ಮೈಸೂರು ವಿಶ್ವವಿದ್ಯಾನಿಲಯ

University of Mysore

(Estd. 1916)

M.Tech. in Computer Cognition Technology

Flexible
Choice Based
Credit System
(FCBCS)

Master of Technology

Computer Cognition Technology

MTech in CCT

Program Outcome
After successful completion of MTech degree, the graduates will be able to:

- Understand the theoretical foundations and the limits of computing and acquire the skills to adapt existing models, techniques, algorithms, data structures, etc. for efficiently solving problems.
- Inculcate the knowledge to design, develop and evaluate new computer based systems for novel applications, which meet the desired needs of industry and society.
- Undertake original research at the cutting edge of Computer Science and its related areas and to use advanced computing techniques and tools to address the issues very efficiently.
- Understand the professional and ethical responsibility, communicate effectively with a wide range of audience and function effectively as an individual or as a part of a team to accomplish a stated goal.
- Learn independently and understand the impact of IT related solutions in an economic, societal and environment context.

List of Courses and Syllabus
Course Structure for M. Tech. (CCT)

Hard Core Courses

Course Code	Course Title	Credit Pattern
CCTH1	Advanced Data Structures and Algorithms	2:1:1
CCTH2	Advanced Mathematics, Probability and Statistics	3:1:0
CCTH3	Image Processing	2:1:1
CCTH4	Pattern Recognition	2:1:1

Soft Core Courses

Course Code	Course Title	Credit Pattern
CCTS1	Advanced Computer Graphics	2:1:1
CCTS2	Cloud Computing	3:1:0
CCTS3	Soft Computing	2:1:1
CCTS4	Data Compression	0:1:1
CCTS5	Artificial Intelligence	3:1:0
CCTS6	Symbolic Data	2:1:1
CCTS7	Data Clustering	2:1:1
CCTS8	Fuzzy Sets and Logic	2:1:1
CCTS9	Multimedia Databases	2:1:1

CCTS10	Biometrics	1:0:1
CCTS11	Information Retrieval	2:1:1

Elective Courses

CCTE1	Logic Programming	0:1:1
CCTE2	Rough Sets	2:0:0
CCTE3	Wavelets	1:1:0
CCTE4	Decision Support System	2:0:0
CCTE5	Graph Theory	2:1:1
CCTE66	Multimedia Retrieval	2:1:1
CCTE7	Machine Learning	2:1:1
CCTE8	Study of Proximity	0:1:1
CCTE9	Medical Signal Processing	1:0:1
CCTE10	Robotics	1:0:1
CCTE11	Parallel Computing	2:0:2
CCTE12	Simulation and Modelling (Prerequisite : CCTE-12)	2:1:1
CCTE13	Optimization	2:1:1
CCTE14	Cryptography	2:1:1
CCTE15	Advanced numerical Computing	2:0:2
CCTE16	Logic Programming	0:1:1
CCTE17	Network Security (Prerequisite : CCTE-13)	1:1:0
CCTE18	Wireless Computing	3:0:1
CCTE19	Content Management	0:1:1
CCTE20	Symantec Web	1:0:1
CCTE21	Embedded Systems	1:1:0
CCTE22	Virtual Reality	1:1:0
CCTE23	Data Mining	2:1:1

Note:

1) Additional credits earned through soft core can be transferred to elective credits.
2) Depending on the requirements and availability of expertise additional electives may be offered.

Cloud Computing

Course description

Cloud computing is the on-demand availability of computer system resources, especially data storage and computing power, without direct active management by the user. The term is generally used to describe data centers available to many users over the Internet. Large clouds, predominant today, often have functions distributed over multiple locations from central servers. If the connection to the user is relatively close, it may be designated an edge server.

Course objective

To make familiar with various cloud computing concepts like SAAS, PAAS, IAAS and other concepts.

Course content

Introduction to Cloud Computing, Definition, Characteristics, Components, Cloud provider, SAAS, PAAS, IAAS and Others, Organizational scenarios of clouds, Administering & Monitoring cloud services, benefits and limitations, Deploy application over cloud, Comparison among SAAS, PAAS, IAAS Cloud computing platforms: Infrastructure as service: Amazon EC2,Platform as Service: Google App Engine, Microsoft Azure, Utility Computing, Elastic Computing Data in the cloud: Relational databases, Cloud file systems: GFS and HDFS, BigTable, HBase and Dynamo. Issues in

cloud computing, Implementing real time application over cloud platform Issues in Intercloud environments, QOS Issues in Cloud, Dependability, data migration, streaming in Cloud. Quality of Service (QoS) monitoring in a Cloud computing environment

References:

1. Cluster Computing by Rajkumar Buyya, Clemens Szyperski
2. High Performance Cluster Computing: Architectures and systems by Rajkumar Buyya
3. Grid and Cluster Computing by C.S.R Prabhu.
4. Fran Bermn, Geoffrey Fox, Anthony Hey J.G., "Grid Computing: Making the Global Infrastructure a Reality", Wiley, USA, 2003.
5. Joshy Joseph, Craig Fallenstein, "Grid Computing", Pearson Education, New Delhi, 2004.

