Course Name: Multimedia Technology Lab
Course Code: CS594B
Contacts: 0:0:3
Credits: 1.5

Perquisites: Computer Graphics Programming

Course Outcomes:

CO1: To understand about various latest interactive multimedia devices, the basic concepts about images and image format.
CO2: To Apply and analyze data compression techniques, image compression techniques like JPEG, video compression techniques like MPEG, and the basic concepts about animation.
CO3: To evaluate and develop an interactive multimedia presentation by using multimedia devices and identify theoretical and practical aspects in designing multimedia applicationsare surrounding the emergence of multimedia technology.
CO4: To analyze the effects of scale and use on both presentation and lowerlevel requirements along with feedback evaluation in response to an objective set of criteria for multimedia design.

Course Contents:

1. Perceptual and cognitive psychology related to visual and auditory perception.
2. Methods of data sampling and digitization relative to different formats of audio and video media: frequency- and spatial-based sampling., vector-based and sampling-based media representations, audio and video files including AVI and WAV, uses and application of XML, media data compression.
3. Sound capturing & editing using tools like SOUNDFORGE
4. Image editing using tools like Adobe PhotoshopCreating/editing motion video/animation clips (using tools like Flash / Adobe Premier)

Text Books:

1. Adobe Photoshop CC Classroom in a Book (2018 release), Pearson Ed.,
2. Anushka Wirasinha , Flash in a Flash- Web Development , PHI

Reference Books:

1. Macromedia Flash5 fast and easy Web Development, Design, PHI,
2. Lozano, Multimedia- Sound & Video , PHI

CO-PO Mapping:

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	2	-	-	2	2	-	-
CO2	3	3	3	3	3	2	-	-	2	2	2	-
CO3	3	3	3	3	3	2	2	1	2	2	2	2
CO4	3	3	3	3	3	3	2	-	2	1	2	3

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Course Name: Communication Engineering Lab
Course Code: CS 594C
Contacts: 0:0:3
Credits: 1.5

Prerequisites: Knowledge in Electronics and Communication

Course Objective:
To provide the basic skills required to understand, develop, and design of various engineering applications involving analog and digital communication theory. To provide basic laboratory exposures for communication principles and applications.

Course outcomes:

On completion of the course students will be able to

CO1: Analyse the concept of analog and digital communication techniques and their applications.

CO2: Demonstrate to the practical methods of the use of generating and demodulating communication signals.

CO3: Distinguish the significance of signal constellation and spectral width.

CO4: Develop insight into the relations between the input and output signals in various stages of a transmitter and a receiver.

List of Experiments:

1. Measurement of modulation index of an AM signal.
2. Generation of FM using VCO chip (to view the wave shapes).
3. Study of PAM and demodulation.
4. Study of PCM and demodulation.
5. Study of ASK modulator and demodulator.
6. Study of BPSK modulator and demodulator.
7. Study of BFSK modulator and demodulator.
8. Study on QPSK modulator and demodulator.
9. One innovative experiment on bread-board realization of any one analog or digital communication circuit.

Text Books:

1. An Introduction to Analog and Digital Communications by Simon Haykin; Published by Wiley India.
2. Principles of Communication Systems, H. Taub and D .L.Schilling, TMH Publishing Co.

Reference Books:

1. Communication Systems 4th Edition by Simon Haykin; Published by Wiley India (Student Edition).
2. Communication Systems by A. B. Carlson, Published by McGraw-Hill.
3. Modern Digital and Analog Communication Systems, B.P.Lathi and Z.Ding, Oxford University Press.
4. Communications System (Analog and Digital) by Dr. Sanjay Sharma S K Kataria and Sons.

Course Name: Computer Networks
Course Code: CS601
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Prerequisite:

1. Familiarity and knowledge of Operating Systems and Computer Architecture
2. Also require little bit programming languages concepts like C, Java.

Course Objective(s):

- To be familiar with the basics of data communication
- To be familiar with various types of computer networks
- To have experience in designing communication protocols
- To be exposed to the TCP/IP protocol suite

Course Outcome(s):

CO1: To understand OSI and TCP/IP models.

CO2: To analyze MAC layer protocols and LAN technologies.

CO3: To design applications using internet protocols.

CO4: To implement routing and congestion control algorithms.

CO5: To develop application layer protocols and understand socket programming

Course Contents:

Module I: Introduction[6L]

Introduction (3L):

Introduction: Computer Network, data communication, topology, OSI & TCP/IP Reference Models, layers and characteristics, Wireless Network, comparison to wired and wireless network.

Physical Layer: [3L]

Overview of data (analog & digital), signal (analog & digital), transmission (analog & digital) & transmission media (guided & unguided); Circuit switching: time division & space division switch, TDM bus; Telephone Network;

Module II: Data Link Layer [10L]

Framing, Error Control, Error Detection and Correction, Flow Control, Data Link Protocols, Simple Stop-and-Wait Protocol, ARQ mechanism, Sliding Window Protocols, One-Bit Sliding Window Protocol, Go-Back-N and Selective Repeat, HDLC, PPP Medium Access Control Sub-layer, The Channel Allocation. **[5L]**

Multiple Access Protocols : ALOHA, Carrier Sense Multiple Access Protocols, IEEE 802.x Ethernet, Switched Ethernet, Fast Ethernet, Gigabit Ethernet, 10 Gigabit Ethernet, Wireless LANs - IEEE 802.xx , Bluetooth, RFID, Bridges, Virtual LANs, Switching.**[5L]**

Module III: Network Layer [10L]

IP Addressing, IPv4and IPv6. Difference IPv4and IPv6, Conversion ofIPv4and IPv6, Subnetting, Supernetting, Design Issues, Store-and-Forward Packet Switching, Virtual-Circuit and Datagram Networks, ARP, IP, ICMP, IPV6, BOOTP and DHCP–Delivery protocols Other Protocols such as mobile IP in wireless Network.. **[5L]**

Routing: Shortest Path Algorithms, Flooding, Distance Vector Routing, Link State Routing, Hierarchical Routing, Broadcast Routing, Multicast Routing, Anycast Routing, : RIP, OSPF, BGP; Routing for Mobile Hosts. **[5L]**

Module IV: Transport layer: [6L]

Process to Process delivery; UDP; TCP, SCTP, TCP RENO, TCP/IP in Wireless environment, Congestion control in TCP:Congestion Control: Open Loop, Closed Loop choke packets; Quality of service: techniques to improve QoS: Leaky bucket algorithm, Token bucket algorithm. **[5L]**

Advanced topic such as Remote Procedure Call, Delay Tolerant Networks.**[1L]**

Module V: Application Layer [3L]

Introduction to DNS, SMTP, SNMP, FTP, HTTP & WWW: Cryptography (Public, Private Key based), Digital Signature, Firewalls

Module VI: Socket Programming [1L]

Introduction to Socket Programming, UDP socket and TCP Socket

Course Name: Microprocessors & Microcontrollers
Course Code: CS602
Contact: 2:1:0
Total Contact Hours: 36
Credits: 3

Prerequisite:

1. Familiarity with the number system
2. A solid background in digital logic.

Course Objective(s):

- To learn the basics of a particular microprocessor.
- To learn the basics of a particular microcontroller.
- To learn the interfacing of microprocessor.

Course Outcomes:

CO1: To acquire the knowledge of hardware details of 8085 and 8086 microprocessor AND 8051 microcontroller with the related signals and their implications.
CO2: To develop skill in assembly Language programming of 8085
CO3: To understand the concept and techniques of designing and implementing interfacing of microprocessor with memory and peripheral chips involving system design.
CO4: To analyze the performance of computers and its architecture to real-life applications

Course Contents:

Module -1: [9L]

Introduction to Microcomputer based system. [1L]
History of evolution of Microprocessor and Microcontrollers and their advantages and disadvantages. [1L]
Architecture of 8085 Microprocessor, Pin description of 8085. [2L] Address/data bus De-multiplexing, Status Signals and the control signals. [1L]
Interrupts of 8085 processor (software and hardware) [2L]
I/O Device Interfacing - I/O Mapped I/O and Memory Mapped I/O,
Memory interfacing with 8085 [2L]

Module -2: [11L]

Instruction set of 8085 microprocessor, Addressing modes. [3L]
Assembly language programming with examples, Counter and Time Delays, Stack and Subroutine. [6L]
Timing diagram of the instructions (a few examples) [2L]

Module 3: [9L]

The 8086 microprocessor- Architecture, Pin Details, Addressing modes, interrupts [4L]
Instruction set, Examples of Simple Assembly Language [3L]
Memory interfacing with 8086 [2L]

Module -4: [7L]

Introduction to 8051 Microcontroller – Architecture, Pin Details. [3L]
Addressing modes, Instruction set, Examples of Simple Assembly Language. [4L]

Text Books:

1. MICROPROCESSOR architecture, programming and Application with 8085 - R. Gaonkar (Penram international Publishing LTD.) ***[For Module 1 and 2]***
2. Fundamentals of Microprocessor and Microcontrollers - B. Ram (Paperback) ***[For Module 3]***
3. 8051 Microcontroller – K. Ayala (Cengage learning) ***[For Module 4]***

ReferenceBooks:

1. 8086 Microprocessor – K Ayala (Cengage learning)
2. The 8051 microcontroller and Embedded systems - Mazidi, Mazidi and McKinley (PEARSON)

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	–	3	–	–	–	–	–	–	–	2	–
CO2	–	–	2	1	–	–	–	–	–	–	–	–
CO3	1	–	3	2	–	1	1	–	–	–	1	–
CO4	–	–	–	2	–	2	2	–	–	–	2	–

Course Name: Software Engineering
Course Code: CS603
Contact: 3:0:0
Total Contact Hours: 36
Credits:3

Prerequisites:

1. An understanding of basic computer software
2. Object Oriented programming skills.

Course Objective(s):

1. To develop basic Knowledge in Software Engineering and its applications.
2. To understand software Engineering layered architecture and the process frame work.
3. To analyze software process models such as the waterfall, spiral, evolutionary models and agile method for software development.
4. To design software requirements and specifications of documents.
5. To understand project planning, scheduling, cost estimation, risk management.
6. To describe data models, object models, context models and behavioral models.
7. To learn coding style and testing issues.
8. To know about the quality checking mechanism for software process and product

Course Outcomes:

CO1: To analyze, elicit and specify software requirements through a productive workingrelationship with various stakeholders of the project.

CO2: To design applicable solutions in one or more application domains using softwareengineering approaches that integrates ethical, social, legal and economic concerns.

CO3: To develop the code from the design and effectively apply relevant standards and performtesting, and quality management and practice.

CO4: To identify modern engineering tools necessary for software project management, time management and software reuse, and an ability to engage in life-long learning.

Course Contents:

Module- 1:[6L]

SoftwareEngineeringCharacteristics,Components,Application,Definitions,SoftwareProcessmodels-WaterfallModel,Prototypemodel,RAD,EvolutionaryModels,Incremental,Spiral. Agile Method

SoftwareProjectPlanning-
FeasibilityAnalysis,TechnicalFeasibility,CostBenefitAnalysis,COCOMO (Basic, intermediate, Complete) model

Module– 2: [3L]

SystemAnalysis:PrincipleofStructureAnalysis,RequirementAnalysis,DFD,EntityRelationship Diagram,DataDictionary,DataModeling,SoftwareRequirementsSpecification

Module – 3:[3L]

SoftwareDesignAspects:Objectives,Principles,Concepts,Top-DownandBottom-Updesign;Decision tree,decisiontableandstructuredEnglish,Structurechart,TransformanalysisFunctional Vs.Object-Orientedapproach

Module- 4:[4L]

UnifiedModelingLanguage:Classdiagram,interactiondiagram:collaborationdiagram,sequencediagram,statechartdiagram,activity, diagram,implementationdiagram, Use Case diagram

Module –5:[14L]

Coding&Documentation StructuredProgramming,ModularProgramming,ModuleRelationship-Coupling,Cohesion,OOP Programming,InformationHiding,Reuse,SystemDocumentation.

Testing–LevelsofTesting,IntegrationTesting,SystemTesting.

TestCases-
WhiteBoxandBlackBoxtestingSoftwareQuality,QualityAssurance,SoftwareMaintenance, SoftwareConfigurationManagement,SoftwareArchitecture.

Module– 6:[6L]

Software Project Management – Project Scheduling, Staffing, Quality Assurance, Risk Management: Reactive vs. Proactive Risk strategies, software risks, Risk identification, Risk projection, Risk refinement Project Monitoring.

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Course Name: Compiler Design
Course Code: CS604A
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Prerequisites:

- ✓ Mathematics
- ✓ Concept of programming languages
- ✓ Data structures
- ✓ Computer architecture
- ✓ Formal languages and automata theory
- ✓ Some advanced math might be required if you adventure in code optimization

Course Objectives:

To make the student understand the process involved in a compiler, create an overall view of various types of translators, linkers, loaders, and phases of a compiler, understand what is syntax analysis, various types of parsers especially the top down approach, awareness among students the various types of bottom up parsers, understand the syntax analysis and, intermediate code generation, type checking, the role of symbol table and its organization, Code generation, machine independent code optimization and instruction scheduling.

Course Outcomes:

CO1: To illustrate the basic concept of compilers and discuss on the components as well as the strengths and weaknesses of various phases of designing a compiler.
CO2: To explain the role of finite automata in compiler design.
CO3: To design and analyze algorithms for syntactic or parsing techniques and semantic analysis of the process of designing compilers.
CO4: To formulate the theories of creating simple compilers using C programming languages.

Course Contents:

Module I [7L]
Compilers, Cousins of the Compiler, Analysis-synthesis model, The phases of the compiler.
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 DFA, Design of a lexical analyzer generator (Lex).

Module II [10L]

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, Canonical LR), 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.

Module III [7L]
Type systems, Specification of a simple type checker, Equivalence of type expressions, Type conversions
Source language issues (Activation trees, Control stack, scope of declaration, Binding of names), Symbol tables, dynamic storage allocation techniques.

Module IV [4L]
Intermediate languages, Graphical representation, Three-address code, Implementation of three address statements (Quadruples, Triples, Indirect triples).

Module V [8L]
Consideration for Optimization, scope of optimization, local optimization, loop optimization, folding, DAG representation, Flow Graph, Data flow equation, global optimization, redundant sub expression elimination, induction variable elimination, copy propagation, basic blocks & flow graphs, transformation of basic blocks, DAG representation of basic blocks, peephole optimization
Object code forms, machine dependent code optimization, register allocation and assignment, generic code generation algorithms, DAG for register allocation.

Text Books:

[1] Alfred Aho, V. Ravi Sethi, D. Jeffery Ullman, "Compilers Principles, Techniques and Tools", Addison Wesley, 2nd edition
[2] Holub Allen. Compiler Design in C, PHI, 1993.

Reference Books:

[1] Chattopadhyay, Santanu. Compiler Design. PHI Learning Pvt. Ltd., 2005
[2] Tremblay and Sorenson Compiler Writing-McgrawHill International

CO-PO Mapping:

CO & PO Mapping												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	–	–	–	–	–	–	–	–	–	–	–
CO2	3	2	–	–	–	–	–	–	–	–	–	–
CO3	–	–	3	3	–	–	–	–	–	–	–	–
CO4	–	3	–	–	–	–	–	–	–	–	–	–

Course Name: Computer Vision
Course Code: CS604B
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Prerequisites:
No prior experience with computer vision is assumed, although previous knowledge of visual computing or signal processing will be helpful. The following skills are necessary for this class:

- Data structures
- Programming: Projects are to be completed and graded in Python. All project starter code will be in Python.
- Mathematics: Linear algebra, vector calculus, and probability.

Course Objective:

Computer Vision focuses on development of algorithms and techniques to analyze and interpret the visible world around us. This requires understanding of the fundamental concepts related to multi-dimensional signal processing, feature extraction, pattern analysis visual geometric modeling, stochastic optimization etc. Knowledge of these concepts is necessary in this field, to explore and contribute to research and further developments in the field of computer vision. Applications range from Biometrics, Medical diagnosis, document processing, mining of visual content, to surveillance, advanced rendering etc.

Course Outcomes:
CO1: To understand the Image formation process
CO2: To understand the 3D vision techniques
CO3: To extract the features form an images and accordingly analyze the Image
CO4: To develop applications using the Computer Vision Techniques
CO5: To understand the basics of video processing, motion computation and 3D vision and geometry

Course Contents:

Introduction [2L]
Introduction to Computer Vision: Low-level, Mid-level, High-level, Impact of Computer Vision, Components and its applications.
Digital Image Formation and low-level processing [5L]
Overview: Fundamentals of Image Formation, Transformation: Orthogonal, Euclidean, Affine, Projective etc. Fourier Transform, Convolution and Filtering, Light and Color and Image Filtering, Image Enhancement, Restoration, Histogram Processing.
Depth estimation and Multi-camera views [5L]

Perspective, Binocular Stereopsis: Camera and Epipolar Geometry; Image sensing, pixel arrays, CCD cameras. Image coding, Homography, Rectification, DLT, RANSAC, 3-D reconstruction framework; Auto-calibration.Apparel.

Feature Extraction [7L]

Edge detection - Canny, LOG, DOG; Line detectors (Hough Transform), Corners - Harris and Hessian Affine, Orientation Histogram, SIFT, Image preprocessing, Image representations (continuous and discrete) , Scale-Space Analysis- Image Pyramids and Gaussian derivative filters, Gabor Filters and DWT.

Image Segmentation [4L]

Contour based representation, Region based representation, Deformable curves and surfaces, Snakes and active contours, Level set representations, Fourier and wavelet descriptors, Medial representations, Multi-resolution analysis.

Pattern Analysis [7L]

Clustering: K-Means, K-Medoids, Mixture of Gaussians, Classification: Discriminant Function, Supervised, Un-supervised, Semi-supervised; Classifiers: Bayes, KNN, ANN models; Dimensionality Reduction: PCA, LDA, ICA; Non-parametric methods.

Motion Analysis [3L]

Background Subtraction and Modeling, Regularization theory, Optical computation, Stereo Vision, Motion estimation, Structure from motion.

Shape representation [3L]

Inferring 3D shape from shading; surface geometry.Boundary descriptors; codons; super-quadrics.

Text Books:

1. Szeliski, R., 2010. Computer vision: algorithms and applications. Springer Science & Business Media.
2. Forsyth, D.A. and Ponce, J., 2003. A modern approach. Computer vision: a modern approach, 17, pp.21-48.

Reference Books:

1. Hartley, R. and Zisserman, A., 2003. Multiple view geometry in computer vision.Cambridge university press.
2. Fukunaga, K., 2013. Introduction to statistical pattern recognition.Elsevier.
3. Gonzalez, R.C. and Woods, R.E., 1992. Digital image processing addison-wesley. Reading, Ma, 2.
4. Gonzalez, R.C., Woods, R.E. and Eddins, S.L., 2004. Digital image processing using MATLAB.Pearson Education India.
5. Forsyth, D.A., Mundy, J.L., diGesu, V. and Cipolla, R. eds., 2003. Shape, contour and grouping in computer vision. Springer.
6. Gruen, A. and Huang, T.S. eds., 2013. Calibration and orientation of cameras in computer vision (Vol. 34). Springer Science & Business Media.

Journals:

Course Name: Simulation and Modeling
Course Code: CS604C
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Prerequisites:

- Programming and Data Structures
- Discrete Mathematics and Probability theory
- Game theory
- Numerical Analysis

Course Objective(s):

1. To understand the Models and Simulation of Continuous and Discrete Systems.
2. To enable students to analyze Continuous Uniformly Distributed Random Numbers
3. To assess the strengths and weaknesses of various methods and to analyze their behavior.

Course Outcome:

On completion of the course students will be able to

CO1: Student will be able to summarize the issues in Modeling and Simulation and to explain the System Dynamics & Probability concepts in Simulation.

CO2: Student will be able to solve the Simulation of Queuing Systems

CO3: Student will be able to analyze the Simulation output.

CO4: Student will be able to identify the application area of Modeling and Simulation, and apply them.

Course Contents:

Module-I: Introduction to Modeling and Simulation [7L]
Nature of Simulation. Systems , Models and Simulation, Continuous and Discrete Systems, system modeling, Components of a simulation study, Introduction to Static and Dynamic System simulation , Application areas, Advantages ,Disadvantages and pitfalls of Simulation.

Module –II : System Dynamics & Probability concepts in Simulation [10L]

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.

Module-III : Simulation of Queuing Systems and Discrete System Simulation [14L]

Poisson arrival patterns, Exponential distribution, Service times, Normal Distribution Queuing Disciplines, Simulation of single and two server queue. Application of queuing theory in computer system. Discrete Events ,Generation of arrival patterns ,Simulation programming tasks
Gathering statistics, Measuring occupancy and Utilization , Recording Distributions and Transit times .

Module-IV : Analysis of Simulation output [5L]

Sensitivity Analysis, Validation of Model Results

Text Books:

1. Jerry Banks, John Carson, B.L.Nelson and D.M.Nicol — Discrete Event System Simulationǁ,

Fifth Edition, Pearson.

2. NarsinghDeo, 1979, System Simulation with Digital Computers, PHI.

Reference Books:

1. Averill M. Law and W.DavidKelton, —Simulation Modeling and Analysisǁ, Third Edition, McGraw Hill 5. J. N. Kapoor.. Mathematical Modeling, Wiley eastern Limited

2. Geoffrey Gordon, —System Simulationǁ, PHI.

CO-PO Mapping:

CO	PO1	PO2	POP3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	-	-	1	-	-	-	-	-	-
CO2	2	3	2	2	3	-	-	-	-	-	-	-
CO3	2	2	3	1	3	1	-	-	-	-	-	-
CO4	1	3	1	1	3	1	-	-	-	-	-	-

Course Name: Pattern Recognition
Course Code: CS605A
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Prerequisites:

- Probability theory,
- Artificial Intelligence

Course Objectives

- Understand the concept of a pattern and the basic approach to the development of pattern recognition and machine intelligence algorithms
- Understand the basic methods of feature extraction, feature evaluation, and data mining
- Understand and apply both supervised and unsupervised classification methods to detect and characterize patterns in real-world data
- Develop prototype pattern recognition algorithms that can be used to study algorithm behavior and performance against real-world multivariate data

Course Outcomes:

After the completion of four years of B.Tech, students will be able to:
CO1: Explain and compare a variety of pattern classification methods.
CO2: Analyze different clustering and classification problem and solve using different pattern recognition technique.
CO3: Apply performance evaluation methods for pattern recognition, and can do comparisons of techniques
CO4: Apply pattern recognition techniques to real-world problems such as document analysis and recognition.
CO5: Implement simple pattern classifiers, classifier combinations, and structural pattern recognizers.

Course Contents:

Module – I[4L]
Introduction[2]: The nature of statistical pattern recognition, Definitions, data sets for Pattern Recognition
Different Paradigms of Pattern Recognition [1]
Representations of Patterns and Classes [1]
Different learning paradigms, The basic structure of a pattern recognition system[2]

Module –II[6L]
Feature extraction [6]:

Feature Extraction, Feature subset selection and classification stages [2]
Dimensionality reduction: Principal component analysis, Fisher discriminant analysis, Factor Analysis[4]

Module –III[13L]
Different Approaches to Prototype Selection [2]
Nearest Neighbour Classifier and variants [2]
Bayes Classifier [3]
Decision Trees [3]
Linear Discriminant Function [3]

Module – IV[13L]
Support Vector Machines [2]
Clustering [3]
Clustering Large datasets [3]
Combination of Classifiers [3]
Applications - Document Recognition [2]

Text Books:

- R.O.Duda, P.E.Hart and D.G.Stork, Pattern Classification, John Wiley, 2001
- Devi V.S.; Murty, M.N. (2011) Pattern Recognition: An Introduction, Universities Press, Hyderabad.

Reference books:

- S.Theodoridis and K.Koutroumbas, Pattern Recognition, 4th Ed., Academic Press, 2009
- C.M.Bishop, Pattern Recognition and Machine Learning, Springer, 2006

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	3	-	-	-	-	-	-	-	2
CO2	3	3	-	-	-	-	-	-	-	-	-	-
CO3	-	3	-	-	-	2	-	-	-	-	-	-
CO4	2	-	-	3	-	-	3	-	-	-	-	-
CO5	3	-	-	2	3	-	1	-	-	-	-	3

Course Name: Distributed Operating system
Course Code: CS605B
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Prerequisites:

1. Have to knowledge about Computer Network, operating system and Computer architecture.
2. Required C and UNIX knowledge.

Course Objective(s):

This course covers general issues of design and implementation of distributed operating systems. The focus is on issues that are critical to the applications of distributed systems and computer networks, which include inter-process communication, distributed processing, sharing and replication of data and files.

Course Outcome(s):
CO1: To understandings outline the potential benefits of distributed systems and major security issues associated with distributed system.
CO2: To understand and analyze Distributed Computing techniques, Synchronous and Processes and Apply Shared Data access and Files concepts.
CO3: To understand Distributed File Systems and Distributed Shared Memory
CO4: To apply standard design principles in the construction of these systems.

Course Contents:

Module I [6L]

Functions of an Operating System, Design Approaches, Review of Network Operating System and Distributed Operating System, Issue in the design of Distributed Operating System, Overview of Computer Networks, Modes of communication, System Process, Interrupt Handling, Handling Systems calls, Protection of resources, Micro-Kernel Operating System, client server architecture.

Module II [8L]

The Critical Section Problem, Other Synchronization Problems, Language Mechanisms for Synchronization, Axiomatic Verification of Parallel Programs, Inter process communication (Linux IPC Mechanism), Remote Procedure calls, RPC exception handling, security issues, RPC in Heterogeneous Environment, Case studies.

Module III [8L]

Clocks: Logical clocks, Physical clocks, Vector Clock, clock synchronization algorithms, Mutual Exclusion, Non-Token Based Algorithms – Lamppost's Algorithm, Token-Based Algorithms, Suzuki-Kasami's Broadcast Algorithm, Election Algorithms-Bully algo etc, Dead locks in Distributed Systems, Thrashing, Resource Management (Load Balancing approach, Load Sharing approach), Process Management, process Migration, Thread, and Case studies.

Module IV [8L]

Overview of shared memory, Architecture, Algorithm, Protocols, Design Issues, consistency model, Page based Distributed Shared Memory, Shared variable Distributed shared Memory, and Object based Distributed shared Memory, Heterogeneous DSM, Distributed Scheduling, Issues, Components, Algorithms Case studies.

Module V [6L]

File models, File access, File sharing, file-caching, File Replication, Features of Naming system terminologies and concepts of naming, fault Tolerance, Network File System (case study), 8NFS on Linux Directory Services, Security in Distributed File system, Tools (Cuda, , Amazon AWS, OpenStack, Cilk, gdb, threads, OpenMP, Hadoop), Case studies

Text Books:

- P.K. Sinha Distributed Operating system (Willey publication)
- M. Beck et al Linux Kernel, Internal Addition Wesley, 1997.

Reference Books:

- T. L. Casavant and M. Singhal, Distributed Computing Systems, IEEE Computer Society Press (1994) ISBN 0-8186-3032-9
- R. Chow and T. Johnson, Distributed Operating Systems & Algorithms, Addison-Wesley (1997) ISBN 0-201-49838-3
- G. Coulouris, J. Dollimore, and T. Kindberg, Distributed Systems: Concepts & Design, 3rd edition, Addison-Wesley (2001) ISBN 0-201-61918-0

Course Name: Distributed Database
Course Code: CS605C
Contact: 3:0:0
Contact Hours: 36
Credits: 3

Prerequisites:

- Good knowledge in Database ManagementSystem.
- Determination to learn new and difficultthings.

Course Objective(s):

- To learn the principal and foundation of distributeddatabase.
- To learn the architecture, design issue and integrity control of distributeddatabase.
- To learn the details of query processing and query optimizationtechnique.
- To learn the concept of transaction management in distributeddatabase.

Course Outcome(s):

On completion of the course students will be able to
CO1: Describe database management system internals, understand and describe internal algorithms in detail.
CO2: Identify and be able to use recent and advanced database techniques (e.g. in concurrency control, buffer management, and recovery
CO3: Decide on configuration issues related to database operation and performance. Identify which parameters are suitable and what are its implications
CO4: Analyze and optimize transactional code, identifying causes of possible anomalies and correct them.
CO5: Decide on optimization issues given a known database workload, by manipulating indexes, choosing more adequate data types, and modifying queries.

Course Contents:

Module I: [9L]
Introductory concepts and design of (DDBMS)
Data Fragmentation; Replication; and allocation techniques for DDBMS; Methods for designing and implementing DDBMS, designing a distributed relational database; Architectures for DDBMS: cluster federated, parallel databases and client server architecture.

Module II: [9L]
QueryProcessing [4L]

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Overview of Query Processing: Query processing problem; Objectives of Query Processing; Complexity of Relational Algebra operations; characterization of Query processors; Layers of Query Processing; Translation of global queries.

Transaction Management [5L]

Introduction to Transaction Management: Definition of Transaction, Properties of Transaction, types of transaction; Distributed Concurrency Control: Serializability theory; Taxonomy of concurrency control mechanisms; locking bases concurrency control algorithms.

Module III: [5L]

Partitioned network; check point and cold start; Management of distributed transaction; Architectural aspect; Node and link failure recoveries

Module IV: [3L]

Distributed data dictionary management.Distributed database administration. Heterogeneous databases- federated database, reference architecture, loosely and tightly coupled.

Module V: [5L]

Distributed Object Database Management systems [5L]

Fundamental Object concepts and Object models; Object distribution design; Architectural issues; Object management; Distributed object storage; Object query processing

Module IV: [5L]

Current trends & developments related to Distributed database applications technologies [5L]

Distributed Object/component-based DBMS; Database Interoperability including CORBA; DCOM and Java RMI;Distributed document-based systems; XML and Workflow management.

Text books:

1. Distributed Databases - Principles and Systems; Stefano Ceri; GuiseppePelagatti; Tata McGraw Hill; 1985.
2. Fundamental of Database Systems; Elmasri&Navathe; Pearson Education;Asia

Reference books:

1. Database System Concepts; Korth&Sudarshan;TMH
2. Principles of Distributed Database Systems; M. Tamer Özsu; and Patrick Valduriez PrenticeHall

CO-PO Mapping:

CO#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	2	2	3	1	-	-	-	2	2	3	2	3	2	2

Course Name: Data Warehousing & Data Mining
Course Code: CS606A
Contact: 3:0:0
Contact Hours: 36
Credits: 3

Perquisites:

Programming and Data Structures, Database Management System

Course Objective(s):

1. To understand classical models and algorithms in data warehousing and data mining.
2. To enable students to analyze the data, identify the problems, and choose the relevant models and algorithms to apply.
3. To assess the strengths and weaknesses of various methods and algorithms and to analyze their behavior.

