Title of Course: Cloud Computing
Course Code: CS701
L-T Scheme: 3-0
Course Credits: 3

Objectives: The course covers the fundamental concepts and practical aspects of Service Oriented Architecture. The current software development and delivery model is service oriented in nature. The applications are inherently getting distributed and shared by multiple clients. Thus, there is a need to get an insight into service oriented architectures.

Learning Outcome: After having undergone the course, the student shall be able to understand the issues related with detailed design aspects and standards of SOA.

Course Contents:
Unit-1: SOA Fundamentals, Technologies, Benefits, Challenges and basic mechanisms associated with other computing service (Delivery models - SAS, IAS & PAS, Common Cloud deployment models and cloud characters), Security threats and mechanisms.

Unit-2: Introduction and fundamental of SOA, Benefits and Goals, SOA Manifesto, SOA and network management architecture, Service as web services, Discovery and publishing of web services, Service roles, Service models, Description of services with WSDL, Messaging with SOAP.

Unit-3: Exchange patterns of message, Service activity, Coordination, Composition, Types, Activation and registration process, Business activities, Orchestration, Composition of heterogeneous web services Choreography, Addressing, Reliable messaging, Correlation, Policies, Notification and eventing.

Unit-4: Security threats and mechanisms, Essential techniques, Patterns, Security architecture for service oriented solutions, Infrastructure, Middleware, Multitenancy concepts.

Text Books
2. SOA in Practice: The Art of Distributed System Design, Nicolai M. Josuttis, O'Reilly, 2007
Title of Course: Compiler Design  
Course Code: CS702  
L-T Scheme: 3-1  
Course Credits: 3

Introduction:  
This course examines compiler design concepts, phases of compiler in detail and cousins of compiler. The Topics to be covered (tentatively) include:

• Introduction to Compiler  
• Lexical Analysis  
• Syntax Analysis  
• Type Checking  
• Intermediate Code Generation  
• Code Generation  
• Code Optimization

Objectives:  
In this course the students will study the introduction to the major concept areas of language translation and compiler design. To enrich the knowledge in various phases of compiler ant it’s use, code optimization techniques, machine code generation, and use of symbol table. To extend the knowledge of parser by parsing LL parser and LR parser. To provide practical programming skills necessary for constructing a compiler. To provide practical programming skills necessary for constructing a compiler.

Learning Outcomes:
Knowledge:
1. To apply the knowledge of lex tool & yacc tool to devleop a scanner & parser.  
2. To design & conduct experiments for Intermediate Code Generation in compiler.  
3. To design & implement a software system for backend of the compiler.  
4. To deal with different translators.  
5. To develop program to solve complex problems in compiler  
6. To learn the new code optimization techniques to improve the performance of a program in terms of speed & space.  
7. To acquire the knowledge of modern compiler & its features.  
8. To learn & use the new tools and technologies used for designing a compiler  
9. To use the knowledge of patterns, tokens & regular expressions for solving a problem in the field of data mining.

Application:
1. To apply compiler design techniques.  
2. To relate theory of compiler design to practice  
3. To learn to build domain specific generators  
4. The students shall acquire the generic skills to design and implement a compiler along with analysis of practical aspects.

Course Contents:
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Course Description

Unit 1: Introduction to Compiling
Compilers, Analysis-synthesis model, The phases of the compiler, Cousins of the compiler.

Lexical Analysis
The role of the lexical analyzer, Tokens, Patterns, Lexemes, Input buffering, Specifications of a token, Recognition of tokens, Finite automata, From a regular expression to an NFA, From a regular expression to NFA, From a regular expression to DFA, Design of a lexical analyzer generator (Lex).

Unit 2: Syntax Analysis
The role of a parser, Context free grammars, Writing a grammar, Top down Parsing, Non-recursive Predictive parsing (LL), Bottom up parsing, Handles, Viable prefixes, Operator precedence parsing, LR parsers (SLR, LALR), Parser generators (YACC). Error Recovery strategies for different parsing techniques.

Syntax directed translation
Syntax directed definitions, Construction of syntax trees, Bottom-up evaluation of S attributed definitions, L attributed definitions, Bottom-up evaluation of inherited attributes.

Unit 3: Type checking
Type systems, Specification of a simple type checker, Equivalence of type expressions, Type conversions

Run time environments
Source language issues (Activation trees, Control stack, scope of declaration, Binding of names), Storage organization (Subdivision of run-time memory, Activation records), Storage allocation strategies, Parameter passing (call by value, call by reference, copy restore, call by name), Symbol tables, dynamic storage allocation techniques.

Unit 4: Intermediate code generation
Intermediate languages, Graphical representation, Three-address code, Implementation of three address statements (Quadruples, Triples, Indirect triples).

Code optimization
Introduction, Basic blocks & flow graphs, Transformation of basic blocks, Dag representation of basic blocks, The principle sources of optimization, Loops in flow graph, Peephole optimization.

Code generations
Issues in the design of code generator, a simple code generator, Register allocation & assignment.

Text Books
2. Holub - “Compiler Design in C” – PHI
3. Tremblay and Sorenson Compiler Writing-McgrawHill International .
4. Chattopadhyay , S- Compiler Design ( PHI)

References
1. J. Archer Harris, Operating systems – Schuam’s outlines, Tata Mc Graw Hill.
Title of Course: Image Processing  
Course Code: CS703A  
L-T-P Scheme: 3-0-0  
Course Credits: 3

Introduction:
Signal processing is a discipline that deals with analysis and processing of analog and digital signals. It deals with storing, filtering, and other operations on signals. These signals include transmission signals, sound or voice signals, image signals, and other signals etc.
Out of all these signals, the field that deals with the type of signals for which the input is an image and the output is also an image is done in image processing. As it name suggests, it deals with the processing on images.
It can be further divided into analog image processing and digital image processing.

Objectives:
Digital image processing deals with manipulation of digital images through a digital computer. It is a subfield of signals and systems but focus particularly on images. DIP focuses on developing a computer system that is able to perform processing on an image. The input of that system is a digital image and the system process that image using efficient algorithms, and gives an image as an output.

Learning Outcomes:
Students will be able to apply various image processing concepts and models to input images or input signals for various purposes. For example: image compression, image de-noising, image enhancement, edge detection and sharpening etc.

Application:
- Remote Sensing picture processing:
  - Tracking of Earth Resources
  - Weather Forecasting
  - Geographical Mapping
  - Identifying different areas like – Water Body
  - area, Forest Area, Hilly area etc.
- Image Transmission & Storage
  - Image Compression technique is applied

- Medical applications:
  - X-Ray, Ultra sound, etc.
- Defence:
  - Tracking missiles, vehicles etc.
- Industrial machine vision
  - we can inspect different objects

Course Contents:

Unit 1: Introduction

Unit 2: Digital Image Formation
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Course Description

A Simple Image Model, Geometric Model- Basic Transformation (Translation, Scaling, Rotation), Perspective Projection, Sampling & Quantization - Uniform & Non uniform.

Unit 3: Mathematical Preliminaries
Neighbour of pixels, Connectivity, Relations, Equivalence & Transitive Closure; Distance Measures, Arithmetic/Logic Operations, Fourier Transformation, Properties of The Two Dimensional Fourier Transform, Discrete Fourier Transform, Discrete Cosine & Sine Transform

Unit 4: Image Enhancement
Spatial Domain Method, Frequency Domain Method, Contrast Enhancement - Linear & Nonlinear Stretching, Histogram Processing; Smoothing - Image Averaging, Mean Filter, Low-pass Filtering; Image Sharpening, High-pass Filtering, High-boost Filtering, Derivative Filtering, Homomorphic Filtering; Enhancement in the frequency domain - Low pass filtering, High pass filtering.

