi and hyperspectral data analysis
- Learn techniques for classification and analysis of multi and hyperspectral data.

Syllabus Contents:

Unit 1

Hyperspectral Sensors and Applications: Introduction, Multi-spectral Scanning Systems (MSS), Hyperspectral Systems, Airborne sensors, Spaceborne sensors, Ground Spectroscopy, Software for Hyperspectral Processing, Applications, Atmosphere and Hydrosphere, Vegetation, Soils and Geology, Environmental Hazards and Anthropogenic Activity

Unit 2

Overview of Image Processing: Introduction, Image File Formats, Image Distortion and Rectification, Radiometric Distortion, Geometric Distortion and Rectification, Image Registration, Image Enhancement, Point Operations, Geometric Operation, Image Classification, Supervised Classification, Unsupervised Classification, Crisp Classification Algorithms, Fuzzy Classification Algorithms, Classification Accuracy Assessment, Image Change Detection, Image Fusion, Automatic Target Recognition

Unit 3

Mutual Information: A Similarity Measure for Intensity Based Image Registration: Introduction, Mutual Information Similarity Measure, Joint Histogram Estimation Methods, Two-Step Joint Histogram Estimation, One-Step Joint Histogram Estimation, Interpolation Induced Artifacts, Generalized Partial Volume Estimation of Joint Histograms, Optimization Issues in the Maximization of MI

Unit 4

Independent Component Analysis: Introduction, Concept of ICA, ICA Algorithms, Preprocessing using PCA, Information Minimization Solution for ICA, ICA Solution through Non-Gaussianity Maximization, Application of ICA to Hyperspectral Imagery, Feature Extraction Based Model, Linear Mixture Model Based Model, An ICA algorithm for Hyperspectral Image Processing, Applications using ICA.

Unit 5

Support Vector Machines : Introduction, Statistical Learning Theory, Empirical Risk Minimization, Structural Risk Minimization, Design of Support Vector Machines, Linearly Separable Case, Linearly Non-Separable Case, Non-Linear Support Vector Machines, SVMs for Multiclass Classification, One Against the Rest Classification, Pair wise Classification, Classification based on Decision Directed Acyclic Graph and Decision Tree Structure, Multiclass Objective Function, optimization Methods , Applications using SVM.

Markov Random Field Models: Introduction, MRF and Gibbs Distribution, Random Field and Neighborhood ,Cliques, Potential and Gibbs Distributions, MRF Modeling in Remote Sensing Applications, Optimization Algorithms, Simulated Annealing, Metropolis Algorithm, Iterated Conditional Modes Algorithm

References:

1.Pramod K. Varshney, Manoj K. Arora, “Advanced Image Processing Techniques for Remotely Sensed Hyperspectral Data”, Springer, 2013.
2.S. Svanberg, “Multi-spectral Imaging– from Astronomy to Microscopy – from Radio waves to Gamma rays”, Springer Verlag, 2009

Course Outcomes

COs	Description of CO’s
CO1	Select appropriate hyper spectral data for a particular application
CO2	Understand basic concepts of data acquisition and image processing tasks required for multi and hyper spectral data analysis
CO3	Learn techniques for classification and analysis of multi and hyper spectral data.

3.CO-PO Mapping

POs / COs	POa	POb	POc	POd	POe
CO1	3	3	3	3	1
CO2	3	3	3	3	1
CO3	3	3	3	3	1

SPPE42 Audio Processing

Teaching Scheme

Instruction Hours/week : 3(L) **Credits : 3**

Sessional Marks : 40 **Semester-end Examination : 60**

Course Outcomes:

At the end of this course, students will be able to

- Understand different characteristics of Speech.
- Identify and analyze different speech analysis system.
- Write algorithms for Recognition of speech.

