Course Structure for M.Tech in Computer Science with specialization in Image Processing

First Semester

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Name of Course</th>
<th>Internal Marks</th>
<th>Ext. Marks</th>
<th>Total Marks</th>
<th>Credits</th>
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<tbody>
<tr>
<td>CSD101</td>
<td>Digital Image Processing</td>
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**Laboratory**

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**Total Credits** 17

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<td>Random Processes</td>
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<td>CSD204</td>
<td>Pattern Recognition</td>
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**Laboratory**

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**Total Credits** 19

Third Semester

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Fourth Semester

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## List of Electives

### Semester I

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<td>CSD107</td>
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<td>CSD206</td>
<td>Medical Imaging Techniques</td>
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CSD101 DIGITAL IMAGE PROCESSING

Module – I

Digital image fundamentals

Module – II

Image transforms and enhancement

Module – III

Image restoration and construction

Module – IV

Image compression & segmentation

Module – V

Color and multispectral image processing

References
CSD102 COMPUTER GRAPHICS

Module 1.

Introduction to 3D graphics: 3D transformation for right handed coordinate systems- Parallel projections on X-Y plane – Perspective projections- 1, 2, 3 vanishing points – Handling points at infinity – Reconstruction of 3D images – Clipping – 2D Cyrus Beck clipping – 3D Sutherland Cohen clipping

Module 2.

Curves & Surfaces: Conics – Parametric forms for circle, ellipse, and parabola – Bezier curves – Need for cubic parametric curves – Conditions for smoothly joining curve segments – B-Splines – Uniform, Periodic, Open, Non uniform rational B splines – Quadratic surfaces – Parametric bi-cubic surfaces

Module 3.


Module 4.


Module 5.


REFERENCES:

CSD103 ADVANCED DATA STRUCTURES AND ALGORITHMS

Module I

Module II
Abstract Data Type (ADT) – List ADT – Array implementation of lists – Linked List – Doubly and circularly linked lists – Stack ADT – Queue ADT – Trees: Binary trees – Binary search trees -B-Trees

Module III

Module IV

Module V

References:


CSD104 ADVANCED COMPUTER NETWORKS

Module I

Module II

Module III

Module IV

Module V
Traffic Management: utility function, traffic models, self similarity, traffic classes, service models, class-based allocation controls at different time scales, renegotiation Applications/middleware: multimedia and adaptive applications, voice and video over IP, real time transport protocols, forward error correction, scalable and QoS-aware servers, web proxy coaching. Cellular vs ad-hoc networks

References
5. TCP/IP network administration Craig Hunt, 3/e, O'Reilly

CSD105 MULTIMEDIA SYSTEMS

Module I
Defining the scope of multimedia: Hypertext and Collaborative research-Multimedia and personalized computing, Multimedia on the map, emerging applications, Multimedia applications, Hybrid Devices, Designers perspective, Key challenges ahead, Technical, regulatory, Social issues Multimedia File systems and information models: The case for multimedia information Models: The case for multimedia information systems, The file system support for continuous Media, Data models for multimedia and Hypermedia information, Content- based Retrieval of Unstructured Data

Module II

Module III
Digital Video and Image Compression: Video Compression techniques, standardization of algorithm, The JPEG Image Compression Standard, ITU-T Recommendations, The EPEG Motion video Compression Standard, DVU Technology Virtual reality, Virtual reality systems, Real time computer graphics. The circular world space Perspective projection, Stereo vision, 3D clipping, Colour theory instruction to animation, the dynamics of numbers, updating real-time graphics, shape and object inbetweening, free-form deformation. Simulation of physical systems, mathematical modeling, collisions, projectiles, introduction to dynamics, motion kinematics

Module IV
Distributed Multimedia systems: Architectures and issues for Distributed Multimedia systems Synchronization, and QOS Architecture, The role of Standards, A frame work for Multimedia systems Operating systems Support for Continuous Media Applications : Limitation of work station Operating systems, New OS support, Experiments Using Real Time Mach Goals of Multimedia Systems services, Multimedia systems services Architecture, Media stream protocol Multimedia Devices, Presentation Services, and the User Interface. Client control of continuous multimedia, Device control, Temporal coordination and composition, toolkits, hyper applications.