Unit 5: Image Restoration
Degradation Model, Discrete Formulation, Algebraic Approach to Restoration - Unconstrained & Constrained; Constrained Least Square Restoration, Restoration by Homomorphic Filtering, Geometric Transformation - Spatial Transformation, Gray Level Interpolation

Unit 6: Image Segmentation
Point Detection, Line Detection, Edge detection, Combined detection, Edge Linking & Boundary Detection - Local Processing, Global Processing via The Hough Transform; Thresholding - Foundation, Simple Global Thresholding, Optimal Thresholding; Region Oriented Segmentation - Basic Formulation, Region Growing by Pixel Aggregation, Region Splitting & Merging.

Text Books

1. Digital Image Processing, Gonzalves, Pearson
2. Digital Image Processing, Jahne, Springer India
3. Digital Image Processing & Analysis, Chanda & Majumder, PHI
5. Image Processing, Analysis & Machine Vision, Sonka, VIKAS
6. Getting Started with GIS- Clarke Keith. C; PE.
Title of Course: Pattern Recognition  
Course Code: CS703B  
L-T Scheme: 3-0  
Course Credits: 3

Introduction:
This course introduces fundamental concepts, theories, and algorithms for pattern recognition and machine learning. Topics to be covered include linear regression, linear classification, support vector machines, dimensionality reduction, clustering, boosting, and probabilistic graphical models.

Objectives:
Pattern Recognition (PR) techniques are widely used for various applications like medical and biological. The objective of this new elective course is first to make student familiar with general approaches such as Bayes Classification, Nearest Neighbor Rule, Neural Networks and later to concentrate on more often used modern classification techniques such as Support Vector Machines and Multiclassifiers for solving Bio-Medical problems.

Learning Outcomes:
Knowledge:
1. To understand the fundamental pattern recognition and machine learning theories
2. To design and implement certain important pattern recognition techniques
3. To apply the pattern recognition theories to applications of interest.

Application:
1. To apply PR concept for various applications like medical and biological applications.
2. To give basics of pattern recognition concepts with applications to computer vision.
3. To apply the concept in fingerprint recognition, handwriting recognition and handwriting verification etc.

Course Contents:
Unit 1: Introduction – Definitions, data sets for Pattern Recognition Different Paradigms of Pattern Recognition Representations of Patterns and Classes Metric and non-metric proximity measures

Unit 2: Feature extraction Different approaches to Feature Selection Nearest Neighbour Classifier and variants Efficient algorithms for nearest neighbour classification

Unit 3: Different Approaches to Prototype Selection Bayes Classifier Decision Trees Linear Discriminant Function

Unit 4: Support Vector Machines Clustering Clustering Large datasets Combination of Classifiers Applications – Document Recognition

Text Books

References
Introduction:
Soft computing (SC) solutions are unpredictable, uncertain and between 0 and 1. Soft Computing became a formal area of study in Computer Science in the early 1990s. Earlier computational approaches could model and precisely analyze only relatively simple systems. More complex systems arising in biology, medicine, the humanities, management sciences, and similar fields often remained intractable to conventional mathematical and analytical methods. However, it should be pointed out that simplicity and complexity of systems are relative, and many conventional mathematical models have been both challenging and very productive. Soft computing deals with imprecision, uncertainty, partial truth, and approximation to achieve practicability, robustness and low solution cost. As such it forms the basis of a considerable amount of machine learning techniques. Recent trends tend to involve evolutionary and swarm intelligence based algorithms and bio-inspired computation.

There are main differences between soft computing and possibility. Possibility is used when we don't have enough information to solve a problem but soft computing is used when we don't have enough information about the problem itself. These kinds of problems originate in the human mind with all its doubts, subjectivity and emotions; an example can be determining a suitable temperature for a room to make people feel comfortable.

Objectives:
This course introduces soft computing techniques that are different from conventional AI techniques. This course also provides necessary mathematical background for understanding and implementing soft computing Techniques, such as neural networks, fuzzy systems, and genetic algorithms. This course also introduces case studies where soft computing techniques can be implemented.

Learning Outcomes:
At the end of the course, students will be able to:
Knowledge:
1. Understand importance of soft computing.
2. Understand different soft computing techniques like Genetic Algorithms, Fuzzy Logic, Neural Networks and their combination.

Application:
1. Implement algorithms based on soft computing.
2. Apply soft computing techniques to solve engineering or real life problems.

Course Contents:
Unit 1: Introduction to soft computing; introduction to fuzzy sets and fuzzy logic systems; introduction to biological and artificial neural network; introduction to Genetic Algorithm.

Unit 2: Fuzzy sets and Fuzzy logic systems:
Models– Sugeno Fuzzy Models. Applications of Fuzzy Logic: How Fuzzy Logic is applied in Home Appliances, General Fuzzy Logic controllers, Basic Medical Diagnostic systems and Weather forecasting

**Unit 3: Neural Network**

**Unit 4: Genetic Algorithms**
Simple GA, crossover and mutation, Multi-objective Genetic Algorithm (MOGA). Applications of Genetic Algorithm: genetic algorithms in search and optimization, GA based clustering Algorithm, Image processing and pattern Recognition

**Unit 5: Other Soft Computing techniques**
Simulated Annealing, Tabu search, Ant colony optimization (ACO), Particle Swarm Optimization (PSO).

**Text Books**
1. Fuzzy logic with engineering applications, Timothy J. Ross, John Wiley and Sons.
5. Neuro-Fuzzy and Soft computing. Jang, Sun, Mizutani, PHI
6. Neural Networks: A Classroom Approach,1/e by Kumar Satish, TMH

**References**
Title of Course: Artificial Intelligence
Course Code: CS703D
L-T Scheme: 3-0
Course Credits: 3

Objectives: In this course we will study the basic components of an intelligent system, their functions, mechanisms, policies and techniques used in their implementation and examples.

Learning Outcomes: The students will have a detailed knowledge of the concepts of artificial intelligence, various applications of AI in different fields, Aware of a variety of approaches to AI techniques

Course Contents:

Unit-2 (Problems Solving, Search and Control Strategies)

Unit- 3 (Knowledge Representations Issues, Predicate Logic, Rules)

Unit-4 (Quantifying Uncertainty, Learning Systems)
Unit-5 (Expert Systems)

Text Books
2. Luger, George F, Artificial Intelligence: Structures and Strategies for Complex Problem Solving, Pearson Education.

References
Title of Course: Distributed Operating System  
Course Code: CS704A  
L-T-P Scheme: 3-0-0  
Course Credit: 3

Introduction:
The structure of distributed systems using multiple levels of software is emphasized. Specific topics include:

- distributed algorithms
- distributed file systems
- distributed databases,
- security and protection
- distributed services such as the world-wide web, and
- examples of research and commercial distributed systems

Objectives:
This course provides an introduction to the fundamentals of distributed computer systems, assuming the availability of facilities for data transmission.

Learning Outcomes:
After completion of the course, students will learn

- Conception of Distributed clock synchronization Concepts and Algorithms
- The example Distributed Operating Systems
- The concepts of Distributed Operating System.
- The methods that have emerged from the field of distributed operating systems in an application perspective.