Syllabus Contents:

Unit 1

Principle Characteristics of Speech: Linguistic information, Speech and Hearing, Speech production mechanism, Acoustic characteristic of speech Statistical Characteristics of speech. Speech production models, Linear Separable equivalent circuit model, Vocal Tract and Vocal Cord Model.

Unit 2

Speech Analysis and Synthesis Systems: Digitization, Sampling, Quantization and coding, Spectral Analysis, Spectral structure of speech, Autocorrelation and Short Time Fourier transform, Window function, Sound Spectrogram, Mel frequency Cepstral Coefficients, Filter bank and Zero Crossing Analysis, Analysis –by-Synthesis, Pitch Extraction.

Unit 3

Linear Predictive Coding Analysis: Principle of LPC analysis, Maximum likelihood spectral estimation, Source parameter estimation from residual signals, LPC Encoder and Decoder, PARCOR analysis and Synthesis, Line Spectral Pairs, LSP analysis and Synthesis.

Unit 4

Speech Coding: Reversible coding, Irreversible coding and Information rate distortion theory,
coding in time domain: PCM, ADPCM, Adaptive Predictive coding, coding in Frequency domain: Sub band coding, Adaptive transform coding, Vector Quantization, Code Excited Linear Predictive Coding (CELP).

Unit 5

Speech Recognition: Principles of speech recognition, Speech period detection, Spectral distance measure, Structure of word recognition system, Dynamic Time Warping (DTW), Theory and implementation of Hidden Markov Model (HMM).

Speaker recognition: Human and Computer speaker recognition Principles Text dependent and Text Independent speaker recognition systems. Applications of speech Processing.

References:

1.SadaokiFurui, “Digital Speech Processing, Synthesis and Recognition” 2nd Edition, Taylor & Francis, 2000.
2.Rabiner and Schafer, “Digital Processing of Speech Signals”, Pearson Education, 1979.

Course Outcomes

COs	Description of CO’s
CO1	Understand different characteristics of Speech.
CO2	Identify and analyze different speech analysis system.
CO3	Write algorithms for Recognition of speech.

3.CO-PO Mapping

POs / COs	POa	POb	POc	POd	POe
CO1	3	3	3	3	2
CO2	3	3	3	3	2
CO3	3	3	3	3	2

Teaching Scheme

Instruction Hours/week : 3(L) **Credits : 3**
Sessional Marks : 40 **Semester-end Examination : 60**

Course Outcomes:

At the end of this course, students will be able to

- Understand different types of biomedical signal.
- Identify and analyze different biomedical signals
- Find applications related to biomedical signal processing

Syllabus Contents:

Unit 1

Acquisition, Generation of Bio-signals,Origin of bio-signals, Types of bio-signals,Study of diagnostically significant bio-signal parameters

Unit 2

Electrodes for bio-physiological sensing and conditioning, Electrode-electrolyte interface, polarization, electrode skin interface and motion artefact, biomaterial used for electrode, Types of electrodes (body surface, internal, array of electrodes,microelectrodes), Practical aspects of using electrodes, Acquisition of bio-signals (signal conditioning) and Signal conversion (ADC's DAC's) Processing, Digital filtering

Unit 3

Biomedical signal processing by Fourier analysis, Biomedical signal processing by wavelet (time-frequency) analysis, Analysis (Computation of signal parameters that are diagnostically significant),Classification of signals and noise, Spectral analysis of deterministic, stationary random signals and non-stationary signals.

Unit 4

Coherent treatment of various biomedical signal processing methods and applications.
Principal component analysis, Correlation and regression, Analysis of chaotic signals Application areas of Bio–Signals analysis Multiresolution analysis(MRA) and wavelets, Principal component analysis(PCA), Independent component analysis(ICA)

Unit 5

Pattern classification–supervised and unsupervised classification, Neural networks, Support vector Machines, Hidden Markov models. Examples of biomedical signal classification examples.

References:

1.W. J. Tompkins, “Biomedical Digital Signal Processing”, Prentice Hall, 1993.

