# UTTARAKHAND TECHNICAL UNIVERSITY, DEHRADUN


## M TECH (Digital Signal Processing)

## 2018

# M. Tech.(Electronics and Telecommunication)
# Curriculum Structure
## Specialization: Digital Signal processing

**Semester-I**

| Sr. No. | Course Type/Code | Course Name | Teaching Scheme | | | Credits |
|---|---|---|---|---|---|---|
| | | | L | T | P | |
| 1 | Core 1/ MDST-101 | Advanced Digital Signal Processing | 3 | 0 | 0 | 3 |
| 2 | Core 2/ MDST-102 | Digital Image and Video Processing | 3 | 0 | 0 | 3 |
| 3 | Prog. Specific Elective PE1 | Elective I | 3 | 0 | 0 | 3 |
| | MDST-111 | (1) DSP Architecture | | | | |
| | MDST-112 | (2) Computer Vision | | | | |
| | MDST-113 | (3) Remote Sensing | | | | |
| 4 | Prog. Specific Elective PE2 | Elective II | 3 | 0 | 0 | 3 |
| | MDST-121 | (1) JTFA and MRA | | | | |
| | MDST-122 | (2) Voice and Data Networks | | | | |
| | MDST-123 | (3) Audio Video Coding & Compression | | | | |
| 5 | LAB 1/ MDSP-011 | Advanced Digital Signal Processing Lab | 0 | 0 | 4 | 2 |
| 6 | LAB 2/ MDSP-102 | Digital Image and Video Processing Lab | 0 | 0 | 4 | 2 |
| 7 | | Research Methodology and IPR | 2 | 0 | 0 | 2 |
| 8 | Aud 1 | Audit course 1 | 2 | 0 | 0 | 0 |
| 9 | | **Total** | 16 | 0 | 8 | 18 |

**Semester-II**

| Sr. No. | Course Type/Code | Course Name | Teaching Scheme | | | Credits |
|---|---|---|---|---|---|---|
| | | | L | T | P | |
| 1 | Core 3/ MDST-201 | Pattern Recognition and Machine Learning | 3 | 0 | 0 | 3 |
| 2 | Core 4/ MDST-202 | Detection and Estimation Theory | 3 | 0 | 0 | 3 |
| 3 | Prog. Specific Elective PE3 | Elective III | 3 | 0 | 0 | 3 |
| | MDST-321 | (1) Advanced Compute Architecture | | | | |
| | MDST-322 | (2) IOT and Applications | | | | |
| | MDST-323 | (3) Digital Design and Verification | | | | |
| 4 | Prog. Specific Elective PE2 | Elective IV | 3 | 0 | 0 | 3 |

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|---|---|---|---|---|---|---|
| | MDST-241 | (1) Multispectral Signal Analysis | | | | |
| | MDST-242 | (2) AudioProcessing | | | | |
| | MDST-243 | (3) Biomedical Signal Processing | | | | |
| 5 | LAB 3/ MDSP-201 | Pattern Recognition and Machine Learning Lab | 0 | 0 | 4 | 2 |
| 6 | LAB 4/ MDSP-202 | Detection and Estimation Theory Lab | 0 | 0 | 4 | 2 |
| 7 | MDSP-203 | Seminar | 0 | 0 | 4 | 2 |
| 8 | Aud 2 | Audit course 2 | 2 | 0 | 0 | 0 |
| 9 | | **Total** | 14 | 0 | 12 | 18 |

**Semester-III**

| Sr. No. | Course Type/Code | Course Name | Teaching Scheme | | | Credits |
|---|---|---|---|---|---|---|
| | | | L | T | P | |
| 1 | Prog. Specific Elective PE5 | Elective V | 3 | 0 | 0 | 3 |
| | MDST-351 | (1) Artificial Intelligence | | | | |
| | MDST-352 | (2) Optimization Techniques | | | | |
| | MDST-353 | (3) Modelling and Simulation Techniques | | | | |
| 2 | Open Elective / MDST-391 | 1. Business Analytics<br>2. Industrial Safety<br>3. Operations Research<br>4. Cost Management of Engineering Projects<br>5. Composite Materials<br>6. Waste to Energy | 3 | 0 | 0 | 3 |
| 3 | Dissertation / MDSP-301 | Dissertation Phase – I | 0 | 0 | 20 | 10 |
| | | Total | 06 | 0 | 20 | 16 |

**Semester-IV**

| Sr. No. | Course Type/Code | Course Name | Teaching Scheme | | | Credits |
|---|---|---|---|---|---|---|
| | | | L | T | P | |
| 1 | Dissertation / MDSP-401 | Dissertation Phase – II | -- | -- | 32 | 16 |
| | | Total | -- | -- | 32 | 16 |

**Audit course 1 & 2**

English for Research Paper Writing
Disaster Management
Sanskrit for Technical Knowledge

Value Education
Constitution of India
Pedagogy Studies
Stress Management by Yoga
Personality Development through Life Enlightenment Skills.