Course outcome:

The student will be able to learn various cloud computing concepts like SAAS, PAAS, IAAS and other concepts.

Internet programming

Course description

An Internet application is a client-server application that uses standard Internet protocols for connecting the client to the server. We can use exactly the same techniques to create a true Internet application, which is available publicly through the World-Wide Web, or to create an intranet application.

Course objective

Make familiar with the internet technologies and scripting languages like HTML, Cascading Style Sheets (CSS), JavaScript, CGI Programming.

Course content

Internet, WWW, Web Browsers, and Web Servers; URLs; MIME; HTTP; Security; the Web Programmers Toolbox. HTML: Origins and evolution of HTML; Basic syntax; Standard HTML document structure; Basic text markup, Hypertext Links; Lists; Tables; Forms; Frames, cascading Style Sheets (CSS**):** Introduction; Levels of style sheets; Style specification formats; Selector forms; Property value forms; Font properties; List properties; Color; Alignment of text; The Box model; Background images; The and tags; JavaScript**:** Overview of JavaScript; Object orientation and JavaScript; General syntactic characteristics; Primitives, operations, and expressions; Screen output and keyboard input; Control statements; Object creation and modification; Arrays; Functions; Constructor; Pattern matching using regular expressions; Errors in scripts; Examples the Common Gateway Interface; CGI linkage; Query string format; CGI.pm module; A survey example; Cookies.

Reference Books:

1. Programming the World Wide Web – Robert W. Sebesta, 4th Edition, Pearson Education, 2008.
2. Internet & World Wide Web How to H program – M. Deitel, P.J. Deitel, A. B. Goldberg, 3rd Edition, Pearson Education / PHI, 2004.
3. Web Programming Building Internet Applications – Chris Bates, 3rd Edition, Wiley India, 2006.
4. The Web Warrior Guide to Web Programming – Xue Bai et al, Thomson, 2003.

Course outcome:

The student will be able to learn about HTML. CSS, JAVA Script, CGI programming

Multimedia Processing

Course description:

A Multimedia System is a system capable of processing multimedia data and applications. A Multimedia System is characterised by the processing, storage, generation, manipulation and rendition of Multimedia information.

Course Objectives:

After successful completion of this course students will be able to:

- Get the key concepts in current multimedia technology.
- Summarize the representation of text, images, audio and video.
- Classify and develop various compression techniques for text, images, audio and video.
- Analyze and evaluate the strengths and limitations of various audio and video codecs.
- Design codes using the best techniques of compression, encoding and decoding.

Course content

Multimedia Communications: Introduction to Multimedia Systems and Processing, multimedia information representation, multimedia networks, multimedia applications, network QoS and application QoS. Information Representation: text, images, audio and video, Text compression: Text compression principles, Lossless compression , Lossy compression, static coding, dynamic coding, Static Huffman Coding, Dynamic Huffman coding, Arithmetic coding, Lempel – Ziv coding, Lempel – Ziv Welsh coding, transform encoding, entropy encoding, differential encoding, Image compression: GIF format, TIFF format, digital Pictures, Raster scan principles, JPEG, audio: types, Audio compression: PCM, Adaptive PCM, Adaptive Differential PCM, Adaptive predictive coding, Linear predictive coding, code excited LPC, perceptual coding, MPEG audio coders, Dolby Audio coders,Video: broadcast TV, color signals, NTSC, PAL, Digital formats: 4:2:2, 4:2:0, HDTV format, SIF, CIF, QCIF, PC video. Video compression: video compression principles, frame types, motion estimation and compensation,, encoding of frames, implementation issues, Video compression standards: H.261, H.263,MPEG 1, MPEG 2, MPEG 4 (scene composition, coder , decoders), MPEG 7 , MPEG 21 multimedia framework.

Course Outcomes:

- Describe how text, audio, image and video information can be represented digitally in a computer, so that it can be processed, transmitted and stored efficiently.
- Able to differentiate and design lossless and lossy compression techniques.
- Analyze and evaluate the possibility and limitations of multimedia data compression
- Evaluate the audio coding techniques including predictive coding and more advanced techniques based around LPC and others.
- Apply various compressions, encoding and decoding techniques to solve the real problems in multimedia processing and adopt the best methods.

Soft Computing

Course description

Soft computing is the use of approximate calculations to provide imprecise but usable solutions to complex computational problems. The approach enables solutions for problems that may be either unsolvable or just too time-consuming to solve with current hardware.