Course Contents:
Module-I: Introduction to Distributed System
Introduction, Examples of distributed system, Resource sharing, Challenges

Module-II: Operating System Structures

Module-III: Communication
Inter-process communication, Remote Procedure Call, Remote Object Invocation, Tasks and Threads. Examples from LINUX, Solaris 2 and Windows NT.

Module-IV: Theoretical Foundations

Module-V: Distributed Mutual Exclusion
Module VI: Distributed Deadlock Detection
Deadlock handling strategies in distributed systems. Control organizations for distributed deadlock detection. Centralized and Distributed deadlock detection algorithms: Completely Centralized algorithms, path pushing, and edge chasing, global state detection algorithm.

Module VII: Protection and Security
Requirements for protection and security regimes. The access matrix model of protection. System and user modes, rings of protection, access lists, capabilities. User authentication, passwords and signatures. Use of single key and public key encryption.

Module VIII: Distributed File Systems
Issues in the design of distributed file systems: naming, transparency, update semantics and fault resilience. Use of the Virtual File System layer. Examples of distributed systems including Sun NFS, the Andrew filestore, CODA file system and OSF DCE.

Module IX: Distributed Shared Memory
Architecture and motivations. Algorithms for implementing DSM. Memory Coherence

Module X: CORBA

Text Books:
1. Andrew S. Tanenbaum and Maarten Van Steen, Distributed Systems Principles and Paradigms,
2. PHI

References:
Course Description

Title of Course: Data Warehousing & Data Mining
Course Code: CS704B
L-T-P Scheme: 3-0-0

Introduction: The recent years have generated explosive expansion of digital data stored in computer databases as well as increased pressure on companies to keep competitive advantage. This has put Data Mining (DM) as a key method for extracting meaningful information from the flood of digital data collected by businesses, government, and scientific agencies.

Objective: Data mining is a class of analytical techniques that examine a large amount of data to discover new and valuable information. This course is designed to introduce the core concepts of data mining, its techniques, implementation, benefits, and outcome expectations from this new technology. It will also identify industry branches which most benefit from DM (such as retail, target marketing, fraud protection, health care and science, web and e-commerce). The course will focus on business solutions and results by presenting detailed case studies from the real world and finish with implementing leading mining tools on real (public domain) data.

Learning Outcomes:

Knowledge:
1. To understand the basic principles, concepts and applications of data warehousing and data mining
2. To introduce the task of data mining as an important phase of knowledge recovery process
3. Ability to do Conceptual, Logical, and Physical design of Data Warehouses OLAP applications and OLAP deployment
4. Have a good knowledge of the fundamental concepts that provide the foundation of data mining
5. Design a data warehouse or data mart to present information needed by management in a form that is usable for management client.

Application:
- Weather Forecasting
- Disaster Forecasting
- Business Management
- Market Analysis and Management
- Corporate Analysis & Risk Management

Course Contents:

Unit -I: Overview of data mining process
Data Mining, Data Warehouse, KDD

Unit -II: Data Mining Processes and Knowledge Discovery
Data Cleaning Unit, Data Integration Unit, Mining
Course Description

Unit –III: Database Support to Data Mining
Real life application on data set

Unit –IV: Data Mining Techniques and Functions
Knowledge grow and prediction

Unit –V: Cluster Analysis
K-mean, K-Median, DBSCAN, CLARA, CLARANS, ROCK etc

Unit –VI: Regression Algorithms in Data Mining
Regression is a data mining technique used to predict a range of numeric values, given a particular dataset

Unit –VII: Neural Networks in Data Mining
GA Algorithm

Unit –VIII: Decision Tree Algorithms
F-P Tree, Decision Tree

Unit –IX: Data Mining for Customer Relationship Management Fraud detection, and risk management applications
Customer Relationship Management, Risk Management

Unit –X: Link Analysis in Text Mining, Web Mining Taxonomy, Mining the Web User Behavior, Web Analytics
Web Mining, Text Mining etc

Text Book:

References:
1. Gajendra Sharma, “Data Mining Data Warehousing and OLAP”, S.K.KATARIA & SONS.
2. Sam Anahory, Dennis Murray, “Data Warehousing in the Real World”, PEARSON
Title of Course: Sensor Networks
Course Code: CS704C
L-T Scheme: 3-1
Course Credits: 3

Introduction:
This course examines the characteristics of Sensor Node, internal architecture, communication process and clustering. The Topics to be covered (tentatively) include:
• Overview of sensor networks
• Architecture of Sensor nodes
• Sensor node communication
• Topology control and clustering
• Simulation environment
• Applications of Sensor Networks

Objectives:
1. To provide an overview about sensor networks and emerging technologies
2. To study about the node and network architecture of sensor nodes and its execution environment.
3. To understand the concepts of communication, MAC, routing protocols and also study about the naming and addressing in WSN
4. To learn about topology control and clustering in networks with timing synchronization for localization services with sensor tasking and control.
5. To study about sensor node hardware and software platforms and understand the simulation and programming techniques.

Learning Outcomes:
Knowledge:
1. You can get information regarding sensor networks and emerging technologies
2. Understand the theory of network architecture of sensor nodes and its execution environment.
3. Understand the concepts of communication, MAC, routing protocols.
4. You can get the knowledge about the naming and addressing in WSN.
5. You can get the knowledge about topology control and clustering techniques.
6. Get the idea about sensor node architecture
7. Understand the simulation and programming techniques

Application:
1. To analyze the characteristics of sensor node.
2. Create the environment to deploy the sensor nodes.
3. To develop cluster formation techniques.
4. To develop the techniques to control the topology and establish the routing path to communicate.

Course Contents:
Unit 1: Overview of wireless networks, types, infrastructure-based and infrastructure-less, introduction to MANETs (Mobile Ad-hoc Networks), characteristics, reactive and proactive routing protocols with examples, introduction to sensor networks, commonalities and differences with MANETs, constraints and challenges, advantages, applications, enabling technologies for WSNs.

Unit 2: Single-node architecture - hardware components, design constraints, energy consumption of sensor nodes, operating systems and execution environments, examples of sensor nodes,
sensor network scenarios, types of sources and sinks – single hop vs. multi hop networks, multiple sources and sinks – mobility, optimization goals and figures of merit, gateway concepts, design principles for WSNs, service interfaces for WSNs.

**Unit 3:** Physical layer and transceiver design considerations, MAC protocols for wireless sensor networks, low duty cycle protocols and wakeup concepts - S-MAC, the mediation device protocol, wakeup radio concepts, address and name management, assignment of MAC addresses, routing protocols-classification, gossiping, flooding, energy-efficient routing, unicast protocols, multi-path routing, data-centric routing, data aggregation, SPIN, LEACH, Directed-Diffusion, geographic routing.

**Unit 4:** Topology control, flat network topologies, hierarchical networks by clustering, time synchronization, properties, protocols based on sender-receiver and receiver-receiver synchronization, LTS, TPSN, RBS, HRTS, localization and positioning, properties and approaches, single-hop localization, positioning in multi-hop environment, range based localization algorithms – location services, sensor tasking and control.

**Unit 5:** Sensor node hardware, Berkeley motes, programming challenges, node-level software platforms, node-level simulators, state-centric programming, Tiny OS, nesC components, NS2 simulator, TOSSIM.