2.Eugene N Bruce, “Biomedical Signal Processing and Signal Modeling”, John Wiley & Son’s publication, 2001.

3.MyerKutz, “Biomedical Engineering and Design Handbook, Volume I”, McGraw Hill, 2009.

4.D C Reddy, “Biomedical Signal Processing”, McGraw Hill, 2005.

5.Katarzyn J. Blinowska, JaroslawZygierewicz, “Practical Biomedical Signal Analysis Using MATLAB”, 1st Edition, CRC Press, 2011.

Course Outcomes

COs	Description of CO’s
CO1	Understand different types of biomedical signal.
CO2	Identify and analyze different biomedical signals
CO3	Find applications related to biomedical signal processing

3.CO-PO Mapping

POs / COs	POa	POb	POc	POd	POe
CO1	**3**	**3**	**3**	**3**	**2**
CO2	**3**	**3**	**3**	**3**	**1**
CO3	**3**	**3**	**2**	**3**	**1**

SPCP03 Pattern Recognition & Machine Learning Laboratory

Teaching Scheme

Instruction Hours/week : 4(P) **Credits : 2**
Sessional Marks : 40 **Semester-end Examination : 60**

Course Outcomes:

At the end of this course, students will be able to

- Perform image and video enhancement
- Perform image and video segmentation
- Detect an object in an image/video

List of Assignments:

1. Implement maximum likelihood algorithm
2. Implement Bayes classifier
3. Implement linear regression
4. Design a classifier using perceptron rule
5. Design a classifier using feedforward back-propagation and delta rule algorithms
6. Implement deep learning algorithm
7. Implement linear discriminant algorithm
8. Design a two class classifier using SVM
9. Design a multiclass classifier using SVM
10. Perform unsupervised learning

Course Outcomes

COs	Description of CO's
CO1	Perform image and video enhancement
CO2	Perform image and video segmentation

CO3	Detect an object in an image/video

3.CO-PO Mapping

POs / COs	POa	POb	POc	POd	POe
CO1	**3**	**3**	**3**	**3**	**2**
CO2	**3**	**3**	**3**	**3**	**1**
CO3	**3**	**3**	**3**	**3**	**1**

SPCP04 Detection and Estimation Theory Laboratory

Teaching Scheme

Instruction Hours/week : 4(L) **Credits : 2**
Sessional Marks : 40 **Semester-end Examination : 60**

Course Outcomes:

Syllabus Contents:

At the end of this course, students will be able to

- Simulate signals and noise
- Detect signals in the presence of noise
- Compare various estimation techniques

List of Assignments:

1. Simulate signal and noise models models.
2. Simulate spatially separated target Signal in the presence of Additive Correlated White Noise
3. Simulate spatially separated target Signal in the presence of Additive Uncorrelated White Noise
4. Simulate spatially separated target Signal in the presence of Additive Correlated Colored Noise
5. Detect Constant amplitude Signal in AWGN
6. Detect Time varying Known Signals in AWGN
7. Detect Unknown Signals in AWGN
8. Compare performance comparison of the Estimation techniques - MLE, MMSE, Bayes Estimator, MAP Estimator, Expectation Maximization (EM) algorithm
9. Performance comparison of conventional Energy Detectors and Coherent Matched Filter Techniques

Course Outcomes

COs	Description of CO's
CO1	Simulate signals and noise
CO2	Detect signals in the presence of noise
CO3	Compare various estimation techniques

3.CO-PO Mapping

POs / COs	POa	POb	POc	POd	POe
CO1	3	3	2	3	2
CO2	3	2	3	3	1
CO3	3	3	2	3	1

AUDIT COURSE-2

PGPA 21 CONSTITUTION OF INDIA

Instruction Hours/week : 2(L) **Credits : 2**
Sessional Marks : 100 **Semester-end Examination : -**

Course Objectives:

Students will be able to:

1. understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
2. address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
3. address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