Module V
CSD106 ARTIFICIAL NEURAL NETWORKS AND FUZZY SYSTEMS

Module I

Module II

Module III

Module IV
Crisp and fuzzy relations – binary relations – binary relations on a single set- equivalence and similarity relations – Compatibility or tolerance relations– orderings – Membership functions – methods of generation – defuzzification methods

Module V

Reference Books
CSD107 DATA MINING

Module I
Introduction:- Datamining- DataMining on what kind of data, Datamining Functionalities, Classification of DataMining Systems, Major Issues on Datamining, Introduction to OLAP,OLAP technology for Data Mining, Data warehousing, Data warehousing to Datamining, Optimizing Data for mining, Data preprocessing.

Module II
Data Mining Primitives:- Datamining Querylanguage, Association Rules in large Datamining, KDD Process, Fuzzy sets and logic, , Classification and Prediction:- Information retrieval, Dimensional Modeling of Data, Pattern Matching, Estimation Error- Em, MLE.

Module III

Module IV
Clustering Algorithms:- Hierarchical algorithm-SingleLink, MSTSingle Link, Complete Link, Average Link, Dendrogram. Partitional Algorithm-MST, Squared Error, K-Means, Nearest Neighbor, PAM, BEA, GA, Categorical algorithm, Large Database.

Module V

References:
CSD202 RANDOM PROCESSES

Module I:

Probability theory & random variables:
Probability axioms, conditional probability, discrete and continuous random variables, cumulative distribution function (CDF), probability mass function (PMF), probability density function (PDF), conditional PMF/PDF, expected value, variance, functions of a random variable, expected value of the derived random variable, multiple random variables, joint CDF/PMF/PDF

Module II:
Functions of multiple random variables, multiple functions of multiple random variables, independent/uncorrelated random variables, sums of random variables, moment generating function, random sums of random variables. The sample mean, laws of large numbers, central limit theorem, convergence of sequence of random variables.

Module III:
Introduction to random processes, specification of random processes, nth order joint PDFs, independent increments, stationary increments, Markov property, Markov process and martingales, Gaussian process, Poisson process and Brownian motion, Mean and correlation of random processes, stationary, wide sense stationary, ergodic processes, Mean-square continuity, mean-square derivatives.

Module IV:
Random processes as inputs to linear time invariant systems: power spectral density, Gaussian processes as inputs to LTI systems, white Gaussian noise. Discrete-time Markov chains: state and n-step transition probabilities, Chapman-Kolmogorov equations, first passage probabilities, classification of states, limiting state probabilities.

Module V:
Series representation of random process: Fourier series, Karhunen-Loeve expansion, Mercer’s theorem, sampled band-limited processes, filtering using series representation

References:
CSD203 COMPUTER VISION

MODULE 1
Image formation and Image model-Components of a vision system-Cameras-Radiometry-Light in space-Light in surface- sources, shadows and shading, Color-Human color perception-Representation of color- A model for image color-Surface color from image color

MODULE 2
Early vision-Line F ilters and Convolution-Shift variant Linear system- Spatial Frequency and Fourier Transforms-Sampling and Aliasing-Filters as Templates-Normalized co relation and finding patterns-Edge detection-Texture Representation ,Analysis and Application

MODULE 3
Multiple images-The Geometry of multiple views-Stereopsis-Affine structure from motion-Elements of Affine Geometry-Affine structure and motion from two images-Affine structure and motion from multiple images-From Affine to Euclidean images.

MODULE 4
Middle level vision-Segmentation by clustering-Shot Boundary Detection and Background Subtraction-Image segmentation by clustering pixels-Segmentation by Graph-Theoretic clustering- Segmentation by fitting a model-The Hough Transform-Fitting lines-Fitting curves- Fitting as a probabilistic inference problem-Robustness-Segmentation and fitting using probabilistic methods.