Course objective

To study about Soft Computing, Fuzzy sets and Fuzzy logic, Artificial Neural Network, Evolutionary and Stochastic techniques and Applications. Rough Set.

Course content

Introduction to Soft Computing:Evolution of Computing - Soft Computing Constituents – From Conventional Artificial Intelligence to Computational Intelligence - Machine Learning Basics, Fuzzy Logic fuzzy sets and Fuzzy logic: Introduction, Fuzzy sets versus crisp sets, operations on

fuzzy sets, Extension principle, Fuzzy relations and relationequations, Fuzzy numbers, Linguistic variables, Fuzzy logic, Linguistic hedges, App lications, fuzzy controllers, fuzzy pattern recognition, fuzzy image processing, fuzzy database, Artificial Neural Networks Artificial Neural Network: Introduction, basic models, Hebb's learning, Adaline, Perceptron, Multilayer feed forward network, Back propagation,Different issues regarding convergence of Multilayer Perceptron, Competitive learning, SelfOrganizing Feature Maps, Adaptive Resonance Theory, Associative Memories, Applications, Genetic Algorithms Evolutionary and Stochastic techniques: Genetic Algorithm (GA), different operators of GeneticAlgorithm,Analysis of selection oper ations, Hypothesis of buildingBlocks, Schema theorem and convergence of Genetic Algorithm, Simulated annealing and Stochastic models, Boltzmann Machine, Applications. Rough Set: Introduction, Imprecise Categories Approximations and Rough Sets, Reducti on of Knowledge, Decision Tables, and Applications, Hybrid Systems [8L] Neural-Network-Based Fuzzy Systems, Fuzzy Logic-Based Neural Networks, Genetic Algorithm for Neural Network Design andLe arning, Fuzzy Logic and Genetic Algorithm for Optimization, Applications.

Books/References:

1. Mitchell Melanie, “An Introduction to Genetic Algorithm”, Prentice Hall, 1998.
2. David E. Goldberg, “Genetic Algorithms in Search, Optimization and Machine Learning”, Addison Wesley, 1997.
3. S. Haykin, “Neural Networks”, Pearson Education, 2ed, 2001.
4. S. Rajasekaran & G. A. V. Pai , Neural Networks, Fuzzy logic, and Genetic Algorithms, PHI.
5. Fuzzy Sets and Fuzzy Logic, Klir & Yuan, PHI, 1997
6. Rough Sets, Z. Pawlak, Kluwer Academic Publisher, 1991.
7. Neural Networks, Fuzzy logic, and Genetic Algorithms, S. Rajasekaran and G. A. V. Pai, PHI.
8. Intelligent Hybrid Systems, D. Ruan, Kluwer Academic Publisher, 1997.

Course outcome

The student will be able to know about Soft Computing, Fuzzy sets and Fuzzy logic, Artificial Neural Network, Evolutionary and Stochastic techniques and Applications. Rough Set.

Logic Programming

Course description

Logic programming is a type of programming paradigm which is largely based on formal logic. Any program written in a logic programming language is a set of sentences in logical form, expressing facts and rules about some problem domain.

Course objective

To familiarize with modern *programming* languages and paradigms, solve problems using the functional paradigm, solve problems using the *logic programming* paradigm.

Course content

Logic as a Language for Problem Solving, Sentence structure, Implication and Interface, General Structure and Computational Behaviour of Logic Programs, Procedural interpretation of Logic, Algorithmic view of logic program execution; Pragmatic and Stylistic considerations for structuring of program and data; Specification, Verification and synthesis of logic programs; Elementary features of typical logic implementations, Contribution of Logic Programming to Theory, practice and technology of computing.

Books/References:

1. Hogger C J, Introduction to Logic Programming, Academic Press
2. Bundy A., Computer Modelling of Mathematical Reasoning, Academic Press
3. Lloyd, J W., Foundations of Logic Programming, Springer Verlag

Course outcome:
The student will be able to write program in modern *programming* languages and paradigms, solve problems using the functional paradigm, solve problems using the *logic programming* paradigm.

Data Compression

Course description
Data compression is grounded in information theory, and there are many fundamental algorithms that must deal with our information transmission and storage tasks. In this subject discuss the theoretical underpinnings of data compression and cover many fundamental algorithms.

Course objective
Data compression is grounded in information theory, and there are many fundamental lgorithms that must deal with our information transmission and storage tasks. In this subject discuss the theoretical underpinnings of data compression and cover many fundamental algorithms.