UNIT I

History and philosophy of the Indian Constitution
History -Drafting Committee, (Composition& Working) - Preamble - Salient Features

UNIT II

Contours of Constitutional Rights & Duties: Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

UNIT III

Organs of Governance: Parliament – Composition - Qualifications and Disqualifications - Powers and Functions, Executive President – Governor - Council of Ministers - Judiciary, Appointment and Transfer of Judges, Qualifications - Powers and Functions

UNIT IV

Local Administration:
District's Administration Head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. Pachayati raj: Introduction, PRI: ZilaPachayat. Elected officials and their roles, CEO ZilaPachayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy

UNIT V

Election Commission: Election Commission: Role and Functioning - Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning.
Institute and Bodies for the welfare of SC/ST/OBC and women.

References:

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

Course Outcomes:

Students will be able to discuss:
1. the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
2. the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
3. the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
4. the passage of the Hindu Code Bill of 1956.

Instruction Hours/week : 2(L) **Credits : 2**
Sessional Marks : 100 **Semester-end Examination : -**

Course Objectives:
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.

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 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.

References:

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.

Course Outcomes:

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?

PGPA 23 STRESS MANAGEMENT BY YOGA

Instruction Hours/week : 2(L) **Credits : 2**
Sessional Marks : 100 **Semester-end Examination : -**

Course Objectives:

1. To achieve overall health of body and mind

2. To overcome stress

UNIT I

 Definitions of Eight parts of yog. (Ashtanga)

UNIT II

Yam -Ahinsa, satya, astheya, bramhacharya and aparigraha

UNIT III

Niyam- Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

UNIT IV

Asan - Various yog poses and their benefits for mind & body

UNIT V

Pranayam - Regularization of breathing techniques and its effects-Types of pranayam 8

References:

1. 'Yogic Asanas for Group Tarining-Part-I" :Janardan Swami YogabhyasiMandal, Nagpur

2. “Rajayoga or conquering the Internal Nature” by Swami Vivekananda, AdvaitaAshrama (Publication Department), Kolkata

Course Outcomes:

Students will be able to

1. Develop healthy mind in a healthy body thus improving social health also
2. Improve efficiency

PGPA 24 PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS

Instruction Hours/week : 2(L) **Credits : 2**
Sessional Marks : 100 **Semester-end Examination : -**

Course Objectives :

1. To learn to achieve the highest goal happily.
2. To become a person with stable mind, pleasing personality and determination 3. To awaken wisdom in students

UNIT I

Neetisatakam-Holistic development of personality
Verses- 19,20,21,22 (wisdom) - Verses- 29,31,32 (pride & heroism) - Verses- 26,28,63,65 (virtue)

UNIT II

Verses- 52,53,59 (dont’s) - Verses- 71,73,75,78 (do’s)

UNIT III

Approach to day to day work and duties.
ShrimadBhagwadGeeta : Chapter 2-Verses 41, 47,48- Chapter 3-Verses 13, 21, 27, 35 - Chapter 6-Verses 5,13,17, 23, 35 - Chapter 18-Verses 45, 46, 48.

UNIT IV

Statements of basic knowledge.
ShrimadBhagwadGeeta: Chapter2-Verses 56, 62, 68 - Chapter 12 -Verses 13, 14, 15, 16,17, 18

UNIT V

Personality of Role model.ShrimadBhagwadGeeta: Chapter2-Verses 17 - Chapter 3-Verses 36,37,42 Chapter 4 - Verses 18, 38,39 - Chapter18 – Verses 37,38,63.

References :

1. “Srimad Bhagavad Gita” by Swami SwarupanandaAdvaita Ashram (Publication Department), Kolkata 2. Bhartrihari’s Three Satakam (Niti-sringar-vairagya) by P.Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi.

Course Outcomes :

Students will be able to

1. Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life
2.The person who has studied Geeta will lead the nation and mankind to peace and prosperity 3. Study of Neetishatakam will help in developing versatile personality of students.

