M TECH (Digital Signal Processing)
2018
M. Tech.(Electronics and Telecommunication)  
Curriculum Structure  
Specialization: Digital Signal processing

### Semester-I

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

### Semester-II

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Course Type/Code</th>
<th>Course Name</th>
<th>Teaching Scheme</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Core 3/ MDST-201</td>
<td>Pattern Recognition and Machine Learning</td>
<td>3 0 0</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>Core 4/ MDST-202</td>
<td>Detection and Estimation Theory</td>
<td>3 0 0</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>Prog. Specific Elective PE3</td>
<td>Elective III</td>
<td>3 0 0</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>MDST-321</td>
<td>(1) Advanced Compute Architecture</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>MDST-322</td>
<td>(2) IOT and Applications</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>MDST-323</td>
<td>(3) Digital Design and Verification</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Prog. Specific Elective PE2</td>
<td>Elective IV</td>
<td>3 0 0</td>
<td>3</td>
</tr>
<tr>
<td>Sr. No.</td>
<td>Course Type/Code</td>
<td>Course Name</td>
<td>Teaching Scheme</td>
<td>Credits</td>
</tr>
<tr>
<td>--------</td>
<td>------------------</td>
<td>--------------------------------------------------</td>
<td>-----------------</td>
<td>---------</td>
</tr>
<tr>
<td>1</td>
<td>Prog. Specific Elective PE5</td>
<td>Elective V</td>
<td>3 0 0</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>MDST-351</td>
<td>(1) Artificial Intelligence</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>MDST-352</td>
<td>(2) Optimization Techniques</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>MDST-353</td>
<td>(3) Modelling and Simulation Techniques</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Dissertation / MDSP-301</td>
<td>Dissertation Phase – I</td>
<td>0 0 20</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Total</strong></td>
<td>06 0 20</td>
<td>16</td>
</tr>
</tbody>
</table>

**Semester-IV**

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Course Type/Code</th>
<th>Course Name</th>
<th>Teaching Scheme</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Dissertation / MDSP-401</td>
<td>Dissertation Phase – II</td>
<td>-- -- 32</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Total</strong></td>
<td>-- -- 32</td>
<td>16</td>
</tr>
</tbody>
</table>

**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.
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

Unit 6
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:


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:

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**

**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:**
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

References:
Syllabus Contents

Unit 1

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

Unit 5

Unit 6

References:
Syllabus Contents:

Unit 1

Unit 2

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

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:


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

Syllabus Contents:

Unit 1

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
Queueing 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:

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  

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:


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
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 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 2: Effective literature studies approaches, analysis of Plagiarism, 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


References:

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

Wayne Goddard and Stuart Melville, “Research Methodology: An Introduction”


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 and adaptation, 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 Linear Models 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, bias and variance, re-sampling for classifier design, combining classifiers

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

References:


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

Syllabus Contents:

Unit 1

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

Unit 2

Properties of Symmetric Matrices: Diagonalization of 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


Unit 6


References:


Syllabus Contents:

Unit 1
Parallel Processing and Pipelining Processing- Architectural Classification, Applications of parallel 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 pipelining processors, 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

Unit 4
Multiprocessor Architecture - Loosely and Tightly coupled multiprocessors, Inter Processor communication network, Time shared bus, Multiport Memory Model, Memory contention and arbitration techniques, Cache coherency and bus snooping, Massively Parallel Processors (MPP).

Unit 5

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:


Syllabus Contents:

Unit 1

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

Unit 6

References:
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.


References:
Paper Code: MDST-241
Paper: Multispectral Signal Analysis
Syllabus Contents:

Unit 1

Unit 2

Unit 3

Unit 4

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

References:

Syllabus Contents:

Unit 1


Unit 2


Unit 3


Unit 4


Unit 5


Unit 6


References:

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


References:

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
List of Assignments:

Simulate signal and noise 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 35
Paper: Artificial Intelligence

Syllabus Contents:

Unit 1

Unit 2

Unit 3

Unit 4

Unit 5

Unit 6

References:

Paper Code: MDST-352  
Paper: Optimization Techniques

Syllabus Contents:

Unit 1

Unit 2

Unit 3

Unit 4

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 Grammar 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:
Syllabus Contents:

Unit 1

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, Monte Carlo Methods.

Unit 4

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:


(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.


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

<table>
<thead>
<tr>
<th>Course Code</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Course Name</td>
<td>Business Analytics</td>
</tr>
<tr>
<td>Credits</td>
<td></td>
</tr>
<tr>
<td>Prerequisites</td>
<td></td>
</tr>
</tbody>
</table>

Total Number of Lectures: 48

Course objective

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

LECTURE WITH BREAKUP

<table>
<thead>
<tr>
<th>Unit 1:</th>
<th>NO. OF LECTURES</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Unit 2:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>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.</td>
<td>8</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Unit 3:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>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.</td>
<td>9</td>
</tr>
</tbody>
</table>
Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modelling, nonlinear Optimization.