Course Outcomes:

On completion of the course students will be able to
CO1: Student will be able to summarize the issues in Data mining.
CO2: Student will be able to explain and give examples of Data warehousing.
CO3: Student will be able to solve Business problems and can apply the Data mining in real applications in industry.
CO4: Student will also be able to implement the classical algorithms in data mining and data warehousing.

Course Contents:

Module I: Introduction to Data Warehousing [8L]

Data Warehousing: Data warehouse Architecture and Infrastructure , Data warehousing Components –Building a Data warehouse — Mapping the Data Warehouse to a Multiprocessor Architecture – DBMS Schemas for Decision Support –Data Extraction, Cleanup, and Transformation Tools –Metadata.

Module II: Business Analysis [5L]

Business Analysis: Reporting and Query tools and Applications – Tool Categories – The Need for Applications – Cognos Impromptu – Online Analytical Processing (OLAP) – Need – Multidimensional Data Model – OLAP Guidelines – Multidimensional versus Multirelational OLAP – Categories of Tools – OLAP Tools and the Internet.

Module III: Data Mining and Classification [12L]

Data Mining: Introduction – Data – Types of Data – Data Mining Functionalities – Interestingness of Patterns – Classification of Data Mining Systems – Data Mining Task Primitives –Integration of a Data Mining System with a Data Warehouse – Issues –Data Preprocessing.
Association Rule Mining and Classification: Mining Frequent Patterns, Associations and Correlations – Mining Methods – Mining Various Kinds of Association Rules – Correlation Analysis – Constraint Based Association Mining – Classification and Prediction - Basic Concepts - Decision Tree Induction – Bayesian Classification – Rule Based Classification – Classification by Backpropagation – Support Vector Machines – Associative Classification – Lazy Learners – Other Classification Methods – Prediction.

Module IV: Clustering and Applications [11L]

Clustering and Applications and Trends in Data Mining: Cluster Analysis - Types of Data – Categorization of Major Clustering Methods – Kmeans – Partitioning Methods – Hierarchical Methods - Density-Based Methods –Grid Based Methods – Model-Based Clustering Methods – Clustering High Dimensional Data - Constraint – Based Cluster Analysis – Outlier Analysis – Data Mining Applications.

Text Books:

1. Jiawei Han and MichelineKamber, "Data Mining Concepts and Techniques", Second Edition, Elsevier, 2007.
2. Pang-Ning Tan, Michael Steinbach and Vipin Kumar, " Introduction To Data Mining",Person Education, 2007.

Reference Books:

1. Daniel T.Larose, "Data Mining Methods and Models", Wile-Interscience, 2006.
2. Margaret H. Dunham, "Data Mining: Introductory and Advanced Topics", Prentice Hall, 2003.

CO-PO Mapping:

CO-PO Mapping												
PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	1	-	-	-	-	-	2
CO2	3	2	1	-	-	-	-	-	-	-	-	3
CO3	2	3	2	2	-	2	2	2	-	-	-	3
CO4	2	2	3	1	1	1	-	-	-	-	-	2

Course Name: Digital Image Processing
Course Code: CS606B
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Prerequisite:

- Fourier analysis
- Linear algebra
- Probability

Course Objective(s)

- To learn discrete Fourier transform and its properties
- To study the monochrome and color image fundamentals
- To learn the analytical tools and methods which are currently used in digital image processing as applied to image information for human viewing.
- To learn image compression and segmentation techniques.

Course Outcomes:

CO1: To acquire the knowledge of basic preprocessing techniques in monochrome and color images.
CO2: To develop skill in concepts of image enhancement like linear and non linear spatial filters using MATLAB.
CO3: To understand the concept and techniques of simple image processing projects using different methods of restoration.
CO4: To acquire the knowledge of the various segmentation algorithms for practical applications.
CO5: To analyze the performance of Lossless and Lossy compression techniques in images.

Course Contents:

Module -1: Introduction:[5L]
Digital Image Fundamentals **:** Overview, Computer imaging systems , Digital Image Representation, Fundamental steps in Image Processing **[1L]**, Elements of Digital Image Processing - Image Acquisition, Storage, Processing, Communication, Display **[1L]**. Digital Image Formation: A Simple Image Model, Use and Analysis of Color Models in Image Processing **[2L]**, Sampling & Quantization - Uniform & Non-uniform **[1L]**.

Module -2: Mathematical Preliminaries : [5L]
Neighbour of pixels, Connectivity, Relations, Equivalence & Transitive Closure **[1L]**; Distance Measures, Arithmetic/Logic Operations, Discrete Signals and Systems **[1L]**- A Review – Fourier Transformation, Properties of The Two Dimensional Fourier Transform **[2L]**, Discrete Fourier Transform, Discrete Cosine & Sine Transform **[1L]**.

Module 3: Image Enhancement : [6L]
Spatial Domain: Gray level transformations – Histogram processing **[2L]** Basics of Spatial Filtering–Smoothing and Sharpening Spatial Filtering – Frequency Domain **[2L]**– Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters **[2L]**.

Module -4: Image Restoration, Segmentation and Filtering :[14L]
Image Restoration and Segmentation:Image restoration: noise removal: mean & adaptive filters, degradation model, inverse filter **[2L]**. Discrete Formulation, Algebraic Approach to RestorationUnconstrained & Constrained **[1L]**; Constrained Least Square Restoration, Restoration by Homomorphic Filtering **[1L]**, Geometric Transformation - Spatial Transformation, Gray Level Interpolation **[1L]**. Image Segmentation : Point Detection, Line Detection, Edge detection, Combined detection **[2L]**,

Module -5: Edge Linking, Boundary Detection and Image compression : [5L]
Edge Linking & Boundary Detection- Local Processing, Global Processing via The Hough Transform **[2L]**; Thresholding - Foundation, Simple Global Thresholding, Optimal Thresholding**[2L]**; Region Oriented Segmentation - Basic Formulation, Region Growing by PixelAggregation, Region Splitting & Merging **[2L]**.
Image compression: system model, lossless methods ,lossy methods [2L]

Module -6: Image Representation and Recognition :[5L]
Image Representation and Recognition :Boundary representation – Chain Code – Polygonal approximation **[1L]**, signature, boundary segments – Boundary description **[1L]** – Shape number- Fourier Descriptor **[1L]**, moments- Regional Descriptors –Topological feature **[1L]**, Texture – Patterns and Pattern classes – Recognition based on matching **[1L]**.

Text Books:
1. Chanda&Majumder , Digital Image Processing & Analysis, PHI

Reference books:
1.Malay K. Pakhira, Digital Image Processing and Pattern Recognition, First Edition, PHI Learning Pvt. Ltd., 2011.

Course Name: E-commerce and ERP
Course Code: CS606C
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Perquisites: Knowledge of basic and Networking

Course Objective(s)

- To impart knowledge on E-Commerce & ERP and its various applications.
- To understand E-Commerce framework and business model applications of E-Commerce
- To understand e-payment mechanisms

Course Outcome(s)
On completion of the course students will be able to
CO1: To define and differentiate various types of Ecommerce.
CO2: To define and describe E-business and its Models.
CO3: To describe Hardware and Software Technologies for Ecommerce.
CO4: To understand the basic concepts of ERP and identify different technologies used in ERP.
CO5: To apply different tools used in ERP

Course Contents:

Module 1: Overview of E-Commerce [10L]
Introduction to E-Commerce [4L]: Definition, Scope of E-Commerce, Hardware requirements, E-Commerce and Trade Cycle, Electronic Markets, Electronic Data Interchange and Internet Commerce.
Business to Business E-Commerce [6L]: Business Models of e–commerce: Model Based On Transaction Type, Model Based On Transaction Party - B2B, B2C, C2B, C2C, E – Governance.Electronic Markets, Electronic Data Interchange (EDI): Technology, Standards (UN/EDIFACT), Communications, Implementations, Agreements, Security, EDI and Business, Inter-Organizational E-commerce.

Module 2: Security Issues in E-Commerce [10L]
Legal issues [4L]: Risks: Paper Document vs. Electronic document, Authentication of Electronic document, Laws, Legal issues for Internet Commerce: Trademarks and Domain names, Copyright, Jurisdiction issues, Service provider liability, Enforceable online contract.
Security Issues [6L]:
Risk of E – Commerce: Overview, Security for E – Commerce, Security Standards, Firewall, Cryptography, Key Management, Password Systems
Security Solutions: Symmetric and Asymmetric Cryptosystems, RSA, DES, and Digital Signature, Protocols for secure messaging, Secure Electronic Transaction (SET) Protocol, Electronic cash over internet, Internet Security.

Module 3: Applications [2L]

E-business [2L]: Internet bookshops, Software supplies and support, Electronic Newspapers, Internet Banking, Virtual Auctions, Online Share Dealing, Gambling on the net, E-Diversity, Case studies through internet.

Module 4: Overview of ERP (7L)

The evolution of ERP systems: A historical perspective [3L]

Evolution through Payroll system, Inventory Control system, Materials Requirement Planning (MRP I) system, Manufacturing Resource Planning (MRP II) system, their advantages and disadvantages. Definition and Concept of ERP, Business reasons for rise and popularity of ERP system - Benefits of an ERP system

Business processes supported by ERP systems [4L]

Various business functions in an Organization – Purchasing, Materials Management, Manufacturing, Sales & Distribution, Plant Maintenance, Quality Management, Finance & Accounting including Costing, Human Resources etc.

ERP market place – SAP, Oracle, PeopleSoft, JD Edwards, Baan, Microsoft's suit of products etc. Business modules in these ERP packages – a brief comparative description of business function modules and sub-modules.

Overview of key end-to-end business processes supported in two major ERP systems (preferably SAP and Oracle) – Order to Cash, Procure to Pay, Plan to Produce and Despatch.

Module 5 : Emerging Trends and Future of ERP systems (7L)

Emerging Technologies and ERP [5L]

Service-oriented Architecture (SOA): Enterprise SOA layers – Business processes, Business services, Difference between multi-layered Client-server architecture and SOA, basic awareness of NetWeaver from SAP, Websphere from Oracle and .Net from Microsoft. Enterprise Application Integration (EAI): Basic understanding of the concept, Types of EAI (levels) – User Interface, Method (logic), Application Interface, Data.

Radio Frequency Identification (RFID) and ERP: awareness of RFID technology, Benefits of RFID integrated with ERPs.

M-Commerce: basic concept and applications, difference with E-Commerce, benefits of integration with ERPs.

Future of ERP Technology [2L]

Enterprise Application Integration (EAI), ERP and E-Commerce, ERP and Internet, Growing mobile applications, Economical and Easy models of ERP deployment etc.

Text books:

1. E-Commerce-Strategy, Technologies & Applications by David Whitley, TMH
2. Enterprise Resource Planning – A Managerial Perspective by D P Goyal, Tata McGraw Hill Education

Recommended books:

1. E-Commerce- The cutting edge of business by Kamlesh K. Bajaj, TMH

Course Name: Computer Networks Lab
Course Code: CS691
Contact: 0:0:3
Credit Point: 1.5

Prerequisites:

1. Familiarity and knowledge of Computer Network and Computer Architecture
2. Also require strong knowledge of programming languages like C, Java and UNIX or Linux environment.

Course Outcome(s)

CO1: Demonstrate the socket program using TCP & UDP.

CO2: Develop simple applications using TCP & UDP.

CO3: Develop the code for Data link layer protocol simulation.

CO4: Examine the performances of Routing protocol.

CO5: Experiment with congestion control algorithm using network simulator

Course Contents:

- Familiarization of UNIX or Linux environment, UNIX or Linux general Commands specially Network Commands. Familiarization of Internetworking - Network Cables - Color coding - Crimping. Internetworking Operating Systems - Configurations. **[6L]**
- Socket Programming using TCP and UDP **[18L]**
- Implementing routing protocols such as RIP, OSPF. **[2L]**
- Familiarization of advanced simulators like Packet Tracer, NS2/NS3, OMNET++, TinyOS**[4L]**
- Server Configuration: only web server (If time permit..instructor can do more than that) **[6L]**

Text books:

Course Name: Microprocessors & Microcontrollers Lab
Course Code: CS692
Contact: 0:0:3
Credits: 1.5

Prerequisites:

1. Familiarity with the number system
2. A solid background in digital logic and implementation of digital circuit in a bread board.

Course Objective(s)

- To learn the assembly language programming of a microprocessor.
- To learn the assembly language programming of a microcontroller.
- To learn the interfacing of microprocessor.
- To be familiar with microprocessor and microcontroller based projects.

Course Outcomes:

CO1: To understand and apply the fundamentals of assembly level programming of microprocessors and microcontroller
CO2: To work with standard microprocessor real time interfaces including GPIO, serial ports, digital-to-analog converters and analog-to-digital converters.
CO3: To troubleshoot interactions between software and hardware.
CO4: To analyze abstract problems and apply a combination of hardware and software to address the problem

Course Contents:

Module -1: [3L]

Study of Prewritten programs on 8085 trainer kit using the basic instruction set (data transfer,Load/Store, Arithmetic, Logical).
Or,
Familiarization with 8085 simulator on PC.
Programs using basic instruction set (data transfer,Load/Store, Arithmetic, Logical) on the simulator.

Module -2: [24L]
Programming using kit or Simulator for:

1. Table look up
2. Copying a block of memory
3. Shifting a block of memory
4. Packing and unpacking of BCD numbers
5. Addition of BCD numbers
6. Binary to ASCII conversion and vice-versa (Using Subroutine Call)
7. BCD to Binary Conversion and vice-versa
8. HCF of two numbers
9. Addition of numbers using subroutine
10. Clearing the flag register

Module -3: [3L]
Study of Prewritten programs on 8051 Microcontroller Kit using the basic instruction set (datatransfer, Load/Store, Arithmetic, Logical).
Or,
Familiarization with 8051 Simulator on PC.
Study of prewritten programs using basic instruction set (data transfer, Load/Store, Arithmetic, Logical).

Text Books:

1. MICROPROCESSOR architecture, programming and Application with 8085 - R.Gaonkar (Penram international Publishing LTD.)
2. Fundamentals of Microprocessor and Microcontrollers - B. Ram (Paperback)
3. 8051 Microcontroller – K. Ayala (Cengage learning)

Reference books:

1. The 8051 microcontroller and Embedded systems - Mazidi, Mazidi and McKinley (PEARSON)

CO-PO Mapping:

	CO & PO Mapping											
	PO1	PO2	POP3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	–	–	–	–	–	–	–	–	–	–
CO2	–	–	2	–	–	–	–	–	–	–	–	–
CO3	1	–	2	–	–	–	–	–	–	–	–	–
CO4	2	3	–	–	–	–	–	–	–	–	–	–

Course Name: Software Engineering Lab
Course Code: CS693
Contact: 0:0:3
Credits: 1.5

Prerequisites:

For Software Engineering Lab, design a project proposal which will be used throughout the lab for performing different experiments using CASE Tools.

Course Outcomes:

CO1: To handle software development models through rational method.
CO2: To prepare SRS document, design document, project management related document.
CO3: To develop function oriented and object-oriented software design using tools like rational rose.
CO4: To apply various testing techniques through test cases.

Course Contents:

Assignments to be given as following:

1. Preparation of requirement document for standard application problems in standard format. (e.g. Library Management System, Railway Reservation system, Hospital management System, University Admission system).

2. Project Schedule preparation. Software Requirement Analysis: Describe the individual Phases/ modules of the project, Identify deliverables, and draw DFD

3. Use Case diagram, Class Diagram, Sequence Diagram, Activity Diagram and prepare Software Design Document using tools like Rational Rose. (For standard application problems)

4. Software Development and Debugging. Estimation of project size using Function Point (FP) for calculation.

5. Design Test Cases/Test Plan (both Black box and White Box approach)

6. Compute Process and Product Metrics (e.g. Defect Density,DefectAge,Productivity,Cost etc.) Cost Estimation models. COCOMO

CO-PO Mapping:

16-17

2. Rafael C. Gonzales and Richard E. Woods, Digital Image Processing, Third Edition, Pearson Education, 2010.

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
IT(CSE)**606B.1**	3					1	1					
IT(CSE)**606B.2**		1	2	1								1
IT(CSE)**606B.3**	1	2		2	2				1			
IT(CSE)**606B.4**	2					2	2			1	1	
IT(CSE)**606B.5**		3		1		3		1				

Name of the Paper: E Commerce & ERP
Paper Code: IT(CSE)**606C**
Contact (Periods/Week):=3L/Week
Credit Point: 3
No. of Lectures: 39

Prerequisite: Knowledge of Software Engineering and Networking

Course Objective(s)

- To impart knowledge on E-Commerce & ERP and its various applications.
- To understand E-Commerce framework and business model applications of E-Commerce
- To understand e-payment mechanisms

Course Outcome(s)

On completion of the course students will be able to

IT(CSE)**606C.1** **Define** and **differentiate** various types of Ecommerce.
IT(CSE)**606C.2** **Define** and **describe** E-business and its Models.
IT(CSE)**606C.3** **Describe** Hardware and Software Technologies for Ecommerce.
IT(CSE)**606C.4** **Understand** the basic concepts of ERP and **identify** different technologies used in ERP.
IT(CSE)**606C.5** **Apply** different tools used in ERP

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Module 1: Overview of E-Commerce[10L]

Introduction to E-Commerce [4L]: Definition, Scope of E-Commerce, Hardware requirements, E-Commerce and Trade Cycle, Electronic Markets, Electronic Data Interchange and Internet Commerce.

Business to Business E-Commerce [6L]: Electronic Markets, Electronic Data Interchange (EDI): Technology, Standards (UN/EDIFACT), Communications, Implementations, Agreements, Security, EDI and Business, Inter-Organizational E-commerce.

Module 2: Security Issues in E-Commerce [10L]

Legal issues [4L]: Risks: Paper Document vs. Electronic document, Authentication of Electronic document, Laws, Legal issues for Internet Commerce: Trademarks and Domain names, Copyright, Jurisdiction issues, Service provider liability, Enforceable online contract.

Security Issues [6L]: Security Solutions: Symmetric and Asymmetric Cryptosystems, RSA, DES, and Digital Signature, Protocols for secure messaging, Secure Electronic Transaction (SET) Protocol, Electronic cash over internet, Internet Security.

Module 3: Applications [3L]

E-business [3L]: Internet bookshops, Software supplies and support, Electronic Newspapers, Internet Banking, Virtual Auctions, Online Share Dealing, Gambling on the net, E-Diversity, Case studies through internet.

Module 4: Overview of ERP (9L)

The evolution of ERP systems: A historical perspective [4L]

Evolution through Payroll system, Inventory Control system, Materials Requirement Planning (MRP I) system, Manufacturing Resource Planning (MRP II) system, their advantages and disadvantages. Definition and Concept of ERP, Business reasons for rise and popularity of ERP system - Benefits of an ERP system

Business processes supported by ERP systems [5L]

Various business functions in an Organization – Purchasing, Materials Management, Manufacturing, Sales & Distribution, Plant Maintenance, Quality Management, Finance & Accounting including Costing, Human Resources etc.

ERP market place – SAP, Oracle, PeopleSoft, JD Edwards, Baan, Microsoft's suit of products etc. Business modules in these ERP packages – a brief comparative description of business function modules and sub-modules.

Overview of key end-to-end business processes supported in two major ERP systems (preferably SAP and Oracle) – Order to Cash, Procure to Pay, Plan to Produce and Despatch.

Module 5 : Emerging Trends and Future of ERP systems (7L)

Emerging Technologies and ERP [5L]

Service-oriented Architecture (SOA): Enterprise SOA layers – Business processes, Business services, Components and Integration services, Advantages and Drawbacks of SOA, When to use SOA, Difference between multi-layered Client-server architecture and SOA, basic awareness of NetWeaver from SAP, Websphere from Oracle and .Net from Microsoft. Enterprise Application Integration (EAI): Basic understanding of the concept, Types of EAI (levels) – User Interface, Method (logic), Application Interface, Data. EAI architecture – Typical framework (Business Processes, Components &Services, Messaging service, and Transport service. Mention

Practical

Name of the Paper: COMPUTER NETWORKS Lab
Paper Code: CS691
Contact (Periods/Week):=3L/Week
Credit Point: 2
No. of Lectures: 36

Prerequisite:

5. Familiarity and knowledge of Computer Network and Computer Architecture
6. Also require strong knowledge of programming languages like C, Java and UNIX or Linux environment.

Course Objectives:

1. To provide students with an overview of the concepts and fundamentals of data communication and computer networks
2. To familiarize with the basic taxonomy and terminology of computer networking area. 3
3. To experience the designing and managing of communication protocols while getting a good exposure to the TCP/IP protocol suite

Course Outcome(s)

CO1: Demonstrate the socket program using TCP & UDP.

CO2: Develop simple applications using TCP & UDP.

CO3: Develop the code for Data link layer protocol simulation.

CO4: Examine the performances of Routing protocol.

CO5: Experiment with congestion control algorithm using network simulator

Syllabus

- Familiarization of UNIX or Linux environment, UNIX or Linux general Commands specially Network Commands. Familiarization of Internetworking - Network Cables - Color coding - Crimping. Internetworking Operating Systems - Configurations. **[6L]**
- Implementation of flow control mechanisms [3L]
- Socket Programming using TCP and UDP **[15L]**

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- Implementing routing protocols such as RIP, OSPF. **[2L]**
- Familiarization of advanced simulators like Packet Tracer, NS2/NS3, OMNET++, TinyOS**[4L]**
- Server Configuration: only web server (If time permit..instructor can do more than that) **[6L]**

Text books:

1. **TCP sockets in C programs-Practical guide for Programmers By Micheal J Donahoo and Kenneth L calvert.**
2. **Socket Programming by rajkumar Buyaa.**

Substantial/ High	3
Medium	2
Low	1
No Correlation	

CO-PO Mapping

CO	PO1	PO2	POP3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS692.1	3	3	3	2	3	2	1		3	2	2	3
CS692.2	3	3	3	2	3	3	2	3	3	2	2	3
CS692.3	3	3	3	2	2	1	2	1	3	2	2	3
CS692.4	3	3	3	1	2	2	1	3	3	2	2	3
CS692.5	3	3	3	2	2	2	1	2	3	2	2	3
CS692	3	3	3	2	3	2	1	1	3	2	2	3

Name of the Paper: Microprocessors & Microcontrollers Lab
Paper Code: CS692
Contact (Periods/Week): 3P/Week
Credit Point: 2
No. of Lectures: 30

Prerequisite:

7. Familiarity with the number system
8. A solid background in digital logic and implementation of digital circuit in a bread board.

Course Objective(s)

- To learn the assembly language programming of a microprocessor.
- To learn the assembly language programming of a microcontroller.
- To learn the interfacing of microprocessor.
- To be familiar with microprocessor and microcontroller based projects.

Course Outcomes

CS692.1 To understand and apply the fundamentals of assembly level programming of microprocessors and microcontroller
CS692.2 To work with standard microprocessor real time interfaces including GPIO, serial ports, digital-to-analog converters and analog-to-digital converters.
CS692.3 To troubleshoot interactions between software and hardware
CS692.4 To analyze abstract problems and apply a combination of hardware and software to address the problem
CS692.5 To use standard test and measurement equipment to evaluate digital interfaces

List of Experiments:

1. Write an assembly language program to transfer a data from one memory location to another memory location.
2. Write an assembly language program to add two numbers stored in memory locations 9140 and 9141. Store the sum at 9142 and carry at 9143.
3. Write an assembly language program to add a series of numbers. The length is given in the location 913F and the series itself starts from 9140. Store the result at 9160.
4. Write an assembly language program to find maximum of a series of numbers. The length is given in the location 913F and the series itself starts from 9140. Store the result at 9160.
5. Write an assembly language program to copy 16 data from 9140-914F to 9148-9157 (overlapping memory locations).
6. A set of eight data bytes is stored in the memory location starting at 9140. Check each data byte for bits D7 and D0. If D7 or D0 is 1, reject the data byte; otherwise, store the data bytes at memory locations starting at 9160.
7. Write an assembly language program to count number of 0's and number of 1's in the string (data byte) stored in the memory location 9140. Store the results in 9141 and 9142, respectively.
8. Write an assembly language program to find HCF of two numbers stored in memory locations 9140 and 9141. Store the result at 9142.
9. Write an assembly language program to convert a BCD number to its equivalent Binary form. The BCD number is within memory location 9140. Store the bits of equivalent binary number from 9141-9148. The LSB should be stored into 9141.
10. Write an assembly language program to find square value of a number using Look Up Table.
11. Write an assembly language program to add two numbers using subroutine.
12. Write an assembly language program to fill flag register by 5D.

Text Books:

1.MICROPROCESSOR architecture, programming and Application with 8085 - R. Gaonkar (Penram international Publishing LTD.)

Recommended books:

1.Fundamentals of Microprocessor and Microcontrollers - B. Ram (Paperback)
2.The 8051 microcontroller and Embedded systems - Mazidi, Mazidi and McKinley (PEARSON)

CO-PO Mapping

CO	PO1	PO2	POP3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS692.1	2	2	2									
CS692.2		2	3	1							1	
CS692.3		1	2	1								
CS692.4		3	2	2							1	
CS692.5			1		1							

Name of the Paper: Software Engineering Lab
Paper Code: CS693
Contact (Periods/Week): 3L
Credit Point: 2

Prerequisite:

For Software Engineering Lab, design a project proposal which will be used throughout the lab for performing different experiments using CASE Tools.

Course Objective(s)

- To learn software development skill through various stages of software life cycle. .
- To ensure the quality of software through software development with various protocol based environment.

Course Outcomes

CS693.1 To handle software development models through rational method.
CS693.2 To prepare SRS document, design document, test cases and software configuration management and risk management related document.
CS693.3 To Develop function oriented and object oriented software design using tools like rational rose.
CS693.4 To perform unit testing and integration testing
CS 693.5 To apply various white box and black box testing techniques

Assignments to be given from the following

1. Preparation of requirement document for standard application problems in standard format. (e.g. Library Management System, Railway Reservation system, Hospital management System, University Admission system) .DFD of standard application problems.

2. Project Schedule preparation. Software Requirement Analysis: Describe the individual Phases/ modules of the project, Identify deliverables.

3. Use Case diagram, Class Diagram, Sequence Diagram, Activity Diagram and prepare Software Design Document using tools like Rational Rose.(For standard application problems)

4. Software Development and Debugging. Estimation of project size using Function Point(FP) for calculation.

5. Design Test Script/Test Plan(both Black box and White Box approach)

6. Compute Process and Product Metrics (e.g Defect Density, Defect Age, Productivity, Cost etc.) Cost Estimation models. COCOMO

Recommended books:

4. SoftwareEngineering:Apractitioner'sapproach–Pressman(TMH)
5. SoftwareEngineering-PankajJalote(Wiley-India)

CO-PO Mapping

CO	PO1	PO2	POP3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS693.1	3	3	3	2	2							3
CS693.2	3	2	3									2
CS693.3	3	2	3	2	3							
CS693.4	3	3										
CS693.5	3	2										2

Syllabus

Theory

Name of the Paper: Artificial Intelligence
Paper Code: CS701
Contact (Periods/Week):=3L/Week
Credit Point: 3
No. of Lectures: 37

Prerequisite:

9. Basics of Design and Analysis of Algorithm
10. A solid background in mathematics, including probability.

Course Objective(s)

- To learn the overview of artificial intelligence principles and approaches.
- To develop a basic understanding of the building blocks of AI as presented in terms of intelligent agents.
- This course also covers fundamental areas of Local Search Algorithms, Adversarial Searching and Neural Networks.

Course Outcome(s)

On completion of the course students will be able to

CS701.1 Understand the concepts of Artificial intelligence

CS701.2 Analyze the dimensions along which agents and environments vary, along with key functions that must be implemented in a general agent

CS701.3 Develop intelligent algorithms for constraint satisfaction problems and also design intelligent systems for Game Playing

CS701.4 Represent knowledge of the world using logic and **infer** new facts from that Knowledge.

CS701.5 Demonstrate working knowledge in PROLOG in order to write simple PROLOG programs and **explore** more sophisticated PROLOG code on their own.

Module 1: Basics of AI [7L]
Introduction [2]
Overview of Artificial intelligence- Problems of AI, AI technique, Tic - Tac - Toe problem.
Intelligent Agents [2]
Agents & environment, nature of environment, structure of agents, goal based agents, utility based agents, learning agents.
Learning [3]
Forms of learning, inductive learning, learning decision trees, explanation based learning, learning using relevance information, neural net learning & genetic learning.

Module 2: Different types of searching algorithms [14L]
Problem Solving [3]

Problems, Problem Space & search: Defining the problem as state space search, production system, constraint satisfaction problems, issues in the design of search programs.

Search techniques [4]

Solving problems by searching: Problem solving agents, searching for solutions; uniform search strategies: breadth first search, depth first search, depth limited search, bidirectional search, comparing uniform search strategies.

Heuristic search strategies [4]

Greedy best-first search, A* search, memory bounded heuristic search: local search algorithms & optimization problems: Hill climbing search, simulated annealing search, local beam search, genetic algorithms; constraint satisfaction problems, local search for constraint satisfaction problems.

Adversarial search [3]

Games, optimal decisions & strategies in games, the minimax search procedure, alpha-beta pruning, additional refinements, iterative deepening.

Module 3: Knowledge & Reasoning [12L]

Knowledge & Reasoning [3]

Knowledge representation issues, representation & mapping, approaches to knowledge representation, issues in knowledge representation.

Using predicate logic [4]

Representing simple fact in logic, representing instant & ISA relationship, computable functions & predicates, resolution, natural deduction.

Representing knowledge using rules [2]

Procedural verses declarative knowledge, logic programming, forward verses backward reasoning, matching, control knowledge.

Probabilistic reasoning [3]

Representing knowledge in an uncertain domain, the semantics of Bayesian networks, Dempster-Shafer theory, Fuzzy sets, and fuzzy logics.

Module 4: Different fields of AI [4L]

Natural Language Processing [2]

Introduction, Syntactic processing, semantic analysis, discourse, and pragmatic processing.

Expert Systems [2]

Representing and using domain knowledge, expert system shells, and knowledge acquisition.
Basic knowledge of programming language like Prolog

Text books:

1. Artificial Intelligence, Ritch & Knight, TMH
2. Artificial Intelligence, A Modern Approach, Stuart Russel, Peter Norvig ,Pearson

Recommended books:

3. Introduction to Artificial Intelligence & Expert Systems, Patterson, PHI
4. Poole, Computational Intelligence, OUP
5. Logic & Prolog Programming, Saroj Kaushik, New Age International
6. Expert Systems, Giarranto, VIKAS

Module: 4. ***Ethics of Profession:***
Engineering profession: Ethical issues in Engineering practice, Conflicts between business demands and professional ideals.
Social and ethical responsibilities of Technologists. Codes of professional ethics. Whistle blowing and beyond, Case studies.