MODULE 5

References:

CSD204 PATTERN RECOGNITION

MODULE 1
Basics of Pattern recognition-Bayesian Decision Theory-Minimum error rate classification
Classifiers, discriminant functions, decision surfaces -The normal density and discriminant-functions for the Normal density-Continuous and discrete valued features-Bayesian Belief Networks

MODULE 2
Methods for parameter estimation-Maximum-Likelihood (ML) estimation-Maximum a posteropri (MAP) estimation-Bayesian estimation-Gaussian mixture model (Both unimodal-and multimodal distribution)-Expectation-maximization method

MODULE 3
Sequential pattern classification-Discrete hidden Markov model-Continuous density hidden Markov models-Non-parametric techniques for density estimation-Parzen-window method
K-Nearest Neighbour method

MODULE 4
Dimension reduction methods-Principal component analysis-Fisher discriminant analysis
Linear discriminant function based classifiers-Perceptron-Minimum Mean Squared Error (MME) method -The Ho-Kashyap method-Non-metric methods for pattern classification
Decision trees-Classification and Regression Tree (CART)

MODULE 5

References

CSD205 NATURAL LANGUAGE PROCESSING

Module I
Introduction and Overview; Brief Review of Regular Expressions and Automata; Finite State Transducers; Word level Morphology.
Module II
N-gram Models, Statistical estimation and smoothing for language models; Introduction to HMMs; Parts of Speech Tagging.

Module III
Parsing with CFGs; Lexicalized and Probabilistic Parsing; Language and Complexity.

Module IV
Representation of Meaning; Semantic Analysis; Lexical Semantics; Word Net; Word Sense Disambiguation.

Module V
Discourse understanding; Natural Language Generation; Techniques of Machine Translation; Indian Language Case studies.

REFERENCES:

CSD206 MEDICAL IMAGING TECHNIQUES

Module I
Ultra Sound In Medicine - Introduction, production of ultra sound - properties, principles of image formation, capture and display - principles of A-mode, B-mode and M-mode display - Doppler Ultra sound and Colour flow mapping - Applications of diagnostic ultra sound.

Module II
X-Ray computed tomography - Principles of sectional imaging - scanner configuration - data acquisition system - image formation principles - conversion of x-ray data into scan image - 2D image reconstruction techniques - Iteration and Fourier methods. Types of CT scanners.

Module III
Magnetic Resonance Imaging - Principles of MRI pulse sequence - image acquisition and reconstruction techniques - MRI instrumentation - magnets, gradient system - RF coils, receiver system - Functional MRI - Application of MRI.
Module IV
Radio isotope imaging - Rectilinear scanners, Linear scanners - SPECT - PET Gamma Camera Radio nuclides for imaging, Emission Computed Tomography.

Module V
Infra red Imaging - Physics of thermography - Imaging systems - Pyroelectric vidicon camera, clinical thermography - liquid crystal thermography.

References:

CSD207 DISTRIBUTED COMPUTING

Module I.

Module II.
Distributed Operating systems kernel processes and threads Naming and protection Communication and Invocation. Distributed file service design issues interfaces implementation techniques. Case study sun NFS. Name service SNS and DNS.

Module III.
Time and co-ordination. Synchronizing physical clocks logical time and logical clocks. Distributed co-ordination distributed mutual exclusion elections. Replication basic architectural model consistency and request ordering.

Module IV.
Shared data and transactions _ client server _ fault tolerance and recovery _ transactions _ nested transactions. Concurrency control - locks _ optimistic concurrency control _ timestamp ordering. Distributed transactions _ atomic commit protocols _ concurrency control in distributed transactions _ distributed deadlocks _ transactions with replicated data.

Module V.

References
8. "Introduction to Parallel Processing", M.Sasikumar, et.al., PHI, New Delhi, 2000

CSD208 DATA COMPRESSION

Module-I :

Module - II :

Module-III :

Module -IV :
Video Compression Analog Video, Composite and Components Video, Digital Video, Video compression, MPEG and H.261.

**Module - V:**


**References:**