**Paper Code: MDST-101**
**Paper: Advanced Digital Signal Processing**

**Syllabus Contents:**

**Unit 1**

Overview of DSP,Characterization in time and frequency, FFT Algorithms, Digital filter design and structures: Basic FIR/IIR filter design &structures, design techniques of linear phase FIR filters,IIR filters by impulse invariance, bilinear transformation,FIR/IIR Cascaded lattice structures, and Parallel all pass realization of IIR.

**Unit 2**

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

**Unit 3**

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 4**

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

**Unit 5**

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.

**Unit6**

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:**

J.G.Proakis and D.G.Manolakis"Digital signal processing: Principles, Algorithm and Applications", 4th Edition, Prentice Hall, 2007.

N. J. Fliege, "Multirate Digital Signal Processing: Multirate Systems -Filter Banks – Wavelets", 1st Edition, John Wiley and Sons Ltd, 1999.

Bruce W. Suter, "Multirate and Wavelet Signal Processing",1st Edition, Academic Press, 1997. M. H. Hayes, "Statistical Digital Signal Processing and Modeling", John Wiley & Sons Inc., 2002.

S.Haykin, "Adaptive Filter Theory", 4th Edition, Prentice Hall, 2001.

D.G.Manolakis, V.K. Ingle and S.M.Kogon, "Statistical and Adaptive Signal Processing", McGraw Hill, 2000.

**Paper code: MDST- 102**
**Paper: Digital Image and Video Processing**

**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, de-interlacing, video resolution enhancement, Image and Video restoration (recovery).

**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: Colour image Processing**

Colour fundamentals, Colour models, Conversion of colour models, Pseudo colour image processing, Fullcolour processing

**Unit 5: 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 6: 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:**

Ed. Al Bovik ,"Handbook of Image and Video Processing", 2nd Edition, Academic Press, 2000.
J. W. Woods, "Multidimensional Signal, Image and Video Processing and Coding",2nd Edition, Academic Press, 2011.
Rafael C. Gonzalez and Richard E. Woods," Digital Image Processing", 3rd Edition, Prentice Hall, 2008.
A. M. Tekalp, "Digital Video Processing", 2nd Edition, Prentice Hall, 2015.
S. Shridhar, "Digital Image Processing", 2nd Edition, Oxford University Press, 2016.

**Paper code: MDST-111**
**Paper: DSP Architecture**

**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.

**Unit 6**
High Performance Computing using P-DSP: Preliminaries of HPC, MPI, OpenMP, multicore DSP as HPC infrastructure.

**References:**
M. Sasikumar, D. Shikhare, Ravi Prakash, "Introduction to Parallel Processing", 1st Edition, PHI, 2006.
Fayez Gebali, "Algorithms and Parallel Computing",1st Edition, John Wiley & Sons, 2011
Rohit Chandra, Ramesh Menon, Leo Dagum, David Kohr, DrorMaydan, Jeff McDonald,"Parallel Programming in OpenMP", 1st Edition, Morgan Kaufman,2000.
Ann Melnichuk,Long Talk, "Multicore Embedded systems", 1st Edition, CRC Press,2010. Wayne Wolf, "High Performance Embedded Computing: Architectures, Applications and Methodologies", 1st Edition, Morgan Kaufman, 2006.
E.S.Gopi, "Algorithmic Collections for Digital Signal Processing Applications Using MATLAB", 1st Edition, Springer Netherlands,2007.

**Paper code: MDST-112**
**Paper: Computer Vision**

**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

**Unit 6**
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:**

D. Forsyth and J. Ponce,"Computer Vision - A modern approach", 2nd Edition, Pearson Prentice Hall, 2012
Szeliski, Richard, "Computer Vision: Algorithms and Applications", 1st Edition, Springer-Verlag London Limited, 2011.
Richard Hartley and Andrew Zisserman, "Multiple View Geometry in Computer Vision", 2nd Edition, Cambridge University Press, 2004.
K. Fukunaga,"Introduction to Statistical Pattern Recognition",2ndEdition, Morgan Kaufmann, 1990.
Rafael C. Gonzalez and Richard E. Woods," Digital Image Processing", 3rd Edition, Prentice Hall, 2008.
B. K. P. Horn, "Robot Vision", 1st Edition, McGraw-Hill, 1986.
E. R. Davies"Computer and Machine Vision: Theory, Algorithms, Practicalities", 4th Edition, Elsevier Inc,2012.

**Paper Code: MDST-113**
**Paper: Remote Sensing**

**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.

**Unit 2**
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 3**
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 4**
Scattering System: Microwave scatterometry,types of RADAR –SLAR –resolution –rangeand azimuth –real aperture and synthetic aperture RADAR. Characteristics of Microwave imagestopographic effect-different types of Remote Sensing platforms –airborne and space borne sensors -ERS, JERS, RADARSAT, RISAT -Scatterometer, Altimeter-LiDAR remote sensing, principles, applications.

**Unit 5**
Thermal And Hyper Spectral Remote Sensing:Sensors characteristics-principle of spectroscopy-imaging spectroscopy–fieldconditions, compound spectral curve, Spectral library, radiative models, processing procedures, derivative spectrometry, thermal remote sensing –thermal sensors, principles, thermal data processing, applications.