Module: 5. Self Development: Character strengths and virtues, Emotional Intelligence, Social intelligence, Positive cognitive states and processes (Self-efficacy, Empathy, Gratitude, Compassion, and Forgiveness).

Module: 6.Effects ***of Technological Growth:***
Rapid Technological growth and depletion of resources, Reports of the Club of Rome. Limits of growth: sustainable development Energy Crisis: Renewable Energy Resources, Environmental degradation and pollution. Eco-friendly Technologies. Environmental Regulations, Environmental Ethics
Appropriate Technology, Movement of Schumacher; Problems of man, machine, interaction.

Text / Reference Books:

1. Stephen H Unger, Controlling Technology: Ethics and the Responsible Engineers, John Wiley & Sons, New York 1994 (2nd Ed)
2. Deborah Johnson, Ethical Issues in Engineering, Prentice Hall, Englewood Cliffs, New Jersey 1991.
3. A N Tripathi, Human values in the Engineering Profession, Monograph published by IIM, Calcutta 1996.

CO-PO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
Co-1	_	_	_	_	_	1	1	1	1	2	_	_
Co-2	_	_	_	_	_	1	1	3	1	2	_	_
Co-3	_	_	_	_	_	3	2	3	_	1	_	_
Co-4	_	_	_	_	_	3	2	1	_	_	_	_
Co-5	_	_	_	_	_	3	2	2	_	1	3	_

Paper Name: Soft Computing
Code: CS 702A
Contacts: 3L
Credits: 3
Allotted hours: 38L

Prerequisite:

11. A solid background in mathematical and programming Knowledge

Course Objective(s)

- To learn the basics of Soft Computing usage.
- To learn the basics of many optimization algorithm
- To learn to solve and optimize the real world problem using soft computing methodology.

Course Outcomes

- **CS702A.1** To acquire the knowledge of soft computing and hard computing
- **CS702A.2** To develop skill in soft computing methodology
- **CS702A.3** To understand the concept and techniques of designing and implementing of soft computing methods in real world problem
- **CS702A.4** To acquire the knowledge of the fuzzy Neural network and Genetic Language
- **CS702A.5** To analyze and optimized the problem of real-life applications

Soft Computing: Module-I [7L]

1. An Overview of Artificial Intelligence
2.Soft Computing: Introduction of soft computing, soft computing vs. hard computing, various types of soft computing techniques, applications of soft computing.
3. Artificial Intelligence : Introduction, Various types of production systems, characteristics of production systems, breadth first search, depth first search techniques, other Search Techniques like hill Climbing, Best first Search, A* algorithm, AO* Algorithms and various types of control

Soft Computing: Module-II **[10L]**

1. Introduction to derivative free optimization, GA; biological background, search space of genetic algorithm, genetic algorithm Vs. Traditional algorithm; Simple genetic algorithm, Genetic algorithm Operators: Encoding, selection criteria, Crossover, Mutation, advantages and disadvantages of genetic algorithm, Convergence of GA, Applications & advances in GA, Differences & similarities between GA & other traditional method.

Soft Computing: Module-III **[12L]**

1. Neural Network : Biological neuron, artificial neuron, definition of ANN, Taxonomy of neural net, Difference between ANN and human brain, Structure and Function of a single neuron, characteristics and applications of ANN, single layer network, Perceptron training algorithm, Linear separability, Widrow & Hebb;s learning rule/Delta rule, ADALINE, MADALINE, AI v/s ANN.
2. Introduction of MLP, different activation functions, Error back propagation algorithm, derivation of EBPA, momentum, heuristic, limitation, characteristics and application of EBPA.
3.Adaptive Resonance Theory: Architecture, classifications, Implementation and training, Associative Memory.

Soft Computing: Module-IV **[11L]**

1. Fuzzy Logic: Fuzzy set theory, Fuzzy set versus crisp set, Crisp relation & fuzzy relations, Fuzzy systems: crisp logic, fuzzy logic, introduction & features of membership functions,
2. Fuzzy rule base system: fuzzy propositions, formation, decomposition & aggregation of fuzzy rules, fuzzy reasoning, fuzzy inference systems, fuzzy decision making & Applications of fuzzy logic.

Text Books:

1. Fuzzy logic with engineering applications, Timothy J. Ross, John Wiley and Sons.
2.Neural Networks: A Comprehensive Foundation (2nd Edition), Simon Haykin, Prentice Hall.

Reference Books:

1. K.H.Lee. First Course on Fuzzy Theory and Applications, Springer-Verlag.
2. J. Yen and R. Langari.. Fuzzy Logic, Intelligence, Control and Information, Pearson Education.

CO-PO Mapping

CO	PO1	PO2	POP3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS702A.1	2											
CS702A.2			2									
CS702A.3	1		3									
CS702A.4	2											
CS702A.5		1				3						

Processing", MIT Press. Cambridge, MA: May 1999.

Reference books:

1. Allen, James. 1995. – "Natural Language Understanding". Benjamin/Cummings, 2ed.
2. Bharathi, A., Vineet Chaitanya and Rajeev Sangal. 1995. Natural Language Processing- "A Pananian Perspective". Prentice Hll India, Eastern Economy Edition.

CO-PO Mapping

CO	PO1	PO2	POP3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	CO	PO1	PO2
CS702B.1		2	3	3	3						3	2	3	2	3
CS702B.2		2	2	2	1						3	2	3	2	2
CS702B.3		2	3	3	3	3					3	2	3	2	2
CS702B.4		2	2	2	1						3	2	3	2	2
CS702B.5	3				2	3	1						2	2	3
CS702B	3	2	3	3	2	3	1	-	-	-	3	2	3	2	2

Name of the Paper: Web Technology
Paper Code: CS702C
Contact (Periods/Week): 3L/Week
Credit Point: 3
No. of Lectures: 35

Prerequisites:

1. Fundamentals of Programming
2. Concepts of Networking

Course Objective(s):

- To impart the design, development and implementation of Static and Dynamic Web Pages.
- To develop programs for Web using Scripting Languages and .net framework.
- To give an overview of Server Side Programming in Web

Course Outcome(s) (CO):

CS702C.1 To understand the notions of World Wide Web(www), Internet, HTTP Protocol, Web Browsers, Client-Server etc.
CS702C.2 To develop interactive web pages using HTML, DHTML and CSS.
CS702C.3 To procure the knowledge of different information interchange formats like XML.

CS702C.4 To design web applications using scripting languages like JavaScript, CGI, PHP.
CS702C.5 To acquire the server side programming concepts using servlet, JSP and .Net framework.

Module 1: [4L]

Introduction to Web[4L]: Concept of World Wide Web (www), Internet and the relation with www**[1L];**The Internet - Basic Internet Protocols, HTTP Protocol - Request and Response, Web browser **[1L];** Web clients and Web servers, Dynamic IP**[1L];** Clients, Servers, and Communication, Web site design principles, Planning the site and navigation**[1L].**

Module -2: [9L]

HTML, DHTML & CSS [6L]: Introduction, Elements, Attributes, Heading, Paragraph. Formatting**[1L];** Link, Table, List, Block, Layout, Html Forms and input **[1L];** Iframe, Colors, Image Maps and attributes of image area **[2L];**Introduction to CSS, basic syntax and structure of CSS, different types- internal, external and inline CSS**[1L];**Basic Introduction of DHTML, Difference between HTML and DHTML, Documentary Object Model (DOM) **[1L].**
Extended Markup Language (XML) [3L]: Introduction, Difference between HTML & XML, XML-Tree **[1L];** Syntax, Elements, Attributes, Validation and parsing, DTD**[2L].**

Module 3: [8L]

Java Scripts[3L]: Basic Introduction, Statements, comments, variable, operators, data types**[1L];** condition, switch, loop, break [1L]; Java script functions, objects and events**[1L].**
CGI Scripts [1L]: Introduction, Environment Variable, GET and POST Methods.
PHP Scripting [4L]: Introduction, Syntax, Variables, Output, Data types, String, Constants**[1L];** Operator, Decision Control statements**[1L];** switch-case, Loop, PHP function**[1L];** array, Form Handling**[1L].**

Module-4: [14L]

Java Server Page (JSP) [8L]:
JSP Architecture **[1L];** JSP Servers , JSP Life Cycle **[1L];** Understanding the layout of JSP, JSP Scriptlet Tag**[1L];** JSP implicit object (request and response) **[1L];** Variable declaration, methods in JSP **[1L];**JSP directive (Taglib and Include), Javabean- inserting javabean in JSP **[1L];**JSP Action tags (Forward & Include) **[1L];** Creating ODBC data source name, Introduction to JDBC, prepared statement and callable statement **[1L].**

Java Servlet [3L]: Servlet environment and role, Servlet life cycle **[1L];** Servlet methods- Request, Response, Get and post **[1L];**Cookies and Session **[1L].**

.NET Framework [3L]: ASP.Net with MVC introduction, MVC Architecture, MVC routing, controller, Action method, Action Selector and Action verb, Model and View **[1L];**.net framework, C#.net introduction, environment variable, basic syntax of conditional statement, loop and function**[2L].**

Text Books:

1. "Web Technology: A Developer's Perspective", N.P. Gopalan and J. Akilandeswari, PHI Learning, Delhi, 2013. **(Topics covered: html, CSS, imagemap, xml)**
2. "Learning PHP, MySQL & JavaScript", Robin Nixon, O'Reilly Publication.**(Topics covered: PHP, Java Script)**
3. "Head First Servlet's & JSP", Bryan Basham, Kathy Sterra, Bert Bates, O'Reilly Publication.**(Topics covered: Servlet, JSP)**
4. ASP.NET Core 2.0 MVC And Razor Pages For Beginners:", Jonas Frajerberg, O'Reilly Publication.**(Topics covered: MVC, ASP.Net, C#)**

Recommended books:

1. "Programming the World Wide Web", Robert. W. Sebesta, Fourth Edition, Pearson Education, 2007.

2. "Core Web Programming"- Second Edition-Volume I and II, Marty Hall and Larry Brown, Pearson Education, 2001.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C01	1	-	2	-								
C02	-	2	3	2								
C03	-	2	2	-								
C04	1	2	3	2								
C05	1	-	3	2								

PaperName:CloudComputing
Code:CS703A
Contacts:3L ; Credits:3
Allottedhours:35L

PREREQUISITE

- Should have the basic knowledge of Operating Systems and Virtualization Technologies
- Should aware of the fundamental concepts of Networking
- Should have knowledge of heterogeneous systems and resource management.

COURSE OBJECTIVES

- To learn the work-flow of cloud business model and optimized resource allocation.
- To gain knowledge of cloud service and delivery models and develop an understanding of the risk and compliance responsibilities and Challenges for each Cloud type and service delivery model.
- To learn virtualization techniques, load balancing, and work strategy of different cloud infrastructure.
- To know the security and privacy issues in cloud infrastructure.

COURSE OUTCOMES

After completion of course, students would be able to:

CS703A.1 Articulate the business model concepts, architecture and infrastructure of cloud computing, including cloud service models and deployment models.

CS703A.2 Apply and design suitable Virtualization concept, Cloud Resource Management and design scheduling algorithms

CS703A.3 Explore some important cloud computing driven commercial systems such as Google Apps, Microsoft Azure and Amazon Web Services and other businesses cloud applications

CS703A.4 Analyze the core issues of cloud computing such as security, privacy, interoperability, and its impact on cloud application

Module 1: Definition of Cloud Computing and its Basics [8L]

1. Definition of Cloud Computing: Defining a Cloud, Cloud Types – NIST model, Cloud Cube model, Deployment models (Public , Private, Hybrid and Community Clouds), Service models – Infrastructure as a Service, Platform as a Service, Software as a Service with examples of services/ service providers, Cloud Reference model, Characteristics of Cloud Computing – a shift in paradigm Benefits and advantages of Cloud Computing **[3]**
2. Cloud Architecture: Cloud Infrastructure, Architecture of each components, Virtualization versus Traditional Approach, Virtualization Model for Cloud Computing. **[2]**
3. Services and Applications by Type**[3]**

IaaS – Basic concept, Workload, partitioning of virtual private server instances, Pods, aggregations, silos
PaaS – Basic concept, tools and development environment with examples
SaaS - Basic concept and characteristics, Open SaaS and SOA, examples of SaaS platform
Identity as a Service (IDaaS) Compliance as a Service (CaaS)

Module 2: Use of Platforms in Cloud Computing [6L]

1. Concepts of Abstraction and Virtualization **[2]**
Virtualization technologies: Types of virtualization, Load Balancing and Virtualization: Basic Concepts, Network resources for load balancing; Classification of Virtualization Environment: Scheduling-based Environment, Load-Distribution-Based Environment, Energy Aware-Based Environment, Operational-Based Environment, Distributed Pattern-Based Environment, Transactional-Based Environment
2. Mention of The Google Cloud as an example of use of load balancing Hypervisors: Virtual machine technology and types, VMware vSphere Machine imaging (including mention of Open Virtualization Format – OVF) **[2]**
Porting of applications in the Cloud: The simple Cloud API and AppZero Virtual Application appliance
3. Concepts of Platform as a Service **[2]**
Definition of services, Distinction between SaaS and PaaS (knowledge of Salesforce.com and Force.com), Application development.Use of PaaS Application frameworks

Module 3 : Cloud Service Models [6L]

1. Use of Google Web Services **[2L]**
Discussion of Google Applications Portfolio – Indexed search, Dark Web, Aggregation and disintermediation, Productivity applications and service, Adwords, Google Analytics, Google Translate, a brief discussion on Google Toolkit (including introduction of Google APIs in brief), major features of Google App Engine service.
2. Use of Amazon Web Services **[2L]**
Amazon Web Service components and services: Amazon Elastic Cloud, Amazon Simple Storage system, Amazon Elastic Block Store, Amazon SimpleDB and Relational Database Service
3. Use of Microsoft Cloud Services **[2L]**
Windows Azure platform: Microsoft's approach, architecture, and main elements, overview of Windows Azure AppFabric, Content Delivery Network, SQL Azure, and Windows Live services

Module 4 : Cloud Infrastructure [10L]

Types of services required in implementation – Consulting, Configuration, Customization and Support
1. Cloud Management **[3L]**
An overview of the features of network management systems and a brief introduction of related products from large cloud vendors, Monitoring of an entire cloud computing deployment stack – an overview with mention of some products, Lifecycle management of cloud services (six stages of lifecycle)
2. Live Migration of Virtual Machines: **[2L]**
Need of Live Migration of Virtual Machine, A Designing Process of Live Migration, and Security Issues during live migration
3. Concepts of Cloud Security **[3L]**
Infrastructure Security, Infrastructure Security: The Network Level, The Host Level, The Application Level, Data Security and Storage, Aspects of Data Security, Data Security Mitigation Provider Data and Its Security, Identity and Access Management
4. Auditing and Compliance in Cloud Environment: **[2L]**

Data Security in Cloud Computing Environment, Need for Auditing in Cloud Computing Environment, Third Party Service Provider, Cloud Auditing Outsourcing Lifecycle Phases, Auditing Classification.

Module 5 : Concepts of Services and Applications [5L]

1. Service Oriented Architecture: Basic concepts of message-based transactions, Protocol stack for an SOA architecture, Event-driven SOA, Enterprise Service Bus, Service catalogs **[1]**
2. Applications in the Cloud: Concepts of cloud transactions, functionality mapping, Application attributes, Cloud service attributes, System abstraction and Cloud Bursting, Applications and Cloud APIs **[2]**
3. Cloud-based Storage: Cloud storage definition – Manned and Unmanned. **[1]**
4. Webmail Services: Cloud mail services including Google Gmail, Mail2Web, Windows Live Hotmail, Yahoo mail, concepts of Syndication services **[1]**

BooksRecommended:

1.***MasteringCloudComputing***byRajkumarBuyya,ChristianVecchiola,S.ThamaraiSelvi,McGrawHill Education (India)PrivateLimited,2013
2. ***Fundamentals of Cloud Computing*** by P. K. Pattnaik, S. Pal, M. R. Kabat, Vikas Publications, 2014.

References:

1. ***CloudComputingBible***byBarrieSosinsky,WileyIndiaPvt. Ltd,2013
2. ***Cloudcomputing:Apracticalapproach***,AnthonyT.Velte,TataMcgraw-Hill

CO-PO Mapping

CO	PO1	PO2	POP3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS703A.1				2								
CS703A..2			1				1				3	
CS703A.3						2			2			
CS703A.4								2	1			

Name of the Paper: Data Analytics
Paper Code: CS703B
Contact (Periods/Week):=3L/Week
Credit Point: 3
No. of Lectures: 40

Prerequisite:

14. Familiarity and knowledge of Database Management Systems
15. Familiarity and knowledge of Database Management Systems Laboratory.

Course Objective(s)

1. Conceptualization and summarization of big data and trivial data versus big data
2. Big data computing technologies.
3. Help students learn, understand, and practice big data analytics with distributed approaches.
4. Learn and understand different programming model of big data.

Course Outcome(s)

CS703B.1: Identify the difference between structured, semi-structured and unstructured data.

CS703B.2: Summarize the challenges of big data and how to deal with the same.

CS703B.3: Explain the significance of NoSQL databases.

CS703B.4: Explain about Hadoop Ecosystem.

CS703B.5: Identify the difference between Pig and Hive

Module I: DATA AND BIG DATA ANALYTICS [6L]

Introduction (2L):

Types of digital data [1L]: Structured: Sources of structured data and Ease with Structured data Semi-Structured: sources of semi-structured data Unstructured: sources of unstructured data: Issues with terminology, dealing with unstructured data.

Big data analytics-1 [2L]: Characteristics of data-Definition of big data-Challenges of big data Traditional BI vs. Big data-A typical BI environment-A big data environment-Big data stack

Big data analytics-2 [1:]: Classification of analytics-Top challenges facing big data-Data science.

Terminologies used in big data environment [2L]: In memory analytics-In database processing. Massively parallel processing-Parallel vs distributed systems-Shared Memory architecture CAP (Consistency, Availability, Partition Tolerance) theorem explained- BASE (Basically Available Soft State Eventual Consistency)-Few top Analytics tools.

Module II: BIG DATA TECHNOLOGY AND HADOOP [8L]

The big data technology landscape [1]: NoSQL-Types of NoSQL databases-Why NoSQL -Advantages of NoSQL- What we miss with NoSQL?- NoSQL Vendors SQL Vs. NoSQL. NewSQL - Comparison of SQL, NoSQL and NewSQL.

Hadoop [1] : Features of Hadoop- Key advantages of Hadoop- Versions of Hadoop-Hadoop 1.0 Hadoop 2.0- Overview of Hadoop Ecosystems- Hadoop Vs. SQL- Integrated Hadoop systems offered by leading market vendors-Cloud based Hadoop solutions.

Introducing Hadoop [2]: Why not RDBMS-Distributed Computing Challenges. Hadoop Overview: Hadoop Components-High Level Architecture of Hadoop. Hadoop Distributed File System: HDFS Architecture-Daemons Related to HDFS- Working with HDFS Command-Special Features of Hadoop.

Processing Data With Hadoop [2]: Introduction-How Map Reduce Works-Map Reduce Example. Word Count Example using Java.

Managing Resources and Applications with YARN [2] : Introduction-Limitation of Hadoop 1.0- Hadoop 2: HDFS-Hadoop 2: YARN-Business Intelligence on Hadoop

Module III: NOSQL – MONGODB AND CASSANDRA [9L]

NoSQL – MongoDB [4] : What is MongoDB? - Using JSON-Creating or generating a unique key Support for dynamic queries- Storing binary data-Replication-Sharding-Updating information in-place. Terms used in RDBMS and MongoDB-Data types in Mongodb-MongoDB - CRUD (Insert (), Update (), Save (), Remove (), find ())-MongoDB- Arrays, Java Scripts, Cursors, Map Reduce Programming, Aggregations.

NoSQL – Cassandra [4] : What is Cassandra?-Why Cassandra?- Peer to peer network-Gossip and Failure detection- Anti-Entropy & Read Repair- Writes in Cassandra- Hinted handoffsTunable consistency. Cassandra- CQLSH - CRUD, Counter, List, Set, Map, Tracing.
NoSQL – MongoDB Vs. NoSQL – Cassandra **[1L]**

Module IV: HADOOP HIVE [9L]

Introduction to Hive - The Problem Solution [3]: Hive Use Case- Data Growth- Schema Flexibility and Evolution- Extensibility. What is Hive: History of Hive and Recent Releases of Hive-Hive Features-Hive Integration and Work Flow- Hive Data Units.

Hive Architecture-Hive Primitive Data Types and Collection Types-Hive File Formats-Hive Query Language Statements: DDL-DML. Hive Partitions-Bucketing-Views-Sub Query-Joins Hive User Defined Function-Aggregations in Hive-Group by and Having-Serialization and Deserialization-Hive Analytic Functions. **[6L]**

Module V: HADOOP – PIG [8L]

Hadoop – Pig: Introducing Pig [2L] : History and Anatomy of Pig-Pig on Hadoop-Pig Features-Pig Philosophy-Word count example using Pig-Use Case for Pig-Pig Primitive Data Types , Collection Types and NULL.

Pig Latin Overview [2L]: Pig Latin Grammar - Comments, Keywords, Identifiers-Case sensitivity in Pig-Common Operators in Pig.

Pig Statements [1L]: LOAD-STORE-DUMP-Interactive Shell – GRUNT: FILTER- SORTGROUP BY-ORDER BY-JOIN-LIMIT.

Pig Latin Script [2L]: Local Mode-Map Reduce Mode-Running Pig Script. Working with: Field Tuple-Bag. User Defined Function-Parameters in Pig.

Jasper Report using Jasper soft studio: Introduction to Jasper Report using Jasper Soft Studio Reporting using MongoDB-Reporting using Cassandra **[1L]**

Text books:

1. Mark Dexter, Louis Landry, "Joomla Programming", 2012 Pearson Education.
2. Seema Acharya and Subhashini C, "Big Data and Analytics", Wiley Publication, 2015

Recommended books:

1. Judith Hurwitz, Alan Nugent, Fern Halper, Marcia Kaufman, "Big data for dummies", Wiley Publication, 2013.
2. Tom White, "Hadoop: The Definitive Guide", O"Rilly Publication, 2015.
3. Chuck Lam, "Hadoop in action", Dreamtech Press, 2011.
4. Dirk Deroos, Paul C. Zikopoulos, Roman B. Melnyk, Bruce Brown, "Hadoop for dummies", Wiley publication, 2015.

Other References:

1. https://www.mongodb.org
2. http://cassandra.apache.org
3. http://apache.bytenet.in/hadoop/common/hadoop-2.6.0/
4. http://apache.bytenet.in/hive/
5. http://apache.bytenet.in/pig/
6. https://community.jaspersoft.com

CO-PO Mapping

CO	PO1	PO2	POP3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS703B.1		2		2								
CS703B.2					2							
CS703B.3					3							
CS703B.4												
CS703B.5		2			3							
CS703B												

Name of the Paper: Sensor Network and IOT
Paper Code: CS703C
Contact (Periods/Week):3L/Week
Credit Point: 3
No. of Lectures: 35

Prerequisite:

16. Familiar with basic Computer Networks concepts
17. Basic knowledge of Microcontroller fundamentals

Course Objective(s)

- To explore the interconnection and integration of the physical world and the cyberspace
- To understand building blocks of Internet of Things and characteristics
- To design and develop IoT Device

Course Outcomes

CS703C.1	To analyze basic protocols in wireless sensor network
CS703C.2	To understand the concepts of Internet of Things
CS703C.3	To recognize the M2M communication protocols
CS703C.4	To design IoT applications in different domain on embedded platformand be able to analyze their performance

Module -1: [11L]
Wireless Sensor Networks Fundamentals
Wireless medium access issues [1L]
MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols And Wakeup Concepts - S-MAC , The Mediation Device Protocol, Wakeup Radio Concepts, Contention based protocols(CSMA,PAMAS) [2L]
Schedule based protocols (LEACH, SMACS, TRAMA) Address and Name Management in WSNs, Assignment of MAC Addresses [2L]
Routing Protocols- Energy-Efficient Routing, Geographic Routing, Hierarchical networks by clustering. [2L]
Sensor deployment & Node discovery [2L]
Dataaggregation & dissemination [2L]

Module -2: [6L]
Fundamentals on IoT
Definition of IoT and Characteristics of IoT [1L]
Physical and logical design of IoT [2L]
Functional blocks of IoT [1L]

Communication models &APIs: Internet connectivity, Internet-based communication,IPv4, IPv6,6LoWPAN protocol, IP Addressing in the IoT, Application layer protocols: HTTP, HTTPS,FTP,TELNET and ports. [2L]

Module 3: [7L]
Message to Message Communication and IoT
M2M communication and Modified OSI Model for the IoT/M2M Systems [1L]
Data enrichment, data consolidation and device management at IoT/M2M Gateway [2L]
Web communication protocols used by connected IoT/M2M devices [2L]
Message communication protocols (CoAP-SMS, CoAP-MQ, MQTT,XMPP) for IoT/M2M devices [2L]

Module -4: [11L]
IoT Prototyping and Security
Introduction to Prototyping Embedded device software [1L]
Programming Embedded Device Arduino Platform using IDE [1L]
Reading data from sensors and devices, Devices, Gateways [2L]
Internet and Web/Cloud services software development [1L]
Programming MQTT clients and MQTT server [2L]
Introduction to IoT privacy and security [2L]
Vulnerabilities, security requirements and threat analysis [1L]
Domain specific applications of IoT [1L]

Text Books:

1. Vijay Madisetti, Arshdeep Bahga, "Internet of Things: A Hands-On Approach", Orient BlackSwan
2. Waltenegus Dargie,Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice", Wiley

Recommended books:

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton, Jerome Henry, Rowan Trollope, "IoT Fundamentals : Networking Technologies, Protocols and Use Cases for the Internet of Things", Pearson
2. C. Siva Ram Murthy, B. S. Manoj, "Ad Hoc Wireless Networks: Architectures and Protocols", Prentice Hall

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS703C.1	3	2	3	3	3							
CS703C.2	3	2			3							
CS703C.3	3	2	2									
CS703C.4	3	3	3	3	3	3	3					

Name of the Paper: Distributed Algorithms
Paper Code: CS 704(A)
Contact (Periods/Week):=3L/Week
Credit Point: 2
No. of Lectures: 35

Prerequisite:

18. Familiarity with the basic concept of Algorithm and protocols
19. A solid background in mathematics, including probability, connective arithmetic.

Course Objective(s)

- To learn the basic concept of different models of distributed algorithm.
- To learn the principles of Analyze of synchronous, asynchronous and shared allocation techniques.
- To build concepts of shared storage, data links and agreement mechanisms for algorithms.

Course Outcome(s)

On completion of the course students will be able to

CS-704(A).1: Acquire a basic concept of different models and organizational structure of distributed algorithm

CS-704(A).2: Analyze basic idealization of synchronous, asynchronous and shared allocation techniques

CS-704(A).3: Understand different models of synchronous, asynchronous allocation techniques in the light of implementation in network and memories.

CS-704(A).4: Explain the concepts of shared storage, data links and agreement mechanisms along with its failure detection technique for algorithms.

CS-704(A).5: Concept of advance application and development of partial and distributed algorithms in timed based proof, protocols and methods along with its perspective in modern computing era.

MODULE– I [TOTAL – 7L]

Introduction to Distributed Algorithms, Kinds of Distributed Algorithm (**1L**);
Timing Models (**1L**),
Synchronous Network Algorithms: Synchronous Network Model, (**1L**);
Leader Election in a synchronous Ring (**1L**);
Algorithms in General Synchronous Networks (**1L**);
Distributed Consensus with Link Failures, Distributed Consensus with Process failures (**1L**);
More Consensus problems (**1L**)

MODULE – II [TOTAL – 5L]

Asynchronous System and network Model (2**L**);
Shared Memory Algorithms and Model (**1L**);
Mutual Exclusion, Resource Allocation (**1L**);
Consensus; Atomic Objects (**1L**)

MODULE – III [TOTAL – 5L]

Basic Network Algorithms (**2L**);
Synchronizers, Shared Memory versus Networks (**2L**);
Logical Time, Global Snapshots and Stable properties (**1L**)

MODULE – IV [TOTAL – 11L]

Network Resource Allocation: Mutual Exclusion, General Resource Allocation (**2L**);
Process Failures: Network methodology (**1L**);
Impossibility of Agreement in the presence of Faults, A Randomized Algorithm (**2L**);
Failure Detectors, Approximate Agreement (**2L**);
Data Link Protocols: The Problem, Stenning'sProtocol (**2L**);
Alternating Bit Protocol (**1L**);
Bounded Tag protocols tolerating Reordering, Tolerating Crashes (**1L**)

MODULE – V [TOTAL – 7L]

Partially Synchronous Algorithms: Partially Synchronous System Models: MMT and General Timed Automata (**2L**);
Properties and Proof methods, Modeling Shared Memory and Network Systems (**2L**);
Mutual Exclusion with Partial Synchrony: A single-register algorithm (**1L**);
Resilience to Timing Failures, Consensus with partial Synchrony: An Efficient algorithm (**2L**).

Text Book:

1.Joseph Jaja, "**An Introduction to Parallel Algorithms**", Addison Wesley
2.Nancy A. Lynch, "**Distributed Algorithms**", Morgan Kaufmann Publishers, 2000
3.A.D. Kshemkalyani, M. Singhal, "**Distributed Computing: Principles, Algorithms, and Systems**", Cambridge University Press, March 2011.

References

1.Geral Tel, "**Introduction to Distributed algorithms**", 2nd Edition, Cambridge, 2004
2.Nicola Santoro, "**Design and Analysis of Distributed Algorithms**", Wiley Inter-science, John Wiley & Sons, Inc., Publication, 2007.

CO-PO Mapping

CO/PO Mapping Table (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak)												
	Program Outcomes (POs)											
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		3		3								
CO2		3	2					3				
CO3	2			1						1		
CO4		2	1									1
CO5		1		3	2							

Name of the Paper: Bio-informatics
Paper Code: CS704B
Contact (Periods/Week): L-T-P=3-0-0
Credit Point: 3
No. of Lectures: 35

OBJECTIVES: The student should be made to:

- Be familiar with the modeling techniques.
- Learn microarray analysis.
- Exposed to Pattern Matching and Visualization.