**Text Books**

**References**
Title of Course: Mobile Computing
Course Code: CS704D
L-T-P Scheme: 3-0-0
Course Credit: 3

Introduction:
This subject covers the development of the wireless network technology from cellular networks to IP wireless networks. The emphasis is on the concepts, infrastructure, and protocols for supporting device and user mobility.

Objectives:
Upon successful completion of this subject students should be able to

- Explain the limitations of fixed networks; the need and the trend toward mobility; the concepts of mobility.
- Describe and analysis the network infrastructure requirements to support mobile devices and users like Personal Communications Services, Global Systemfor Mobile Communication, General Packet Radio Services etc.
- Illustrate the concepts, techniques, protocols and architecture employed in wireless local area networks, cellular networks, and perform basic requirements analysis. Apply techniques and technologies to design and communicate a simple mobile application for smaller devices.

Learning Outcomes:

- Be able to understand the architecture of PCS, GSM, GPRS, and WLANs etc. Mobility management, Network signaling, Mobile IP.
- Understand the WAP protocol, gateway. Conception of WML, WLL etc. Third Generation (3G) Mobile Services, Wide band Code Division Multiple Access (WCDMA), Quality of services in 3G.
- Be able to learn the concept of Server-side programming in Java, Pervasive web application architecture.

Course Contents:

Module-I: PCS Architecture, GSM
Introduction to Personal Communications Services (PCS): PCS Architecture, Mobility management, Network signalling, Global System for Mobile Communication (GSM): System overview; GSM Architecture, Mobility management, Network signalling.

Module-II: GPRS
General Packet Radio Services (GPRS): GPRS Architecture, GPRS Network Nodes. Mobile Data Communication: WLANs (Wireless LANs) IEEE802.11standard, MobileIP.

Module-III: Wireless Application Protocol
Module-IV: 3G Services
Third Generation (3G) Mobile Services: Introduction to International Mobile Telecommunications2000 (IMT 2000) vision, Wideband and Code Division Multiple Access (WCDMA), and CDMA2000, Quality of services in 3G.

Module-V: GMSS, Bluetooth

Module-VI: Server side concept, Applications
Server-side programming in Java, Pervasive web application architecture, Device independent example application

Text Books:

References:
Title of Course: Information Technology  
Course Code: CS705A  
L-T Scheme: 3-0  
Course Credits: 3

Introduction:  
This course involves study of the necessary theoretical foundations to design and develop state-of-the-art web applications. Next to the technical aspects to develop applications for the web, business aspects are covered with the most common business models and explained with real-world examples.

Objectives:  
The course will be supplemented by a separate Lab course in which the students learn how to design a good web site using the web technology tools (HTML, CSS, JavaScript, DHTML, XML and PHP). Technical aspects for the development of web applications are presented along with generic platforms and architectures. Students participating in the exercise apply this knowledge in individual projects that cover all aspects from the lecture/lab with the design and development of a web application. Students are strongly encouraged to participate actively in class discussions.

Learning Outcomes:  
Knowledge:  
1. You will broaden your knowledge of WWW, Internet, HTTP, URL, DNS, Web browser, Web Server and FTP  
2. You will become aware of the benefits and future of Web Applications  
3. You will increase your proficiency in Scripting languages.  
4. You will know the Web Architecture and how a Web client-server interaction happens.  
5. You will Know the Website Development Process  
6. You shall be exposed to various client side and server side technologies required to design web sites  
7. You will know how a search engine and Meta search engine works and advantages and disadvantages of Meta search engine over a search engine.

Application:  
1. The lab work and homework portions of the course are intended to help you apply your understanding.  
2. To develop and implement client-side and server-side scripting language programs that meet stated specifications.  
3. To develop and implement, and demonstrate Database Driven Websites through a project that meet stated specifications

Course Contents:  
Unit 1: Overview, Network of Networks, Intranet, Extranet and Internet.


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Course Description

Definition of cookies, Create and Store a cookie with example. Container Class, Components, Applet Life Cycle, Update method; Parameter passing applet, Applications.


Unit 5: Introduction of VoIP. Multimedia over IP: RSVP, RTP, RTCP and RTSP. Streaming media, Codec and Plugins, IPTV. Definition, Meta data, Web Crawler, Indexing, Page rank, overview of SEO.

Text Books
2. Internetworking Technologies, An Engineering Perspective, Rahul Banerjee, PHI Learning, Delhi, 2011. (Chapters 5,6,12)

References
3. Data Communications and Networking, Behrouz A. Forouzan, TMH
4. Data and Computer Communications, William Stallings, PHI
Title of Course: Microelectronics & VLSI Design
Course Code: CS705B
Course Credits: 3

Introduction:
This course examines microelectronics & VLSI design concepts, and MOS fabrication basics. The topics to be covered (tentatively) include:
- Introduction to VLSI Design
- Micro-electronic Processes for VLSI Fabrication
- CMOS for Digital VLSI Circuits
- VHDL

Objectives:
The Course Educational Objectives are:
1. To acquire knowledge on basics of microelectronics & VLSI design.
2. To get acquainted with IC fabrication process and layout design rules.
3. To gain knowledge on design concept of CMOS digital circuits.
4. To gain knowledge on VHDL.

Learning Outcomes:
Knowledge:
Once the student has successfully completed this course, he/she will be able to answer the following questions or perform following activities:
1. Able to explain the basic concepts of Microelectronics & VLSI design.
2. Able to describe VLSI design steps.
3. Able to describe the IC fabrication steps and different layout design rules.
4. Able to design various CMOS based digital circuits.
5. Able to describe various digital circuits using VHDL.

Application:
1. To design and implement CMOS based circuits.
2. To fabricate NMOS, PMOS, and CMOS.
3. To design VHDL based digital circuits.

Course Contents:
Pre-requisite: Knowledge of Basic Electronics Engineering of first year and Analog Electronics of second year.

Unit 1: Introduction to VLSI Design: VLSI Design Concepts, Moor’s Law, Scale of Integration (SSI, MSI, LSI, VLSI, ULSI – basic idea only), Types of VLSI Chips (Analog & Digital VLSI chips, ASIC, PLA, FPGA), Design principles (Digital VLSI – Concept of Regularity, Granularity etc), Design Domains (Behavioral, Structural, Physical).

Unit 2: MOS structure: E-MOS & D-MOS, Charge inversion in E-MOS, Threshold voltage, Flat-Band voltage, Potential balance & Charge balance, Inversion, MOS capacitances, three-terminal MOS structure with Body-effect, four-terminal MOS transistor: Drain current, I-V characteristics, Current-voltage equations (simple derivation), scaling in MOSFET: General scaling, Constant voltage scaling & Constant field scaling, Short channel effects. CMOS inverter, Simple Combinational Gates-NAND gate and NOR gate using CMOS.
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**Course Description**

**Unit 3:** Micro-electronic Processes for VLSI Fabrication: Silicon Semiconductor Technology- An Overview, Wafer processing, Oxidation, Epitaxial deposition, Ion-implantation & Diffusion, Cleaning, Etching, Photo-lithography – Positive & Negative photo-resist; Basic CMOS Technology – (Steps in fabricating CMOS), Basic n-well CMOS process, p-well CMOS process, Twin tub process, Silicon on insulator; Layout Design Rule: Stick diagram with examples, Layout rules.