**Unit 6**
Data Analysis:Resolution–Spatial, Spectral, Radiometric and temporal resolution-signal to noise ratio-data products and their characteristics-visual and digital interpretation–Basicprinciples of data processing –Radiometric correction–Image enhancement–Imageclassification–Principles of LiDAR, Aerial Laser Terrain Mapping.

**References:**

Lillesand.T.M. and Kiefer.R.W,"Remote Sensing and Image interpretation", 6thEdition, John Wiley & Sons, 2000.

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

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

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

Charles Elachi, Jakob J. van Zyl, "Introduction to ThePhysicsand Techniques of Remote Sensing", 2nd Edition, Wiley Serie, 2006.

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

**Paper Code: MDST-121**
**Paper: Joint Time Frequency Analysis & Multi Resolution Analysis**

**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, Connectionbetween 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 orthogonalbases ofsecond generation wavelets.

**Unit 6**
JTFA Applications:Riesz Bases, Scalograms, Time-Frequency distributions: fundamental ideas, Applications: Speech,audio, image and video compression; signal de-noising, feature extraction, inverse problem.

**References:**

S. Mallat, "A Wavelet Tour of Signal Processing," 2nd Edition, Academic Press, 1999. L. Cohen, “Time-frequency analysis”, 1st Edition, Prentice Hall, 1995.

G.Strang and T. Q. Nguyen, “Wavelets and Filter Banks",2nd Edition, Wellesley Cambridge Press, 1998.

I. Daubechies, "Ten Lectures on Wavelets", SIAM, 1992.

P. P. Vaidyanathan, "Multirate Systems and Filter Banks", Prentice Hall, 1993.

M. Vetterli and J. Kovacevic, "Wavelets and Subband Coding", Prentice Hall, 1995

**Paper Code: MDST-122**
**Paper: Voice and Data Networks**

**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,

**Unit 6**
Congestion avoidance, RED TCP Throughput Analysis, Quality of Service in Packet Networks. Network Calculus, Packet Scheduling Algorithms.

**References:**


D. Bertsekas and R. Gallager, "Data Networks", 2nd Edition, Prentice Hall, 1992.
L. Peterson and B. S. Davie, "Computer Networks: A Systems Approach",5th Edition, Morgan Kaufman, 2011.

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

Walrand,"Communications Network: A First Course", 2nd Edition, McGraw Hill, 2002.
Leonard Kleinrock, "QueueingSystems,Volume I: Theory", 1st Edition, John Wiley and Sons, 1975.

Aaron Kershenbaum, "Telecommunication Network Design Algorithms", McGraw Hill, 1993.

Vijay Ahuja, "Design and Analysis of Computer Communication Networks", McGraw Hill, 1987

**Paper Code: MDST-123**
**Paper: Audio Video Coding &Compression**

**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

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

**Unit 5**
Audio Coding, Basic of Audio Coding, Audio Coding, Transform and Filter banks, Polyphase filter implementation , Audio Coding, Format and encoding, Psychoacoustic Models

**Unit 6**
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:**

Iain E.G. Richardson, “H.264 and MPEG-4 Video Compression”, Wiley, 2003.

Khalid Sayood, “Introduction to Data Compression”, 4th Edition, Morgan Kaufmann, 2012

Mohammed Ghanbari, “Standard Codecs: Image Compression to Advanced Video Coding”, 3rd Edition, The Institution of Engineering and Technology, 2011.

Julius O. Smith III, “Spectral Audio Signal Processing”, W3K Publishing, 2011.

Nicolas Moreau, “Tools for Signal Compression: Applications to Speech and Audio Coding”, Wiley, 2011.

**Paper Code: MDSP-101**

**Paper : Advanced Digital Signal Processing lab**

List of Assignments:

Basic Signal Representation

Correlation Auto And Cross

Stability Using Hurwitz Routh Criteria

Sampling FFT Of Input Sequence

Butterworth Low pass And High pass Filter Design

Chebychev Type I,II Filter

State Space Matrix from Differential Equation

Normal Equation Using Levinson Durbin

Decimation And Interpolation Using Rationale Factors

Maximally Decimated Analysis DFT Filter

Cascade Digital IIR Filter Realization

Convolution And M Fold Decimation &PSD Estimator

Estimation of PSD

Inverse Z Transform

Group Delay Calculation

Separation Of T/F

Parallel Realization of IIR filter

**Paper Code: MDSP-102**
**Paper : Digital Image and Video Processing lab**

List of Assignments:

Perform basic operations on images like addition, subtraction etc.

Plot the histogram of an image and perform histogram equalization

Implement segmentation algorithms

Perform video enhancement

Perform video segmentation

Perform image compression using lossy technique

Perform image compression using lossless technique

Perform image restoration

Convert a colour model into another

Calculate boundary features of an image

Calculate regional features of an image

Detect an object in an image/video using template matching/Bayes classifier

**Paper: Research Methodology and IPR**

**Syllabus Contents:**

**Unit 1:**Meaning of research problem, Sources of research problem, Criteria Characteristicsof 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 2:**Effective literature studies approaches, analysisPlagiarism , Research ethics,
**Unit 3:**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 4:**Nature of Intellectual Property: Patents, Designs, Trademarks 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.