OUTCOMES: The students will be able to upon completion of the course,

- Develop models for biological data
- Apply pattern matching techniques to bioinformatics data – protein data genomic data.
- Apply micro array technology for genomic expression study

Course Outcomes

CS704B.1 To acquire the knowledge of Bioinformatics technologies with the related concept of DNA, RNA and their implications
CS704B.2 To develop idea in MOLECULAR BIOLOGY
CS704B.3 To understand the concept and techniques of different types of Data Organization and Sequence Databases with different types of Analysis Tools for Sequence Data Banks
CS704B.4 To acquire the knowledge of the DNA SEQUENCE ANALYSIS
CS704B.5 To analyze the performance of different types of Probabilistic models used in Computational Biology

Module -1: [7L]

INTRODUCTION TO MOLECULAR BIOLOGY:

Concepts of Cell, tissue, types of cell, components of cell, organelle. Functions of different organelles.
Concepts of DNA: Basic Structure of DNA; Double Helix structure; Watson and crick model. Exons and Introns and Gene Concept.
Concepts of RNA : Basic structure, Difference between RNA and DNA. Types of RNA.
Concept of Protein: Basic components and structure. Introduction to Central Dogma: Transcription and Translation, Introduction to Metabolic Pathways.
Introduction to Bioinformatics. Recent challenges in Bioinformatics.

Module -2: [10L]

Introduction to Genomic data, Data Organization and Sequence Databases: Sequence Data Banks - Introduction to sequence data banks - protein sequence data bank. Signal peptide data bank, Nucleic acid sequence data bank - GenBank, AIDS virus sequencedata bank. RRNA data bank, structural data banks - protein Data Bank (PDB), The Cambridge Structural Database (CSD) : Genome data bank - Metabolic pathway data : Microbial and Cellular Data Banks.
Introduction to MSDN (Microbial Strain Data Network):Numerical Coding Systems of Microbes, Hibridoma Data Bank Structure, Virus Information System Cell line information system; Protein Sequence Databases, DNA sequence databases. sequence database search programs like BLAST and FASTA. NCBI different modules: GenBank; OMIM, Taxonomy browser, PubMed;

Module 3: [8L]

DNA SEQUENCE ANALYSIS
DNA Mapping and Assembly : Size of Human DNA ,Copying DNA: Polymerase Chain Reaction (PCR), Hybridization and Microarrays, Cutting DNA into Fragments, Sequencing
Secondary Structure predictions;
prediction algorithms; Chao-Fasman algorithm, Hidden-Markov model, Neural Networking.
Tertiary Structure predictions;
prediction algorithms; Chao-Fasman algorithm, Hidden-Markov model, Neural Networking
Module -4: [10L]

Introduction Probabilistic models used in Computational Biology:
Probabilistic Models;
Gene Regulatory Method Application of HMM in Bioinformatics : Genefinding, profile searches, multiple sequence alignment and regulatory site identification.
Applications in Biotechnology
: Protein classifications, Fold libraries, Protein structure prediction: Fold recognition (threading), Protein structure predictions : Comparative modeling (Homology), Advanced topics: Protein folding, Protein-ligand interactions, Molecular Modeling & Dynamics, Drug Designing.

TEXT BOOK:

- Yi-Ping Phoebe Chen (Ed), "BioInformatics Technologies", First Indian Reprint, Springer Verlag, 2007.

REFERENCES:

- Bryan Bergeron, "Bio Informatics Computing", Second Edition, Pearson Education, 2003.
- Arthur M Lesk, "Introduction to Bioinformatics", Second Edition, Oxford University Press, 2005

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS704B.1	3					1	1					
CS704B.2		1	2	1								1
CS704B.3	1	2		2	2				1			
CS704B.4	2					2	2			1	1	
CS704B.5		3		1		3		1				

Name of the Paper: Cryptography and Network Security
Paper Code: CS704C
Contact (Periods/Week):3L/Week
Credit Point: 3
No. of Lectures: 35

Prerequisite:

20. Knowledge of Computer Networksand Operating Systems fundamentals
21. Understanding of Discreet Mathematics concepts

Course Objective(s)

- To impart concepts on cryptography and Network security
- To gain knowledge ofthe standard algorithms used to provide confidentiality, integrity, and authenticity
- To recognize the various key distribution and management systems for security of a cryptosystem

Course Outcomes

- **CS704C.1** To understand the basic concepts in cryptography
- **CS704C.2** To applythe deployment ofdifferent encryption techniques to secure messages in transit across datanetworks
- **CS704C.3** To discuss various techniques used to assure Integrity and Authentication

- **CS704C.4** To analyze diverse security measures and issues in practice

Module -1: [6L]
INTRODUCTION AND NUMBER THEORY
Introduction - Services, Mechanisms, and Attacks, OSI security architecture, Network security model**[1L]**
Classical Encryption techniques (Symmetric cipher model, substitution techniques, transposition techniques, steganography)**[1L]**
Finite Fields and Number Theory: Groups, Rings, Fields, Modular arithmetic, Euclid's algorithm**[2L]**
Finite fields, Polynomial Arithmetic, Prime numbers, Fermat"s and Euler"s theorem**[1L]**
Testing for primality -The Chinese remainder theorem - Discrete logarithms **[1L]**

Module -2: [8L]
BLOCK CIPHERS AND PUBLIC KEY CRYPTOGRAPHY
Data Encryption Standard- Block cipher principles, block cipher modes of operation**[2L]**
Advanced Encryption Standard (AES), Triple DES, Blowfish, RC5 algorithm**[2L]**
Public key cryptography: Principles of public key cryptosystems, The RSA algorithm**[2L]**
Key management - Diffie Hellman Key exchange, Elliptic curve arithmetic, Elliptic curve cryptography **[2L]**

Module 3: [6L]
HASH FUNCTIONS AND DIGITAL SIGNATURES
Authentication requirement, Authentication function, MAC, Hash function**[2L]**
Security of hash function and MAC, MD5, SHA, HMAC, CMAC**[2L]**
Digital signature and authentication protocols, DSS, ElGamal, Schnorr **[2L]**

Module -4: [9L]
SECURITY PRACTICE AND SYSTEM SECURITY
Authentication applications, Kerberos, X.509**[1L]**
Authentication services, Internet Firewalls for Trusted System: Roles of Firewalls**[1L]**
Firewall related terminology- Types of Firewalls**[1L]**
Firewall designs principles, SET for E-Commerce Transactions**[2L]**
Intruder, Intrusion detection system**[1L]**
Virus and related threats, Countermeasures**[1L]**
Trusted systems, Practical implementation of cryptography and security **[2L]**

Module -5: **[6L]**
E-MAIL, IP,AND WEB SECURITY
E-mail Security: Security Services for E-mail-attacks possible through E-mail, Establishing keys privacy, authentication of the source **[1L]**
Message Integrity, Non-repudiation, Pretty Good Privacy, S/MIME**[1L]**
IP Security: Overview of IPSec, IPv4 and IPv6-Authentication Header, Encapsulation Security Payload (ESP)**[1L]**
Internet Key Exchange (Phases of IKE, ISAKMP/IKE Encoding)**[1L]**
Web Security: SSL/TLS Basic Protocol, computing the keys, client authentication**[1L]**

PKI as deployed by SSL Attacks fixed in v3, Exportability, Encoding, Secure Electronic Transaction**[1L]**

Text Books:

3. Atul Kahate, "Cryptography and Network Security", Third edition, McGraw Hill Education

Recommended books:

3. William Stallings, "Cryptography and Network Security: Principles and Practice", Sixth edition, Pearson
4. Behrouz A. Forouzan, Debdeep Mukhopadhyay, "Cryptography and Network Security", Second edition, McGraw Hill Education

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS704C.1	3		2			3						
CS704C.2	3	2	3	2	3							
CS704C.3		3	2	3								
CS704C.4	2	3		3		3						

Practical

CourseCode:CS791

Course Name: Artificial Intelligence Lab

Objective(s):

- To learn the fundamentals of PROLOG Programming.
- To impart adequate knowledge on the need of PROLOG programming languages and problem solving techniques.

Course Outcome(s):

On completion of the course students will be able to

CS793C.1	**Learn** the concept of simple programming using PROLOG.
CS793C.2	**Understand** the concept of AI based programs using PROLOG.
CS793C.3	**Develop** the capability to represent various real life problem domains using logic based techniques

Syllabus:

Programming Languages such as PROLOG or LISP covering the sample following topics (but not limited to):-

1. Basic computational related programs, e.g., factorial, Fibonacci, GCD etc.
2. Mini program to express the flavour of intelligence, e.g. if any symptoms are given, the disease should be identified using the program
3. Family tree related problem to understand how to apply logic to solve complex problems
4. Programs related to list/array

Mapping with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

CO #	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS791.1	3	3	3	3	3	1	1	1	1	2	3	2
CS791.2	3	3	3	3	3	1	1	1	1	2	3	2
CS791.3	3	3	3	3	3	1	1	1	1	2	3	2
CS791	3	3	3	3	3	1	1	1	1	2	3	2

Paper Name: Soft Computing Lab
Code: CS 792A
Contacts: 3P
Credits: 2

Prerequisite:

22. Familiarity with the Matlab command
23. A solid background in mathematical and programming Knowledge

Course Objective(s)

- To learn the to implement soft computing methods.
- To learn to solve the real world problem through program of Matlab/Python
- To learn to solve and optimize the real world problem using Matlab/Python
- **Course Outcomes**

- **CS792A.1** To understand the concept and techniques of designing and implementing of soft computing methods in real world problem
- **CS792A.2** To acquire the knowledge of the fuzzy Neural network and Genetic Language
- **CS792A.3** To analyze and optimized the problem of real-life applications

Lab

1.Python/Matlabprogrammingintroduction.
2.Matlabprogrammingfundamental./Pythonprogrammingfundamental.

3. Matlab tool box implementation. / Python introduction to numerical calculation programming(scitificpython,Numericalpython,Imageprocessing).
4.Python/Matlabprogrammingtosimulateasinglelayerneuralnetworkdesigns.
5.Python/Matlabprogrammingtosimulatemultiplelayerneuralnetworkdesigns.
6.Python/Matlabprogrammingtoobservetheperceptronlearningalgorithmperformances forasinglelayernetwork.Inthis experimentconsidertheXOR dataset.
7.WriteaMatlab/pythoncodeformaximizingF(x)=x2,,wherexrangesfromsay0to31 usingGeneticAlgorithm.
8. Use of Genetic Algorithm toolbox in matlab for optimization problem solving. ImplantationSimpleGeneticAlgorithminpythonforsolvingoptimizationproblem.
9.WriteaMatlab/pythonprogramtoimplementthedifferentFuzzyMembershipfunctions.
10.WriteaMatlab/pythonprogramtoimplementFuzzysetoperations andits properties.

CO-PO Mapping

CO	PO1	PO2	POP3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS792A.1	1		3									
CS792A.2	2											
CS792A.3		0				3						

Name of the Paper: Natural Language Processing Lab
Paper Code: CS792B
Contact (Periods/Week):=3L/Week
Credit Point: 2

Prerequisite:

24. Familiarity with the programming concepts in any language
25. A solid background in mathematics, including probability, statistics.

Course Objective(s)

- To learn the basics of NLTK toolkit.
- To learn the principles of NLP through programming.
- To build an application using different algorithms and natural language processing techniques.

Course Outcome(s)

On completion of the course students will be able to

CS792B.1 Access text corpora and lexical resources and process of raw text.
CS792B.2 Write structured programs for categorizing and tagging of words, segmentation of sentences.
CS792B.3 Classify text and extract information from it.
CS792B.4 Analyze sentence structure and build feature based grammar.

CS792B.5 Analyze meaning of sentences and to manage linguistic data.

Module I:
Fundamentals of Python languages, introduction to list, dictionaries etc., input and output handling, saving data to files, retrieving data from files. Writing functions and code reusing. Introduction to working knowledge of matplotlib, SciKit, NumPy and other necessary tools and libraries as per the need.

Module II:
Language processing with python. Manipulating texts and words by writing programs programs. Accessing text corpora, lexical resources,using WordNet through NLTK tool kit. Processing raw text, normalizing, segmenting, applying regular expressions.

Module III:
Writing programs to categorize texts, words, tagging words using tagger, generating tagged tokens, N-Gram tagging, text classification. Writing programs to extract information from texts.

Module IV:
Writing programs to analyze sentence, its meaning etc. Managing linguistic data through programs.

Text books:

1. Steven Bird, Ewan Klein, and Edward Loper. "Natural Language Processing– Analyzing Text with the Natural Language Toolkit". 2009, O'Reilly, 1ed.

Reference books:

1. Learning Python: Powerful Object-Oriented Programming: 5th Edition by Mark Lutz, 2013, O'Reilly.
2. Natural Language Toolkit documentation (https://www.nltk.org/)

CO-PO Mapping

CO	PO1	PO2	POP3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	CO	PO1	PO2
CS792B.1	2	1	2	2	2	1	1	1	1	2	2	2	2	1	2
CS792B.2	2	2	2	2	2	2	2	1	1	2	2	2	2	1	2
CS792B.3	2	2	3	3	3	1	1	1	2	2	1	2	2	2	2
CS792B.4	2	2	2	2	2	2	1	1	1	2	1	3	2	2	3
CS792B.5	2	2	3	3	3	2	1	1	1	2	1	3	2	2	3
CS792B	2	2	2	2	2	2	1	1	1	2	1	2	2	2	2

Name of the Paper: Web Technology Lab
Paper Code: CS792C
Contact (Periods/Week): 3P/Week
Credit Point: 2
No. of Lectures: 30

Prerequisite:

1. Fundamentals of Programming.

Course Objective(s)

- To impart the design, development and implementation of Static and Dynamic Web Pages.
- To develop programs for Web using Scripting Languages as well as .net framework.
- To give an overview of Server Side Programming in Web

Course Outcomes

CS792C.1 To develop interactive web pages using HTML, DHTML, CSS and image map.
CS792C.2 To procure the knowledge of information interchange formats like XML.
CS792C.3 To validate fields of web pages using scripting languages like JavaScript.
CS792C.4 To develop web applications using PHP and ASP.net.
CS792C.5 To acquire the server side programming concepts using servlet, JSP.

List of Experiments:

1. Write a single html program through which you can explain a) anchor tag, b)'img' tag with 'src' attribute, c)paragraph d) heading.

2. Write a single html program through which you can draw a table which consists of 3 row and 4 columns where 1st row contains 4 different column fields of a student's information with red text color and Calibri font style with font 12. Rest cells of whole table contain values with blue text colors and Times new roman font style with font 10.

3. Write a single html program where 1st paragraph can collect its specified style from internal stylesheet describes inside that html program and 2nd paragraph can collect its specified style from another file (external stylesheet).

4. Write a single html program which implements image map concept using 'usemap' and <map>.

5. Write a html program to find out Celsius temperature of a given Fahrenheit temperature using JavaScript.

6. Write a html program to find out m to the power n (m, n valid integer no) using a function using javascript.

7. Write a xml parsing technique through which parse a text string into an XML DOM object, and extracts the info from it with JavaScript.

8. Write a simple php program through which you can find out maximum and minimum among three no's specified by the user.

9. Write a simple php program through which you can implement the concept of GET & POST method w.r.t PHP Form handling.

10. Write a simple program in ASP.net through which you can create a login page of your own website.

11. Write a simple JSP program through which you can print even and odd no separately within a given range.

12. Create a Online Registration form for individual user of an website using Servlet.

Text Books:

1."Web Technology: A Developer's Perspective", N.P. Gopalan and J. Akilandeswari, PHI Learning, Delhi, 2013. **(Topics covered: html, CSS, imagemap, xml)**
2."Learning PHP, MySQL & JavaScript", Robin Nixon, O'Reilly Publication.**(Topics covered: PHP, Java Script)**
3."Head First Servlet's & JSP", Bryan Basham, Kathy Sterra, Bert Bates, O'Reilly Publication.**(Topics covered: Servlet, JSP)**
4.ASP.NET Core 2.0 MVC And Razor Pages For Beginners:", Jonas Frajerberg, O'Reilly Publication.**(Topics covered: ASP.Net, C#)**

Recommended books:

1. "Web Technologies", Black Book, Dreamtech Press
"Core Web Programming" Second Edition, Marty Hall and Larry Brown,"Volume Iand II, Pearson Education, 2001.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C01	1	-	2									
C02	2	1	1									
C03	-	2	-	2	-							
C04	-	2	3	-	1							
C05	-	-	3	2	-							

Name of the Paper: Mobile Computing
Paper Code: CS801A
Contact (Periods/Week):=3L/Week
Credit Point: 3
No. of Lectures: 35

Prerequisite:

1.Basic concept of computer network and communication engineering
2.Basic programming knowledge

Course Objective(s)

- Describe the basic concepts and principles in mobile computing
- To introduce wireless communication and networking principles, that support connectivity to cellular networks, wireless internet and sensor devices.
- Understand positioning techniques and location-based services and security issues

Course Outcome(s)

On completion of the course students will be able to

CS801A.1 Analyze the working of modern communication technologies.
CS801A.2 Demonstrate the various routing algorithms for both infrastructure based and ad hoc networks.
CS801A.3 Develop mobility and bandwidth management in cellular network
CS801A.4 Design and build an energy efficient and secure mobile computing environment using heterogeneous wireless technologies
CS801A.5 Identify the technical issues related to recent mobile computing environment.

Module I: Introduction [6L]:
Evolution of different types of wireless communication devices; Effects of mobility of devices; Cellular mobile networks – mobility management (call setup, handoff, interoperability and internetworking), bandwidth management, energy management, security; Brief introduction about different generations of wireless communication technology – 1G, 2G, 3G, 4G, 5G.

Module II: Mobile Data Communication [5L]

Mobile Data Communication, WLANs (Wireless LANs) IEEE 802.11 standard, Bluetooth technology, Bluetooth Protocols, Ad hoc networks initialization, leader election, location identification, communication protocols, energy and security.

Module III: Mobility Management in Cellular Networks [4L]
Call setup in PLMN (location update, paging), GPRS, Call setup in mobile IP networks; Handoff management; Mobility models- random walk, random waypoint, map-based, group-based.

Module IV: Bandwidth Management in Cellular Mobile networks [3L]
Mathematical formulation of the channel assignment problem (CAP); CAP and generalized graph coloring; Benchmark instances; Lower bound on bandwidth.

Module V: Localization of Nodes in a Mobile Network [4L]
Different approaches, Indoor and outdoor localizations, LOS and NLOS signals, Outdoor localization techniques – triangulation (TOA-based, AOA- based), errors due to inaccuracies in coordinates of beacon nodes and in measurements.

Module VI: Message Communication in Ad Hoc Networks [6L]
Collision avoidance mechanism (different schemes for a deterministic transmission schedule), collision resolution mechanism – successive partitioning approach; Time slot assignment based on location information, Point-to-point routing in ad hoc networks – proactive, reactive and hybrid approaches, different protocols - DSDV, DSR, AODV, TORA, ZRP

Module VII: Energy-efficient Communication [3L]
Energy efficiency at various layers - Physical layer, MAC layer, Network layer, Application layer, performance analysis in noisy channel environment.

Module VIII: Secure Wireless Communication [4L]
Introduction-different types of attacks, internal attacks, external attacks; measures against attacks (authentication, intrusion detection, encryption); RC4 algorithm

Text books:

1) K. Sinha, S.Ghosh and B. P. Sinha, Wireless Networks and Mobile Computing. CRC Press : New York, 2015.

Recommended books:

1) Research articles published on secure wireless communication (authentication, mitigation of DoS, DDoS, eavesdropping) published in leading journals.
2) Mark Ciampa, Guide to Designing and Implementing wireless LANs, Thomson learning, Vikas Publishing House, 2001.

CO-PO Mapping

CO #	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CS801A.1	2	2	2	2	3	2	1	1	2	2	3	3	2	2	1
CS801A.2	2	3	3	3	3	1	1	1	2	2	3	3	2	2	2
CS801A.3	3	3	2	3	3	2	2	2	3	3	3	3	3	2	2
CS801A.4	3	3	2	2	2	1	1	1	1	1	2	3	2	1	1
CS801A.5	3	3	3	3	3	2	2	2	3	3	3	3	3	2	2

Name of the Paper: Human computer Interaction
Paper Code: CS801B
Contact (Periods/Week):3L/Week
Credit Point: 3
No. of Lectures: 35

Prerequisite:

- Basic understanding of relevant psychological theories and approaches

Course Objective(s): The Student Should Be Made To:

- Learn The Foundations Of Human Computer Interaction
- Be Familiar With The Design Technologies For Individuals And Persons With Disabilities
- Be Aware Of Mobile HCI
- Learn The Guidelines For User Interface

Course Outcomes: Upon Completion Of The Course, The Student Should Be Able To:

CS801B.**1**Design Effective Dialog For HCI.
CS801B.**2**Design Effective HCI For Individuals And Persons With Disabilities.
CS801B.**3**Assess The Importance Of User Feedback.
CS801B.**4**Explain The HCI Implications For Designing Multimedia/ Ecommerce/ E-Learning Web Sites.
CS801B.**5**Develop Meaningful User Interface.

Module I : FOUNDATIONS OF HCI [7L]
The Human: I/O Channels – Memory – Reasoning And Problem Solving; The Computer: Devices – Memory – Processing And Networks; Interaction: Models – Frameworks – Ergonomics – Styles – Elements – Interactivity- Paradigms.
Module II : DESIGN & SOFTWARE PROCESS [7L]
Interactive Design Basics – Process – Scenarios – Navigation – Screen Design – Iteration And Prototyping. HCI In Software Process – Software Life Cycle – Usability Engineering – Prototyping In Practice – Design Rationale. Design Rules – Principles, Standards, Guidelines, Rules. Evaluation Techniques – Universal Design.

Module III : MODELS AND THEORIES [7L]

Cognitive Models –Socio-Organizational Issues And Stake Holder Requirements – Communication And Collaboration Models-Hypertext, Multimedia And WWW.

Module IV : MOBILE HCI [7L]

Mobile Ecosystem: Platforms, Application Frameworks- Types Of Mobile Applications: Widgets, Applications, Games- Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements Of Mobile Design, Tools.

Module V : WEB INTERFACE DESIGN [7L]

Designing Web Interfaces – Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays And Virtual Pages, Process Flow. Case Studies.

Text Books:

- Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, "Human Computer Interaction", 3rd Edition, Pearson Education, 2004 (Module I , II & III)
- Brian Fling, "Mobile Design And Development", First Edition , O'Reilly Media Inc., 2009 (Module –IV)

Recommended books:

1. Preece J , Rogers Y, Sharp H, Baniyon D., Holland S. and Carey T. Human Computer Interaction, Addison-Wesley, 1994.
2. B. Shneiderman ; Designing the User Interface, Addison Wesley 2000 (Indian Reprint).

CO-PO Mapping

CO	PO1	PO2	POP3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS801B.1	1	3	3									2
CS801B.2	1	3	3									2
CS801B.3	2	3		2								2
CS801B.4		3		3	2							2
CS801B.5	1		3									2

Name of the Paper: Cyber law and Security Policy
Paper Code: CS801C
Contact (Periods/Week): 3L/Week
Credit Point: 3
No. of Lectures: 35

Prerequisite:

26. Familiarity in computer Networking.
27. Basic concepts about network security.

Course Objective(s)

- To Enable Learner To Understand, Explore, And Acquire A Critical Understanding Cyber Law.
- To learn the basics of a Cyber security.
- To Develop Competencies For Dealing With Frauds And Deceptions (Confidence Tricks, Scams)

Course Outcomes

CS801C.1 Make Learner Conversant With the Social and Intellectual Property Issues Emerging From 'Cyberspace.
CS801C.2 Give Learners In Depth Knowledge of Information Technology Act And Legal Frame Work of Right to Privacy, Data Security and Data Protection.
CS801C.3 Develop the understanding of relationship between commerce and cyberspace
CS801C.4 To be familiar with network security threats and countermeasures.
CS801C.5 To be familiar with advanced security issues and technologies.

Module – 1A: Introduction of Cybercrime: [7]
Cybercrime, Forgery, Hacking, Software Piracy, Computer Network intrusion
Jurisdiction to prescribe/Legislative Jurisdiction; Jurisdiction to adjudicate to enforce; Cyber Jurisdiction in Civil, Criminal & International Cases.

Module – 1B: Category of Cybercrime: [5]
Criminals plan attacks, passive attack, Active attacks, cyberstalking. Unicitral Model Law, Information Technology Act.

Module – 2: Cybercrime Mobile & Wireless devices: [8]
Security challenges posted by mobile devices, cryptographic security for mobile devices, Attacks on mobile/cell phones, Theft, Virus, Hacking. Bluetooth; Different viruses on laptop.

Module -3: Tools and Methods used in Cyber crime: [8]
Proxy servers, panword checking, Random checking, Trojan Horses and Backdoors; DOS & DDOS attacks; SQL injection: buffer over flow.Most Common Attacks, Scripts Kiddies and Packaged Defense.

Module – 4A: Phishing & Identity Theft: [4]
Phising methods, ID Theft; Online identity method.

Module – 4B: Cybercrime & Cyber security: [3]
Legal aspects, Indian laws, IT act, Public key certificate

Text Books:

4. Cyber security by Nina Gobole & Sunit Belapune; Pub: Wiley India.
5. Chris Reed & John Angel, Computer Law, OUP, New York, (2007).
6. Justice Yatindra Singh, Cyber Laws, Universal Law Publishing Co, New Delhi, (2012).
7. Verma S, K, Mittal Raman, Legal Dimensions of Cyber Space, Indian Law Institute, New Delhi, (2004)

Recommended books:

1. Kenneth J. Knapp, "Cyber Security and Global Information Assurance: Threat Analysis and Response Solutions", IGI Global, 2009.

28. Jonathan Rosenoer, "Cyber law: the Law of the Internet", Springerverlag, 1997
29. Sudhir Naib, The Information Technology Act, 2005: A Handbook, OUP, New York,
30. Vasu Deva, Cyber Crimes and Law Enforcement, Commonwealth Publishers, New Delhi, (2003)

CO-PO Mapping

CO	PO1	PO2	POP3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS801C.1		3		3								1
CS801C.2		3		3								2
CS801C.3				2	2							
CS801C.4	3	2										1
CS801C.5	3	2		3								1

Name of the Paper: Parallel Computing
Paper Code: CS802A
Contact (Periods/Week):=3L/Week
Credit Point: 3
No. of Lectures: 35

Prerequisite:

31. Familiarity with Operating Systems
32. A solid background in Computer Organization and Architecture & Algorithm

Course Objective(s)

The objectives of this course are:

- To learn the basics of parallel system and how parallel computers work.
- To learn how to analyze the correct designs of parallel architectures, especially within the technological constraints.
- To prepare students for a career in designing the computer systems of the future.

Course Outcome(s)

On completion of the course students will be able to

CS802A.1:	Explain the range of requirements that modern parallel systems have to address.
CS802A 2:	Define the functionality that parallel systems must deliver to meet some need.
CS802A.3:	Articulate design tradeoffs inherent in large-scale parallel system design.
CS802A.4:	Demonstrate the potential run-time problems arising from the concurrent operation of many (possibly a dynamic number of) tasks in a parallel system.
CS802A.5:	Justify the presence of concurrency within the framework of a parallel system.

Module I (Introduction) (7L)
Concepts of pipelining and parallelism, Temporal vs. spatial parallelism, differences between distributed computing and parallel computing, loosely coupled vs. tightly coupled systems, Types of parallel architectures – Instruction vs. data (SIMD, MISD, MIMD) (Flynn's classification), Series vs. parallel (Feng's classification), Pipelining vs. parallelism (Haendler's classification). Performance measures – Speed-up factor, AT and AT^2 measures, Amdahl's law,. Models of parallel computation – Parallel RAM (PRAM) model, (EREW, CREW, CRCW models), Interconnection network based model, Interrelationship among the performances under EREW, CREW and CRCW models.

Memory interleaving - S-access and C-access organization.
Concept of reservation table in multifunction static pipeline and minimum average latency.
Elementary concepts of data low architecture.

Module II (Interconnection Networks) (9L)
Static interconnection networks – concept of network graph and the desirable features of a network graph in terms of node degree, diameter, fault-tolerance and bisection width, Different types of interconnection network - Crossbar, Clos, loop, star, wheel, double-loop, tree, mesh, torus, multi-mesh, mesh of trees, multi-mesh of trees, shuffle-exchange, pyramid, hypercube, butterfly, cube-connected cycles, Moebius network, De Bruijn network, OTIS architecture.
Dynamic interconnection networks – concept of blocking, non-blocking and re-arrangeable networks, Baseline, Omega and Benes networks.

Module III (Parallel Arithmetic) (10L)
Addition/Subtraction - Addition of two n-bit numbers in O(log n) time with O(n log n) logic gates using precarry addition, carry-propagation free addition in redundant binary number system.
Multiplication – Dadda's generalized multiplier, column compression technique, parallel algorithm for multiplying two n-bit signed integers in O(log n) time, parallel multiplication in redundant binary and quarternary number systems.
Division : O($\log^2 n$) division algorithm using repeated multiplications and additions.
Parallel algorithm for prefix sum computation on different architectures.
Matrix transpose : O(n) algorithm on a mesh architecture, O(log n) algorithm on a shuffle-exchange network.
Matrix multiplication : parallel algorithms for multiplying two n x n matrices in O(n2), time, O(n log n) time, O(n) time, O(log n) time and O(1) time on appropriate parallel architectures, matrix by vector computation.

Module IV (Numerical Problems) (4L)
Solution of simultaneous linear equations: parallel algorithm based on Gauss-Jordan elimination, parallel algorithm based on Gauss-Seidel iteration.
Finding roots of a polynomial equation : parallel algorithms based on bisection method and Newton-Raphson method.

Module V (Sorting and Searching) (5L)
Odd-even transposition sort, sorting networks, 0-1 principle, Batcher's odd-even merge sort, Batcher's bitonic sort, sorting n^2 elements in O(n) time on a 2-D mesh, brief discussion on sorting n^4 elements in O(n) time a on a multi-mesh. Parallel algorithms for searching.

Text books:

1. Design and Analysis of Parallel Algorithms- Selim G. Akl, Prentice Hall.
2. Computer Architecture and Parallel Processing – Kai Hwang and F. A. Briggs, McGraw-Hill.

Recommended books:

1. Parallel Computing –Theory and Practice -Michael J. Quinn. McGraw-Hill.
2. The Art of Computer Programming Vol. 3 (Sorting and Searching) – Donald E. Knuth, Addison-Wesley.