SPMP01 Mini Project

Teaching Scheme | **Examination Scheme**

Instruction Hours/week : 4(P) | **Credits : 2**

Sessional Marks :100 | **Semester-end Examination :-**

Course Outcomes:

At the end of this course, students will be able to

- Understand of contemporary / emerging technology for various processes and systems.
- Share knowledge effectively in oral and written form and formulate documents.

Syllabus Contents:

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

Course Outcomes

COs	Description of CO's
CO1	Understand of contemporary / emerging technology for various processes and systems
CO2	Share knowledge effectively in oral and written form and formulate documents.

CO-PO Mapping

POs / COs	POa	POb	POc	POd	POe
CO1	3	3	3	3	2
CO2	2	3	3	3	1

Semester III

SPPE51 Remote Sensing

Teaching Scheme

Instruction Hours/week : 3(L) **Credits : 3**
Sessional Marks : 40 **Semester-end Examination :60**

Course Outcomes:

At the end of this course, students shall be able to
Understand basic concepts, principles and applications of remote sensing, particularly the geometric and radiometric principles
Provide examples of applications of principles to a variety of topics in remote sensing, particularly related to data collection, radiation, resolution, and sampling.

Syllabus Contents:

Unit 1

Physics Of Remote Sensing: Electro Magnetic Spectrum, Physics of Remote Sensing-Effects of Atmosphere-Scattering–Different types–Absorption-Atmospheric window-Energy interaction with surface features –Spectral reflectance of vegetation, soil and water atmospheric influence on spectral response patterns-multi concept in Remote sensing.

Data Acquisition: Types of Platforms–different types of aircrafts-Manned and Unmanned space crafts–sun synchronous and geo synchronous satellites –Types and characteristics of different platforms –LANDSAT, SPOT, IRS, INSAT, IKONOS, QUICKBIRDetc.

Unit 2

Photographic products, B/W,color, color IR film and their characteristics –resolving power of lens and film - Optomechanical electro optical sensors –across track and along track scanners-multispectral scanners and thermal scanners–geometric characteristics of scanner imagery - calibration of thermal scanners.

Unit 3

Scattering System: Microwave scatterometry, types of RADAR –SLAR –resolution –range and azimuth –real aperture and synthetic aperture RADAR. Characteristics of Microwave images topographic effect-different types of Remote Sensing platforms –airborne and space borne sensors -ERS, JERS, RADARSAT, RISAT -Scatterometer, Altimeter-LiDAR remote sensing, principles, applications.

Unit 4

Thermal And Hyper Spectral Remote Sensing: Sensors characteristics-principle of spectroscopy-imaging spectroscopy–field conditions, compound spectral curve, Spectral library, radiative models, processing procedures, derivative spectrometry, thermal remote sensing –thermal sensors, principles, thermal data processing, applications.

Unit 5

Data Analysis: Resolution–Spatial, Spectral, Radiometric and temporal resolution-signal to noise ratio-data products and their characteristics-visual and digital interpretation–Basic principles of data processing –Radiometric correction–Image enhancement–Image classification–Principles of LiDAR, Aerial Laser Terrain Mapping.

References:

1.Lillesand.T.M. andKiefer.R.W,"Remote Sensing and Image interpretation", 6th Edition, John Wiley & Sons, 2000.

2.John R. Jensen, "Introductory Digital Image Processing: A Remote Sensing Perspective", 2nd Edition, Prentice Hall,1995.

3.Richards, John A., Jia, Xiuping, "Remote Sensing Digital Image Analysis", 5th Edition, Springer-Verlag Berlin Heidelberg, 2013.

4.Paul Curran P.J. Principles of Remote Sensing, 1st Edition, Longman Publishing Group, 1984.

5.CharlesElachi, Jakob J. van Zyl, "Introduction to The Physicsand Techniques of Remote Sensing", 2nd Edition, Wiley Serie, 2006.