**Unit5:**Patent Rights: Scope of Patent Rights. Licensing and transfer of technology.Patentinformation and databases.Geographical Indications.

**Unit 6:** New Developments in IPR: Administration of Patent System. New developments inIPR; IPR of Biological Systems, Computer Software etc.Traditional knowledge Case Studies, IPR and IITs.

**References:**

Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students'"

Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"

Ranjit Kumar, 2nd Edition , "Research Methodology: A Step by Step Guide for beginners"

Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007. Mayall , "Industrial Design", McGraw Hill, 1992.

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

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

Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in New Technological Age", 2016.

T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008

**Semester II**

**Paper Code : MDST-201**
**Paper : Pattern Recognition and Machine Learning**

**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, backpropagation algorithm, error surfaces,practical techniques for improving backpropagation, 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

**Unit 6**
Unsupervised learning and clustering – k-means clustering, fuzzy k-means clustering,hierarchical clustering

**References:**

Richard O. Duda, Peter E. Hart, David G. Stork, “Pattern Classification”, 2nd Edition John Wiley & Sons, 2001.

Trevor Hastie, Robert Tibshirani, Jerome H. Friedman, “The Elements of Statistical Learning”, 2nd Edition, Springer, 2009.

C. Bishop, “Pattern Recognition and Machine Learning”, Springer, 2006.

**Paper Code: MDST-202**
**Paper: Detection and Estimation Theory**

**Syllabus Contents:**

**Unit 1**

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

**Unit 2**

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

**Unit 3**

Stochastic Processes: Time average and moments, ergodicity, power spectral density, covariance matrices, response of LTI system to random process, cyclostationary process, and spectral factorization.

**Unit 4**

Detection Theory:Detection in white Gaussian noise, correlator and matched filter interpretation, Bayes‘ criterion of signal detection, MAP, LMS, entropy detectors, detection in colored Gaussian noise, Karhunen-Loeve expansions and whitening filters.

**Unit 5**

Estimation Theory: Minimum variance estimators, Cramer-Rao lower bound, examples of linear models, system identification, Markov classification, clustering algorithms.

**Unit 6**

Topics in Kalman and Weiner Filtering: Discrete time Wiener-Hopf equation, error variance computation, causal discrete time Wiener filter, discrete Kalman filter, extended Kalman filter, examples. Specialized Topics in Estimation:Spectral estimation methodslike MUSIC, ESPIRIT, DOA Estimation.

**References:**

Steven M. Kay, “Fundamentals of Statistical Signal Processing, Volume I: Estimation Theory”, Prentice Hall, 1993
Steven M. Kay, “Fundamentals of Statistical Signal Processing, Volume II: Detection Theory”, 1st Edition, Prentice Hall, 1998
Thomas Kailath, BabakHassibi, Ali H. Sayed, “Linear Estimation”, Prentice Hall, 2000.

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

**Paper Code: MDST-231**
**Paper: Advanced Computer Architecture**

**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, SIMDComputer 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.

**Unit 6**
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:**

Kai Hwang, Faye A. Briggs, "Computer Architecture and ParallelProcessing" McGraw Hill Education, 2012.

Kai Hwang, "Advanced Computer Architecture", McGraw Hill Education, 1993.

William Stallings, "Computer Organization and Architecture, Designing for Performance" Prentice Hall, 6th edition, 2006.

Kai Hwang, "ScalableParallelComputing", McGraw Hill Education, 1998.

Harold S. Stone "High-Performance Computer Architecture", Addison-Wesley, 1993.

**Paper Code: MDST-232**
**Paper: IOT and Applications**

**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,, 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 value
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. 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

**Unit 6**
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:**

Douglas Smith, “HDL Chip Design: A Practical Guide for Designing, Synthesizing & Simulating ASICs & FPGAs Using VHDL or Verilog”, Doone publications, 1998.
Samir Palnitkar, “Verilog HDL: A guide to Digital Design and Synthesis”, Prentice Hall, 2nd Edition, 2003.
Doug Amos, Austin Lesea, Rene Richter, “FPGA based Prototyping Methodology Manual”, Synopsys Press, 2011.
Christophe Bobda, “Introduction to Reconfigurable Computing, Architectures, Algorithms and Applications”, Springer, 2007.

Janick Bergeron, “Writing Testbenches: Functional Verification of HDL Models”, Second Edition, Springer, 2003.

**Paper Code: MDST-233**
**Paper: Digital Design and Verification**

**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 .

**Unit 6:** 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:


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

**Paper Code: MDST-241**
**Paper: Multispectral Signal Analysis**
**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.

**Unit 6**
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:**

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

**Paper Code: MDST-242**
**Paper: Audio Processing**

**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).

**Unit 6**

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

**References:**

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

**Paper Code: MDST-243**
**Paper: 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)

Unit 4

Classification of signals and noise, Spectral analysis of deterministic, stationary random signals and non-stationary signals, Coherent treatment of various biomedical signal processing methods and applications.