**Unit 4:** Hardware Description Language: VHDL or Verilog Combinational & Sequential Logic circuit Design.

**Text Books**

1. Wayne Wolf; Modern VLSI Design, Pearson Education. [For unit-I]
3. J. Bhaskar; A VHDL primer, third edition, Prentice hall [For unit-IV]

**References**

3. Advance Digital Design Using Verilog, Michel D. Celliti, PHI
Title of Course: Control System
Course Code: CS705C
L-T Scheme: 3-0
Course Credits: 3

Introduction:
This course examines control system analysis and design concepts in classical and modern state space methods. The Topics to be covered (tentatively) include:
- Fundamentals of control system
- Transfer function representation
- Time response analysis
- Stability analysis in S-domain
- Frequency response analysis
- Stability analysis in frequency domain
- Classical control design techniques
- State space analysis of continuous systems

Objectives:
The Course Educational Objectives are:
1. In recent years, control systems have assumed an increasingly important role in the development and advancement of modern civilization and technology. Practically every aspect of our day-to-day activities is affected by some type of control systems.
2. Control systems are found in abundance in all sectors of industry, such as equality control of manufactured products, automatic assembly line, machine-tool control, space technology and weapon systems, computer control, transportation systems, power systems, robotics, Micro-Electro-Mechanical systems (MEMS), nano-technology and many others.
3. In this subject it is aimed to introduce to the students the principles and application of control systems in everyday life. The basic concepts of block diagram reduction, time domain analysis solutions to time invariant systems and also deals with the different aspects of stability analysis of systems in frequency domain and time domain.
4. Simulation exercises are included in Matlab tool and Simulink tool throughout for practice.

Learning Outcomes:
Knowledge:
Once the student has successfully completed this course, he/she will be able to answer the following questions or perform following activities:
1. Able to understand the basic concepts of linear control system.
2. Able to describe different stability analysis of the system.
3. Able to analyze the classical control design technique.
4. Able to understand the modern state space analysis.
Applications:
1. To develop, implement, and analyze all stability checking methods.
2. To develop and implement different controllers.
3. To develop classical and modern control system approaches.

Course Contents:

Unit 1: INTRODUCTION
Concepts of Control Systems- Open Loop and closed loop control systems and their differences- Different examples of control systems- Classification of control systems, Feed-Back Characteristics, Effects of feedback.
Mathematical models – Differential equations, Impulse Response and transfer functions - Translational and Rotational mechanical systems.

Unit 2: TRANSFER FUNCTION REPRESENTATION
Transfer Function of linear systems, Block diagram representation of systems considering electrical systems as examples -Block diagram algebra –Representation by Signal flow graph - Reduction using mason’s gain formula.

Unit 3: TIME RESPONSE ANALYSIS

Unit 4: STABILITY ANALYSIS IN S-DOMAIN
The concept of stability: Routh’s stability criterion – limitations of Routh’s stability. Root Locus Technique: The root locus concept - construction of root loci-effects of adding poles and zeros to G(s)H(s) on the root loci.

Unit 5: FREQUENCY RESPONSE ANALYSIS
Introduction, Frequency domain specifications-Bode diagrams-Determination of Frequency domain specifications and transfer function from the Bode Diagram-Phase margin and Gain margin-Stability Analysis from Bode Plots.

Unit 6: STABILITY ANALYSIS IN FREQUENCY DOMAIN
Polar Plots, Nyquist Plots, Stability Analysis.

Unit 7: CLASSICAL CONTROL DESIGN TECHNIQUES
Compensation techniques – Lag, Lead, Lead-Lag Controllers design in frequency Domain, PID Controllers.

Text Books
1. Linear Control Systems with MATLAB Applications (11th edition), by B SManke, Khanna Publishers. (Unit-1 to Unit-8)

References
Title of Course: Modelling & Simulation

Course Code: CS705D

Credit: 3

Introduction:
The goal is to introduce students to basic simulation methods and tools for modelling and simulation of continuous, discrete and combined systems. In this course, the student will study the representation and simulation of physical systems using a range of mathematical formulations. There are many modelling techniques to describe system characteristics. The student will learn to develop typical mathematical models. Case studies and engineering software applications are used to illustrate a variety of modelling techniques. Once the models are validated, the student can utilize them to predict the behavior of common industrial and engineering systems including: mechanical, electrical, civil, environmental, fluid, magnetic, thermal, and transport. Problem solving with these systems may involve graphical, algebraic, numerical, state space, simulation, and computational processes.

Objectives:

1. Learn to develop mathematical models of phenomena involved in various engineering fields
2. Processes and solutions for these models.
3. Classification of simulation models
4. Design of Discrete-Event Simulation (DES)
5. Verification and validation of simulation models
6. Understand the important physical phenomena from the problem statement
7. Develop model equations for the given system
8. Demonstrate the model solving ability for various processes/unit operations
9. Demonstrate the ability to use a process simulation
10. The ability to create simulation models of various types.
11. Construct a model for a given set of data and motivate its validity
12. Analyze output data produced by a model and test validity of the model

Learning Outcomes:

Knowledge:

1. Characterize a given engineering system in terms of its essential elements, that is, purpose, parameters, constraints, performance requirements, subsystems, interconnections, and environmental context.
2. Develop a modelling strategy for a real-world engineering system, which considers prediction and evaluation against design criteria, and integrates any required sub-system models.
3. Assess and select a model for an engineering system taking into consideration its suitability to facilitate engineering decision making and predicted advantages over alternative models.
4. Interpret the simulation results of an engineering system model, within the context of its capabilities and limitations, to address critical issues in an engineering project.

Application:

There are many categorizations possible, but the following taxonomy has been very successfully used in the defense domain, and is currently applied to medical simulation and transportation simulation as well.

Analyses Support is conducted in support of planning and experimentation. Very often, the search for an optimal solution that shall be implemented is driving these efforts. What-if analyses of alternatives fall into this category as well. This style of work is often accomplished by simulators - those having skills in
both simulation and as analysts. This blending of simulation and analyst is well noted in Kleijnen Systems Engineering Support is applied for the procurement, development, and testing of systems. This support can start in early phases and include topics like executable system architectures, and it can support testing by providing a virtual environment in which tests are conducted. This style of work is often accomplished by engineers and architects.

Training and Education Support provides simulators, virtual training environments, and serious games to train and educate people. This style of work is often accomplished by trainers working in concert with computer scientists.

Course Contents:

Unit 1: Introduction to Modelling and Simulation:

Unit 2: System Dynamics & Probability Concepts in Simulation:
Exponential Growth and Decay Models, Generalization of Growth Models, Discrete and Continuous Probability Functions, Continuous Uniformly Distributed Random Numbers, Generation of a Random Numbers, Generating Discrete Distributions, Non Uniform Continuously Distributed Random Numbers, Rejection Method.

Unit 3: Simulation of Queuing Systems and Discrete System Simulation:

Unit 4: Analysis of Simulation Output:
Sensitivity Analysis, Validation of Model Results

Text Books
2. Narsingh Deo, 1979, System Simulation with Digital Computers, PHI.

References
Title of Course: Image Processing Lab
Course Code: CS793A
L-T-P Scheme: 0-0-3
Course Credits: 2

Objectives:
Digital image processing deals with manipulation of digital images through a digital computer. It is a subfield of signals and systems but focus particularly on images. DIP focuses on developing a computer system that is able to perform processing on an image. The input of that system is a digital image and the system process that image using efficient algorithms, and gives an image as an output.

Learning Outcomes:
Students will be able to apply various image processing concepts and models to input images or input signals for various purposes. For example: image compression, image de-noising, image enhancement, edge detection and sharpening etc.