### Unit 4:

### Unit 5:

### Unit 6:
Recent Trends in : Embedded and collaborative business intelligence, 4 Visual data recovery, Data Storytelling and Data journalism.

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

**Reference:**
OPEN ELECTIVES

Industrial Safety

Teaching scheme
Lecture: - 3 h/week

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-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 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, H. P. Garg, S. Chand and Company.
Pump-hydraulic Compressors, Audels, Mcgrew Hill Publication.
OPEN ELECTIVES

Operations Research

Teaching Scheme
Lectures: 3 hrs/week

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

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

Students should be able to carry out sensitivity analysis.

Student should be 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:

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


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


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

TEXT BOOKS:


References:

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-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:
### Course objectives:
Students will be able to:
- Understand 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

<table>
<thead>
<tr>
<th>Units</th>
<th>CONTENTS</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>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, 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</td>
<td>4</td>
</tr>
<tr>
<td>6</td>
<td>useful phrases, how to ensure paper is as good as it could possibly be the first-time submission</td>
<td>4</td>
</tr>
</tbody>
</table>

**Suggested Studies:**
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.

<table>
<thead>
<tr>
<th>Units</th>
<th>CONTENTS</th>
<th>Hours</th>
</tr>
</thead>
</table>
| 1     | Introduction  
Disaster: Definition, Factors And Significance; Difference Between Hazard And Disaster; Natural And Manmade Disasters: Difference, Nature, Types And Magnitude. | 4 |
| 2     | 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. | 4 |
| 3     | Disaster Prone Areas In India  
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  
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  
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  
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:**
Sahni, PardeepEt.Al. (Eds.),” Disaster Mitigation Experiences And Reflections”, Prentice Hall Of India, 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

<table>
<thead>
<tr>
<th>Unit</th>
<th>Content</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Alphabets in Sanskrit, Past/Present/Future Tense, Simple Sentences</td>
<td>8</td>
</tr>
<tr>
<td>2</td>
<td>Order Introduction of roots Technical information about Sanskrit Literature</td>
<td>8</td>
</tr>
<tr>
<td>3</td>
<td>Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics</td>
<td>8</td>
</tr>
</tbody>
</table>

Suggested reading

“Abhyaspustakam” – Dr.Vishwas, Samskrita-Bharti Publication, New Delhi
“Teach Yourself Sanskrit” Prathamadeeksha-VenpatiKutumbshastri, 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 them know about the importance of character

Syllabus

<table>
<thead>
<tr>
<th>Unit</th>
<th>Content</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>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</td>
<td>4</td>
</tr>
</tbody>
</table>

Suggested reading

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: Drafting Committee, (Composition & Working) | 4 |
| Preamble | Philosophy of the Indian Constitution: Salient Features | 4 |
| 4 | 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 | 4 |
| 5 | **Local Administration:**  
District’s Administration head: Role and Importance,  
Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation.  
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 | 4 |
| 6 | **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. | 4 |

**Suggested reading**

- The Constitution of India, 1950 (Bare Act), Government Publication.

**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.
## 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

<table>
<thead>
<tr>
<th>Units</th>
<th>Content</th>
</tr>
</thead>
</table>
| 1     | 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. |
| 2     | Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries.  
Curriculum, Teacher education. |
| 3     | 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. |
| 4     | 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 |
| 5     | Research gaps and future directions  
Research design  
Contexts  
Pedagogy  
Teacher education  
Curriculum and assessment  
Dissemination and research impact. |
Suggested reading


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

<table>
<thead>
<tr>
<th>Unit</th>
<th>Content</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Definitions of Eight parts of yog. ( Ashtanga )</td>
<td>8</td>
</tr>
<tr>
<td>2</td>
<td>Yam and Niyam. Do’s and Don'ts in life.</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>i) Ahinsa, satya, astheya, bramhacharya and aparigraha</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ii) Shaucha, santosh, tapa, swadhyay, ishwarpanidhan</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Asan and Pranayam</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>i) Various yog poses and their benefits for mind &amp; body</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ii) Regularization of breathing techniques and its effects-Types of</td>
<td></td>
</tr>
<tr>
<td></td>
<td>pranayam</td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Unit</th>
<th>Content</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Neetisatakam-Holistic development of personality</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Verses- 19,20,21,22 (wisdom)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Verses- 29,31,32 (pride &amp; heroism)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Verses- 26,28,63,65 (virtue)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Verses- 52,53,59 (dons)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Verses- 71,73,75,78 (dos)</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Statements of basic knowledge.</td>
<td>8</td>
</tr>
<tr>
<td>3</td>
<td>ShrimadBhagwadGeeta: Chapter2-Verses 56, 62, 68</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Chapter 12 - Verses 13, 14, 15, 16,17, 18</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Personality of Role model. ShrimadBhagwadGeeta:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Chapter2-Verses 17, Chapter 3-Verses 36,37,42,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Chapter 4-Verses 18, 38,39</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Chapter 18 – Verses 37,38,63</td>
<td></td>
</tr>
</tbody>
</table>

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.