CO-PO Mapping:

CO #	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS802A.1	2	3	3	2	3		1		1	1		2
CS802A.2	3	2	3	3	2		1		1	1		2
CS802A.3	3	3	3	3	2		1		1	1		2
CS802A.4	2	3	3	3	3		1		1	1		2
CS802A.5	2	3	2	3	2		1		1	1		2
CS802A	3	3	3	3	3		1		1	1		2

Name of the Paper: Machine Learning
Paper Code: CS802B
Contact (Periods/Week): 3L/Week
Credit Point: 3
No. of Lectures: 35

Prerequisite:

1. Basic programming skills, Algorithm design.
2. Probability, Axioms of Probability, Conditional Probability, Bernoulli Distribution, Binomial Distribution, Multinomial Distribution, Uniform Distribution, Normal (Gaussian) Distribution, Chi-Square Distribution, t Distribution, F Distribution. Probability Distribution and Density Functions, Joint Distribution and Density Functions, Conditional Distributions, Bayes' Rule, Expectation, Variance, Weak Law of Large Numbers.
3. Linear Algebra; Convex Optimization ; Statistics; Calculus.

Course Objective(s)

CS802B.1 Be able to formulate machine learning problems corresponding to different applications.
CS802B.1 Understand a range of machine learning algorithms along with their strengths and weaknesses.
CS802B.1 Understand the basic theory underlying machine learning.
CS802B.1 Be able to apply machine learning algorithms to solve problems of moderate complexity.
CS802B.1 Be able to read current research papers and understand the issues raised by current research.

Course Outcomes

CS802B.1 Have a good understanding of the fundamental issues and challenges of machine learning: data, model selection, model complexity, etc.

CS802B.2 Have an understanding of the strengths and weaknesses of many popular machine learning approaches.

CS802B.3 Appreciate the underlying mathematical relationships within and across Machine Learning algorithms and the paradigms of supervised, un-supervised learning and reinforcement learning.

CS802B.4 Be able to design and implement various machine learning algorithms in a range of real-world applications.

Module – 1: Introduction [3L]

Applications and problems, learning scenarios, concepts of tasks (problems to be solved by machine learning), models (output of machine learning) and features (workhorses of machine learning). geometric models, probabilistic models, logical models. [3L]

Module – 2 Classification Schemes [5L]

Binary classification, assessing and visualizing performance of classification, scoring and ranking, turning rankers into classifiers, class probability estimation. [3L]

Multiclass classification, multiclass scores and probabilities, regression, unsupervised and descriptive learning, predictive and descriptive clustering. [2L]

Module - 3: Various Models[15L]

Tree Models [3L]

Decision trees, ranking and probability estimation trees, tree learning as variance reduction, regression trees. [3L]

Rule Models [2L]

Learning ordered rule lists, learning unordered rule sets, descriptive rule learning, rule learning for subgroup discovery, association rule mining, first-order rule learning. [2L]

Linear Models [4L]

Least squares method, multivariate linear regression, regularized regression. [1L]

Perceptron, support vector machine, soft margin SVM, probabilities from linear classifiers, beyond linearity with kernel methods. [3L]

Distance-based Models [3L]

Nearest neighbour classification, distance[-based clustering, K-means algorithm, clustering around medoids. Hierarchical clustering.
[3L]

Probabilistic Models [3L]

Normal distribution, probabilistic models for categorical data, naïve Bayes model for classification, probabilistic models with hidden variables, Gaussian mixture model, compression-based model.

[3L]

Module - 4 : Features [4L]

Types of features, calculation on features, categorical, ordinal and quantitative features, structured features, thresholding and discretization, normalization and calibration, incomplete features, feature selection - matrix transformations and decompositions. [4L]

Module - 5 : Model Ensembles and Machine Learning Experiments [4L]

Model Ensembles [2L]

Bagging and random forests, boosted rule learning, mapping the ensemble landscape – bias, variance and margins, meta learning. [2L]

Machine Learning Experiments [2L]

What to measure, how to measure, how to interpret, interpretation of results over multiple data sets.

[2L]

Module - 6 : More Selected Topics in Machine Learning [4L]

Support vector machines – separable and unseparable cases, primal optimization and dual optimization problems, kernel methods – positive definite symmetric kernels and negative definite symmetric kernels, kernel-based algorithms. [4L]

Text Book

- Peter Flach, Machine Learning. Cambridge University Press, 2012.

Reference Books

- M. Mohri, A. Rostamizadeh and A. Talwalkar, Foundations of Machine Learning, MIT Press, 2012.

- Kevin P. Murphy, Machine Learning : A Probabilistic Perspective. MIT Press, 2012.

CO-PO Mapping

CO	PO1	PO2	POP3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS802B.1	3	2	3	2	3							2
CS802B.2		3	3	2								1
CS802B.3	3	3	2									2
CS802B.4			2	2	3							1

Name of the Paper: Real Time Operating System
Paper Code: CS802C
Contact (Periods/Week):=3L/Week
Credit Point: 3
No. of Lectures: 36

Prerequisite:
7. Programming and Data Structures
8. Operating Systems
9. Computer Architecture and Organization
10. Computer Communication
11. Database Systems

Course Objective(s)

1. Syllabus deals with issues in real time operating systems, importance of deadlines and concept of task scheduling.

2. Student will be able to understand and design real time operating systems which are backbone of embedded industry.

Course Outcome(s)

On completion of the course students will be able to

CS802C .1. Student will be able to summarize the issues in real time computing.

CS802C.2. Student will be able to explain and give examples of real time operating systems.

CS802C.3. Student will be able to solve scheduling problems and can apply them in real time applications in industry.

CS802C.4. Student will also be able to design an RTOS and will be able to interpret the feasibility of a task set to accomplish or not.

CS802C.5. Analyze the situation of fault occurrence and will be able to apply solutions accordingly.

Module I: Introduction to Real time systems 08L

Issues in real time computing (1L)
Structure of real time system (1L)
Need for RTOS (1L)
Task classes, Performance measures for real time system: Properties, traditional performance measures, performability, cost functions and hard deadlines, and Estimating program run times. (2L)
Introduction LINUX/ UNIX OS.(1L)

Module II: Embedded software and Task Scheduling 12L

Examples of embedded system (1L)
Characteristics and their typical hardware components, embedded software architectures (1L)
Scheduling algorithms: round robin, round robin with interrupts, function queue scheduling real time operating system selection (3L)
CPU scheduling algorithms: Rate monotonic, EDF, MLF.(2L)
Priority Scheduling, Priority Ceiling and Priority inheritance (2L)
Real time operating system: Tasks and task states, shared data and reentrancy semaphores and shared data, use of semaphores (2L)
Protecting shared data. (1L)

Module III: Features of Real Time Operating System 5L

Messages, queues , mailboxes , pipes , timer function , events, memory management
Interrupt basic system design using an RT (OS design principles, interrupt routines, task structures and priority.) (4L)
Case Studies: Vx Works and Micro OS-II.(1L)

Module IV: Real Time Databases 6L

Real time v/s general purpose databases, main memory databases, transaction priorities transaction aborts, concurrency control issues: pessimistic concurrency control and optimistic concurrency control, Disk scheduling algorithms.(6L)

Module V: Fault Tolerance Techniques 5 L

Causes of failure, Fault types(1L)

Fault detection , Fault and error containment (1L)

Redundancy: hardware redundancy, software redundancy, Time redundancy, information redundancy (1L)

Data diversity (1L)

Integrated failure handling (1L).

Text Books

3. Rajib Mall, "Real-Time Systems: Theory and Practice," Pearson, 2008.
4. Jane W. Liu, "Real-Time Systems" Pearson Education, 2001.

References

3. Alan C. Shaw, Real-Time Systems and Software, Wiley, 2001.
4. Philip Laplante, Real-TIme Systems Design and Analysis, 2nd Edition, Prentice Hall of India.

CO-PO Mapping

CO	PO1	PO2	POP3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS802C.1	3					1						2
CS802C.2	3	2	1									3
CS802C.3	2	3	2	2		2	2	2				3
CS802C.4	2	2	3	1	1	1						2
CS802C.5	1	3	1	1		1		2				3
CS802C	2	3	2	1	1	1	2	2				3

Name of the Paper: Advanced Computer Architecture
Paper Code: CS802D
Contact (Periods/Week):3L/Week
Credit Point: 3
No. of Lectures: 35

Prerequisite:

33. Familiarity with the functionalities of basic digital computer system
34. Fundamentals of Computer Architecture

Course Objective(s)

CS802D.1 To acquire the knowledge of parallelism and pipelining

CS802D.2 To develop knowledge of parallel processing

CS802D.3 To combine the concept and design techniques of interconnection network

CS802D.4 To acquire the knowledge of shared memory architecture

CS802D.5 To describe the fundamentals of embedded system architecture

Total :35 Lectures

Module – 1: Introduction to Advanced Computer Architectures [5L]

Different types of architectural classifications – instruction vs. data (SISD, SIMD, MISD, MIMD), serial vs. parallel, pipelining vs. parallelism; Pipelining: Definition, different types of pipelining, hazards in pipelining.
Concept of reservation tables, issue of multiple instructions with minimum average latency (MAL).

Module –2: Parallel Processing & ILP[8L]

RISC architecture, characteristics of RISC instruction set & RISC pipeline, its comparisons with CISC,necessity of using optimizing compilers with RISC architecture, Review of instruction-level parallelism-Super pipelining, Superscalar architecture, Diversified pipelines and out of order execution, VLIW architecture, Dataflow and Control Flow Architectures, Loop Parallelization

Module – 3: Interconnection Networks[13L]
Desirable properties of interconnection networks, static interconnection networks – path, cycle, double-loop, star, wheel, 2D mesh and its variants, multi-mesh, tree, shuffle-exchange, cube, cube-connected cycles

Dynamic interconnection networks: concepts of blocking, rearrangeable and blocking but rearrangeable networks, various types of multistage interconnection networks (MIN)- crossbar, clos, baseline, omega, Benes.

Module -4: Shared Memory Architecture [4L]

Fundamentals of UMA, NUMA, NORMA,COMA architectures, Performance measurement for parallel architectures –Amadahl's law, Gustafson's law

Module – 5: Embedded System Architecture [5L]

Definition, Example, Classification ofEmbedded system, Embedded System Design Issues: Hardware issues (Processor, Memory, Peripherals) ,Softwareissues (Programming Languages, Time Criticality, RTOS)

Recommended Books

15-16

Data Structure & Algorithm
Code: CS302
Contacts: 3L +1T
Credits: 4

Pre-requisites: CS 201 (Basic Computation and Principles of C), M101 & M201 (Mathematics), basics of set theory

Objective(s)

- To learn the basics of abstract datatypes.
- To learn the principles of linear and nonlinear data structures.
- To build an application using sorting and searching.

Detailed Syllabus:

Module -I. [8L] Linear Data Structure
Introduction (2L):

Why we need data structure?

Concepts of data structures: a) Data and data structure b) Abstract Data Type and Data Type. Algorithms and programs, basic idea of pseudo-code.

Algorithm efficiency and analysis, time and space analysis of algorithms – order notations.

Array (2L):

Different representations – row major, column major.

Sparse matrix - its implementation and usage. Array representation of polynomials.

Linked List (4L):

Singly linked list, circular linked list, doubly linked list, linked list representation of polynomial and applications.

Module -II: [7L] Linear Data
Structure [Stack and Queue (5L):

Stack and its implementations (using array, using linked list), applications.

Queue, circular queue, dequeue. Implementation of queue- both linear and circular (using array, using linked list), applications.

Recursion (2L):

Principles of recursion – use of stack, differences between recursion and iteration, tail recursion. Applications - The Tower of Hanoi, Eight Queens Puzzle.

Module -III. [15L] Nonlinear Data structures Trees (9L):

Basic terminologies, forest, tree representation (using array, using linked list).

Binary trees - binary tree traversal (pre-, in-, post- order), threaded binary tree (left, right, full) - non-recursive traversal algorithms using threaded binary tree, expression tree.

Binary search tree- operations (creation, insertion, deletion, searching).

Height balanced binary tree – AVL tree (insertion, deletion with examples only). B- Trees – operations (insertion, deletion with examples only).

Graphs (6L):

Graph definitions and concepts (directed/undirected graph, weighted/un-weighted edges, sub-graph, degree, cut- vertex/articulation point, pendant node, clique, complete graph, connected components – strongly connected component, weakly connected component, path, shortest path,isomorphism).

Graph representations/storage implementations – adjacency matrix, adjacency list, adjacency multi-list.

Graph traversal and connectivity – Depth-first search (DFS), Breadth-first search (BFS) – concepts of edges used in DFS and BFS (tree-edge, back-edge, cross-edge, forward-edge),applications.

Minimal spanning tree – Prim's algorithm (basic idea of greedy methods).

Module - IV. Searching, Sorting (10L):

Sorting Algorithms (5L): Bubble sort and its optimizations, insertion sort, shell sort, selection sort, merge sort, quick sort, heap sort (concept of max heap, application – priority queue), radix sort.

Searching (2L): Sequential search, binary search, interpolation search.

Hashing (3L): Hashing functions, collision resolution techniques.

Recommended books:

1. "Data Structures And Program Design In C", 2/E by Robert L. Kruse, Bruce P.Leung.
2. "Fundamentals of Data Structures of C" by Ellis Horowitz, Sartaj Sahni, Susan Anderson-freed.
3. "Data Structures in C" by Aaron M.Tenenbaum.
4. "Data Structures" by S.Lipschutz.
5. "Data Structures Using C" by Reema Thareja.
6. "Data Structure Using C", 2/e by A.K. Rath, A. K. Jagadev.
7. "Introduction to Algorithms" by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, CliffordStein.

Learning outcome:

Ideally this course should act as a primer/pre-requisite for CS 503 (Design and Analysis of Algorithms). On completion of this course, students are expected to be capable of understanding the data structures, their advantages and drawbacks, how to implement them in C, how their drawbacks can be overcome and what the applications are and where they can be used. Students should be able to learn about the data structures/ methods/algorithms mentioned in the course with a comparative perspective so as to make use of the most appropriate data structure/ method/algorithm in a programto enhance the efficiency (i.e. reduce the run-time) or for better memory utilization, based on the priority of the implementation. Detailed time analysis of the graph algorithms and sorting methods are expected to be covered in CS 503 but it is expected that the students will be able to understand at least the efficiency aspects of the graph and sorting algorithms covered in this course. The students should be able to convert an inefficient program into an efficient one using the knowledge gathered from this course.

Course Outcomes:

CO1	**Differentiate** how the choices of data structure & algorithmic method simpact the performance of program.
CO2	**Solve** problems based upon different data structure & also write programs.
CO3	**Identify** appropriate data structure & algorithmic methods in solving problem.
CO4	**Discuss** the computational efficiency of the principal algorithms for sorting, searching, and hashing.
CO5	**Compare** and **contrast** the benefits of dynamic and static data structure simplementations.

CO-PO(PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	3	3	2	–	1	1	1	1	3	3	3
CO2	3	3	3	2	3	3	2	–	1	1	1	1	3	3	3
CO3	3	3	3	2	3	3	2	–	1	1	1	1	3	3	3
CO4	3	3	3	2	3	3	2	–	1	1	1	1	3	3	3
CO5	3	3	3	2	3	3	2	–	1	1	1	1	3	3	3

Principal
NARULA INSTITUTE OF TECHNOLOGY
81, Nilgunj Road, Agarpara, Kol-109

Computer organization

Code: CS303

Contacts: 3L +1T

Credits: 4

Prerequisites:

1. Computer Fundamentals and principal of computerprogramming
2. Basic Electronics Engineering

Course Objective(s)

- To acquire the basic knowledge of digital logic levels and application of knowledge to understand digital electronics circuits.
- To prepare students to perform the analysis and design of various digital electronic circuits.
- To know how Computer Systems work & its basic principles,
- To know how I/O devices are being accessed and its principles etc

Module – 1: [8L]

Basic organization of the stored program computer and operation sequence for execution of a program. Role of operating systems and compiler/assembler. Fetch, decode and execute cycle, Concept of operator, operand, registers and storage, Instruction format. Instruction sets and addressing modes. [7L]

Commonly used number systems. Fixed and floating point representation of numbers. [1L]

Module – 2: [8L]

Overflow and underflow. Design of adders - ripple carry and carry look ahead principles. [3L]

Design of ALU. [1L]

Fixed point multiplication -Booth's algorithm. [1L]

Fixed point division - Restoring and non-restoring algorithms. [2L] Floating point - IEEE754standard. [1L]

Module – 3: [10L]

Memory unit design with special emphasis on implementation of CPU-memory interfacing. [2L] Memory organization, static and dynamic memory, memory hierarchy, associative memory. [3L]Cache memory, Virtual memory. Data path design for read/write access. [5L]

Module – 4: [10L]

Design of control unit - hardwired and microprogrammed control. [3L] Introduction to instruction pipelining. [2L]

Introduction to RISC architectures. RISC vs CISC architectures. [2L]

I/O operations - Concept of handshaking, Polled I/O, interrupt and DMA. [3L]

Learning Outcome:

Additional Tutorial Hours will be planned to meet the following learning outcome.

Through this course, the students will be exposed to extensive development and use of computer organization based concepts for the future knowledge outcome of Advanced Computer Architecture offered in subsequent semester. The students will be able to understand different instruction formats, instruction sets, I/O mechanism. Hardware details, memory technology, interfacing between the CPU and peripherals will be transparent to the students. Students will be able to design hypothetical arithmetic logic unit.

Course Outcomes:

CS303.1	Demonstratethe working principles of the logic gates, combinational and sequential circuits as well as different components of a digital computer.
CS303.2	Solve the problem related to number system conversion, minimization techniques and their application in digital design.
CS303.3	Analyze, design and implement combinational and sequential circuits for solving real world problems.
CS303.4	Evaluate the performance of different algorithms for floating point representation, Booth's multiplication algorithm and division algorithm as well as stored program concept, addressing mode, instruction format.
CS303.5	Compare and contrast different methods for computer I/O.

Principal
MARULA INSTITUTE OF TECHNOLOGY
Nilgunj Road, Agarpara, Kolkata

Practical

Physics Lab-2
Code: PH-391
Contacts: (3P)
Credit: (2)

Prerequisites: Knowledge of Physics up B. Tech 1st year Physics-I course

Course Objective(s)

The Physics-II course will provide

- exposure to the physics of materials that are applied in digital circuitry, storage devices.
- exposure to the physics of quantum logic gate operation and quantum computation
- an insight into the science & technology of next generation.
- foundations of electromagnetic theory and communication systems
- concept of fundamental particles and associated applications in semiconductors

Detailed Syllabus:

Group 1: Experiments on Electricity and Mangentism

1. Determination of dielectric constant of a given dielectric material.
2. Determination of resistance of ballistic galvanometer by half deflection method and study of variation of logarithmic decrement with series resistance.
3. Determination of the thermo-electric power at a certain temperature of the given the rmo couple.
4. Determination of specific charge (e/m) of electron by J.J. Thomson's method. Group 2: Quantum Physics
5. Determination of Planck's constant using photocell.
6. Determination of Lande'g factor using Electron spin resonancespetrometer.
7. Determination of Stefan's radiation constant
8. Verification of Bohr's atomic orbital theory through Frank-Hertzexperiment.
9. Determination of Rydberg constant by studying Hydrogen/ Heliumspectrum Group 3: Modern Physics
10. Determination of Hall co-efficient of semiconductors.
11. Determination of band gap of semiconductors.
12. To study current-voltage characteristics, load response, areal characteristics and

spectral response of photo voltaic solar cells.

a) A candidate is required to perform 3 experiments taking one from each group. Initiative should be taken so that most of the Experiments are covered in a college in the distribution mentioned above. Emphasis should be given on the estimation of error in the datataken.

b) In addition a student should perform one more experiments where he/she will have to transduce the output of any of the above experiments or the experiment mentioned in c] into electrical voltage and collect the data in a computer using phoenix or similar interface.

c) Innovative experiment: One more experiment designed by the student or the concerned teacher orboth.

Note:

Failure to perform each experiment mentioned in b] and c] should be compensated by two experiments mentioned in the above list.

At the end of the semester report should sent to the board of studies regarding experiments, actually performed by the college, mentioned in b] and c]

Experiment in b] and c] can be coupled and parts of a single experiment.

Recommended Text Books and Reference Books:

For Both Physics I and II

1. Dutta Roy (Basic Physics)
2. R.K. Kar (Engineering Physics)
3. Mani and Meheta (Modern Physics)
4. Arthur Baiser (Perspective & Concept of Modern Physics)
5. Physics I (PH101/201) Vibration and Waves Kingsler and Frey
6. D.P. Roy chaudhury
7. N.K. Bajaj (Waves and Oscillations)
8. K. Bhattacharya
9. R.P. Singh (Physics of Oscillations and Waves)
10. A.B. Gupta (College Physics Vol.II)
11. Chattopadhya and Rakshit (Vibration, Waves and Acoustics)

Optics

1. Möler (Physical Optics)
2. A.K. Ghatak
3. Hecht (Optics)
4. Hecht (Schaum Series)
5. F.A. Jenkins and H.E. White

Quantum Mechanics Eisberg and Resnick

A.K. Ghatak and S. Lokenathan

S.N. Ghoshal (Introductory Quantum Mechanics)

E.E. Anderson (Modern Physics)

Haliday, Resnick and Crane (Physics vol.III)

Binayak Dutta Roy [Elements of Quantum Mechanics]

Statistical Mechanics

Sears and Sallinger (Kinetic Theory,Thermodynamicsand StatisticalThermodynamics) Mondal (StatisticalPhysics)

S.N. Ghoshal (Atomic and Nuclear Physics) Singh and Singh

B.B. Laud (Statistical Mechanics)

F. Reif (Statistical Mechanics)

Dilectrics

Bhattacharyya [Engineering Physics] Oxford

Course Outcomes:

CO-PO(PSO) Mapping

Analog & Digital Electronics
Code: S391
Contact: 3
Cr: 2

Prerequisites:

Objectives:

Detailed Syllabus:

ANALOG: At least any two of the following

1. Design a Class Aamplifier
2. Design a Phase-Shift Oscillator
3. Design of a Schmitt Trigger using 555timer.

DIGITAL : At least any five of the following

1. Design a Full Adder using basic gates and verify its output / Design a Full Subtractor circuit using basic gates and verify its output.
2. Construction of simple Decoder & Multiplexer circuits using logic gates.
3. Realization of RS / JK / D flip flops using logic gates.
4. Design of Shift Register using J-K / D FlipFlop.
5. Realization of Synchronous Up/Down counter.
6. Design of MOD- NCounter
7. Study of DAC.

Any one experiment specially designed by the college.

(Detailed instructions for Laboratory Manual to follow for further guidance. The details will be uploaded in the website from time to time)

Course Outcomes:

CO-PO(PSO) Mapping

Data Structure & Algorithm
Code: CS392
Contacts:3
Credits: 2

Perquisites: Computer Fundamentals and principal ofcomputer programming Lab

Objectives:

- To write and execute programs in C to solve problems using data structures such as arrays, linked lists, stacks, queues, trees, graphs, hash tables and search trees.
- To write and execute write programs in C to implement various sorting and searching methods.

Detailed Syllabus:

Experiments should include but not limited to :Implementation of array operations:

Stacks and Queues: adding, deleting elements Circular Queue: Adding & deleting elements Merging Problem : Evaluation of expressions operations on Multiple stacks & queues : Implementation of linked lists: inserting, deleting, inverting a linked list. Implementation of stacks & queues using linked lists:
Polynomial addition, Polynomial multiplication Sparse Matrices : Multiplication, addition. Recursive and Nonrecursive traversal of Trees

Threaded binary tree traversal. AVL tree implementation

Application of Trees. Application of sorting and searching algorithms

Hash tables implementation: searching, inserting and deleting, searching & sorting techniques.

(Detailed instructions for Laboratory Manual to follow for further guidance. The details will be uploaded in the website from time to time)

CourseOutcomes:

On completion of the course students will be able to

CO1	**Choose** appropriate data structure and **apply** itto solve specific problem in hand.
CO2	**Solve** problems based upon different data structure & also write programs.
CO3	**Differentiate** how the choices of data structure & algorithmic methods impact the performance of program.
CO4	**Discuss** the computational efficiency of the principal algorithms for sorting, searching, and hashing.
CO5	**Compare** and **contrast** the benefits of dynamic and static data structures and **use** it in problem solving.

CO-PO(PSO) Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	3	3	2	–	1	1	1	1	3	3	3
CO2	3	3	3	2	3	3	2	–	1	1	1	1	3	3	3
CO3	3	3	3	2	3	3	2	–	1	1	1	1	3	3	3
CO4	3	3	3	2	3	3	2	–	1	1	1	1	3	3	3
CO5	3	3	3	2	3	3	2	–	1	1	1	1	3	3	3

Computer organization
Code: CS393
Contacts:3
Credits: 2

Prerequisite: Basic concepts of Logic gates, Truth Tables, function realization –minimization of Logic expressions by K-map, Concept of basic components of a digital computer, Binary Arithmetic

Course objectives:

This subject will act as prerequisite for computer architecture. The aims of this lab are to make students familiar with the principles of combinational and sequential digital logic design and optimization at a gate level and designing various circuits with ICs.

Detailed Syllabus:

a) Familiarity with IC-chips, e.g.Multiplexer , b) Decoder, c) Encoder b) Comparator Truth Table verification and clarification fromData-book.

1. Design an Adder/Subtractor composite unit.
2. Design a BCDadder.
3. Design of a 'Carry-Look-Ahead' Addercircuit.
4. Use a multiplexer unit to design a composite ALU.
5. Use ALU chip for multibit arithmetic operation.
6. Implement read write operation using RAMIC.
7. (a) & (b) Cascade two RAM ICs for vertical and horizontal expansion.

(Detailed instructions for Laboratory Manual to follow for further guidance. The details will be uploaded in the website from time to time)

Course Outcomes:

CS393.1	Comprehend the working principles of the logic gates, combinational and sequential circuits as well as different components of a digital computer.
CS393.2	Demonstrate and realize the basic logic gate operations.
CS393.3	Design and compare different combinational circuits- adder, subtractor, multiplexer, De-multiplexer, decoder, encoder, Comparator.
CS393.4	Analyze and implement sequential circuits - flip flops, register, counter.
CS393.5	Construct ALU and RAM circuits and evaluate their performance for solving real world problems.

CO-PO(PSO) Mapping:

CO #	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CS391.1	2	3	2	2	-	-	-	-	-	-	-	-	-	-	-
CS391.2	3	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CS391.3	3	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CS391.4	3	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CS391.5	3	2	2	2		-	-	-	-	-	-	-	-	-	-
CS391	2.8	2.8	2.6	2.4	-	-	-	-	-	-	-	-	-	-	-

CO	PO1	PO2	POP3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1									
CO2	3	3		2								
CO3	3	3	3	2	2							
CO4	3	3		3								
CO5	3	3	3	3	2							

Computer Architecture
Code: CS403
Contacts: 3L+1T
Credits: 4

Objective(s)

- To learn the basics of stored program concepts.
- To learn the principles of pipelining.
- To learn mechanism of data storage
- To distinguish between the concepts of serial, parallel, pipeline architecture.

Pre-requisite: Basic Electronics in First year, Introduction to Computing in second semester, Analog & Digital Electronics and Computer Organisation in Third semester.

Detailed Syllabus

Module – 1: [12 L]

Introduction: Review of basic computer architecture (Revisited), Quantitative techniques in computer design, measuring and reporting performance. (3L)

Pipelining: Basic concepts, instruction and arithmetic pipeline, data hazards, control hazards and structural hazards, techniques for handling hazards. Exception handling. Pipeline optimization techniques; Compiler techniques for improving performance. (9L)

Module – 2: [8L]

Hierarchical memory technology: Inclusion, Coherence and locality properties; Cache memory organizations, Techniques for reducing cache misses; Virtual memory organization, mapping and management techniques, memory replacement policies. (8L)

Module – 3: [6L]

Instruction-level parallelism: basic concepts, techniques for increasing ILP, superscalar, super pipelined and VLIW processor architectures. Array and vector processors. (6L)

Module – 4: [12 L]

Multiprocessor architecture: taxonomy of parallel architectures; Centralized shared- memory architecture: synchronization, memory consistency, interconnection networks. Distributed shared-memory architecture. Cluster
computers. (8L)
Non von Neumann architectures: data flow computers, reduction computer architectures, systolic architectures. (4L)

Course Outcomes:

CS401.1	Demonstrate how computer hardware has evolved to meet the basic needs of multiprocessing systems, Instruction set and CPU Architecture.
CS401.2	Identify and compare the properties of memories and levels of parallelism.
CS401.3	Apply instruction set and pipelining concept to enhance the system's performance with modern tool usage.
CS401.4	Solve the problems related to computer architecture.
CS401.5	Analyze the cost issues and design trade-off in designing and constructing computer processors including memories.

CO-PO(PSO) Mapping

CO #	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CS401. 1	2	3	2	2	-	-	-	-	-	-	-	-	-	-	-
CS401. 2	3	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CS401. 3	3	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CS401. 4	3	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CS401. 5	3	2	2	2	-	-	-	-	-	-	-	-	-	-	-
CS401	2.8	2.8	2.6	2.4	-	-	-	-	-	-	-	-	-	-	-

rule.

3. Assignments on numerical solution of a system of linear equations using Gauss elimination and Gauss-Seidel iterations.
4. Assignments on numerical solution of Algebraic Equation by Regular-falsi and Newton Raphson methods.
5. Assignments on ordinary differential equation: Euler's and Runga-Kutta methods.
6. Introduction to Software Packages: Matlab / Scilab / Labview /Mathematica.

Course Outcomes:

CO-PO(PSO) Mapping

Communication Engineering & Coding Theory
Code : CS 491
Contacts : 3L
Credits :2

Prerequisites: Knowledge in Electronics and Communication

Course Objective: To provide the basic skills required to understand, develop, and design of various engineering applications involving analog and digital communication theory. To provide basic laboratory exposures for communication principles and applications.