Unit 5

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 6

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

References:

W. J. Tompkins, "Biomedical Digital Signal Processing", Prentice Hall, 1993.
Eugene N Bruce, "Biomedical Signal Processing and Signal Modeling", John Wiley &Son's publication, 2001.
Myer Kutz, "Biomedical Engineering and Design Handbook, Volume I", McGraw Hill, 2009.
D C Reddy, "Biomedical Signal Processing", McGraw Hill, 2005.
Katarzyn J. Blinowska, JaroslawZygierewicz, "Practical Biomedical Signal Analysis Using MATLAB", 1st Edition, CRC Press, 2011.

**Paper Code: MDSP 401**

**Paper: Pattern Recognition & Machine Learning Laboratory**

**List of Assignments:**

Implement maximum likelihood algorithm
Implement Bayes classifier

Implement linear regression
Design a classifier using perceptron rule

Design a classifier using feedforward back-propagation and delta rule algorithms
Implement deep learning algorithm

Implement linear discriminant algorithm
Design a two class classifier using SVM

Design a multiclass classifier using SVM
Perform unsupervised learning

**Paper Code: MDSP-202**
**Paper: Detection and Estimation Theory Laboratory**

**List of Assignments:**

Simulate signal and noise models models.

Simulate spatially separated target Signal in the presence of Additive Correlated White Noise

Simulate spatially separated target Signal in the presence of Additive Uncorrelated White Noise

Simulate spatially separated target Signal in the presence of Additive Correlated Colored Noise

Detect Constant amplitude Signal in AWGN

Detect Time varying Known Signals in AWGN
Detect Unknown Signals in AWGN

Compare performance comparison of the Estimation techniques - MLE, MMSE, Bayes Estimator, MAP Estimator, Expectation Maximization (EM) algorithm
Performance comparison of conventional Energy Detectors and Coherent Matched Filter Techniques

**Paper: Mini Project**

**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.

**Semester III**

**Paper Code: MDST 351**
**Paper: Artificial Intelligence**

**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, DempsterShafer Theory

**Unit 4**
Fuzzy Logic. Weak Slot-and-Filler Structures: Semantic Nets, Frames. Strong Slot-and-Filler Structures: Conceptual Dependency, Scripts, CYC

**Unit 5**
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 6**
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:**

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

**Paper Code: MDST-352**
**Paper: Optimization Techniques**

**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

**Unit 6**
Genetic Programming (GP): Principles of genetic programming, terminal sets, functional sets, differences between GA & GP, random population generation, solving differential equations using GP.

References:
S. S. Rao, “Engineering Optimisation: Theory and Practice”, Wiley, 2008.

K. Deb, “Optimization for Engineering design algorithms and Examples”, Prentice Hall, 2005.

C.J. Ray, “Optimum Design of Mechanical Elements”, Wiley, 2007.

R. Saravanan, “Manufacturing Optimization through Intelligent Techniques, Taylor & Francis Publications, 2006.

D. E. Goldberg, “Genetic algorithms in Search, Optimization, and Machine learning”, Addison-Wesley Longman Publishing, 1989.

**Paper Code: MDST-353**
**Paper: Modelling and Simulation Techniques**

**Syllabus Contents:**

**Unit 1**
Introduction Circuitsas dynamicsystems, 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.

**Unit 4**
Stochastic Processes and Markov Chains, Time Series Models.

**Unit 5**
Modeling and simulation concepts, Discrete-event simulation, Event scheduling/Time advance algorithms, Verification and validation of simulation models.

**Unit 6**
Continuous simulation: Modeling with differential equations, Example models, Bond Graph Modeling, Population Dynamics Modeling, System dynamics.

References:

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

Z. Navalih, "VHDL Analysis and Modelling of Digital Systems", McGraw-Hill, 1993. J. Banks, JS. Carson and B. Nelson, "Discrete-Event System Simulation", 2nd Edition,Prentice-Hall of India, 1996.

**(Dissertation)**

**MDSP-301 (Phase – I)**
**MDSP-401 (Phase – II)**

**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

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 of

**OPEN ELECTIVES**

**Business Analytics**

**Teaching scheme**
**Lecture: - 3 h/week**

| | |
|---|---|
| **Course Code** | |
| **Course Name** | **Business Analytics** |
| **Credits**<br>**Prerequisites** | |

Total Number of Lectures: 48

| **Course objective** |
|---|
| Understand the role of business analytics within an organization.<br>Analyze data using statistical and data mining techniques and understand relationships between the underlying business processes of an organization.<br>To gain an understanding of how managers use business analytics to formulate and solve business problems and to support managerial decision making.<br>To become familiar with processes needed to develop, report, and analyze business data.<br>Use decision-making tools/Operations research techniques.<br>Mange business process using analytical and management tools.<br>Analyze and solve problems from different industries such as manufacturing, service, retail, software, banking and finance, sports, pharmaceutical, aerospace etc. |