Course content
Compression Techniques: Loss less compression, Lossy Compression, Measures of prefonnance, Modeling and coding, Mathematical Preliminaries for Lossless. compression: A brief introduction to information theory, Models: Physical models, Probability models, Markov models, composite source model, Coding: uniquely decodable codes, Prefix codes,The Huffman coding algorithm: Minimum variance Huffman codes, Adaptive Huffman coding: Update procedure, Encoding procedure, Decoding procedure. Golomb codes, Rice codes, Tunstall codes, Applications of Hoffman coding: Loss less image compression, Text compression, Audio Compression, Coding a sequence, Generating a binary code, Comparison of Binary and Huffman coding, Applications: Bi-level image compression-The JBIG standard, JBIG2, Image compression. Dictionary Techniques: Introduction, Static Dictionary: Diagram Coding, Adaptive Dictionary. The LZ77 Approach, The LZ78 Approach, Applications: File Compression-UNIX compress, Image Compression: The Graphics Interchange Format (GIF), Mathematical Preliminaries for Lossy Distortion criteria, Models, Scalar Ouantization: The Quantization problem, Uniform Quantizer, Adaptive Quantization, Non uniform Quantization. Vector Quantization Advantages of Vector Quantization over Scalar Quantization, The Linde-Buzo-Gray Algorithm, Tree structured Vector Quantizers. Structured Vector Quantizers.

References:

1. Khalid Sayood, “Introduction to Data Compression,” Morgan Kaufmann Publishers.
2. D. Salomon, “Data Compression, The Complete Reference,” Springer, 2nd Edition, 2000.
3. Gersho and R.M. Gray “Vector Quantization and Signal Compression,” Kluwer Academic Press, 1992.

Course outcome: After the completion of the course the student will be able to learn many fundamental algorithms that must deal with our information transmission and storage tasks. In this subject the student will be able to learn theoretical underpinnings of data compression and cover many fundamental algorithms.

Rough Set

Course description
The tuple composed of the lower and upper approximation is called a rough set; thus, a rough set is composed of two crisp sets, one representing a lower boundary of the target set, and the other representing an upper boundary of the target set.

Course objective
To study the rough set approximation, imprecise category approximations and rough sets.

Course content

Rough Set: Introduction, Imprecise Categories Approximations and Rough Sets, Reduction of Knowledge, Decision Tables, and Applications.

Books / References:

1. Rough Sets, Z. Pawlak, Kluwer Academic Publisher, 1991.

Course outcome:

The student will be able to learn about rough set approximation, imprecise category approximations and rough sets

Wavelets

Course description

A wavelet is a mathematical function used to divide a given function or continuous-time signal into different scale components. Usually one can assign a frequency range to each scale component. Each scale component can then be studied with a resolution that matches its scale.

Course objective

To study about Stationary and non-stationary signals, Fourier transform, Wavelet Packet Transform.

Course content

Introduction - Stationary and non-stationary signals - Signal representation using basis and frames- Brief introduction to Fourier transform and Short time Fourier transform - Time frequency analysis- The uncertainty principle and its implications- Piecewise Constant Approximation – the Haar Wavelet – Building up the concept of Multi resolution Analysis (MRA) and Relating it to filter banks, Continuous wavelet transform (CWT) - Condition of admissibility and its implications – Inverse Continuous Wavelet Transform - Discrete Wavelet Transform And Filter banks - Construction of wavelets using time domain and frequency domain approaches - Computation of the discrete wavelet transform using Mallat Algorithm and Lifting Scheme - Two dimensional wavelet transforms and Extensions to higher dimensions, Wavelet Packet Transform – Signal representation using wavelet packet analysis – selection of best basis. Applications of Wavelets and Wavelet Packets in Signal and Image compression - Detection of signal changes - analysis and classification of audio signals - Wavelet based signal de-noising and energy compaction - Image fusion, Edge Detection and object isolation – Biomedical Signal Processing Applications.

References

1. M. Vetterli, J. Kovacevic, Wavelets and Subband Coding, Prentice Hall Inc, 1995.
2. Gilbert Strang and Truong Q. Nguyen, Wavelets and Filter banks, 2nd Edition, WellesleyCambridgePress,1998.
3. Raghuvir Rao and Ajit S. Bopardikar, Wavelet Transforms : Introduction, Theory and Applications, Pearson Education , 2000.
4. J.C. Goswami and A.K. Chan, Fundamentals of Wavelets: Theory, Algorithms and Applications, 2 nd Ed, WILEY, 2011.
5. K. P.Soman and K L Ramachandran, Insight into wavelets from theory to practice, PHI, 2008

Course outcome:

Apply the mathematical basis of the wavelet transform and its performance in the analysis of non-stationary signals Apply the concepts, theory and algorithms behind wavelet transform and wavelet packet transform from an interdisciplinary perspective. Build the concept of dyadic multi resolution analysis and relate it to filter banks Construct Wavelets using the time domain and frequency domain approaches Explore the applications of wavelets and wavelet packets in transient analysis, biomedical signal processing, speech, audio, image and video coding, signal denoising, pattern recognition etc.