Detailed Syllabus:

Practical Designs & Experiments:

Module - 1: Generation of Amplitude Modulation (Design using transistor or Balanced Modulator Chip (to view the wave shapes)

Module - 2: Generation of FM using VCO chip (to view the wave shapes)

Module - 3: Generation of PAM

Module - 4: Generation of PWM& PPM (using IC 555 Timer)

Text Books:

1. An Introduction to Analog and Digital Communications by Simon Haykin; Published by Wiley India.

2. Principles of Communication Systems, H. Taub and D .L.Schilling, TMH Publishing Co.

Reference Books:

1. Communication Systems 4th Edition by Simon Haykin; Published by Wiley India (Student Edition).

2. Communication Systems by A. B. Carlson, Published by McGraw-Hill.

3. Modern Digital and Analog Communication Systems, B.P.Lathi and Z.Ding, Oxford University Press.

4. Communications System (Analog and Digital) by Dr. Sanjay Sharma S K Kataria and Sons.

Course Outcomes:

CO-PO(PSO) Mapping

Software Tools
Code : CS 492
Contacts : 3L
Credits :2

Prerequisites:

Objectives:

Detailed Syllabus:

[Suggested; Feedback invited]

1. Introduction to Visual Basic/VC++& difference with BASIC. Concept about form Project, Application, Tools, Toolbox, Controls & Properties. Idea about Labels, Buttons, Text Boxes.
    a) Data basics, Different type variables & their use inVB,
    b) Sub-functions & Procedure details, Input box () & Msgbox().
    c) Making decisions, looping
    d) List boxes & Data lists, List Box control, Combo Boxes, data Arrays.
    e) Frames, buttons, check boxes, timer control,
    f) Programming with data, ODBC database connectivity.
    g) Data form Wizard, query, and menus in VB Applications,
    h) Graphics.
2. Casestudies using any of the following items including relevant form design with the help of visual programming aids.
    a). Payroll accounting system.
    b). Library circulation management system.
    c). Inventory control system.

d). University examination & grading system.
e). Patient information system.
f). Tourist information system.
g). Judiciary information system.
h). Flight reservation system.
i). Bookshop automation software.
j). Time management software.

Course Outcomes:

CO-PO(PSO) Mapping

ComputerArchitecture Lab
Code : CS 492
Contacts :3L
Credits :2

Prerequisite: Computer Organization Lab

Course Objective(s): Simulate digital circuit using Xilinx tools

Detailed Syllabus:

All laboratory assignments are based on Hardware Description Language (VHDL or Verilog) Simulation.

[**System pre-requisite:** The hardware based design has been done in the Analog & Digital Electronics laboratory and Computer Organization laboratory]

1. HDL introduction
2. Basic digital logic base programming with HDL
3. 8-bit Addition, Multiplication, Division
4. 8-bit Register design
5. Memory unit design and perform memory operations.
6. 8-bit simple ALU design
7. 8-bit simple CPU design
8. Interfacing of CPU and Memory

SEMESTER – V

Theory

Economics for Engineers HU-501

Contracts: 3L

Credits- 3

Module-I

1. Economic Decisions Making – Overview, Problems, Role, Decision making process.
2. Engineering Costs & Estimation – Fixed, Variable, Marginal & Average Costs, Sunk Costs, Opportunity Costs, Recurring And Nonrecurring Costs, Incremental Costs, Cash Costs vs Book Costs, Life-Cycle Costs; Types Of Estimate, Estimating Models - Per- Unit Model, Segmenting Model, Cost Indexes, Power-Sizing Model, Improvement & Learning Curve, Benefits.

Module-II

1. Cash Flow, Interest and Equivalence: Cash Flow – Diagrams, Categories & Computation, Time Value of Money, Debt repayment, Nominal & Effective Interest.
2. Cash Flow & Rate Of Return Analysis – Calculations, Treatment of Salvage Value, Annual Cash Flow Analysis, Analysis Periods; Internal Rate Of Return, Calculating Rate of Return, Incremental Analysis; Best Alternative Choosing An Analysis Method, Future Worth Analysis, Benefit-Cost Ratio Analysis, Sensitivity And Breakeven Analysis. Economic Analysis In The Public Sector - Quantifying And Valuing Benefits & drawbacks.

Module-III

1. Inflation And Price Change – Definition, Effects, Causes, Price Change with Indexes, Types of Index, Composite vs Commodity Indexes, Use of Price Indexes In Engineering Economic Analysis, Cash Flows that inflate at different Rates.
2. Present Worth Analysis: End-Of-Year Convention, Viewpoint Of Economic Analysis Studies, Borrowed Money Viewpoint, Effect Of Inflation & Deflation, Taxes, Economic Criteria, Applying Present Worth Techniques, Multiple Alternatives.
3. Uncertainty In Future Events - Estimates and Their Use in Economic Analysis, Range Of Estimates, Probability, Joint Probability Distributions, Expected Value, Economic Decision Trees, Risk, Risk vs Return, Simulation, Real Options.

Module-IV

1. Depreciation - Basic Aspects, Deterioration & Obsolescence, Depreciation And Expenses, Types Of Property, Depreciation Calculation Fundamentals, Depreciation And Capital Allowance Methods, Straight-Line Depreciation Declining Balance Depreciation, Common Elements Of Tax Regulations For Depreciation And Capital Allowances.
2. Replacement Analysis - Replacement Analysis Decision Map, Minimum Cost Life of a New Asset, Marginal Cost, Minimum Cost Life Problems.

3. Accounting – Function, Balance Sheet, Income Statement, Financial Ratios Capital Transactions, Cost Accounting, Direct and Indirect Costs, Indirect Cost Allocation.

Readings

1. James L.Riggs,David D. Bedworth, Sabah U. Randhawa : Economics for Engineers 4e , Tata McGraw-Hill
2. Donald Newnan, Ted Eschembach, Jerome Lavelle : Engineering Economics Analysis, OUP
3. John A. White, Kenneth E.Case, DavidB.Pratt : Principle of Engineering Economic Analysis, John Wiley
4. Sullivan and Wicks: Engineering Economy, Pearson
5. R.PaneerSeelvan: Engineering Economics, PHI
6. Michael R Lindeburg : Engineering Economics Analysis, Professional Pub

Design & Analysis of Algorithm
Code: CS501
Contact: 3L + 1T
Credits: 4

Complexity Analysis:[2L]
Time and Space Complexity, Different Asymptotic notations – their mathematical significance
Algortihm Design Techniques:
Divide and Conquer: [3L]
Basic method, use, Examples – Binary Search, Merge Sort, Quick Sort and their complexity. Heap Sort and its complexity [1L]
Dynamic Programming: [3L]
Basic method, use, Examples – Matrix Chain Manipulation, All pair shortest paths, single source shortest path. Backtracking: [2L]
Basic method, use, Examples – 8 queens problem, Graph coloring problem. Greedy Method: [3L]
Basic method, use, Examples – Knapsack problem, Job sequencing with deadlines, Minimum cost spanning ree by Prim's and Kruskal's algorithm.

Lower Bound Theory: [1L]
O(nlgn) bound for comparison sort

Disjoint set manipulation: [2L]
Set manipulation algorithm like UNION-FIND, union by rank.

Graph traversal algorithm: Recapitulation [1L]

Breadth First Search(BFS) and Depth First Search(DFS) – Classification of edges - tree, forward, back and cross edges – complexity and comparison

String matching problem: [3L]
Different techniques – Naive algorithm, string matching using finite automata, and Knuth, Morris, Pratt (KMP) algorithm with their complexities.

Amortized Analysis: [3L]
Aggregate, Accounting, and Potential Method.

Network Flow: [3L]
Ford Fulkerson algorithm, Max-Flow Min-Cut theorem (Statement and Illustration)

Matrix Manipulation Algorithm: [3L]
Strassen's matrix manipulation algorithm; application of matrix multiplication to solution of simultaneous linear equations using LUP decomposition, Inversion of matrix and Boolean matrix multiplication

Notion of NP-completeness: [3L]
P class, NP class, NP hard class, NP complete class – their interrelationship, Satisfiability problem, Cook's theorem (Statement only), Clique decision problem

Approximation Algorithms: [3L]
Necessity of approximation scheme, performance guarantee, polynomial time approximation schemes, vertex cover problem, travelling salesman problem.

Text Book:

1. T. H. Cormen, C. E. Leiserson, R. L. Rivest and C. Stein, "Introduction to Algorithms"
2. A. Aho, J.Hopcroft and J.Ullman "The Design and Analysis of Algorithms" D.E.Knuth "The Art of Computer Programming", Vol. 3
3. Jon Kleiberg and Eva Tardos, "Algorithm Design"

Reference:

1. K. Mehlhorn , "Data Structures and Algorithms" - Vol. I & Vol. 2.
2. S. Baase "Computer Algorithms"
3. E. Horowitz and Shani "Fundamentals of Computer Algorithms"
4. E.M. Reingold, J. Nievergelt and N.Deo- "Combinational Algorithms- Theory and Practice", Prentice Hall, 1997

Microprocessors & Microcontrollers
Code: CS502
Contact: 3L + 1T
Credits: 4

Prerequisite:

1. Familiarity with the number system
2. A solid background in digital logic.

CourseObjective(s):

- To learn the basics of a particular microprocessor.
- To learn the basics of a particular microcontroller.
- To learn the interfacing of microprocessor.

Module -1: [8L]

Introduction to Microcomputer based system. History of evolution of Microprocessor and Microcontrollers and their advantages and disadvantages. [1L]
Architecture of 8085 Microprocessor, Pin description of 8085. [2L]
Address/data bus Demultiplexing , Status Signals and the control signals. [1L] Instruction set of 8085 microprocessor, Addressing modes, [3L]
Timing diagram of the instructions (a few examples). [1L]

Module -2: [9L]

Assembly language programming with examples, Counter and Time Delays,
Stack and Subroutine, [6L]
Interrupts of 8085 processor(software and hardware), I/O Device Interfacing-I/O Mapped I/O and Memory Mapped I/O , Serial (using SID and SOD pins and RIM, SIM Instructions) and Parallel data transfer,
[3L]

Module 3: [10L]

The 8086 microprocessor- Architecture, Addressing modes, [3L] [3L]
Interrupts Introduction to 8051 Microcontroller –Architecture, Pin Details. [4L]
Addressing modes, Instruction set, Examples of Simple Assembly Language.

Module -4: [9L]

Memory interfacing with 8085, 8086 [2L]
Support IC chips- 8255 ,8251,8237/8257,8259 [4L]
Interfacing of 8255 PPI with 8085 and Microcontroller 8051. [2L]
Brief introduction to PIC microcontroller (16F877) [1L]

2. N. Chandrasekaran and M. Umaparvathi, Discrete Mathematics, PHI
3. Gary Haggard, John Schlipf and Sue Whitesides, Discrete Mathematics for Computer Science, CENGAGE Learning
4. Gary Chartrand and Ping Zhang – Introduction to Graph Theory, TMH

References:

1. J.K. Sharma, Discrete Mathematics, Macmillan
2. Winfried Karl Grassmann and Jean-Paul Tremblay, Logic and Discrete Mathematics, PEARSON.
3. S. K. Chakraborty and B. K. Sarkar, Discrete Mathematics, OXFORD University Press.
4. Douglas B. West, Introduction to graph Theory, PHI

Free Elective

Circuit Theory & Network

Code: CS504A

Contact: 3L + 1T Credits: 4

Module	Content	Hrs
1.	) ***Resonant Circuits***: Series and Parallel resonance [1L], (*) ***Impedance and Admittance Characteristics, Quality Factor, Half Power Points, Bandwidth [2L], Phasor diagrams, Transform diagrams [1L], Practical resonant and series circuits, Solution of Problems [Tutorial - 1L].***	4 6
	) **Mesh Current Network Analysis**: Kirchoff's Voltage law, Formulation of mesh equations [1L], Solution of mesh equations by Cramer's rule and matrix method [2L], Driving point impedance, Transfer impedance [1L], Solution of problems with DC and AC sources [1L].	
2.	) **Node Voltage Network Analysis**: Kirchoff's Current law, Formulation of Node equations and solutions [2L], driving point admittance, transfer Admittance [1L], Solution of problems with DC and AC sources [1L].	4 6
	) **Network Theorems**: Definition and Implication of Superposition Theorem [1L], Thevenin's theorem, Norton's theorem [1L], Reciprocity theorem, Compensation theorem [1L], maximum Power Transfer theorem [1L], Millman's theorem, Star delta transformations [1L], Solutions and problems with DC and AC sources [1L].	
3.	***Graph of Network***: Concept of Tree and Branch [1L], tree link, junctions, ***(*) Incident matrix, Tie set matrix [2L], Determination of loop current and node voltages [2L].***	4
	Coupled Circuits: Magnetic coupling, polarity of coils, polarity of induced voltage, concept of Self and mutual inductance, Coefficient of coupling, Solution of Problems.	4
	Circuit transients: DC transients in R-L and R-C Circuits with and without initial charge, ***(*) R-L-C Circuits, AC Transients in sinusoidal R-L, R-C and R-L-C Circuits, Solution of Problems [2L].***	2

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4.	**Laplace transform**: Concept of Complex frequency [1L], transform of f(t) into F(s) [1L], transform of step, exponential, over damped surge, critically damped surge, damped and un-damped sine functions [2L], properties of Laplace transform [1L], linearity, real differentiation, real integration, initial value theorem and final value theorem [1L], inverse Laplace transform [1L], application in circuit analysis, Partial fraction expansion, Heaviside's expansion theorem, Solution of problems [1L].	8
	(*) Laplace transform and Inverse Laplace transform [2L]. **Two Port Networks**: Relationship of Two port network variables, short circuit admittance parameters, open circuit impedance parameters, transmission parameters, relationship between parameter sets, network functions for ladder network and general network.	4

Data Communication Code: CS504B
Contact: 3L + 1T Credits: 4

Module I:
Data Communication Fundamentals: Layered Network Architecture; Mode of communication, topology, Data and Signal; Transmission Media: Guided, Unguided; Transmission Impairments and Channel Capacity; Transmission of Digital Data: Interfaces- DTE-DCE, MODEM, Cable MODEM; The telephone network system and DSL technology; **[10L]**

Module II:
Data Link Control: Interfacing to the media and synchronization; Error Control: Error Detection and Correction (Single bit, Multi bit); Flow control: Stop-and-Wait ARQ, Go-Back-N ARQ, Selective-Repeat ARQ
Data Link Protocols: Synchronous, Asynchronous Protocols, Point-to-Point Protocol(PPP). **[12L]**

Module III:
Switching Communication Networks: Circuit switching; Packet switching; Routing in packet switched networks; X.25; Frame Relay; ATM, SONET. **[07L]**

Module IV:
Communication Network: Topology; Medium Access Control Techniques; IEEE CSMA/CD based LANs; IEEE Ring LANs; High Speed LANs – Token Ring Based(FDDI); High Speed LANs – CSMA/CD based; Wireless LANs: Bluetooth; **[07L]**
Network Security: Introduction to Cryptography; User Authentication; Firewalls. **[04L] References:**

a) Data Communications and Networking, Behrouz A. Forouzan, TMH
b) Data and Computer Communications, William Stallings, PHI
c) Computer Networks, Andrew S. Tanenbaum, PHI

Digital Signal Processing
Code: CS504C
Contact: 3L + 1T
Credits: 4

MODULE – I: 9L
Discrete-time signals:
Concept of discrete-time signal, basic idea of sampling and reconstruction of signal, sampling theorem, sequences – periodic, energy, power, unit-sample, unit-step, unit-ramp, real & complex exponentials, arithmetic operations on sequences. 3L
LTI Systems:
Definition, representation, impulse response, derivation for the output sequence, concept of convolution, graphical, analytical and overlap-add methods to compute convolution supported with examples and

exercises, properties of convolution, interconnections of LTI systems with physical interpretations, stability and causality conditions, recursive and non-recursive systems. 6L

MODULE –II: 11L

Z-Transform:

Definition, mapping between s-plane and z-plane, unit circle, convergence and ROC, properties of Z-transform, Z-transform on sequences with examples and exercises, characteristic families of signals along with ROCs, convolution, correlation and multiplication using Z-transform, initial value theorem, Perseval's relation, inverse Z-transform by contour integration, power series & partial-fraction expansions with examples and exercises. 6L

Discrete Fourier Transform:

Concept and relations for DFT/IDFT, Twiddle factors and their properties, computational burden on direct DFT, DFT/IDFT as linear transformations, DFT/IDFT matrices, computation of DFT/IDFT by matrix method, multiplication of DFTs, circular convolution, computation of circular convolution by graphical, DFT/IDFT and matrix methods, linear filtering using DFT, aliasing error, filtering of long data sequences – Overlap-Save and Overlap-Add methods with examples and exercises. 5L

Fast Fourier Transform:

Radix-2 algorithm, decimation-in-time, decimation-in-frequency algorithms, signal flow graphs, Butterflies, computations in one place, bit reversal, examples for DIT&DIFFFT Butterfly computations and exercises. 4L

MODULE – III: 5L

Filter Design:

Basic concepts of IIR and FIR filters, difference equations, design of Butterworth IIR analog filter using impulse invariant and bilinear transforms, design of linear phase FIR filters, no. of taps, rectangular, Hamming and Blackman windows. 5L

MODULE – IV: 7L

Digital Signal Processor:

Elementary idea about the architecture and important instruction sets of TMS320C 5416/6713 processor, writing of small programs in Assembly Language. 4L

FPGA:

Architecture, different sub-systems, design flow for DSP system design, mapping of DSP algorithms onto FPGA. 3L

TEXT BOOKS:

1. Digital Signal Processing – Principles, Algorithms and Applications, J.G.Proakis&D.G.Manolakis, Pearson Ed.
2. Digital Signal processing – A Computer Based Approach, S.K.Mitra, TMH Publishing Co.
3. Digital Signal Processing Signals, Systems and Filters, A. Antoniou, TMH Publishing Co.
4. VLSI Digital Signal Processing Systems Design and Implementation, Wiley International Publication.

5. Digital Signal Processing with Field Programmable Gate Arrays, U.Meyer-Baese, Springer.

REFERENCE BOOKS:

1. Digital Signal Processing, P. Rameshbabu, Scitech Publications (India).
2. Digital Signal Processing, S.Salivahanan, A.Vallabraj& C. Gnanapriya, TMH Publishing Co.Digital Signal Processing; A Hands on Approach, C. Schuler &M.Chugani, TMH Publishing Co.
3. Digital Signal Processing, A. NagoorKani, TMH Education
4. Digital Signal Processing S. Poornachandra& B. Sasikala, MH Education
5. Digital Signal Processing; Spectral Computation and Filter Design Chi-Tsong Chen, Oxford University Press
6. Texas Instruments DSP Processor user manuals and application notes.
7. Digital Signal Processing – A practical Approach (second Edition) – Emmanuel C. Ifeacher& Barrie W. Jervis, Pearson Education
8. Xilinx FPGA user manuals and application notes.

Object Oriented Programming
Code: CS504D
Contact: 3L + 1T
Credits: 4

Object oriented design [10 L]
Concepts of object oriented programming language, Major and minor elements, Object, Class, relationships among objects, aggregation, links, relationships among classes-association, aggregation, using, instantiation, meta-class, grouping constructs.

Object oriented concepts [4 L]
Difference between OOP and other conventional programming – advantages and disadvantages. Class, object, message passing, inheritance, encapsulation, polymorphism

Basic concepts of object oriented programming using Java [22 L]
Implementation of Object oriented concepts using Java.

Language features to be covered:
Class & Object proprieties [6L]
Basic concepts of java programming – advantages of java, byte-code &JVM, data types, access specifiers, operators, control statements & loops, array, creation of class, object, constructor, finalize and garbage collection, use of method overloading, this keyword, use of objects as parameter & methods returning objects, call by value & call by reference, static variables & methods, garbage collection, nested & inner classes, basic string handling concepts- String (discuss charAt() , compareTo(), equals(), equalsIgnoreCase(), indexOf(), length() , substring(), toCharArray() , toLowerCase(), toString(), toUpperCase() , trim() , valueOf() methods) &StringBuffer classes (discuss append(), capacity(),

charAt(), delete(), deleteCharAt(), ensureCapacity(), getChars(), indexOf(), insert(), length(), setCharAt(), setLength(), substring(), toString() methods), concept of mutable and immutable string, command line arguments, basics of I/O operations – keyboard input using BufferedReader& Scanner classes.

Reusability properties[6L]– Super class & subclasses including multilevel hierarchy, process of constructor calling in inheritance, use of super and final keywords with super() method, dynamic method dispatch, use of abstract classes & methods, interfaces. Creation of packages, importing packages, member access for packages.

Exception handling & Multithreading [6L]– Exception handling basics, different types of exception classes, use of try & catch with throw, throws & finally, creation of user defined exception classes. Basics of multithreading, main thread, thread life cycle, creation of multiple threads, thread priorities, thread synchronization, inter- thread communication, deadlocks for threads, suspending & resuming threads.

Applet Programming (using swing) [4L]– Basics of applet programming, applet life cycle, difference between application & applet programming, parameter passing in applets, concept of delegation event model and listener, I/O in applets, use of repaint(), getDocumentBase(), getCodeBase() methods, layout manager (basic concept), creation of buttons (JButton class only) & text fields. Textbooks/References:

1. Rambaugh, James Michael, Blaha – "Object Oriented Modelling and Design" – Prentice Hall, India
2. Ali Bahrami – "Object Oriented System Development" – Mc Graw Hill
3. Patrick Naughton, Herbert Schildt – "The complete reference-Java2" – TMH
4. R.K Das – "Core Java For Beginners" – VIKAS PUBLISHING
5. Deitel and Deitel – "Java How to Program" – 6th Ed. – Pearson
6. Ivor Horton's Beginning Java 2 SDK – Wrox
7. E. Balagurusamy – " Programming With Java: A Primer" – 3rd Ed. – TMH

Practical

Design & Analysis Algorithm Lab
Code: CS591
Contact: 3P
Credits: 2

Programming Language used :C
Lab :1 : Divide and Conquer :
>Implement Binary Search using Divide and Conquer approach
> Implement Merge Sort using Divide and Conquer approach
Lab :2 : Divide and Conquer :

>Implement Quick Sort using Divide and Conquer approach
> Find Maximum and Minimum element from a array of integer using Divide and Conquer approach

Lab :3 : Dynamic Programming :

>Find the minimum number of scalar multiplication needed for chain of matrix

Lab :4 : Dynamic Programming :

>Implement all pair of Shortest path for a graph (Floyed- Warshall Algorithm)
>Implement Traveling Salesman Problem

Lab :5 : Dynamic Programming :

>Implement Single Source shortest Path for a graph (Dijkstra , Bellman Ford Algorithm)

Lab :6 : Brunch and Bound :

>Implement 15 Puzzle Problem

Lab :7 : Backtracking :

>Implement 8 Queen problem

Lab :8 : Backtracking (implement any one of the following problem):

>Graph Coloring Problem
>Hamiltonian Problem

Lab :9 : Greedy method(implement any one of the following problem) :

>Knapsack Problem
>Job sequencing with deadlines

Lab :10 : Greedy method (implement any one of the following problem) :

>Minimum Cost Spanning Tree by Prim's Algorithm
>Minimum Cost Spanning Tree by Kruskal's Algorithm

Lab :11 : Graph Traversal Algorithm :

>Implement Breadth First Search (BFS)
>Implement Depth First Search (DFS)

Microprocessor & Microcontroller Lab
Code: CS592
Contact: 3P
Credits: 2

Prerequisites:

1. Familiarity with the number system
2. A solid background in digital logic and implementation of digital circuit in a bread board.

Course Objective(s)

- To learn the assembly language programming of a microprocessor.
- To learn the assembly language programming of a microcontroller.
- To learn the interfacing of microprocessor.
- To be familiar with microprocessor and microcontroller based projects.

Sl. No.	Experiment Name	No of Hours
1	**Study of Prewritten programs on 8085 trainer kit using the basic instruction set (data transfer, Load/Store, Arithmetic, Logical).** **Or,** **Familiarization with 8085 simulator on PC. Programs using basic instruction set (data transfer, Load/Store, Arithmetic, Logical) on the simulator.**	3
2	**Programming using kit or Simulator for:** **5. Table look up** **6. Copying a block of memory** **7. Shifting a block of memory** **iv) Packing and unpacking of BCD numbers** **8. Addition of BCD numbers** **9. Binary to ASCII conversion and vice-versa (Using Subroutine Call)** **10. BCD to Binary Conversion and vice-versa** **vii) String Matching, Multiplication**	18
3	**Program using IN/OUT instructions and 8255 PPI on the trainer kit e.g. subroutine for delay,** **x. Glowing all the LEDs one by one with particular delay** **xi. Reading switch state and glowing LEDs accordingly.**	3
4	**Serial communication between two trainer kits**	3
5	**Study of Prewritten programs on 8051 Microcontroller Kit using the basic instruction set (data transfer, Load/Store, Arithmetic, Logical).** **Or,** **Familiarization with 8051 Simulator on PC. Study of prewritten programs using basic instruction**	3
	set (data transfer, Load/Store, Arithmetic, Logical).	
	Total 30 hours (10 classes each of 3 periods)	

CourseOutcomes:

After completion of the course students will be able to

CO1	**Apply** the fundamentals of assembly level programming of microprocessors and microcontroller.
CO2	**Illustrate** standard microprocessor, real time interfaces including GPIO, serial ports, digital-to-analog converters and analog-to-digital converters and **use** in problem solving.
CO3	**Develop** systems using different microcontrollers.
CO4	**Analyze** abstract problems and **apply** a combination of hardware and software to address the problem.
CO5	**Explain** the interactions between software and hardware.

CO-PO(PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	3	3	2	–	1	1	1	1	3	3	3
CO2	3	3	3	2	3	3	2	–	1	1	1	1	3	3	3
CO3	3	3	3	2	3	3	2	–	1	1	1	1	3	3	3
CO4	3	3	3	2	3	3	2	–	1	1	1	1	3	3	3
CO5	3	3	3	2	3	3	2	–	1	1	1	1	3	3	3

Programming Practices Using C++
Code: CS593
Contact: 3P(1L+2P)
Credits: 2

Introduction of UNIX/Linux Operating System which includes preliminary commands, start-up & shutdown methodology, file handling as well as introduction to editors like Vi editor, introduction to GNU C & C++ compiler, as well as introduction to GNU &GDB script. **[4P]**

Introduction to C++, basic loop control, executing programs, writing functions, selection statements, review of functions and parameters, command line arguments, recursion, I/O streams, arrays and string manipulation, pointers, structures & unions. **[6P]**
Object-Oriented Programming in C++, fundamentals of classes, constructors-destructors. Dealing with member functions, operator overloading and polymorphism (both static & dynamic). **[6P]**

Dealing with inheritance, derived class handling, abstract class, virtual class, overriding, template class, name-space & exception handling. **[4P]**

Dynamic memory allocation, implementation of Linked Lists, using C++. **[4P]**

Note: GNU C++ can be used for the programming, since it is free and has no licensing anomaly

Circuits and Networks Lab
Code: CS594A
Contacts: 3P
Credits: 2

1. Characteristics of Series & Parallel Resonant circuits
2. Verification of Network Theorems
3. Transient Response in R-L & R-C Networks ; simulation / hardware
4. Transient Response in RLC Series & Parallel Circuits & Networks ; simulation / hardware
5. Determination of Impedance (Z), and Admittance (Y) parameters of Two-port networks
6. Generation of periodic, exponential, sinusoidal, damped sinusoidal, step, impulse, and ramp signals using MATLAB
7. Representation of Poles and Zeros in s-plane, determination of partial fraction expansion in s-domain and cascade connection of second-order systems using MATLAB

8. Determination of Laplace Transform, different time domain functions, and Inverse Laplace
9. Transformation using MATLAB

Note: An Institution / college may opt for some other hardware or software simulation wherever possible in place of MATLAB

Data Communication Lab Code:CS594B
Contact: 3P Credits: 2

List of Experiments

1. To study different types of transmission media
2. Familiarization with Networking cables (CAT5, UTP), Connectors (RJ45, T-connector), Hubs, Switches. Configuration of a HUB/Switch.
3. PC-to-PC Communication with the Data Communication Trainers for File Transfer.

Error detection codes, Data Encryption etc.

4. Experiments using LAN Trainer kit for Point-to-Point Communication Multicast/Broadcast Communication

Data Encryption and security protocols

5. To make inter-connections in cables for data communication in LAN and install LAN using (a) Tree topology (b)STAR topology (c) Bus topology (d) Token-Ring topology
6. Study of MODEMs: (a) configure the modem of a computer (b) Study Serial Interface RS-232 and its applications(c) Study the Parallel Interface and its applications

DSP Lab Code: CS594C
Contact: 3P
Credits: 2

Simulation Laboratory using standard Simulator:

c) Sampled sinusoidal signal, various sequences and different arithmetic operations.
d) Convolution of two sequences using graphical methods and using commands-verification of the properties of convolution.
e) Z-transform of various sequences – verification of the properties of Z-transform.
f) Twiddle factors – verification of the properties.
g) DFTs / IDFTs using matrix multiplication and also using commands.
h) Circular convolution of two sequences using graphical methods and using commands, differentiation between linear and circular convolutions.
i) Verifications of the different algorithms associated with filtering of long data sequences and Overlap –add and Overlap- save methods.

j) Butterworth filter design with different set of parameters.
k) FIR filter design using rectangular, Hamming and Blackman windows.

Hardware Laboratory using either 5416 or 6713 Processor and Xilinx FPGA:

3. Writing & execution of small programs related to arithmetic operations and convolution using Assembly Language of TMS320C 5416/6713 Processor, study of MAC instruction.
4. Writing of small programs in VHDL and downloading onto Xilinx FPGA.
5. Mapping of some DSP algorithms onto FPGA.

OOP Lab Code: CS594D

Contact: 3P Credits: 2

1. Assignments on class, constructor, overloading, inheritance, overriding
2. Assignments on wrapper class, arrays
3. Assignments on developing interfaces- multiple inheritance, extending interfaces
4. Assignments on creating and accessing packages
5. Assignments on multithreaded programming
6. Assignments on applet programming

Note: Use Java for programming

Preferably download "**java_ee_sdk-6u4-jdk7-windows.exe**" from **http://www.oracle.com/technetwork/java/javaee/downloads/java-ee-sdk-6u3-jdk-7u1-downloads-523391.html**

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Database Management System
CS-601
Contact: 3L
Credits: 3

Detailed Syllabus:

Introduction [4L]

Concept & Overview of DBMS, Data Models, Database Languages, Database Administrator, Database Users, Three Schema architecture of DBMS.

Entity-Relationship Model [6L]

Basic concepts, Design Issues, Mapping Constraints, Keys, Entity-Relationship Diagram, Weak Entity Sets, Extended E-R features.

Relational Model [5L]

Structure of relational Databases, Relational Algebra, Relational Calculus, Extended Relational Algebra Operations, Views, Modifications Of the Database.

SQL and Integrity Constraints [8L]

Concept of DDL, DML, DCL. Basic Structure, Set operations, Aggregate Functions, Null Values, Domain Constraints, Referential Integrity Constraints, assertions, views, Nested Subqueries, Database security application development using SQL, Stored procedures and triggers.

Relational Database Design [9L]

Functional Dependency, Different anomalies in designing a Database., Normalization using functional dependencies, Decomposition, Boyce-Codd Normal Form, 3NF, Normalization using multi-valued dependencies, 4NF, 5NF

Internals of RDBMS [7L]

Physical data structures, Query optimization : join algorithm, statistics and cost bas optimization. Transaction processing, Concurrency control and Recovery Management : transaction model properties, state serializability, lock base protocols, two phase locking.