6.Sabins, F.F.Jr, "Remote Sensing Principles and Image Interpretation", 3rd Edition, W.H.Freeman& Co, 1978

Course Outcomes

COs	Description of CO's
CO1	Understand basic concepts, principles and applications of remote sensing, particularly the geometric and radiometric principles
CO2	Provide examples of applications of principles to a variety of topics in remote sensing, particularly related to data collection, radiation, resolution, and sampling.

CO-PO Mapping

POs / COs	POa	POb	POc	POd	POe
CO1	3	3	2	2	1
CO2	2	2	3	3	1

SPPE52 Optimization Techniques

Teaching Scheme

Instruction Hours/week : 3(L) **Credits : 3**
Sessional Marks : 40 **Semester-end Examination :60**

Course Outcomes:

At the end of this course, students will be able to

- Understand importance of optimization
- Apply basic concepts of mathematics to formulate an optimization problem
- Analyze and appreciate variety of performance measures for various optimization problems

Syllabus Contents:

Unit 1

Introduction to ClassicalMethods& Linear Programming ProblemsTerminology, Design Variables, Constraints, Objective Function, Problem Formulation. Calculus method, Kuhn Tucker conditions, Method of Multipliers.

Unit 2

Linear Programming Problem,Simplex method, Two-phase method, Big-M method, duality, Integer linear Programming, Dynamic Programming, Sensitivity analysis.

Unit 3

Single Variable Optimization Problems: Optimality Criterion, Bracketing Methods, Region Elimination Methods, Interval Halving Method, Fibonacci Search Method, Golden Section Method. Gradient Based Methods: Newton-Raphson Method, Bisection Method, Secant Method,Cubic search method.

Unit 4

Multi Variable and Constrained Optimization Technique, Optimality criteria , Direct search Method, Simplex search methods, Hooke-Jeeve‘s pattern search method, Powell‘s conjugate direction method,Gradient based method, Cauchy‘s Steepest descent method, Newton‘s method , Conjugate gradient method. Kuhn - Tucker conditions, Penalty Function, Concept of Lagrangian multiplier, Complex search method, Random search method

Unit 5

Intelligent Optimization Techniques:Introduction to Intelligent Optimization, Soft Computing, Genetic Algorithm: Types of reproduction operators, crossover & mutation, Simulated Annealing Algorithm, Particle Swarm Optimization (PSO) - Graph Grammer Approach - Example Problems

Genetic Programming (GP): Principles of genetic programming, terminal sets, functional sets, differences between GA & GP, random population generation, solving differential equations using GP.

References:

1.S. S. Rao, “Engineering Optimisation: Theory and Practice”, Wiley, 2008.
2.K. Deb, “Optimization for Engineering design algorithms and Examples”, Prentice Hall, 2005.
3.C.J. Ray, “Optimum Design of Mechanical Elements”, Wiley, 2007.
4.R. Saravanan, “Manufacturing Optimization through Intelligent Techniques, Taylor & Francis Publications, 2006.
5.D. E. Goldberg, “Genetic algorithms in Search, Optimization, and Machine learning”, Addison-Wesley Longman Publishing, 1989.

Course Outcomes

COs	Description of CO’s
CO1	Understand importance of optimization
CO2	Apply basic concepts of mathematics to formulate an optimization problem

CO3	Analyze and appreciate variety of performance measures for various optimization problems

CO-PO Mapping

POs / COs	POa	POb	POc	POd	POe
CO1	3	2	2	2	1
CO2	3	3	2	2	1
CO3	2	2	3	3	1

SPPE53 Modelling and Simulation Techniques

Teaching Scheme

Instruction Hours/week : 3(L) **Credits : 3**
Sessional Marks : 40 **Semester-end Examination :60**

Course Outcomes:

At the end of this course, students will be able to

- Identify and model discrete systems (deterministic and random)
- Identify and model discrete signals (deterministic and random)
- Understand modelling and simulation techniques to characterize systems/processes.