Decision Support Systems

Course description:

A **decision support system** (**DSS**) is an information system that supports business or organizational decision-making activities. DSSs serve the management, operations and planning levels of an organization (usually mid and higher management) and help people make decisions about problems that may be rapidly changing and not easily specified in advance—i.e. unstructured and semi-structured decision problems. Decision support systems can be either fully computerized or human-powered, or a combination of both.

Course Objectives:

This Course will enable students to

1. Outline a framework for decision support.
2. Categorize phases of decision making process.
3. Illustrate the characteristics, capabilities and components of DSS.
4. Make use of the DSS development methodology and to get the feeling of the concept.
5. Explain Group Decision making.

Course content

Decision Making and Computerized Support Managers and Decision Making, Managerial Decision Making and Information Systems, Managers and Computerized Support, The need for Computerized Support technologies, a frame work for decision support, the concept of Decision Support systems, Group Decision Support Systems. Executive systems and Information (support) Systems, Expert Systems, Artificial Neural Networks, and Hybrid Support Systems, Decision Making and Computerized Support, The Evolution and Attributes of Computerized Decision aids, Introduction and Definitions, Systems, Models, The Modeling Process, Decision Making: The Intelligent Phase, Decision Making: The Design Phase, Decision Making: The Choice Phase, Evaluation, Decision Making: Implementation Phase, Decision Support Systems-I DSS Configuration, What is DSS? Characteristics, Capabilities, Components of DSS, The Data Management Sub System, The Model Management Subsystem, Management System, The User Interface, The User, DSS Hardware, Distinguishing DSS from Management Science and MIS, DSS Classification, Decision Support Systems – II Introduction to DSS development, The Traditional System Development Life cycle, Alternate Development Methodologies, Prototyping: The DSS Development Methodology, DSS Technology Levels and Tools, DSS Development Platforms, DSS Development Tool Selection, Team-Developed DSS, End User-Developed DSS, Developing DSS: Putting the System Together, DSS Research Directions and the DSS of the future. Group Decision Making, Communication and Collaboration, Communication Support, Collaboration Support: Computer- Supported Cooperative work, Group Support Systems, Group Support Systems Technologies, Group Systems, The GSS Meeting Process, Distance Learning, Creativity and Idea Generation, GSS and Collaborative Computing Issues and Research, Knowledge Based DSS: Concepts and Definitions of Artificial Intelligence, AI versus Natural Intelligence, The Artificial Intelligence field, Types of Knowledge-Based Decision Support systems, Basic Concepts, The Human Element in Expert System, How Expert System work? Problem areas addressed by ES, Benefits, Problems and Limitations of ES, ES Success Factors, Types of Expert Systems, ES and the Internet/ Intranet/ Web, Knowledge Engineering, Scope of Knowledge, Difficulties in Knowledge Acquisition, Methods of Knowledge Acquisition, Machine Learning, Intelligent Agents, Selecting an appropriate Knowledge Acquisition Method, Knowledge Acquisition from Multiple Experts, Validation and Verification of Knowledge Base, Analyzing and Coding, Documenting and Diagramming, Numeric and Documented Knowledge Acquisition, Knowledge Acquisition and Internet/ Intranet, Induction and Table Example.

Course Outcomes:

At the end of the course the student will be able to:

1. Design a framework for decision support
2. Illustrate and classify phases of decision making process
3. Outline the characteristics, capabilities and components of DSS.

4. Explain the DSS development methodology
5. Apply Group Decision making

Network security

Course description

The course is intended for knowledge of various security mechanism employed in a network so that message can be communicated in a secure manner in unsafe network.

Course objective

To make student familiar with various security threats and how we secure the network by means of achieving confidentiality and integrity and authentication.

Course content

Symmetric ciphers-Block cipher principles; DES-Algorithm, strengths and weaknesses of DES, attacks on DES and defense, multiple encryptions; Asymmetric ciphers-Essential mathematics, public key cryptography, RSA, Diffie Hellman key exchange, random number generation, Data integrity and authentication Hash functions; MAC; Digital signatures; Key management; Authentication, Web and system security, Web security; IP security; E mail security; System security-intruders, malicious software, firewalls

References:

1. Cryptography and Network Security - Principles and Practice, William Stallings, PEARSON

2. Cryptography and Network Security, Atul Kahate, Tata McGraw Hill

Course outcome:

The student will be familiar with various security threats and how we secure the network by means of achieving confidentiality and integrity and authentication.

Parallel Computing

Course description

Parallel computing is a type of computation in which many calculations or the execution of processes are carried out simultaneously. Large problems can often be divided into smaller ones, which can then be solved at the same time.