File Organization & Index Structures [6L]

File & Record Concept, Placing file records on Disk, Fixed and Variable sized Records, Types of Single-Level Index (primary, secondary, clustering), Multilevel Indexes, Dynamic Multilevel Indexes using B tree and B+ tree .

Text Books:

1. Henry F. Korth and Silberschatz Abraham, "Database System Concepts", Mc.Graw Hill.
2. Elmasri Ramez and Novathe Shamkant, "Fundamentals of Database Systems", Benjamin Cummings Publishing. Company.

3. Ramakrishnan: Database Management System , McGraw-Hill
4. Gray Jim and Reuter Address, "Transaction Processing : Concepts and Techniques", Moragan Kauffman Publishers.
5. Jain: Advanced Database Management System CyberTech
6. Date C. J., "Introduction to Database Management", Vol. I, II, III, Addison Wesley.
7. Ullman JD., "Principles of Database Systems", Galgottia Publication. Reference:
8. James Martin, "Principles of Database Management Systems", 1985, Prentice Hall of India, New Delhi
9. "Fundamentals of Database Systems", RamezElmasri, ShamkantB.Navathe, Addison Wesley Publishing Edition
10. "Database Management Systems", Arun K.Majumdar, Pritimay Bhattacharya, Tata McGraw Hill

Course Outcome(s)

CO1	**Apply** the fundamentals of assembly level programming of microprocessors and microcontroller.
CO2	**Illustrate** standard microprocessor, real time interfaces including GPIO, serial ports, digital-to-analog converters and analog-to-digital converters and **use** in problem solving.
CO3	**Develop** systems using different microcontrollers.
CO4	**Analyze** abstract problems and **apply** a combination of hardware and software to address the problem.
CO5	**Explain** the interactions between software and hardware.

CO-PO (PSO) Mapping

CO #	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CS503.1	2	2	2	2	-	-	-	-	-	-	-	-	2	2	-
CS503.2	3	3	3	2	-	-	-	-	-	-	-	-	2	2	-
CS503.3	3	3	3	2	-	-	1	-	-	-	-	-	2	1	-
CS503.4	3	3	3	2	3	2	2	-	-	-	-	-	3	-	-
CS503.5	3	2	3	2	3	2	2	-	-	-	1	1	3		
CS503	2.8	2.6	2.8	2.00	1.2	0.8	1	-	-	-	0.2	0.2	2.4	1	-

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Computer Networks CS-602

Contact: 3L Credits: 3

Module I

Overview of Data Communication and Networking: [4L]

Introduction; Data communications: components, data representation (ASCII,ISO etc.), direction of data flow (simplex, half duplex, full duplex); network criteria, physical structure (type of connection, topology), categories of network (LAN, MAN,WAN); Internet: brief history, Protocols and standards; Reference models: OSI reference model, TCP/IP reference model, their comparative study.

Physical Level: [6L]

Overview of data(analog & digital), signal(analog & digital), transmission (analog & digital) & transmission media (guided & unguided); Circuit switching: time division & space division switch, TDM bus; Telephone Network;

Module II

Data link Layer: [5L]

Types of errors, framing(character and bit stuffing), error detection & correction methods; Flow control; Protocols: Stop & wait ARQ, Go-Back- N ARQ, Selective repeat ARQ, HDLC;

Medium Access sub layer: [5L]

Point to Point Protocol, LCP, NCP, Token Ring; Reservation, Polling, Multiple access protocols: Pure ALOHA, Slotted ALOHA, CSMA, CSMA/CD, CSMA/CA Traditional Ethernet, fast Ethernet(in brief);

Module III Network layer: [8L]

Internetworking & devices: Repeaters, Hubs, Bridges, Switches, Router, Gateway; Addressing : IP addressing, subnetting; Routing : techniques, static vs. dynamic routing , Unicast Routing Protocols: RIP, OSPF, BGP; Other Protocols: ARP, IP, ICMP, IPV6;.

Transport layer: [4L]

Process to Process delivery; UDP; TCP; Congestion Control: Open Loop, Closed Loop choke packets; Quality of service: techniques to improve QoS: Leaky bucket algorithm, Token bucket algorithm,

Module IV Application Layer [5L]

Introduction to DNS, SMTP, SNMP, FTP, HTTP & WWW; Security: Cryptography (Public, Private Key based), Digital Signature, Firewalls.

Modern topics: [5L]

ISDN services & ATM, DSL technology, Cable Modem: Architecture & Operation in brief Wireless LAN: IEEE 802.11, Introduction to blue-tooth.

Text Books:

1. B. A. Forouzan – "Data Communications and Networking (3rd Ed.) " – TMH
2. A. S. Tanenbaum – "Computer Networks (4th Ed.)" – Pearson Education/PHI
3. W. Stallings – "Data and Computer Communications (5th Ed.)" – PHI/ Pearson Education
4. Zheng & Akhtar, Network for Computer Scientists & Engineers, OUP
5. Black, Data & Computer Communication, PHI
6. Miller, data Communication & Network, Vikas

7. Miller, Digital & Data Communication, Jaico
8. Shay, Understanding Data Communication & Network, Vikas

Reference Books:

1. Kurose and Rose – " Computer Networking -A top down approach featuring the internet" – Pearson Education
2. Leon, Garica, Widjaja – "Communication Networks" – TMH
3. Walrand – "Communication Networks" – TMH.
4. Comer – "Internetworking with TCP/IP, vol. 1, 2, 3(4th Ed.)" – Pearson Education/PHI

Course Outcomes:

CS601.1	Understand the concepts of protocols, network interfaces, network models and design/performance issues in local area networks and wide area networks.
CS601.2	Comprehend basic computer network technology, explain Data Communications System and its components and to identify the different types of network devices and their functions within a network.
CS601.3	Solve the main problems related to error control, flow control, MAC and addressing, routing.
CS601.4	Analyze the requirements for a given organizational structure and select the most appropriate networking architecture and technologies.
CS601.5	Evaluate why do networks need security and control, what errors might and identify deficiencies in existing protocols, and then propose new protocols.

CO-PO (PSO) Mapping:

CO #	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CS601.1	2	3	2	2	-	-	-	-	-	-	-	-	-	-	-
CS601.2	3	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CS601.3	3	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CS601.4	3	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CS601.5	3	2	2	2	-	-	-	-							
CS601	2.8	2.8	2.6	2.4	-	-	-	-	-	-	-	-	-	-	-

Operating System CS-603
Contact: 3L
Credits: 3

Introduction [4L]

Introduction to OS. Operating system functions, evaluation of O.S., Different types of O.S.: batch, multi-programmed, time-sharing, real-time, distributed, parallel.

System Structure[3L]

Computer system operation, I/O structure, storage structure, storage hierarchy, different types of protections, operating system structure (simple, layered, virtual machine), O/S services, system calls.

Process Management [17L]

Processes [3L]: Concept of processes, process scheduling, operations on processes, co-operating processes, inter-process communication.

Threads [2L]: overview, benefits of threads, user and kernel threads.

CPU scheduling [3L]: scheduling criteria, preemptive & non-preemptive scheduling, scheduling algorithms (FCFS, SJF, RR, priority), algorithm evaluation, multi-processor scheduling.

Process Synchronization [5L]: background, critical section problem, critical region, synchronization hardware, classical problems of synchronization, semaphores.

Deadlocks [4L]: system model, deadlock characterization, methods for handling deadlocks, deadlock prevention, deadlock avoidance, deadlock detection, recovery from deadlock.

Storage Management [19L]

Memory Management [5L]: background, logical vs. physical address space, swapping, contiguous memory allocation, paging, segmentation, segmentation with paging.

Virtual Memory [3L]: background, demand paging, performance, page replacement, page replacement algorithms (FCFS, LRU), allocation of frames, thrashing.

File Systems [4L]: file concept, access methods, directory structure, file system structure, allocation methods (contiguous, linked, indexed), free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency & performance.

I/O Management [4L]: I/O hardware, polling, interrupts, DMA, application I/O interface (block and character devices, network devices, clocks and timers, blocking and nonblocking I/O), kernel I/O subsystem (scheduling, buffering, caching, spooling and device reservation, error handling), performance.

Disk Management [3L]: disk structure, disk scheduling (FCFS, SSTF, SCAN,C-SCAN) , disk reliability, disk formatting, boot block, bad blocks.

Protection & Security [4L]

Goals of protection, domain of protection, security problem, authentication, one time password, program threats, system threats, threat monitoring, encryption.

Text Books / References **:**

1. Milenkovie M., "Operating System : Concept & Design", McGraw Hill.
2. Tanenbaum A.S., "Operating System Design & Implementation", Practice Hall NJ.
3. Silbersehatz A. and Peterson J. L., "Operating System Concepts", Wiley.
4. Dhamdhere: Operating System TMH
5. Stalling, William, "Operating Systems", Maxwell McMillan International Editions, 1992.
6. Dietel H. N., "An Introduction to Operating Systems", Addison Wesley.

Course Outcome(s)

On completion of the course students will be able to:

CS503.1	**Understand** the basic concepts and utility of Database management system
CS503.2	**Design** an Entity Relationship (E-R) Diagram for an application.
CS503.3	**Analyze and create** therelational database based on normalization
CS503.4	**Determine** whether the transaction satisfies the ACID properties.
CS503.5	**Implement** and **maintain** the database of an organization.

CO-PO (PSO) Mapping

CO #	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CS503.1	2	2	2	2	-	-	-	-	-	-	-	-	2	2	-
CS503.2	3	3	3	2	-	-	-	-	-	-	-	-	2	2	-
CS503.3	3	3	3	2	-	-	1	-	-	-	-	-	2	1	-
CS503.4	3	3	3	2	3	2	2	-	-	-	-	-	3	-	-
CS503.5	3	2	3	2	3	2	2	-	-	-	1	1	3		
CS503	2.8	2.6	2.8	2.00	1.2	0.8	1	-	-	-	0.2	0.2	2.4	1	-

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Professional Elective

Information Theory & Coding

CS-604A

Contact: 3L

Credits: 3

Source Coding [7L]

Uncertainty and information, average mutual information and entropy, information measures for continuous random variables, source coding theorem, Huffman codes.

Channel Capacity And Coding [7L]

Channel models, channel capacity, channel coding, information capacity theorem, The Shannon limit.

Linear And Block Codes For Error Correction [8L]

Matrix description of linear block codes, equivalent codes, parity check matrix, decoding of a linear block code, perfect codes, Hamming codes.

Cyclic Codes [7L]

Polynomials, division algorithm for polynomials, a method for generating cyclic codes, matrix description of cyclic codes, Golay codes.

BCH Codes [8L]

Primitive elements, minimal polynomials, generator polynomials in terms of minimal polynomials, examples of BCH codes.

Convolutional Codes [8L]

Tree codes, trellis codes, polynomial description of convolutional codes, distance notions for convolutional codes, the generating function, matrix representation of convolutional codes, decoding of convolutional codes, distance and performance bounds for convolutional codes, examples of convolutional codes, Turbo codes, Turbo decoding.

Books

9. Information theory, coding and cryptography - Ranjan Bose; TMH.
10. Information and Coding - N Abramson; McGraw Hill.
11. Introduction to Information Theory - M Mansurpur; McGraw Hill.
12. Information Theory - R B Ash; Prentice Hall.
13. Error Control Coding - Shu Lin and D J Costello Jr; Prentice Hall.

Computer Graphics
CS-604B
Contact: 3L
Credits: 3

Prerequisites:

1. Mathematics – I,III
2. Computer Fundamentals & Principle of Computer Programming
3. Programming with C++

Course Objective(s)

- To provide comprehensive introduction about computer graphics system, design algorithms and two dimensional transformations.
- To make the students familiar with techniques of clipping, three dimensional graphics and three dimensional transformations.
- The computer graphics course prepares students for activities involving in design, development and testing of modeling, rendering, and shading.

Module I:

Introduction to computer graphics & graphics systems [6L]: Overview of computer graphics, representing pictures, preparing, presenting & interacting with pictures for presentations; Visualization & image processing; RGB color model, direct coding, lookup table; storage tube graphics display, Raster scan display, 3D viewing devices, Plotters, printers, digitizers, Light pens etc.; Active & Passive graphics devices; Computer graphics software.

Scan conversion [8L]: Points & lines, Line drawing algorithms; DDA algorithm, Bresenham's line algorithm, Circle generation algorithm; Ellipse generating algorithm; scan line polygon, fill algorithm, boundary fill algorithm, flood fill algorithm.

Module II:

2D transformation & viewing [15L]: Basic transformations: translation, rotation, scaling; Matrix representations & homogeneous coordinates, transformations between coordinate systems; reflection shear; Transformation of points, lines, parallel lines, intersecting lines. Viewing pipeline, Window to view port co-ordinate transformation, clipping operations, point clipping, line clipping, clipping circles, polygons & ellipse. Cohen and Sutherland line clipping, Sutherland-Hodgeman Polygon clipping, Cyrus-beck clipping method

3D transformation & viewing [5L]: 3D transformations: translation, rotation, scaling & other transformations. Rotation about an arbitrary axis in space, reflection through an arbitrary plane; general parallel projection transformation; clipping, view port clipping, 3D viewing.

Module III:

Curves [3L]: Curve representation, surfaces, designs, Bezier curves, B-spline curves, end conditions for periodic B-spline curves, rational B-spline curves.

Hidden surfaces [3L]: Depth comparison, Z-buffer algorithm, Back face detection, BSP tree method, the Painter's algorithm, scan-line algorithm; Hidden line elimination, wire frame methods , fractal - geometry.Color& shading models [2L]: Light & color model; interpolative shading model; Texture. Introduction to Ray-tracing: [3L]
Human vision and color, Lighting, Reflection and transmission models.

Books:

1. Hearn, Baker – "Computer Graphics (C version 2nd Ed.)" – Pearson education
2. Z. Xiang, R. Plastock – " Schaum's outlines Computer Graphics (2nd Ed.)" – TMH
3. D. F. Rogers, J. A. Adams – "Mathematical Elements for Computer Graphics (2nd Ed.)" – TMH

Table 1: Course Outcomes

On completion of the course students will be able to

CS604.1	**Find** a basic knowledge of computer graphics system, input output devices and application of computer graphics.
CS604.2	**Understand** different scan conversion algorithms and geometric transformations techniques.
CS604.3	**Analyze** the numerical problems using the concept of algebra and geometry
CS604.4	**Apply** computer graphics principles and concepts to animation and game design
CS604.5	**Create** geometric model using geometric primitives

Table 2: Mapping of Course Outcomes with Pos (&PSOs)

CO #	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CS501.1	3	2	2	2	2	1	-	-	-	-	-	2	1	3	1
CS501.2	2	2	2	2	3	-	-	-	-	-	-	-	2	3	2
CS501.3	2	3	2	2	2	2	-	-	-	-	-	-	2	2	2
CS501.4	2	2	3	3	2	1	-	-	-	-	-	-	3	2	3
CS501.5	2	2	3	3	2	1	1	1	1	1	1	1	3	1	2
CS501	2	2	2	2	2	1	1	1	1	1	1	1	2	2	2

ERP
CS-604C
Contact: 3L
Credits: 3

Module 1: Overview of ERP (Lectures : 9)

a) **The evolution of ERP systems: A historical perspective**

Evolution through Payroll system, Inventory Control system, Materials Requirement Planning (MRP I) system, Manufacturing Resource Planning (MRP II) system, Their advantages and disadvantages. Definition and Concept of ERP, Business reasons for rise and popularity of ERP system - Benefits of an ERP system

b) **Business processes supported by ERP systems**

Various business functions in an Organization – Purchasing, Materials Management, Manufacturing, Sales & Distribution, Plant Maintenance, Quality Management, Finance & Accounting including Costing, Human Resources etc.

ERP market place – SAP, Oracle, PeopleSoft, JD Edwards, Baan, Microsoft's suit of products etc. Business modules in these ERP packages – a brief comparative description of business function modules and sub-modules.

Overview of key end-to-end business processes supported in two major ERP systems (preferably SAP and Oracle) – Order to Cash, Procure to Pay, Plan to Produce and Despatch.

Module 2 : Information Technology and ERP systems (Lectures : 9)

1. **The evolution of Information Technology (IT): A historical perspective**

Evolution of computer generations (hardware and software) – Operating systems, File systems to Database Management systems, Communication Networks. Enabling of ERP systems by IT evolution.

2. **The evolution of ERP systems architecture**

Client-Server based architecture, Multi-Tier architecture – Presentation layer, Application layer, and Database layer (On- line Transaction Processing – OLTP). Brief discussion on Extended ERP systems - Web-enabled ERP architecture, Service-Oriented Architecture and Cloud Computing. Open Source ERP.

3. **Related technology concepts**

ERP and Supply Chain Management (SCM), and Customer Relationship Management (CRM), ERP and Business Intelligence (some of the popular tools like Cognos, Business Objects should be mentioned), ERP and Data warehousing (Data Mart, Data Mining and On-line Analytical Processing - OLAP), ERP and E-business.

Module 3 : Implementation of ERP system (Lectures : 11)

Types of services required in implementation – Consulting, Configuration, Customization and Support

1) **ERP implementation approach**

Single vendor versus Best-of Breed ERP implementation, Big Bang versus
Phased (by module/ site) implementation, Using ERP of Application Service Provider (ASP).

2) **ERP implementation life cycle**

Planning different aspects (Economic viability, Senior Management commitment, Resource requirements, Change management etc.), Understanding requirements and Process preparation – Gap analysis and Business Process Engineering, User Acceptance criteria, Design, Configuration, Customization (difference between Configuration and Customization, advantages and disadvantages), Extensions, Data migration, End-user training, User Acceptance, Going live, Roll-out.
Differences between ERP implementation life cycle and Custom Software development phases. Drawbacks of ERP system.

3) **Organizing implementation**

Interaction with Vendors, Consultants, and Users. Contracts with Vendors, Consultants, and Employees. Project Management and Monitoring. ERP Project Organization
– Formation of Steering Committee and different User Groups. Top Management Commitment and Steering Committee meetings. Change Management, Risks and Challenges in ERP implementation.

4) **Post-implementation Support, Review, Maintenance and Security of ERP systems**

A typical Support Cycle (Planning, Stabilization, Ongoing and Upgrade phases). Post-implementation Review of ERP systems – measures of review (Efficiency, Effectiveness, and Competitive Advantage), and approaches for review (User attitude survey, Cost/benefit analysis, Compliance audit, Budget performance review, Service level monitoring, Technical review, Product review, Integration review etc.). System maintenance and ERP system maintenance. Software upgrade (patch, release, version). Security and Access control of ERP systems.

Module 4 : Emerging Trends and Future of ERP systems (Lectures : 7)

1. **Emerging Technologies and ERP**

Service-oriented Architecture (SOA): Enterprise SOA layers – Business processes, Business services, Components and Integration services, Advantages and Drawbacks of
SOA, When to use SOA, Difference between multi-layered Client-server architecture and SOA, basic awareness of NetWeaver from SAP, Websphere from Oracle and .Net from Microsoft.

Enterprise Application Integration (EAI): Basic understanding of the concept, Types of EAI (levels) – User Interface, Method (logic), Application Interface, Data.
EAI architecture – Typical framework (Business Processes, Components &Services, Messaging service, and Transport service. Mention of some of the leading EAI vendors – IBM, Microsoft, Oracle, SAP, TIBCO.
Radio Frequency Identification (RFID) and ERP: awareness of RFID technology, Benefits of RFID integrated with ERPs.
M-Commerce: basic concept and applications, difference with E-Commerce, benefits of integration with ERPs.

2. **Future of ERP**

Technology transformation to SOA, more E-Commerce features, Growing mobile applications, Economical and Easy models of ERP deployment etc.

Books Recommended:

i) Enterprise Resource Planning – A Managerial Perspective by D P Goyal, Tata McGraw Hill Education, 2011
ii) Enterprise Resource Planning by Ashim Raj Singla, Cengage Learning, 2008

References:

1. Enterprise Resource Planning, 2nd Edition by Alexis Leon, Tata McGraw Hill Education, 2008

Operation Research
CS-605A
Contact: 3L
Credits: 3
Free Elective

Module I

Linear Programming Problems (LPP):

Basic LPP and Applications; Various Components of LP Problem Formulation.

Solution of Linear Programming Problems:
Solution of LPP: Using Simultaneous Equations and Graphical Method;

Definitions: Feasible Solution, Basic and non-basic Variables, Basic Feasible Solution, Degenerate and Non-degenerate Solution, Convex set and explanation with examples. **5L**

Solution of LPP by Simplex Method; Charnes' Big-M Method; Duality Theory. Transportation Problems and Assignment Problems.

12L

Module II

Network Analysis:

Shortest Path: Floyd Algorithm; Maximal Flow Problem (Ford-Fulkerson); PERT-CPM (Cost Analysis, Crashing, Resource Allocation excluded). **6L**

Inventory Control:

Introduction to EOQ Models of Deterministic and Probabilistic ; Safety Stock; Buffer Stock.

3L

Module III

Game Theory:

Introduction; 2-Person Zero-sum Game; Saddle Point; Mini-Max and Maxi-Min Theorems (statement only) and problems; Games without Saddle Point; Graphical Method; Principle of Dominance.

5L

Module IV

Queuing Theory:

Introduction; Basic Definitions and Notations; Axiomatic Derivation of the Arrival & Departure (Poisson Queue). Poisson Queue Models: (M/M/1): (∞ / FIFO) and (M/M/1: N / FIFO) and problems.

5L

Text Books:

1. H. A. Taha, "Operations Research", Pearson
2. P. M. Karak – "Linear Programming and Theory of Games", ABS Publishing House
3. Ghosh and Chakraborty, "Linear Programming and Theory of Games", Central Book Agency
4. Ravindran, Philips and Solberg - "Operations Research", WILEY INDIA

References:

1. Kanti Swaroop — "Operations Research", Sultan Chand & Sons
2. Rathindra P. Sen—"Operations Research: Algorithms and Applications", PHI
3. R. Panneerselvam - "Operations Research", PHI
4. A.M. Natarajan, P. Balasubramani and A. Tamilarasi - "Operations Research", Pearson
5. M. V. Durga Prasad – "Operations Research", CENGAGE Learning
6. J. K. Sharma - "Operations Research", Macmillan Publishing Company

Human Resource Management (HSS)
CS-605B
Contact: 3L
Credits: 3

Introduction : HR Role and Functions, Concept and Significance of HR, Changing role of HR managers - HR functions and Global Environment, role of a HR Manager.

Human Resources Planning : HR Planning and Recruitment: Planning Process - planning at different levels - Job Analysis - Recruitment and selection processes - Restructuring strategies - Recruitment-Sources of Recruitment-Selection Process-Placement and Induction-Retention of Employees.

Training and Development : need for skill upgradation - Assessment of training needs - Retraining and Redeployment methods and techniques of training employees and executives - performance appraisal systems.
Performance Management System : Definition, Concepts and Ethics-Different methods of Performance Appraisal- Rating Errors- Competency management.

Industrial Relations : Factors influencing industrial relations - State Interventions and Legal Framework - Role of Trade unions - Collective Bargaining - Workers' participation in management.
Case study.

Books :

1. Gary Dessler, Human Resource Management - (8th ed.,) Pearson Education, Delhi
2. Decenzo & Robbins, Personnel / Human Resource Management, 3rd ed., John Wiley & Sons (Pvt.) Ltd.
3. Biswajeet Patanayak, Human Resource Management, PHI, New Delhi
4. Luis R. Gomez, Mejia, Balkin and Cardy, Managing Human Resources PHI, New Delhi.

Multimedia Technology
CS-605C
Contact: 3L
Credits: 3

Introduction [2L]
Multimedia today, Impact of Multimedia, Multimedia Systems, Components and Its Applications

Text and Audio [6L]
Text: Types of Text, Ways to Present Text, Aspects of Text Design, Character, Character Set, Codes, Unicode, Encryption;
Audio: Basic Sound Concepts, Types of Sound, Digitizing Sound, Computer Representation of Sound (Sampling Rate, Sampling Size, Quantization), Audio Formats, Audio tools, MIDI

Image and Video (8L)
Image: Formats, Image Color Scheme, Image Enhancement; Video: Analogue and Digital Video, Recording Formats and Standards (JPEG, MPEG, H.261) Transmission of Video Signals, Video Capture, and Computer based Animation.

Synchronization [4L]
Temporal relationships, synchronization accuracy specification factors, quality of service

Storage models and Access Techniques [(4L]
Magnetic media, optical media, file systems (traditional, multimedia) Multimedia devices – Output devices, CD-ROM, DVD, Scanner, CCD

Image and Video Database [8L]
Image representation, segmentation, similarity based retrieval, image retrieval by color, shape and texture; indexing- k- d trees, R-trees, quad trees; Case studies- QBIC, Virage. Video Content, querying, video segmentation, indexing

Document Architecture and Content Management [9L]
Content Design and Development, General Design Principles
Hypertext: Concept, Open Document Architecture (ODA), Multimedia and Hypermedia Coding Expert Group (MHEG), Standard Generalized Markup Language (SGML), Document Type Definition (DTD), Hypertext Markup Language (HTML) in Web Publishing. Case study of Applications

Multimedia Applications [4L]
Interactive television, Video-on-demand, Video Conferencing, Educational Applications, Industrial Applications, Multimedia archives and digital libraries, media editors.

Books:

1. Ralf Steinmetz and Klara Nahrstedt , Multimedia: Computing, Communications & Applications , Pearson Ed.
2. Nalin K. Sharda , Multimedia Information System , PHI.
3. Fred Halsall , Multimedia Communications , Pearson Ed.
4. Koegel Buford , Multimedia Systems , Pearson Ed.
5. Fred Hoffstetter , Multimedia Literacy , McGraw Hill.
6. Ralf Steinmetz and Klara Nahrstedt , Multimedia Fundamentals: Vol. 1- Media Coding and Content Processing , PHI.
7. J. Jeffcoate , Multimedia in Practice: Technology and Application , PHI.
8. Prabhat K. Andleigh& Kiran Thakrar , Multimedia Systems Design , PHI.

Practical

Database Management System Lab
Code: CS691
Contact: 3P
Credits: 2

Structured Query Language

1. **Creating Database**
   - Creating a Database
   - Creating a Table
   - Specifying Relational Data Types
   - Specifying Constraints
   - Creating Indexes
2. **Table and Record Handling**
   1. INSERT statement
   2. Using SELECT and INSERT together
   3. DELETE, UPDATE, TRUNCATE statements
   4. DROP, ALTER statements
3. **Retrieving Data from a Database**
   - The SELECT statement
   - Using the WHERE clause
   - Using Logical Operators in the WHERE clause
   - Using IN, BETWEEN, LIKE , ORDER BY, GROUP BY and HAVING **Clause**
   - Using Aggregate Functions
   - Combining Tables Using JOINS
   - Subqueries
4. **Database Management**
   - Creating Views
   - Creating Column Aliases
   - Creating Database Users
   - Using GRANT and REVOKE

Cursors in Oracle PL / SQL
Writing Oracle PL / SQL Stored Procedures

Network Lab
Code: CS692
Contact: 3P
Credits: 2

Detailed Syllabus:

- IPC (Message queue)
- NIC Installation & Configuration (Windows/Linux)
- Familiarization with
  - Networking cables (CAT5, UTP)
  - Connectors (RJ45, T-connector)
  - Hubs, Switches
- TCP/UDP Socket Programming
- Multicast & Broadcast Sockets
- Implementation of a Prototype Multithreaded Server
- Implementation of
  - Data Link Layer Flow Control Mechanism (Stop & Wait, Sliding Window)
  - Data Link Layer Error Detection Mechanism (Cyclic Redundancy Check)
  - Data Link Layer Error Control Mechanism (Selective Repeat, Go Back N)

Course Outcome

On completion of the course students will be able to

CS692.1	Understand the socket program using TCP &UDP.
CS692.2	Develop simple applications using TCP &UDP.
CS692.3	Solve and analyze the Data link layer protocols and simulate them using network simulator.
CS692.4	Compare and contrast the performances of Routing protocol.
CS692.5	Evaluate congestion control algorithm using network simulator.

Mapping of Course Outcomes with POs (&PSOs)

CO #	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CS691. 1	2	3	2	2	-	-	-	-	-	-	-	-	-	-	-
CS691. 2	3	3	3	3	-	-	-	-	-	-	-	-	-	-	-

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CS691.3	3	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CS691.4	3	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CS691.5	3	2	2	2	-	-	-	-							
CS691	2.8	2.8	2.6	2.4	-	-	-	-	-	-	-	-	-	-	-

Operating System Lab
Code: CS693
Contact: 3P
Credits: 2

Prerequisite:
1. Logic of programming language
2. Basic concepts of data structure and algorithms

Course Objectives

1. To learn the data models, conceptualize and depict a database system
2. To learn the fundamental concepts of SQL queries.
3. To understand the concept of designing a database with the necessary attributes.
4. To know the methodology of Accessing, Modifying and Updating data & information from the relational databases
5. To learn database design as well as to design user interface and how to connect with database.