Course Contents:

List of Experiments
1. Display of Grayscale Images.
2. Histogram Equalization.
4. Edge detection using Operators.
5. 2-D DFT and DCT.
6. Filtering in frequency domain.
7. Display of color images.
8. Conversion between color spaces.
9. DWT of images.
10. Segmentation using watershed transform.

REFERENCE:

LIST OF EQUIPMENTS:
Computer, Software MATLAB

Text Books
1. Digital Image Processing, Goncalves, Pearson
2. Digital Image Processing, Jahne, Springer India
3. Digital Image Processing & Analysis, Chanda & Majumder, PHI
5. Image Processing, Analysis & Machine Vision, Sonka, VIKAS
6. Getting Started with GIS, Clarke Keith, C; PE.
Title of Course: Pattern Recognition Lab  
Course Code: CS793B  
L-T-P scheme: 0-0-3  
Course Credit: 2

Objectives:
To introduce the most important concepts, techniques, and algorithms for digital image processing, and implement them using image processing software tools, particularly MATLAB. More specifically, it should enable students to:

- Assess and understand the challenges behind the design of machine vision systems.
- Understand the general processes of image acquisition, storage, enhancement, segmentation, representation, and description.
- Implement filtering and enhancement algorithms for monochrome as well as color images.

Appreciate the challenges and understand the principles and applications of visual pattern recognition.

Learning Outcomes:
1. To implement efficient algorithms for nearest neighbour classification.
2. To construct decision trees.
3. To implement of Linear Discriminate Function and Support Vector Machines.
4. Formulate and describe various applications in pattern recognition
5. Understand the Bayesian approach to pattern recognition
6. Be able to mathematically derive, construct, and utilize Bayesian-based classifiers, and non-Bayesian classifiers both theoretically and practically.
7. Be able to identify the strengths and weaknesses of different types of classifiers
8. Understand basic concepts such as the central limit theorem, the curse of dimensionality, the bias-variance dilemma, and cross-validation
9. Validate and assess different clustering techniques
10. Apply various dimensionality reduction methods whether through feature selection or feature extraction
11. Assess classifier complexity and regularization parameters
12. Be able to combine various classifiers using fixed rules or trained combiners and boost their performance
13. Understand the possibilities and limitations of pattern recognition

Course Contents:
Exercises that must be done in this course are listed below:

Exercise No.1: Data visualization, central limit theorem, multivariate normal distribution, data whitening, non-parametric density estimation: Parzen, nearest neighbour.

Exercise No. 2: Forward selection, backward selection, take l-add-r selection, branch & bound, genetic algorithms. PCA, Fisher mapping, nonlinear feature extraction, multidimensional scaling, dissimilarity representation.

Exercise No. 3: Hierarchical clustering, k-means, fuzzy c-means, Gaussian mixture model, expectation-maximization, Davies-Bouldin index, self-organizing maps.


Exercise No. 5: Linear regression, MMSE, MAP, MLE, quality measures. Nonlinear regression: kernel smoothing/local weighted regression.

Exercise No. 6: Simulate Banker’s Algorithm for Dead Lock PreventiSVM, ANN, ensemble classification, complexity: bias-variance trade-off, improving performance (implement either boosting or cloning).
Text Book:

Recommended Systems/Software Requirements:
2. Basic knowledge in Linear Algebra.
4. Programming knowledge of MATLAB or C+.
Course Description

Title of Course: Soft Computing Lab
Course Code: CS703C
L-T-P scheme: 0-0-3
Course Credit: 2

Objectives:
This course introduces soft computing techniques that are different from conventional AI techniques. This course also provides necessary mathematical background for understanding and implementing soft computing techniques, such as neural networks, fuzzy systems, and genetic algorithms. This course also introduces case studies where soft computing techniques can be implemented.

Learning Outcomes:
1. Understand importance of soft computing.
2. Understand different soft computing techniques like Genetic Algorithms, Fuzzy Logic, Neural Networks and their combination.
3. Implement algorithms based on soft computing.
4. Apply soft computing techniques to solve engineering or real life problems.

Course Contents:

Exercises that must be done in this course are listed below:

Experiment 1: Write a program in MATLAB to plot various membership functions.
Experiment 2: Use Fuzzy toolbox to model tip value that is given after a dinner which can be-not good, satisfying, good and delightful and service which is poor, average or good and the tip value will range from Rs. 10 to 100.
Experiment 3: Implement FIS Editor.
Experiment 4: Generate AND, NOT function using McCulloch-Pitts neural net by MATLAB program.
Experiment 5: Generate XOR function using McCulloch-Pitts neural net by MATLAB program.
Experiment 6: Write a MATLAB program for Perceptron net for an AND function with bipolar inputs and targets.
Experiment 7: Write a MATLAB program for Hebb Net to classify two dimensional input patterns in bipolar with their given targets
Experiment 8: Write a program of Perceptron Training Algorithm
Experiment 9: Write a program to implement Hebb’s rule
Experiment 10: Write a program of Back Propagation Algorithm.

Text Books
1. Fuzzy logic with engineering applications, Timothy J. Ross, John Wiley and Sons.
5. Neuro-Fuzzy and Soft computing, Jang, Sun, Mizutani, PHI
6. Neural Networks: A Classroom Approach,1/e by Kumar Satish, TMH

Recommended Systems/Software Requirements:
1. In this laboratory the students need to implement the soft computing tools in Matlab. Some exposure in C also can be used for neural network and Genetic Algorithm.
Course Description

Title of Course: Artificial Intelligence Lab  
Course Code: CS793D  
L-T-P Scheme: 0-0-2  
Course Credit: 1

Objectives: In this course we will implement the basic components of an intelligent system, their functions, mechanisms, policies and techniques used in their implementation and examples.

Learning Outcomes: The students will have a detailed knowledge of the concepts of artificial intelligence. Various applications of AI in different fields, aware of a variety of approaches to AI techniques.

Course Contents:
Unit-1: Introduction to AI and intelligent agents

Unit-2: Problem solving, Problem spaces and blind search techniques, informed search techniques, Constraint satisfaction problems

Unit-3: Knowledge representation and reasoning techniques, Logic programming, Logical agents, Game playing, planning,

Unit-4: Learning, Reasoning under uncertain situations,

Unit-5: Expert systems, Decision support systems, Domain specific AI applications.

List of AI Problems for Lab-
Problem 1: Solve “Tower of Hanoi” with only 2 disks.
Problem 2: Solve “Tower of Hanoi” with only 3 disks.
Problem 3: Solve “4-Queens” puzzle.
Problem 4: Solve “8-Queens” puzzle.
Problem 5: Solve “4-color map” problem.
Problem 6: Solve “8 – puzzle” take any initial and goal state.
Problem 7: Calculate the sum of n elements in an integer array. Also calculate its Polynomial function the determine its complexity using “Big-O”.
Problem 8: Find out the largest element in an square 2-D array. Also determine the “Big- O” of the algorithm. [Take size greater the 2x2]
Problem 10: Solve “Sudoku Problem” use any initial positions.
Problem 11: Solve “15-puzzle” problem using any initial and goal state.
Problem 12: Solve “Sudoku Problem” use any initial positions.
Problem 13: Code the following games software: Checkers, Chess.
Problem 14: Code the following games using software: Othello, Backgammon.
Problem 15: Code the following games using software: Bridge, Go.
Problem 16: Code the following games using software: Hex, 6x7.
Problem 17: Code the following games using software: Tetris, Tick-Tack-Toe.
Problem 18: Code the following games using software: rubik-cube, same game, mines.
Problem 19: Code the following games using software: Matches, Mines.