Course objective

- To learn parallel and distributed algorithms development techniques for shared memory and message passing models.
- To study the main classes of parallel algorithms.
- To study the complexity and correctness models for parallel algorithms.

Course content

Basic Techniques, Parallel Computers for increase Computation speed, Parallel & Cluster Computing: Message Passing Technique- Evaluating Parallel programs and debugging, Portioning and Divide and Conquer strategies examples Pipelining- Techniques computing platform, pipeline programs examples: Synchronous Computations, load balancing, distributed termination examples, programming with shared memory, shared memory multiprocessor constructs for specifying parallelist sharing data parallel programming languages and constructs, open MP: Distributed shared memory systems and programming achieving constant memory distributed shared memory programming primitives, algorithms – sorting and numerical algorithms.

Reference Books:

1. Parallel Programming, Barry Wilkinson, Michael Allen, Pearson Education, 2nd Edition.
2. Introduction to Parallel algorithms by Jaja from Pearson, 1992.

Course outcome:

- To learn parallel and distributed algorithms development techniques for shared memory and message passing models.
- The student is able to get the knowledge of the main classes of parallel algorithms.
- To able to learn the complexity and correctness models for parallel algorithms.

Fuzzy Sets and Logic

Course Description

In mathematics, fuz**zy** sets are somewhat like sets whose elements have degrees of membership. Fuzzy sets were introduced independently by Lotfi A. Zadeh and Dieter Klaua in 1965 as an extension of the classical notion of set. At the same time, Salii defined a more general kind of structure called an L-relation, which he studied in an abstract algebraic context. Fuzzy relations, which are used now in different areas, such as linguistic decision making and clustering are special cases of *L*-relations when *L* is the unit interval [0, 1].

Course objective

Fuzzy logic algorithm helps to solve a problem after considering all available data. Then it takes the best possible decision for the given the input. The FL method imitates the way of decision making in a human which consider all the possibilities between digital values T and F.

Course Content

Introduction, classical sets and fuzzy sets, classical relations and fuzzy relations, Properties of Membership Functions, Fuzzification, and Defuzzification, Development of Membership Functions, Fuzzy Classification and Pattern Recognition, fuzzy arithmetic, fuzzy system design.

References:

1. Fuzzy Logic with Engineering Applications: Timothy J Ross, Second Edition, John Wiley & Sons Ltd, The Atrium, Southern Gate, Chichester, England.
2. Fuzzy Sets and Fuzzy Logic-Theory and Applications: George J. Klir and Bo Yuan, Prentice Hall, New Jersy.

Course outcome

The student will be able to learn Fuzzy logic*,* unlike probability, handles imperfection in the informational content of the event.

Biometrics

Course Outlines:

Biometrics is about how we can recognize people automatically, by personal characteristic like fingerprints and faces etc. Information needs to sense it and then deliver an assessment of the identity associated with that data. This course covers the uses and applications of biometrics and how to undertake basic research in biometrics using case studies including biometric recognition system like Face, Signature, Fingerprint, Iris, Tongue recognition etc.

Course Objective:
The course aims to:

- Assess ways of identifying people in different environments for authentication.
- To understand various kinds of biometric systems, securities and recognition systems.
- The novel approaches to biometrics and how they fit in its technological landscape.

Course Contents:

Introduction of Biometrics: history, applications, performance evaluation, Biometric system design challenges, basic image operations, edge detection in digital images, filtering, sharpening etc. Biometric system: identification and verification, FAR/FRR, system design issues, positive / negative identification, authentication protocols, matching score distribution, FAR/FRR curve, expected overall error, EER. Biometric system security: Biometric attributes types, verification and identification on multimodel system, normalization strategy, fusion methods, Biometric system security, and vulnerabilities. Recognition systems: general description, features, types of algorithms used for interpretation, components and operations for Face, Signature, Fingerprint, Iris, Tongue etc.

Text/References:

1. Guide to Biometrics, By: Ruud M.Bolle,Sharath Pankanti, Nalini K. Ratha,Andrew W. Senior, Jonathan H. Connell,Springer 2009
2. Biometrics, Woodward, J.D. and Orlans, Nicholos M., McGraw Hill (2002)
3. Digital Image Processing using MATLAB,By: Rafael C. Gonzalez, Richard Eugene Woods, 2nd Edition, Tata McGraw-Hill Education 2010
4. Biometric Solutions for Authentication in an e-World, Zhang, D., (Ed.), Kluwer Publisher, 2002. BIOMETRICS: Personal Identification in Networked Society, A. Jain, R. Bolle, S. Pankanti, (Ed.), Kluwer Academic Publishers, 1999. ISBN 0-7923-8345-1. TK7882.P3 B36 6. Other Research Papers.