| **LECTURE WITH BREAKUP** | **NO. OF LECTURES** |
|---|---|
| **Unit1:**<br>Business analytics: Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organisation, competitive advantages of Business Analytics.<br>Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modelling, sampling and estimation methods overview. | 9 |
| **Unit 2:**<br>Trendiness and Regression Analysis: Modelling Relationships and Trends in Data, simple Linear Regression.<br>Important Resources, Business Analytics Personnel, Data and models for Business analytics, problem solving, Visualizing and Exploring Data, Business Analytics Technology. | 8 |
| **Unit 3:**<br>Organization Structures of Business analytics, Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, Measuring contribution of Business analytics, Managing Changes.<br>Descriptive Analytics, predictive analytics, predicative Modelling, | 9 |

| | |
|---|---|
| Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modelling, nonlinear Optimization. | |
| **Unit 4:**<br>Forecasting Techniques: Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, 10 Forecasting Time Series with Seasonality, Regression Forecasting with Casual Variables, Selecting Appropriate Forecasting Models.<br>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 5:**<br>Decision Analysis: Formulating Decision Problems, Decision 8 Strategies with the without Outcome Probabilities, Decision Trees, The Value of Information, Utility and Decision Making. | |
| **Unit 6:**<br>Recent Trends in : Embedded and collaborative business intelligence, 4 Visual data recovery, Data Storytelling and Data journalism. | |

| **COURSE OUTCOMES** | |
|---|---|
| | |
| Students will demonstrate knowledge of data analytics.<br>Students will demonstrate the ability of think critically in making decisions based on data and deep analytics.<br>Students will demonstrate the ability to use technical skills in predicative and prescriptive modeling to support business decision-making.<br>Students will demonstrate the ability to translate data into clear, actionable insights. | |

**Reference:**

Business analytics Principles, Concepts, and Applications by Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, Pearson FT Press.

Business Analytics by James Evans, persons Education.

## OPEN ELECTIVES

### Industrial Safety

Teaching scheme
Lecture: - 3 h/week

Unit-I: Industrial safety: Accident, causes, types, results and control, mechanical and electricalhazards, 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 reductionmethods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

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

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

Reference:

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

## OPEN ELECTIVES

## Operations Research

Teaching Scheme
Lectures: 3 hrs/week

Course Outcomes: At the end of the course, the student should be able to Students should able to apply the dynamic programming to solve problems of discreet and continuous variables.

Students should able to apply the concept of non-linear programming

Students should able to carry out sensitivity analysis

Student should able to model the real world problem and simulate it.

**Syllabus Contents:**

**Unit 1:**
Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models

**Unit 2:**
Formulation of a LPP - Graphical solution revised simplex method - duality theory - dual simplex method - sensitivity analysis - parametric programming

**Unit 3:**
Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem - max flow problem - CPM/PERT

**Unit 4:**
Scheduling and sequencing - single server and multiple server models - deterministic inventory models - Probabilistic inventory control models - Geometric Programming.

**Unit 5:**
Competitive Models,Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Game Theory Simulation

**References:**


H.A. Taha, Operations Research, An Introduction, PHI, 2008

H.M. Wagner, Principles of Operations Research, PHI, Delhi, 1982.

J.C. Pant, Introduction to Optimisation: Operations Research, Jain Brothers, Delhi, 2008

Hitler Libermann Operations Research: McGraw Hill Pub. 2009

Pannerselvam, Operations Research: Prentice Hall of India 2010

Harvey M Wagner, Principles of Operations Research: Prentice Hall of India 2010

## Open Elective

## Cost Management of Engineering Projects

Teaching scheme
Lecture: - 3 h/week

Introduction and Overview of the Strategic Cost Management Process

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

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

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

References:


Cost Accounting A Managerial Emphasis, Prentice Hall of India, New Delhi

Charles T. Horngren and George Foster, Advanced Management Accounting
Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting

Ashish K. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheeler publisher

N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd.

## Open Elective

## Composite Materials

Teaching scheme
Lecture: - 3 h/week

**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 glassfibers, 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 andprepregs – 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, maximumstrain criteria, interacting failure criteria, hygrothermal failure. Laminate first play failure-insight strength; Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations.

**TEXT BOOKS:**

Material Science and Technology – Vol 13 – Composites by R.W.Cahn – VCH, West Germany.

Materials Science and Engineering, An introduction. WD Callister, Jr., Adapted by R. Balasubramaniam, John Wiley & Sons, NY, Indian edition, 2007.

**References:**

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

## Open Elective

## Waste to Energy

Teaching scheme
Lecture: - 3 h/week

**Unit-I:** Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forestresidue, 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 technologyand 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:**

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

## AUDIT 1 and 2: ENGLISH FOR RESEARCH PAPER WRITING

**Course objectives:**

Students will be able to:

Understand that how to improve your writing skills and level of readability
Learn about what to write in each section
Understand the skills needed when writing a Title

| Units | CONTENTS | Hours |
|---|---|---|
| 1 | Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness | 4 |
| | Clarifying Who Did What, Highlighting Your Findings, Hedging 4 and Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction | |
| 3 | Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check. | 4 |
| 4 | 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, | 4 |
| | skills are needed when writing the Methods, skills needed when 4 writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions | |
| 6 | useful phrases, how to ensure paper is as good as it could possibly 4 be the first- time submission | |

**Suggested Studies:**

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

## AUDIT 1 and 2: DISASTER MANAGEMENT

**Course Objectives: -**Students will be able to:

learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.

critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.

develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.