Syllabus Contents:

Unit 1

Introduction Circuitsasdynamicsystems, Transfer functions, poles and zeroes, State space, Deterministic Systems, Difference and Differential Equations, Solution of Linear Difference and Differential Equations, Numerical Simulation Methods for ODEs, System Identification, Stability and Sensitivity Analysis.

Unit 2

Statistical methods, Description of data, Data-fitting methods, Regression analysis, Least Squares Method, Analysis of Variance, Goodness of fit.

Unit 3

Probability and Random Processes, Discrete and Continuous Distribution, Central Limit theorem, Measure of Randomness, MonteCarlo Methods.

Stochastic Processes and Markov Chains, Time Series Models.

Unit 4

Modeling and simulation concepts, Discrete-event simulation, Event scheduling/Time advance algorithms, Verification and validation of simulation models.

Unit 5

Continuous simulation: Modeling with differential equations, Example models, Bond Graph Modeling, Population Dynamics Modeling, System dynamics.

References:

1.R. L. Woods and K. L. Lawrence, "Modeling and Simulation of Dynamic Systems", Prentice-Hall, 1997.

2.Z. Navalih, "VHDL Analysis and Modelling of Digital Systems", McGraw-Hill, 1993.

3.J. Banks, JS. Carson and B. Nelson, "Discrete-Event System Simulation", 2nd Edition, Prentice-Hall of India, 1996.

Course Outcomes

COs	Description of CO's
CO1	Identify and model discrete systems (deterministic and random)
CO2	Identify and model discrete signals (deterministic and random)

CO3	Understand modelling and simulation techniques to characterize systems/processes.

CO-PO Mapping

POs / COs	POa	POb	POc	POd	POe
CO1	3	2	2	2	1
CO2	3	2	2	2	1
CO3	2	2	3	3	1

OPEN ELECTIVES

PGOE 11 Business Analytics

Instruction Hours/week : 3(L) **Credits : 3**
Sessional Marks : 40 **Semester-end Examination : 60**

UNIT I

Business analytics: Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organization, 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.
Recent Trends in : Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data journalism.

References:
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.

Course outcomes:
Students will demonstrate
1. knowledge of data analytics.

2. the ability of think critically in making decisions based on data and deep analytics.
3. the ability to use technical skills in predicative and prescriptive modeling to support business decision-making.
4. the ability to translate data into clear, actionable insights.

PGPA 12 Industrial Safety

Instruction Hours/week : 3(L) **Credits : 3**
Sessional Marks : 40 **Semester-end Examination : 60**

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.

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 tree concept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in achine 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

References:

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.

PGOE 13 Operations Research

Instruction Hours/week : 3(L) **Credits : 3**
Sessional Marks : 40 **Semester-end Examination : 60**

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

References:

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
4. Hitler Libermann Operations Research: McGraw Hill Pub. 2009
5. Pannerselvam, Operations Research: Prentice Hall of India 2010
6. Harvey M Wagner, Principles of Operations Research: Prentice Hall of India 2010

Course Outcomes:

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

PGOE 14 Cost Management of Engineering Projects

Instruction Hours/week : 3(L) **Credits : 3**
Sessional Marks : 40 **Semester-end Examination : 60**

UNIT I
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.

UNIT II
Project: meaning, Different types, why to manage, cost overruns centers, 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.

UNIT III
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,

UNIT IV

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.

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

References:

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.

PGOE 15 Composite Materials

Instruction Hours/week : 3(L) **Credits : 3**
Sessional Marks : 40 **Semester-end Examination : 60**

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 isostaticpressing.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.

References:

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

PGOE 16 Waste to Energy

Instruction Hours/week : 3(L) **Credits : 3**
Sessional Marks : 40 **Semester-end Examination : 60**

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 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.