Text Books
2. Luger, George F, Artificial Intelligence: Structures and Strategies for Complex Problem Solving, Pearson Education.

References
1. Nilsson, Nils J, Artificial Intelligence, Morgan Kaufmann
2. Russell, Stuart J. Norvig, Peter, Artificial Intelligence: A Modern Approach,
3. Pearson Education
Title of Course: Internet Technology
Course Code: CS795A
L-T-P scheme: 0-0-3

Course Credit: 2

Objectives:
To develop the ability to design and implement web enabled applications.

Learning Outcomes:
The student shall acquire the skill to design and develop web based applications with high usability, scalability and efficiency. They shall be exposed to various technologies required to design web sites. They shall acquire the skill to choose the technology to use based on the requirements and functionality of the web site.

Course Contents:
Exercises that must be done in this course are listed below:

Exercise No.1: Design a login page using HTML, CSS and use JavaScript for validation.
Exercise No.2: Use Image in the previous login page.
Exercise No.3: Use PHP and MySQL to validate Student Id and Password with Existing Student data.
Exercise No.4: Use different database operation.

Text Book:
1. “Web Enabled commercial Application development using HTML,DHTML, Java Script”, Perl CGI” by Ivan Bayross, BPB Publication
2. “Internet and World Wide Web – How to Program” by Deitel, Deitel and Nieto ,Pearson Education Asia Publication
3. “PHP and MYSQL Manual” by Simon Stobart and Mike Vassileiou
5. “The XML Bible”, by Elliotte Rusty Harold
6. “Step by Step XML” by Michael J. Young Prentice Hall Of India

Recommended Systems/Software Requirements:
1. Java Development Kit and Java Runtime Environment, preferable latest version.
2. Text editor and web browser.
Title of Course: Microelectronics & VLSI Design Lab  
Course Code: CS795B  
L-T-P scheme: 0-0-3  
Course Credit: 2

Objectives: The overall course objective is to teach electrical engineering students fundamental concepts of hardware description languages and advanced techniques in digital system design. Specific objectives include the following:
1. Learn VHDL (Very high speed integrated circuit Hardware Description Language).
2. Utilize VHDL to design and analyze digital systems including arithmetic units and state machines.
3. Learn field programmable gate array (FPGA) technologies and utilize associated computer aided design (CAD) tools to synthesize and analyze digital systems.
4. Learn testing strategies and construct test-benches.
5. Conduct laboratory experiments using an FPGA based development board to prototype digital systems and to confirm the analysis done in class.
6. Prepare informative and organized lab reports that describe the methodologies employed, the results obtained, and the conclusions made in a laboratory experiment.

Learning Outcomes: The students will have a detailed knowledge of the concepts of IEEE and ANSI standard HDL. Upon the completion of Operating Systems practical course, the student will be able to:
- Understand and implement basic digital logic circuits of VLSI.
- Model complex digital systems at several levels of abstractions; behavioral and structural, synthesis and rapid system prototyping.
- Develop and Simulate register-level models of hierarchical digital systems.
- Design and model complex digital system independently or in a team.
- Carry out implementations of registers and counters.
- Simulate and synthesize all type of digital logic circuits used in VLSI.
- Finally design a CPU.

Course Contents:
Exercises that must be done in this course are listed below:
Exercise No.1: Design of basic Gates: AND, OR, NOT.
Exercise No. 2: Design of universal gates
Exercise No. 3: Design of XOR and XNOR gate.
Exercise No. 4: Design of 2:1 MUX .
Exercise No. 5: Design of 2 to 4 Decoder.
Exercise No. 6: Design of Half-Adder and Full Adder.
Exercise No. 7: Design of 8:3 Priority Encoder.
Exercise No. 8: Design of 4 Bit Binary to Grey code Converter.
Exercise No. 9: Design of all Flip-Flops.
Exercise No. 10: Design of Shift register.
Exercise No. 11: Design of ALU.

Text Book:

Recommended Systems/Software Requirements:
1. Intel based desktop PC with minimum of 1GHZ or faster processor with at least 1GB RAM and 8 GB free disk space.
2. Xilinx ISE14.2 software in Windows XP or Linux Operating System.
Title of Course: Control System Lab
Course Code: CS795C
L-T-P scheme: 0-0-3

Objective:
1. To provide the students with a hands-on experience on the theoretical concepts through simple experiments.
2. To develop the ability to design and validate their knowledge through open ended experiments.

Learning Outcomes:
On successful completion of this lab course, the students would be able to
1. Demonstrate and analyze the response of Transfer function for various input.
2. Analyze the response of various signal like Impulse Ramp etc.
3. Carry out the root locus of given signal.
4. Analyse different plot and state model.
5. Conduct an open ended experiment in a group of 2 to 3.

Course Contents:
List of Experiments:
1. To obtain a transfer function from given poles and zeroes using MATLAB
2. To obtain zeros and poles from a given transfer function using MATLAB
3. To obtain the step response of a transfer function of the given system using MATLAB
4. To obtain the impulse response of a transfer function of the given system using MATLAB
5. To obtain the ramp response of a transfer function of the given system using MATLAB.
6. To plot the root locus for a given transfer function of the system using MATLAB.
7. To obtain bode plot for a given transfer function of the system using MATLAB.
8. To obtain the transfer function from the state model.
9. To obtain the state model from the given transfer function.
10. To design a lag compensator for a closed loop system.

Text Book:

Recommended Systems/Software Requirements:
SCILAB, MATLAB
Title of Course: Modeling & Simulation Lab  
Course Code: CS795D  
L-T-P scheme: 0-0-3  
Course Credit: 2

Introduction:

Modelling and simulation are a vital part of many areas of engineering, allowing engineers to reason about the expected behaviour of a system without having to physically implement it. Simulation pervades much of electrical engineering, for example models of individual electronic devices, circuit simulation, network modeling, compression of speech/audio/image/video signals, design of biomedical devices, and modeling of physical systems for control purposes. Modelling allows an abstract representation of a signal or system in a (mathematically) compact and/or simplified form that is extremely useful in many fields, including analysis, design, compression, classification, and control. The main high-level aim of the course is to provide a thorough grounding in aspects of constructing and applying models and their simulation using well-known simulation tools (MATLAB and C). In particular, the course looks at how continuous-time systems can be represented and simulated using (discrete-time) computers. This also provides an interesting insight into the relationship between physical systems and computing algorithms. The course is intentionally designed to have a strong practical focus, with extensive laboratory work serving to develop key skills in computing and applications of mathematics.

Objectives:

This course aims to:

a. Familiarise you with programming in MATLAB.

b. Convey the analytical and practical details of a range of modelling techniques.


d. Familiarise you with the modeling of dynamical systems and stochastic signals, including the choice of model, choice of model order, parameter estimation and goodness of fit.

e. Provide a thorough grounding in parameter estimation techniques such as least squares (particularly) and maximum likelihood.

f. Give you practical experience with simulating physical systems and modeling typical experimental data, for example second-order circuits, non-linear circuits, electrical machines and power systems, control systems, biomedical systems, and introductory network simulation.
Learning Outcomes:

On successful completion you should be able to:

1. Express a linear system in terms of its differential equation, transfer function, magnitude response, impulse response and step response, be able to convert between the different forms and explain the advantages of each;

2. Derive expressions that can be used to estimate parameters from different types of data, for different types of model structures;

3. Explain analytically how to simulate a continuous-time system by means of numerical integration;

4. Synthesise MATLAB code to simulate a given system or model;

5. Implement a suitable model for a given problem, making informed choices about the model type and model order, and calculate the model error.