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

**Syllabus**

| Units | CONTENTS | Hours |
|---|---|---|
| 1 | **Introduction**<br>Disaster: Definition, Factors And Significance; Difference Between Hazard And Disaster; Natural And Manmade Disasters: Difference, Nature, Types And Magnitude. | 4 |
| | **Repercussions Of Disasters And Hazards**: Economic Damage, Loss 4Of Human And Animal Life, Destruction Of Ecosystem.<br>Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts. | |
| 3 | **Disaster Prone Areas In India**<br>Study Of Seismic Zones; Areas Prone To Floods And Droughts, Landslides And Avalanches; Areas Prone To Cyclonic And Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases And Epidemics | 4 |
| 4 | **Disaster Preparedness And Management**<br>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. | 4 |
| 5 | **Risk Assessment**<br>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. | 4 |
| 6 | **Disaster Mitigation**<br>Meaning, Concept And Strategies Of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation And Non-Structural Mitigation, Programs Of Disaster Mitigation In India. | 4 |

**SUGGESTED READINGS:**

R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'New Royal book Company.

Sahni, PardeepEt.Al. (Eds.)," Disaster Mitigation Experiences And Reflections", Prentice Hall Of India, New Delhi.

Goel S. L. , Disaster Administration And Management Text And Case Studies" ,Deep &Deep Publication Pvt. Ltd., New Delhi.

## AUDIT 1 and 2: SANSKRIT FOR TECHNICAL KNOWLEDGE

***Course Objectives***

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

***Syllabus***

| **Unit** | ***Content*** | ***Hours*** |
|---|---|---|
| 1 | Alphabets in Sanskrit,<br>Past/Present/Future Tense,<br>Simple Sentences | 8 |
| 2 | Order<br>Introduction of roots<br>Technical information about Sanskrit Literature | 8 |
| 3 | Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics | 8 |

***Suggested reading***

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

***Course Output***

Students will be able to
Understanding basic Sanskrit language
Ancient Sanskrit literature about science & technology can be understood
Being a logical language will help to develop logic in students

## AUDIT 1 and 2: VALUE EDUCATION

***Course Objectives***

Students will be able to

1**.**Understand value of education and self- development

2. Imbibe good values in students

3. Let the should know about the importance of character

***Syllabus***

| **Unit** | ***Content*** | ***Hours*** |
|---|---|---|
| 1 | Values and self-development –Social values and individual attitudes. Work ethics, Indian vision of humanism.<br>Moral and non- moral valuation. Standards and principles.<br>Value judgements | 4 |
| 2 | Importance of cultivation of values.<br>Sense of duty. Devotion, Self-reliance. Confidence, Concentration.<br>Truthfulness, Cleanliness.<br>Honesty, Humanity. Power of faith, National Unity.<br>Patriotism.Love for nature ,Discipline | 6 |
| 3 | Personality and Behavior Development - Soul and Scientific attitude.<br>Positive Thinking. Integrity and discipline.<br>Punctuality, Love and Kindness.<br>Avoid fault Thinking.<br>Free from anger, Dignity oflabour.<br>Universal brotherhood and religious tolerance.<br>True friendship.<br>Happiness Vs suffering, love for truth.<br>Aware of self-destructive habits.<br>Association and Cooperation.<br>Doing best for saving nature | 6 |
| 4 | Character and Competence –Holy books vs Blind faith.<br>Self-management and Good health.<br>Science of reincarnation.<br>Equality, Nonviolence ,Humility, Role of Women.<br>All religions and same message.<br>Mind your Mind, Self-control.<br>Honesty, Studying effectively | 6 |

***Suggested reading***

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

## AUDIT 1 and 2: CONSTITUTION OF INDIA

**Course Objectives:**

Students will be able to:

Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.

To 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.

To 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.

**Syllabus**

| Units | Content | Hours |
|---|---|---|
| History | **History of Making of the Indian Constitution:**<br>Drafting Committee, ( Composition& Working) | 4 |
| Preamble | **Philosophy of the Indian Constitution:**<br>Salient Features | 4 |
| 3 | **Contours of Constitutional Rights & Duties:**<br>Fundamental Rights<br>Right to Equality<br>Right to Freedom<br>Right against Exploitation<br>Right to Freedom of Religion<br>Cultural and Educational Rights<br>Right to Constitutional Remedies<br>Directive Principles of State Policy<br>Fundamental Duties. | 4 |
| 4 | **Organs of Governance:**<br>Parliament<br>Composition<br>Qualifications and Disqualifications<br>Powers and Functions<br>Executive<br>President<br>Governor<br>Council of Ministers<br>Judiciary, Appointment and Transfer of Judges, Qualifications<br>Powers and Functions | 4 |

| | | |
|---|---|---|
| **5** | **Local Administration:**<br>District's Administration head: Role and Importance,<br>Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation.<br>Pachayati raj: Introduction, PRI: ZilaPachayat.<br>Elected officials and their roles, CEO ZilaPachayat: Position and role.<br>Block level: Organizational Hierarchy (Different departments),<br>Village level: Role of Elected and Appointed officials,<br>Importance of grass root democracy | 4 |
| **6** | **Election Commission:**<br>Election Commission: Role and Functioning.<br>Chief Election Commissioner and Election Commissioners.<br>State Election Commission: Role and Functioning.<br>Institute and Bodies for the welfare of SC/ST/OBC and women. | 4 |

**Suggested reading**


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


**Course Outcomes:**

Students will be able to:

Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
Discuss 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.
Discuss the passage of the Hindu Code Bill of 1956.