References:

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.

SPPD01 & SPPD02 (Dissertation) Dissertation Phase – I and Phase - II

Teaching Scheme

Instruction Hours/week : (P) **Credits : 10+16**
Sessional Marks : 40+40 **Semester-end Examination :60+60**

Course Outcomes:

At the end of this course, students will be able to

- Ability to synthesize knowledge and skills previously gained and applied to an in-depth study and execution of new technical problem.
- Capable to select from different methodologies, methods and forms of analysis to produce a suitable research design, and justify their design.
- Ability to present the findings of their technical solution in a written report.
- Presenting the work in International/ National conference or reputed journals.

Syllabus Contents:

The dissertation / project topic should be selected / chosen to ensure the satisfaction of the urgent need to establish a direct link between education, national development and productivity and thus reduce the gap between the world of work and the world of study. The dissertation should have the following

- Relevance to social needs of society
- Relevance to value addition to existing facilities in the institute
- Relevance to industry need
- Problems of national importance
- Research and development in various domain

The student should complete the following:

- Literature survey Problem Definition
- Motivation for study and Objectives
- Preliminary design / feasibility / modular approaches
- Implementation and Verification
- Report and presentation

The dissertation stage II is based on a report prepared by the students on dissertation allotted to them. It may be based on:

- Experimental verification / Proof of concept.
- Design, fabrication, testing of Communication System.
- The viva-voce examination will be based on the above report and work.

Guidelines for Dissertation Phase – I and II at M. Tech. (Electronics):

- As per the AICTE directives, the dissertation is a yearlong activity, to be carried out and evaluated in two phases i.e. Phase – I: July to December and Phase – II: January to June.

- The dissertation may be carried out preferably in-house i.e. department's laboratories and centers OR in industry allotted through department's T & P coordinator.
- After multiple interactions with guide and based on comprehensive literature survey, the student shall identify the domain and define dissertation objectives. The referred literature should preferably include IEEE/IET/IETE/Springer/Science Direct/ACM journals in the areas of Computing and Processing (Hardware and Software), Circuits-Devices and Systems, Communication-Networking and Security, Robotics and Control Systems, Signal Processing and Analysis and any other related domain. In case of Industry sponsored projects, the relevant application notes, while papers, product catalogues should be referred and reported.
- Student is expected to detail out specifications, methodology, resources required, critical issues involved in design and implementation and phase wise work distribution, and submit the proposal within a month from the date of registration.
- Phase – I deliverables: A document report comprising of summary of literature survey, detailed objectives, project specifications, paper and/or computer aided design, proof of concept/functionality, part results, A record of continuous progress.
- Phase – I evaluation: A committee comprising of guides of respective specialization shall assess the progress/performance of the student based on report, presentation and Q & A. In case of unsatisfactory performance, committee may recommend repeating the Phase-I work.
- During phase – II, student is expected to exert on design, development and testing of the proposed work as per the schedule. Accomplished results/contributions/innovations should be published in terms of research papers in reputed journals and reviewed focused conferences OR IP/Patents.
- Phase – II deliverables: A dissertation report as per the specified format, developed system in the form of hardware and/or software, a record of continuous progress.
- Phase – II evaluation: Guide along with appointed external examiner shall assess the
- progress/performance of the student based on report, presentation and Q & A. In case ofunsatisfactory performance, committee may recommend for extension or repeating the work.

Course Outcomes

COs	Description of CO's
CO1	Ability to synthesize knowledge and skills previously gained and applied to an in-depth study and execution of new technical problem
CO2	Capable to select from different methodologies, methods and forms of analysis to produce a suitable research design, and justify their design
CO3	Ability to present the findings of their technical solution in a written report.

CO-PO Mapping

POs / COs	POa	POb	POc	POd	POe
CO1	3	3	2	2	1
CO2	2	2	2	3	2
CO3	2	1	1	2	1