6. Deduce the behaviour of previously unseen models or parameterisations and hypothesise about their merits

Course Contents:

Exercises that must be done in this course are listed below:

Experiment No.1: Introductory MATLAB

Experiment No.2: Circuit simulation

Experiment No.3: Linear system

Experiment No.4: Numerical Des

Experiment No.5: Runge-Kutta

Experiment No.6: Least squares

Experiment No.7: System identification

Experiment No.8: Stochastic models

Experiment No.9: Parameter Estimation

Text Books:

1. Klee, H. (2007). Simulation of Dynamic Systems with MATLAB and Simulink, CRC Press, Boca Raton, FL. – This is a very detailed and comprehensive text, aimed slightly above the level of this course. For anyone with longer-term interests in dynamic systems, this text is highly recommended.

2. Woods, R. L., and Lawrence, K. L. (1997), Modeling and simulation of dynamic systems, Prentice-Hall, Upper Saddle River, NJ. – This is a more introductory level text that also deals with dynamic systems, across all areas of engineering. The coverage of the course is not very complete, but the style is fairly straightforward and there are many problems (with answers) given.
Course Description & Objectives:

1. **Understand** the history of medical research and bioethics related to the HeLa cells. Understand the diverse social and economic, racial and gender contexts within which Henrietta Lacks lived and died. Understand the themes of this seminar. Appreciate the legacy and implications of these medical, ethical and social understandings on today’s society.

2. **Identify**, understand and discuss current, real-world issues.

3. **Distinguish** and **integrate** differing forms of knowledge and academic disciplinary approaches (e.g., humanities and sciences) with that of the student’s own academic discipline (e.g., in agriculture, architecture, art, business, economics, education, engineering, natural resources, etc.). And apply a **multidisciplinary strategy** to address current, real-world issues.

4. Improve oral and written **communication** skills.

5. Explore an appreciation of the **self** in relation to its larger diverse social and academic contexts.

6. Apply principles of **ethics** and **respect** in interaction with others.

Course Outcomes:

After the completion of this course, the student should be able to:

1. **Learn and integrate.** *Through independent learning and collaborative study, attain, use, and develop knowledge in the arts, humanities, sciences, and social sciences, with disciplinary specialization and the ability to integrate information across disciplines.*

2. **Use multiple thinking strategies to examine real-world issues, explore creative avenues of expression, solve problems, and make consequential decisions**

3. **Learn and integrate.** Communicate. *Acquire, articulate, create and convey intended meaning using verbal and non-verbal method of communication that demonstrates respect and understanding in a complex society.*

4. **Use multiple thinking strategies to examine real-world issues, explore creative avenues of expression, solve problems, and make consequential decisions.**
5. Clarify purpose and perspective. Explore one’s life purpose and meaning through transformational experiences that foster an understanding of self, relationships, and diverse global perspectives.

6. Practice citizenship. Apply principles of ethical leadership, collaborative engagement, socially responsible behavior, respect for diversity in an interdependent world, and a service-oriented commitment to advance and sustain local and global communities.
A group discussion aims at a structured but informal exchange of knowledge, ideas, and perceptions among the participants on any issue, topic or sub-topic. Contributions are pooled together and examined in terms of their relevance and validity to the discussion objectives. If planned and organized in a structured way and certain essential conditions are met, it can provide a highly enriching and stimulating experience to the participants. Let us see, the objectives, different steps involved in it and its limitations.

Objectives of a Group Discussion

- Produce a range of options or solutions, addressing a particular problem or an issue.
- Generate a pile of ideas by examining issues in greater depth, looking at different dimensions of these issues.
- Broaden the outlook of the participants through cross-fertilization and exposure to new and different experiences and ideas and enrich their understanding of the issues under discussion.
- Develop their skills in interpersonal communication and in expressing their views in a clear and succinct manner.
- Effective means of changing attitudes through the influence of peers in the group
- Valuable means of obtaining feedback for the training team on verbal skills, motivation level and personal traits of the participants and characteristics of the group

Steps in organizing a Group Discussion

- Setting up the Groups
- Planning a Group Discussion
- Preparation of Group Reports
- Presentation and Consolidation of Group Reports

Limitations

- If the group is large, not all the members may get the opportunity to participate and contribute to the discussion.
- If the task is not clearly defined, the discussion may lack focus and, as a result, it may be unproductive.
- Difficulties can arise if the leader is unskilled in guiding the discussion and/or not familiar with the topic or the issues.
- Some members may dominate and, in a way, hijack the discussion.
Course Description

- As this is a group task, some members may take it easy and not feel constrained to participate.

Learning outcomes

After studying this course, you should be able to:

- understand the key skills and behaviours required to facilitate a group discussion
- prepare effectively before facilitating a meeting
- consider some of the difficult behaviours that can occur in meetings
- think of some possible strategies for dealing with these.
Title of Course: Project Part- I  
Course Code: CS782  
L-T -P Scheme: 6P  
Course Credits: 4

Project: an activity where the participants have some degree of *choice* in the outcome. The result is complete and functional, that is, it has a beginning, middle and end. Usually, it spans multiple lab periods and requires work outside scheduled lab periods. Since there are choices in implementation, *design* is inherently a component of a project. A project is inherently different from an *analysis* or *exercise*, in which the solution has a predictable form. Projects span a wide variety of possibilities: design and build, identify a system, do a forensic analysis, evaluate a product or assess some environmental situation.

**Program Objective 1**  
Graduates shall make their way to the society with proper scientific and technical knowledge in mechanical engineering.

**Program Objective 2**  
Graduates shall work in design and analysis of mechanical systems with strong fundamentals and methods of synthesis.

**Program Objective 3**  
Graduates shall adapt to the rapidly changing environment in the areas of mechanical engineering and scale new heights in their profession through lifelong learning.

**Program Objective 4**  
Graduates shall excel in career by their ability to work and communicate effectively as a team member and/or leader to complete the task with minimal resources, meeting deadlines.

**Program Outcomes:**  

1. Ability to apply knowledge of mathematics, science and mechanical engineering fundamentals for solving problems.  
2. Ability to Identify, formulate and analyze mechanical engineering problems arriving at meaningful conclusions involving mathematical inferences.  
3. Ability to design and develop mechanical components and processes to meet desired needs considering public health, safety, cultural, social, and environmental aspects.  
4. Ability to understand and investigate complex mechanical engineering problems experimentally.  
5. Ability to apply modern engineering tools, techniques and resources to solve complex mechanical engineering activities with an understanding of the limitations.  
6. Ability to understand the effect of mechanical engineering solutions on legal, cultural, social, public health and safety aspects.
7. Ability to develop sustainable solutions and understand their impact on society and environment.
8. Ability to apply ethical principles to engineering practices and professional responsibilities.
9. Ability to function effectively as an individual and as a member or leader in diverse teams and in multidisciplinary settings.
10. Ability to comprehend, design documentation, write effective reports, make effective presentations to the engineering community and society at large.
11. Ability to apply knowledge of engineering and management principles to lead teams and manage projects in multidisciplinary environments.
12. Ability to engage in independent and life-long learning in the broad context of technological changes and advancements.