Course Outcomes:
At the end of the course, the student will be able to:

- Identify emerging trends in the biometrics industry.
- Identify algorithms for finger, face, iris and tongue biometric technology.
- Take up research work in biometric like face, finger, palm print recognition etc.

Biomedical Signals

Course description
Biomedical signal is the application of the natural sciences, especially the biological and physiological sciences, to clinical medicine.

Course objective

To make familiar with biomedical signals and ECG signal characteristics ECG interpretation, bandpass filtering techniques,

Course content
Introduction to Biomedical Signals: The nature of Biomedical Signals, Examples of Biomedical Signals, Objectives and difficulties in Biomedical analysis, electrocardiography: Basic electrocardiography, ECG lead systems, ECG signal characteristics, signal Conversion **:**Simple signal conversion systems, Conversion requirements for biomedical signals, Signal conversion circuits, signal Averaging**:** Basics of signal averaging, signal averaging as a digital filter, a typical averager, software for signal averaging, limitations of signal averaging, adaptive Noise

Cancelling**:** Principal noise canceller model, 60-Hzadaptive cancelling using a sine wave model, other applications of adaptive filtering, data Compression Techniques**:** Turning point algorithm, AZTEC algorithm, Fan algorithm, Huffman coding, data reduction algorithms The Fourier transform, Correlation, Convolution, Power spectrum estimation, Frequency domain analysis of the ECG, cardiological signal processing**:** Basic Electrocardiography, ECG data acquisition, ECG lead system, ECG signal characteristics (parameters and their estimation), Analog filters, ECG amplifier, and QRS detector, Power spectrum of the ECG, Bandpass filtering techniques, Differentiation techniques, Template matching techniques, A QRS detection algorithm, Realtime ECG processing algorithm, ECG interpretation, ST segment analyzer, Portable arrhythmia monitor, neurological signal processing**:** The brain and its potentials, The electrophysiological origin of brain waves, The EEG signal and its characteristics (EEG rhythms, waves, and transients), Correlation, analysis of EEG channels**:** Detection of EEG rhythms, Template matching for EEG, spike and wave detection.

Course outcome:
The students will be able to learn about biomedical signals ECG interpretation and bandpass filter.

Robotics

Course description
Robotics is the study of robot technology that makes use of disciplines such as: dynamic system modelling and analysis, mathematics, physics, biology, mechanical engineering, electrical and electronic engineering, computer science and engineering, and automation (sensors, control, and actuators) technology.

Course objective

To study various facts involved in various kinematic structures, feedback systems, sensory control. Programming Language like VAL, RAIL, AML.

Course content
Introduction. Construction of manipulators, advantages and disadvantages of various kinematic structures. Applications, Nonservo robots, motion planning. Feedback systems, encoders Kinematics, homogeneous coordinates solution of the inverse kinematic problem, multiple solutions, jacobian, work envelopes. Trajectory planning. Joint Interpolated Trajectory, Link joints and their Manipulator dynamics and force control. Sensors: Vision, ranging, laser, acoustic, tactile. Developments in sensor technology, sensory control. Programming Language: VAL, RAIL, AML. Mobile robots, walking devices. Robot reasoning.

Text Books / References:

1. K.S Fu, R.C. Gonzalez, C.S.G. Lee, Robotics, McGraw Hill, 1987.
2. Y. Koren, Robotics for Engineers, McGraw Hill, 1985
3. J.J. Craig, Robotics, Addison-Wesley, 1986.
4. Saeed B. Niku, " Introduction to Robotics – Analysis, Systems and Application" : PHI 2006
5. Richard D, Klafter, Thomason A ChmielOwski, Michel Nagin "Robotics Engg-an Integrated Approach" PHI 2005
6. R.K. Mittal & I.J. Nagrath, "Robotics & Control" TMH-2007.

Course outcome:

The student will be able to learn various facts involved in various kinematic structures, feedback systems, sensory control. Programming Language like VAL, RAIL, AML.

Embedded Systems

Course description

An embedded system is a controller with a dedicated function within a larger mechanical or electrical **sys**tem, often with real-time computing constraints. It is embedded as part of a complete device often including hardware and mechanical parts. Embedded systems control many devices in common use today.

Course objective

To introduce students to the modern embedded systems and to show how to understand and program such **sys**tem**s** using a concrete platform built around. A modern embedded processor like the Intel ATOM.