## AUDIT 1 and 2: PEDAGOGY STUDIES

**Course Objectives:**

Students will be able to:

Review existing evidence on the review topic to inform programme design and policy making undertaken by the DfID, other agencies and researchers.

Identify critical evidence gaps to guide the development.

**Syllabus**

| Units | Content | Hours |
|---|---|---|
| 1 | **Introduction and Methodology:**<br>Aims and rationale, Policy background, Conceptual framework and terminology<br>Theories of learning, Curriculum, Teacher education.<br>Conceptual framework, Research questions.<br>Overview of methodology and Searching. | 4 |
| 2 | Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries.<br>Curriculum, Teacher education. | 2 |
| 3 | Evidence on the effectiveness of pedagogical practices<br>Methodology for the in depth stage: quality assessment of included studies.<br>How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?<br>Theory of change.<br>Strength and nature of the body of evidence for effective pedagogical practices.<br>Pedagogic theory and pedagogical approaches.<br>Teachers' attitudes and beliefs and Pedagogic strategies. | 4 |
| 4 | Professional development: alignment with classroom practices and follow-up support<br>Peer support<br>Support from the head teacher and the community.<br>Curriculum and assessment<br>Barriers to learning: limited resources and large class sizes | 4 |
| 5 | **Research gaps and future directions**<br>Research design<br>Contexts<br>Pedagogy<br>Teacher education<br>Curriculum and assessment<br>Dissemination and research impact. | 2 |

**Suggested reading**

Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261.
Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of

Curriculum Studies, 36 (3): 361-379.
Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.

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.

Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.
Chavan M (2003) Read India: A mass scale, rapid, 'learning to read' campaign. www.pratham.org/images/resource%20working%20paper%202.pdf.

**Course Outcomes:**

Students will be able to understand:

What pedagogical practices are being used by teachers in formal and informal classrooms in developing countries?
What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?

How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?

## AUDIT 1 and 2: STRESS MANAGEMENT BY YOGA

***Course Objectives***

To achieve overall health of body and mind
To overcome stress

***Syllabus***

| **Unit** | ***Content*** | ***Hours*** |
|---|---|---|
| 1 | Definitions of Eight parts of yog. ( Ashtanga ) | 8 |
| 2 | Yam and Niyam.<br>Do`s and Don'ts in life.<br>i) Ahinsa, satya, astheya, bramhacharya and aparigraha<br>ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan | 8 |
| 3 | Asan and Pranayam<br>i) Various yog poses and their benefits for mind & body<br>ii)Regularization of breathing techniques and its effects-Types of pranayam | 8 |

***Suggested reading***

‘Yogic Asanas for Group Tarining-Part-I” : Janardan Swami YogabhyasiMandal, Nagpur

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

**Course Outcomes:**

Students will be able to:

Develop healthy mind in a healthy body thus improving social health also

Improve efficiency

**AUDIT 1 and 2: PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS**

***Course Objectives***

To learn to achieve the highest goal happily

To become a person with stable mind, pleasing personality and determination

To awaken wisdom in students

***Syllabus***

| Unit | Content | Hours |
|---|---|---|
| 1 | Neetisatakam-Holistic development of personality<br>Verses- 19,20,21,22 (wisdom)<br>Verses- 29,31,32 (pride & heroism)<br>Verses- 26,28,63,65 (virtue)<br>Verses- 52,53,59 (dont's)<br>Verses- 71,73,75,78 (do's) | 8 |
| 2 | | 8 |
| 3 | Statements of basic knowledge.<br>ShrimadBhagwadGeeta: Chapter2-Verses 56, 62, 68<br>Chapter 12 -Verses 13, 14, 15, 16,17, 18<br>Personality of Role model. ShrimadBhagwadGeeta:<br>Chapter2-Verses 17, Chapter 3-Verses 36,37,42,<br>Chapter 4-Verses 18, 38,39<br>Chapter18 – Verses 37,38,63 | 8 |

***Suggested reading***

"Srimad Bhagavad Gita" by Swami SwarupanandaAdvaita Ashram (Publication Department), Kolkata

Bhartrihari's Three Satakam (Niti-sringar-vairagya) by P.Gopinath,

Rashtriya Sanskrit Sansthanam, New Delhi.

***Course Outcomes***

Students will be able to

Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life

The person who has studied Geeta will lead the nation and mankind to peace and prosperity

Study of Neetishatakam will help in developing versatile personality of students.