Course content

Introduction: Digital Systems and its applications; Basics on manufacturing process of Digital systems; Device and Wire Model; Design and implementation strategies of digital VLSI systems: Full and Semi-custom; Static and Dynamic MOS Logic design and Characteristics: Combinational and sequential circuits and systems; Introduction to ASIC and FPGA based system Design; Architecture design and HDL; synthesis and Timing Analysis in digital systems; Digital Arithmetic circuits; Memory cell and peripheral circuits; introduction to physical Design and verification; Digital IC testing methodologies;

Reference Books:

1. Ming-Bo Lin, ―Introduction to VLSI Systems: A Logic, Circuit, and System Perspective‖ Indian Edition, CRC Press, 2011.
2. Seetharaman Ramachandran, ―Digital VLSI Systems design‖, 1st Edition, Springer, 2007.
3. Michael John Sebastian Smith, ―Application Specific Integrated Circuit‖ Addison Wesley, Reprint edition, 1997.
4. J. M. Rabaey, A. Chandrakasan, and B. Nikolic, ―Digital Integrated circuits: A design perspective‖ 2nd Edition, Pearson Education India, 2016.
5. Sung-Mo Kang, and Yusuf Leblebici, ―CMOS Digital Integrated Circuits‖, 3 rd Edition McGraw-Hill Education, 2002.
6. Michael, D. Ciletti, ―Advanced Digital Design with the VeriolgHDL‖, PHI Learning Private Limited, 2012.
7. Samir Palnitkar, ―Verilog HDL: A Guide to Digital Design and Synthesis‖, Second Edition, Prentice Hall PTR, 2003.

Course outcome:

The student able to learn the modern embedded systems and program such **sys**tem**s** using a concrete platform built around.

Virtual Reality

Course description

Virtual Reality (VR) is the use of computer technology to create a simulated environment. Unlike traditional user interfaces, VR places the user inside an experience. Instead of viewing a screen in front of them, users are immersed and able to interact with 3D worlds.

Course objective

To study about Real time computer graphics 3D clipping, Reflection models.

Course content

Introduction – Computer graphics – Real time computer graphics – Flight Simulation – Virtual environments –Requirement for virtuality – benefits of virtual reality- Historical development of VR : Introduction – Scientific Landmark -3D Computer Graphics : Introduction – The Virtual world

space – positioning the virtual of server – the perspective projection – human vision – stereo perspective projection – 3D clipping – Colour theory – Simple 3D modeling – Illumination models – Reflection models – Shading algorithms – Radiosity – Hidden-Surface removal – Realism – Stereographic usages.

Course outcome:

The student will be able to learn about the Real time computer graphics 3D clipping, Reflection models.

References

https://www.schellgames.com/assets/images/microsites/hololabhomepage/HoloLABChampionTeacherGuide_ip.pdf

Multimedia Databases

Course Description:

Multimedia Databases (MBD) contain a data encoded in one or more media, where at least one of which, medium is not alphanumeric. The static media includes a text, photographs and drawings, dynamic media - a video, audio sequences (music, speech) and computer animations. In addition to this, the multimedia database will include the so-called metadata, the alphanumeric description of the parameters and the content of the former. What most distinguishes this type of database from the traditional one, the search is based on the content, operations on multimedia and the sophisticated ways of presenting information.

Course content

Introduction, basic definitions, Multimedia systems architecture BD, Large objects in databases, Storage and presentation of multimedia, Characteristics of multimedia data, Query processing in multimedia BD, Standards (SQL / MM, MPEG-7 and MPEG-21), Multimedia data mining, Multimedia in a commercial DBMS.

Textbook

1. V.S. Subrahmanian, Principles of Multimedia Database Systems, Morgan Kaufmann, 1998. 2. Melton J., Eisenberg A.: SQL Multimedia and Application Packages (SQL/MM). SIGMOD Record 30(4), 2001.

Learning Outcomes:

Practical skills training for processing multimedia data in the selected media management system database. The ability to create a dedicated application for multimedia repository.

Optimization Techniques

Learning Objectives:

The focus of the course is on convex optimization though some techniques will be covered for non-convex function optimization too. After an adequate introduction to linear algebra and probability theory, students will learn to frame engineering minima maxima problems in the framework of optimization problems.

Course content

Mathematical preliminaries Linear algebra and matrices, Vector space, eigen analysis, Elements of probability theory Elementary multivariable calculus, Linear programming Simplex method, Introduction to linear programming model, Duality, Karmarkar's method. Unconstrained optimization Conjugate direction and quasi-Newton methods , Gradient-based methods, One-dimensional search methods.

Constrained Optimization Lagrange theorem ,FONC, SONC, and SOSC conditions, Projection methods KKT conditions , Non-linear constrained optimization models ,Non-linear problems

Reference Books:

1. An introduction to Optimization by Edwin P K Chong, Stainslaw Zak

2. Nonlinear Programming by Dimitri Bertsekas

Learning Outcome:
On successful completion of the course the student will be able to use Matlab to implement optimization algorithms, model engineering minima/maxima problems as optimization problems.