Detailed Syllabus:

1. **Shell programming [6P]**: creating a script, making a script executable, shell syntax (variables, conditions, control structures, functions, commands).
2. **Process [6P]**: starting new process, replacing a process image, duplicating a process image, waiting for a process, zombie process.
3. **Signal [9P]**: signal handling, sending signals, signal interface, signal sets.
4. **Semaphore [6P]**: programming with semaphores (use functions semctl, semget, semop, set_semvalue, del_semvalue, semaphore_p, semaphore_v).
5. **POSIX Threads [9P]**: programming with pthread functions(viz. pthread_create, pthread_join, pthread_exit, pthread_attr_init, pthread_cancel)
6. **Inter-process communication [9P]**: pipes(use functions pipe, popen, pclose), named pipes(FIFOs, accessing FIFO

Course Outcomes

On completion of the course students will be able to

CS693.1	Understand the basic concepts regarding database, know about query processing and techniques and related database facilities including concurrency control, backup and recovery.
CS693.2	Understand the introductory concepts of some advanced topics in data management like distributed databases, data warehousing, deductive databases and be aware of some advanced databases.
CS693.3	Differentiate between DBMS and advanced DBMS and use of advanced database concepts and become proficient in creating database queries.
CS693.4	Analyze database system concepts and apply normalization to the database
CS693.5	Apply and create different transaction processing and concurrency control applications

Mapping of Course Outcomes with Pos (&PSOs)

CO #	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CS593.1	2	2	2	2	3	2	1	1	2	2	3	3	2	2	1
CS593.2	2	3	3	3	3	1	1	1	2	2	3	3	2	2	2
CS593.3	3	3	2	3	3	2	2	2	3	3	3	3	3	2	2
CS593.4	3	3	2	2	2	1	1	1	1	1	2	3	2	1	3
CS593.5	3	3	3	3	3	2	2	2	3	3	3	3	3	2	2
CS593	2.6	2.8	2.4	2.6	2.8	1.6	1.4	1.4	2.2	2.2	2.8	3	2.4	1.8	2

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VII Semester

Theory

Software Engineering
CS701
Contracts: 3L
Credits- 3

Module I
Software Engineering –Objectives, Definitions ,Software Process models - Waterfall Model , Prototype model, RAD, Evolutionary Models ,Incremental, Spiral **(4L)**
Software Project Planning- Feasibility Analysis, Technical Feasibility, Cost- Benefit Analysis, COCOMO model. **[4L] Module II**
Structured Analysis , Context diagram and DFD, Physical and Logical DFDs ,Data Modeling, ER diagrams, Software Requirements
Specification **(5L) Module III**
Design Aspects :Top-Down And Bottom-Up design; Decision tree, decision table and structured English, Structure chart, Transform analysis Functional vs. Object- Oriented approach. **[3L]**
Unified Modelling Language
Class diagram, interaction diagram: collaboration diagram, sequence diagram, state chart diagram, activity diagram, implementation diagram. **(4L)**
Module V
Coding & Documentation – Structured Programming, Modular Programming, Module Relationship- Coupling, Cohesion, OO Programming, Information Hiding, Reuse, System Documentation. **[5L]**
Testing – Levels of Testing, Integration Testing, System Testing.**(5L)**
Software Quality, Quality Assurance, Software Maintenance, Software Configuration Management, Software Architecture. **[6L]**

Reference Books:

1. Software Engineering : A practitioner's approach– Pressman(TMH)
2. Software Engineering- Pankaj Jalote (Wiley-India)
3. Software Engineering- Rajib Mall (PHI)
4. Software Engineering –Agarwal and Agarwal (PHI)

Compiler Design
CS702
Contracts: 3L
Credits- 3

Module I

Introduction to Compiling [2L]

Compilers, Analysis-synthesis model , The phases of the compiler, Cousins of the compiler.

Lexical Analysis [5L]

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).

Module II

Syntax Analysis [8L]

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 [4L]

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

Module III

Type checking [3L]

Type systems, Specification of a simple type checker, Equivalence of type expressions, Type conversions

Run time environments [4L]

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.

Module IV

Intermediate code generation [3L]

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

Code optimization [4L]

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 [3L]

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

Text books:

1. Aho, Sethi, Ullman - "Compiler Principles, Techniques and Tools" - Pearson Education.
2. Holub - "Compiler Design in C" – PHI
3. Tremblay and Sorenson Compiler Writing-McgrawHill International .
4. Chattopadhyay , S- Compiler Design (PHI)

Pattern Recognition

CS703A

Contracts: 3L
Credits- 3

Module – I	
Introduction – Definitions, data sets for Pattern Recognition	2
Different Paradigms of Pattern Recognition	1
Representations of Patterns and Classes	2
Metric and non-metric proximity measures	2
Module - II	
Feature extraction	
Different approaches to Feature Selection	2
Nearest Neighbour Classifier and variants	1
Efficient algorithms for nearest neighbour	2
classification	2
Module - III	
Different Approaches to Prototype Selection	2
Bayes Classifier	3
Decision Trees	3
Linear Discriminant Function	3
Module - IV	
Support Vector Machines	2
Clustering	3
Clustering Large datasets	2
Combination of Classifiers	2
Applications – Document Recognition	2

REFERENCES

1. Devi V.S.; Murty, M.N. (2011) Pattern Recognition: An Introduction, Universities Press, Hyderabad.
2. R. O. Duda, P. E. Hart and D. G. Stork, Pattern Classification, Wiley, 2000.

Soft Computing CS703B
Contracts: 3L
Credits- 3
Module-I [2L]

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

Module-II [10L]

Fuzzy sets and Fuzzy logic systems:

Classical Sets and Fuzzy Sets and Fuzzy relations : Operations on Classical sets, properties of classical sets, Fuzzy set operations, properties of fuzzy sets, cardinality, operations, and properties of fuzzy relations.

Membership functions : Features of membership functions, standard forms and boundaries, different fuzzification methods.

Fuzzy to Crisp conversions: Lambda Cuts for fuzzy sets, fuzzy Relations, Defuzzification methods.

Classical Logic and Fuzzy Logic: Classical predicate logic, Fuzzy Logic, Approximate reasoning and Fuzzy Implication

Fuzzy Rule based Systems: Linguistic Hedges, Fuzzy Rule based system – Aggregation of fuzzy Rules, Fuzzy Inference System- Mamdani Fuzzy 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

Module-III [10L]

Neural Network

Introduction to Neural Networks: Advent of Modern Neuroscience, Classical AI and Neural Networks, Biological Neurons and Artificial neural network; model of artificial neuron.

Learning Methods : Hebbian, competitive, Boltzman etc.,

Neural Network models: Perceptron, Adaline and Madaline networks; single layer network; Back-propagation and multi layer networks.

Competitive learning networks: Kohonenself organizing networks, Hebbian learning; Hopfield Networks.

Neuo-Fuzzy modeling:

Applications of Neural Networks: Pattern Recognition and classification

Module-IV[10L]

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

Module-V [4L]

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.
2. S. Rajasekaran and G.A.V.Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithms", PHI
3. Principles of Soft Computing , S N Sivanandam, S. Sumathi, John Wiley & Sons
4. Genetic Algorithms in search, Optimization & Machine Learning by David E. Goldberg
5. Neuro-Fuzzy and Soft computing, Jang, Sun, Mizutani, PHI
6. Neural Networks: A Classroom Approach,1/e by Kumar Satish, TMH,
7. Genetic Algorithms in search, Optimization & Machine Learning by David E. Goldberg, Pearson/PHI
8. A beginners approach to Soft Computing, Samir Roy & Udit Chakraborty, Pearson

Reference Books:

1. Fuzzy Sets and Fuzzy Logic: Theory and Applications, George J. Klir and Bo Yuan, Prentice Hall
2. Neural Networks: A Comprehensive Foundation (2nd Edition), Simon Haykin, Prentice Hall.

Artificial Intelligence
CS703C
Contracts: 3L
Credits- 3 39L

Introduction [2]
Overview of Artificial intelligence- Problems of AI, AI technique, Tic - Tac - Toe problem.

Intelligent Agents [2]
Agents & environment, nature of environment, structure of agents, goal based agents, utility based agents, learning agents.

Problem Solving [2]
Problems, Problem Space & search: Defining the problem as state space search, production system, problem characteristics, issues in the design of search programs.

Search techniques [5]
Solving problems by searching :problem solving agents, searching for solutions; uniform search strategies: breadth first search, depth first search, depth limited search, bidirectional search, comparing uniform search strategies.

Heuristic search strategies [4]

Greedy best-first search, A* search, memory bounded heuristic search: local search algorithms & optimization problems: Hill climbing search, simulated annealing search, local beam search, genetic algorithms; constraint satisfaction problems, local search for constraint satisfaction problems.

Adversarial search [3]

Games, optimal decisions & strategies in games, the min max search procedure, alpha-beta pruning, additional refinements, iterative deepening.

Knowledge & reasoning [3]
Knowledge representation issues, representation & mapping, approaches to knowledge representation, issues in knowledge representation.

Using predicate logic [2]
Representing simple fact in logic, representing instant & ISA relationship, computable functions & predicates, resolution, natural deduction.

Representing knowledge using rules [3]
Procedural verses declarative knowledge, logic programming, forward verses backward reasoning, matching, control knowledge.

Probabilistic reasoning [3]
Representing knowledge in an uncertain domain, the semantics of Bayesian networks, Dempster-Shafer theory, Fuzzy sets & fuzzy logics.

Planning [2]
Overview, components of a planning system, Goal stack planning, Hierarchical planning, other planning techniques.

Natural Language processing [2]
Introduction, Syntactic processing, semantic analysis, discourse & pragmatic processing.

Learning [3]
Forms of learning, inductive learning, learning decision trees, explanation based learning, learning using relevance information, neural net learning & genetic learning.

Expert Systems [2]
Representing and using domain knowledge, expert system shells, knowledge acquisition.
Basic knowledge of programming language like Prolog & Lisp. [3] Books:

1. Artificial Intelligence, Ritch & Knight, TMH
2. Artificial Intelligence A Modern Approach, Stuart Russel Peter Norvig Pearson
3. Introduction to Artificial Intelligence & Expert Systems, Patterson, PHI
4. Poole, Computational Intelligence, OUP
5. Logic & Prolog Programming, Saroj Kaushik, New Age International

6. Expert Systems, Giarranto, VIKAS
7. Artificial Intelligence, Russel, Pearson

Image Processing CS703D

Contracts: 3L Credits- 3 38L

Introduction [3L]

Background, Digital Image Representation, Fundamental steps in Image Processing, Elements of Digital Image Processing - Image Acquisition, Storage, Processing, Communication, Display.

Digital Image Formation [4L]

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

Mathematical Preliminaries [9L]

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.

Image Enhancement [8L]

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.

Image Restoration [7L]

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.

Image Segmentation [7L]

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.

Books:

1. Digital Image Processing, Gonzalves,Pearson
2. Digital Image Processing, Jahne, Springer India
3. Digital Image Processing &Analysis,Chanda&Majumder,PHI 4.Fundamentals of Digital Image Processing, Jain, PHI
5. Image Processing, Analysis & Machine Vision, Sonka, VIKAS
6. Getting Started with GIS- Clarke Keith. C; PE.
7. Concepts & Techniques of GIS - Lo C.P, Albert, Yeung K.W- PHI.

Distributed Operating System
Code: CS704A
Contracts: 3L
Credits- 3 [36L]

Introduction to Distributed System [2]
Introduction, Examples of distributed system, Resource sharing, Challenges

Operating System Structures: [3]
Review of structures: monolithic kernel, layered systems, virtual machines. Process based models and client server architecture; The
micro-kernel based client-server approach.

Communication [4]
Inter-process communication , Remote Procedure Call, Remote Object Invocation, Tasks and Threads. Examples from LINUX, Solaris 2 and Windows NT.

Theoretical Foundations: [2]
Introduction. Inherent Limitations of distributed Systems. Lamport's Logical clock. Global State

Distributed Mutual Exclusion:[4]
Classification of distributed mutual exclusion algorithm. NonToken based Algorithm: Lamport's algorithm, Ricart-Agrawala algorithm. Token based Algorithm: Suzuki-Kasami's broadcast algorithm.

Distributed Deadlock Detection: [4]
Deadlock handling strategies in distributed systems. Control organizations for distributed deadlock detection. Centralized and Distributed deadlock detection algorithms: Completely Centralized algorithms, path pushing, edge chasing, global state detection algorithm.

Protection and Security: [4]
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.

Distributed file systems: [6]
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 OSFDCE.

Distributed Shared Memory: [4]
Architecture and motivations. Algorithms for implementing DSM. Memory Coherence

CORBA: [3]

The Common Object Request Broker Architecture model and software and its relationship to Operating Systems.

Books:

1 Andrew S. Tanenbaum and Maarten Van Steen, Distributed Systems Principles and Paradigms, PHI

2. Singhal Mukesh & Shivaratri N. G., Advanced Concepts in Operating Systems, TMH
3. Tanenbaum, A. S. Distributed Operating Systems, (ISBN 0-131-439-340), Prentice Hall 199
4. Tanenbaum, A. S. Modern Operating Systems, 2nd Edition (ISBN 0-13-031358-0), Prentice Hall 2001.
5. Bacon, J., Concurrent Systems, 2nd Edition, (ISBN 0-201-177-676), Addison Wesley 1998.
6. Silberschatz, A., Galvin, P. and Gagne, G., Applied Operating Systems Concepts, 1st Edition, (ISBN 0-471-36508-4), Wiley 2000.
7. Coulouris, G. et al, Distributed Systems: Concepts and Design, 3rd Edition, (ISBN 0-201- 61918-0), Addison Wesley 2001.
8. Galli, D.L., Distributed Operating Systems: Concepts and Practice (ISBN 0-13-079843-6), Prentice-Hall 2000.

Cloud Computing

CS704B

Contracts: 3L

Credits- 3

Module 1: Definition of Cloud Computing and its Basics (Lectures : 9)

1. **Definition of Cloud Computing:**

Defining a Cloud, Cloud Types – NIST model, Cloud Cube model, Deployment models (Public , Private, Hybrid and Community Clouds), Service models – Infrastructure as a Service, Platform as a Service, Software as a Service with examples of services/ service providers, Cloud Reference model Characteristics of Cloud Computing – a shift in paradigm Benefits and advantages of Cloud Computing

2. **Cloud Architecture:**

A brief introduction on Composability, Infrastructure, Platforms, Virtual Appliances, Communication Protocols, Applications, Connecting to the Cloud by Clients

3. **Services and Applications by Type**

IaaS – Basic concept, Workload, partitioning of virtual private server instances, Pods, aggregations, silos
PaaS – Basic concept, tools and development environment with examples
SaaS - Basic concept and characteristics, Open SaaS and SOA, examples of SaaS platform Identity as a Service (IDaaS)
Compliance as a Service (CaaS)

Module 2 : Use of Platforms in Cloud Computing (Lectures : 12)

1. **Concepts of Abstraction and Virtualization**

Virtualization technologies : Types of virtualization (access, application, CPU, storage), Mobility patterns (P2V, V2V, V2P, P2P, D2C, C2C, C2D, D2D)
Load Balancing and Virtualization: Basic Concepts, Network resources for load balancing, Advanced load balancing (including Application Delivery Controller and Application Delivery Network), Mention of The Google Cloud as an example of use of load balancing
Hypervisors: Virtual machine technology and types, VMware vSphere Machine Imaging (including mention of Open Virtualization Format – OVF)
Porting of applications in the Cloud: The simple Cloud API and AppZero Virtual Application appliance

2. **Concepts of Platform as a Service**

Definition of services, Distinction between SaaS and PaaS (knowledge of Salesforce.com and Force.com), Application development
Use of PaaS Application frameworks

3. **Use of Google Web Services**

Discussion of Google Applications Portfolio – Indexed search, Dark Web, Aggregation and disintermediation, Productivity applications and service, Adwords, Google Analytics, Google Translate, a brief discussion on Google Toolkit (including introduction of Google APIs in brief), major features of Google App Engine service.

4. **Use of Amazon Web Services**

Amazon Web Service components and services: Amazon Elastic Cloud, Amazon Simple Storage system, Amazon Elastic Block Store, Amazon SimpleDB and Relational Database Service

5. **Use of Microsoft Cloud Services**

Windows Azure platform: Microsoft's approach, architecture, and main elements, overview of Windows Azure AppFabric, Content Delivery Network, SQL Azure, and Windows Live services

Module 3 : Cloud Infrastructure (Lectures : 7)

Types of services required in implementation – Consulting, Configuration, Customization and Support

1. **Cloud Management**

An overview of the features of network management systems and a brief introduction of related products from large cloud vendors, Monitoring of an entire cloud computing deployment stack – an overview with mention of some products, Lifecycle management of cloud services (six stages of lifecycle)

2. **Concepts of Cloud Security**

Cloud security concerns, Security boundary, Security service boundary Overview of security mapping
Security of data: Brokered cloud storage access, Storage location and tenancy, encryption, and auditing and compliance Identity management (awareness of Identity protocol standards)

Module 4 : Concepts of Services and Applications (Lectures : 8)

1. **Service Oriented Architecture:** Basic concepts of message-based transactions, Protocol stack for an SOA architecture, Event-driven SOA, Enterprise Service Bus, Service catalogs
2. **Applications in the Cloud:** Concepts of cloud transactions, functionality mapping, Application attributes, Cloud service attributes, System abstraction and Cloud Bursting, Applications and Cloud APIs
3. **Cloud-based Storage:** Cloud storage definition – Manned and Unmanned

4. **Webmail Services:** Cloud mail services including Google Gmail, Mail2Web, Windows Live Hotmail, Yahoo mail, concepts of Syndication services

Books Recommended:

1. Cloud Computing Bible by Barrie Sosinsky, Wiley India Pvt. Ltd, 2013
2. Mastering Cloud Computing by Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, McGraw Hill Education (India) Private Limited, 2013
3. Cloud computing: A practical approach, Anthony T. Velte, Tata Mcgraw-Hill
4. Cloud Computing, Miller, Pearson
5. Building applications in cloud:Concept, Patterns and Projects, Moyer, Pearson

6.

References:

1. Cloud Computing – Second Edition by Dr. Kumar Saurabh, Wiley India

Data Warehousing & Data Mining
CS704C
Contracts: 3L
Credits- 3

Module 1: Overview and Concepts of Data Warehousing (Lectures : 9)

4. **Overview of Data warehousing**

Strategic information and the need for Data warehousing, Defining a Data warehouse, Evolution of Data warehousing, Data warehousing and Business Intelligence

5. **The Building Blocks of Data warehouse**

Defining features – Subject-oriented data, Integrated data, Time-variant data, Nonvolatile data, Data granularity Data warehouses and Data marts

Architectural Types – Centralized, Independent data marts, Federated, Hub-and-Spoke, Data mart bus

Overview of components - Source Data, Data Staging, Data Storage, Information Delivery, Metadata, and Management and Control components

6. **Business Requirements and Data warehouse**

Dimensional nature of Business data and Dimensional Analysis, Dimension hierarchies and categories, Key Business Metrics (Facts), Requirement Gathering methods and Requirements Definition Document (contents)

Business Requirements and Data Design – Structure for Business Dimensions and Key Measurements, Levels of detail

Business Requirements and the Architecture plan Business Requirements and Data Storage Specifications Business Requirements and Information Delivery Strategy

Module 2 : Data warehouse Architecture and Infrastructure (Lectures : 8)

6. Architectural components

Concepts of Data warehouse architecture – Definition and architecture in the areas of Data acquisition, Data storage, and Information delivery

Distinguishing characteristics – Different objectives and scope, Data content, Complex analysis for faster response, Flexible and Dynamic, Metadata-driven etc

Architectural Framework – supporting flow of data, and the Management and Control module Technical architecture – Data acquisition, Data storage, and Information delivery

Overview of the components of Architectural Types introduced in Module 1.

7. Infrastructure for Data warehousing

Distinction between architecture and infrastructure, Understanding of how data warehouse infrastructure supports its architecture

Components of physical infrastructure, Hardware and Operating systems for data warehouse, Database Software, Collection of Tools,

Data warehouse Appliances – evolution and benefits

8. The role of Metadata

Understanding the importance of Metadata

Metadata types by functional areas – Data acquisition, Data storage, and Information delivery Business Metadata – overview of content and examples

Technical Metadata – overview of content and examples

Metadata Requirements, Sources of Metadata, Metadata management – challenges, Metadata Repository, Metadata integration and standards

Module 3 : Data Design and Data Preparation (Lectures : 9)

3. Principles of Dimensional Modeling

Data Design – Design decisions, Basics of Dimensional modeling, E-R modeling versus Dimensional modeling The STAR schema – illustration, Dimension Table, Fact Table, Factless Fact Table, Data granularity

STAR schema keys – Primary, Surrogate, and Foreign Advantages of the STAR schema, STAR schema examples

4. Data Extraction, Transformation, and Loading

Overview of ETL, Requirements of ETL and steps

Data extraction – identification of sources and techniques

Data transformation – Basic tasks, Transformation types, Data integration and consolidation, Transformation for dimension attributes

Data loading – Techniques and processes, Data refresh versus update, Procedures for Dimension tables, Fact tables : History and incremental loads

ETL Tool options

5. Data Quality

Importance of data quality, Challenges for data quality, Data quality tools, Data cleansing and purification, Master Data Management

Module 4 : Information access and delivery (Lectures : 10)

5. Matching information to classes of users

Information from Data warehouse versus Operational systems, Users of information – their needs and how to provide information

Information delivery – queries, reports, analysis, and applications

Information delivery tools – Desktop environment, Methodology and criteria for tool selection, Information delivery framework, Business Activity Monitoring, Dashboards and Scorecards

6. OLAP in Data warehouse

Overall concept of Online Analytical Processing (OLAP), OLAP definitions and rules, OLAP characteristics

Major features and functions of OLAP – General features, Dimensional analysis, Hypercubes, Drill Down and Roll Up, Slice and Dice, Rotation, Uses and Benefits

Familiarity with OLAP models – Overview of variations, MOLAP, ROLAP, HOLAP, DOLAP, Database OLAP, Web OLAP

7. Data Warehouse and the web

Web-enabled Data Warehouse – adapting data warehouse for the web

Web-based information delivery – Browser technology for data warehouse and Security issues OLAP and Web – Enterprise OLAP, Web-OLAP approaches, OLAP Engine design

8. Data Mining

Overview of Data mining – Definition, Knowledge Discovery Process (Relationships, Patterns, Phases of the process), OLAP versus Data mining

Some aspects of Data mining – Association rules, Outlier analysis, Predictive analytics etc) Concepts of Data mining in a Data warehouse environment

Major Data Mining techniques – Cluster Detection, Decision Trees, Memory-based Reasoning, Link Analysis, Neural Networks, Genetic Algorithms etc

Data Mining Applications in industry – Benefits of Data mining, Discussion on applications in Customer Relationship Management (CRM), Retail, Telecommunication, Biotechnology, Banking and Finance etc

Books Recommended:

7. Data Warehousing Fundamentals for IT Professionals, Second Edition by Paulraj Ponniah, Wiley India

References:

2. Data Warehousing, Data Mining, & OLAP – Second Edition by Alex Berson and Stephen J. Smith, Tata McGraw Hill Education
3. Data warehouse Toolkit by Ralph Kimball, Wiley India

Sensor Networks
CS704D
Contracts: 3L
Credits- 3

Module I: Introduction and Overview [4L]
Learning Objective: To provide an overview about sensor networks and emerging technologies.

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.

Module II: Architectures [9L]
Learning Objective: To study about the node and network architecture of sensor nodes and its execution environment.

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.

Module III: Communication Protocols [9L]
Learning Objective: To understand the concepts of communication, MAC, routing protocols and also study about the naming and addressing in WSN.

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.

Module IV: Infrastructure Establishment [9L]
Learning Objective: To learn about topology control and clustering in networks with timing synchronization for localization services with sensor tasking and control.

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.

Module V: Sensor Network Platforms and Tools [9L]
Learning Objective: To study about sensor node hardware and software platforms and understand the simulation and programming techniques.

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

1. Holger Karl & Andreas Willig, "Protocols and Architectures for Wireless Sensor Networks", John Wiley, 2005.
2. Feng Zhao & Leonidas J. Guibas, "Wireless Sensor Networks- An Information Processing Approach", Elsevier, 2007.

REFERENCES

1. Kazem Sohraby, Daniel Minoli, &TaiebZnati, "Wireless Sensor Networks- Technology, Protocols, and Applications", John Wiley, 2007.
2. Anna Hac, "Wireless Sensor Network Designs", John Wiley, 2003.
3. Thomas Haenselmann, "Sensor Networks", available online for free, 2008.
4. Edgar Callaway, "Wireless Sensor Networks: Architectures and Protocols", Auerbach, 2003.

Mobile Computing CS704E
Contracts: 3L Credits- 3

Introduction to Personal Communications Services (PCS): PCS Architecture, Mobility management, Networks signalling. Global System for Mobile Communication (GSM) system overview: GSM Architecture, Mobility management, Network signalling. **[5L**

General Packet Radio Services (GPRS): GPRS Architecture, GPRS Network Nodes. Mobile Data Communication: WLANs (Wireless LANs) IEEE 802.11 standard, Mobile IP.
[5L
Wireless Application Protocol (WAP): The Mobile Internet standard, WAP Gateway and Protocols, wireless mark up Languages (WML). Wireless Local Loop(WLL): Introduction to WLL Architecture, wireless Local Loop Technologies. **[7L**

Third Generation (3G) Mobile Services: Introduction to International Mobile Telecommunications 2000 (IMT 2000) vision, Wideband Code Division Multiple Access (W-CDMA), and CDMA 2000, Quality of services in 3G.

[7L

Global Mobile Satellite Systems; case studies of the IRIDIUM and GLOBALSTAR systems. Wireless Enterprise Networks: Introduction to Virtual Networks, Blue tooth technology, Blue tooth Protocols.
[7L

Server-side programming in Java, Pervasive web application architecture, Device independent example application
[8L

Text :

1. "Pervasive Computing", Burkhardt, Pearson
2. "Mobile Communication", J. Schiller, Pearson
3. "Wireless and Mobile Networks Architectures", Yi-Bing Lin &ImrichChlamtac, John Wiley & Sons, 2001
4. "Mobile and Personal Communication systems and services", Raj Pandya, Prentice Hall of India, 2001.

Reference :

1. "Guide to Designing and Implementing wireless LANs", Mark Ciampa, Thomson learning, Vikas Publishing House, 2001.
2. "Wireless Web Development", Ray Rischpater, Springer Publishing,
3. "The Wireless Application Protocol", Sandeep Singhal, Pearson .
4. "Third Generation Mobile Telecommunication systems", by P.Stavronlakis, Springer Publishers,

Internet Technology CS705A
Contracts: 3L Credits- 3 34L
Module I-6L
Introduction (1L):
Overview, Network of Networks, Intranet, Extranet and Internet.

World Wide Web (1L):
Domain and Sub domain, Address Resolution, DNS, Telnet, FTP, HTTP.

Review of TCP/IP (1L):
Features, Segment, Three-Way Handshaking, Flow Control, Error Control, Congestion control, IP Datagram, IPv4 and IPv6.

IP Subnetting and addressing (1L):
Classful and Classless Addressing, Subnetting. NAT, IP masquerading, IP tables.

Internet Routing Protocol (1L):
Routing -Intra and Inter Domain Routing, Unicast and Multicast Routing, Broadcast.

Electronic Mail (1L):
POP3, SMTP.

Module II-9L

HTML (3L):
Introduction, Editors, Elements, Attributes, Heading, Paragraph. Formatting, Link, Head, Table, List, Block, Layout, CSS. Form, Iframe, Colors, Colorname, Colorvalue.

Image Maps (1L):
map, area, attributes of image area.

Extensible Markup Language (XML) (4L):
Introduction, Tree, Syntax, Elements, Attributes, Validation, Viewing. XHTML in brief.

CGI Scripts (1L):
Introduction, Environment Variable, GET and POST Methods.

Module III-10L

PERL (3L):
Introduction, Variable, Condition, Loop, Array, Implementing data structure, Hash, String, Regular Expression, File handling, I/O handling.

JavaScript (4L):
Basics, Statements, comments, variable, comparison, condition, switch, loop, break. Object – string, array, Boolean, reg-ex. Function, Errors, Validation.

Cookies (1L):
Definition of cookies, Create and Store a cookie with example.

Java Applets (2L):
Container Class, Components, Applet Life Cycle, Update method; Parameter passing applet, Applications.

Module IV-4L

Client-Server programming In Java (2L): Java Socket, Java RMI.

Threats (1L):
Malicious code-viruses, Trojan horses, worms; eavesdropping, spoofing, modification, denial of service attacks.

Network security techniques (2L):
Password and Authentication; VPN, IP Security, security in electronic transaction, Secure Socket Layer (SSL), Secure Shell (SSH).

Firewall (1L):
Introduction, Packet filtering, Stateful, Application layer, Proxy.

Module v-5L
Internet Telephony (1L):
Introduction, VoIP.

Multimedia Applications (2L):
Multimedia over IP: RSVP, RTP, RTCP and RTSP. Streaming media, Codec and Plugins, IPTV.

Search Engine and Web Crawler (2L):
Definition, Meta data, Web Crawler, Indexing, Page rank, overview of SEO. Reference:

1. Web Technology: A Developer's Perspective, N.P. Gopalan and J. Akilandeswari, PHI Learning, Delhi, 2013. (Chapters 1- 5,7,8,9).
2. Internetworking Technologies, An Engineering Perspective, Rahul Banerjee, PHI Learning, Delhi, 2011. (Chapters 5,6,12)

Microelectronics & VLSI Design CS705B
Contracts: 3L Credits- 3 36L

Module	Content	Hour
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, General purpose, ASIC, PLA, FPGA), Design principles (Digital VLSI – Concept of Regularity, Granularity etc), Design Domains (Behavioral, Structural, Physical), Y-Chart, Digital VLSI Design Steps.	6
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:** Body effect. **Four Terminal MOS Transistor**: Drain current, I-V characteristics. Current-voltage equations (simple derivation). **Scaling in MOSFET**: Short Channel Effects, General scaling, Constant Voltage & Field scaling.] **CMOS**: CMOS inverter, Simple Combinational Gates - NAND gate and NOR Gate using CMOS.	10
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	10

	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.	
4	**Hardware Description Language** – VHDL or Verilog Combinational & Sequential Logic circuit Design.	10

Text Books:

1. Digital Integrated Circuit, J.M.Rabaey, Chandrasan, Nicolic, Pearson Education.
2. CMOS Digital Integrated Circuit, S.M.Kang&Y.Leblebici, TMH.
3. Modern VLSI Design, Wayne Wolf, Pearson Education.
4. VHDL, Bhaskar, PHI.
5. Advance Digital Design Using Verilog , Michel D. Celliti, PHI

References:

1. Digital Integrated Circuits, Demassa& Ciccone, John Willey & Sons .
2. Modern VLSI Design: system on silicon, Wayne Wolf; Addison Wesley Longman Publisher
3. Basic VLSI Design, Douglas A. Pucknell& Kamran Eshranghian, PHI
4. CMOS Circuit Design, Layout & Simulation, R.J.Baker, H.W.Lee, D.E. Boyee, PHI

Control System CS705C

Contracts: 3L Credits- 3 36L

Module – I:

a) **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 [4L]

Module – I:

b) **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.

[4L]

Module – II:

a) **TIME RESPONSE ANALYSIS**

Standard test signals - Time response of first order systems – Characteristic Equation of Feedback control systems, Transient response of second order systems - Time domain specifications – Steady state response - Steady state errors and error constants.

[4L]

b) **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. [5L]

Module – III:

a)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. [5L]

b) : STABILITY ANALYSIS IN FREQUENCY DOMAIN

Polar Plots, Nyquist Plots Stability Analysis. [4L]

Module - IV :

a)CLASSICAL CONTROL DESIGN TECHNIQUES

Compensation techniques – Lag, Lead, Lead-Lag Controllers design in frequency Domain, PID Controllers. [5L]

b) STATE SPACE ANALYSIS OF CONTINUOUS SYSTEMS

Concepts of state, state variables and state model, derivation of state models from block diagrams, Diagonalization- Solving the Time invariant state Equations- State Transition Matrix and it's Properties – Concepts of Controllability and Observability

[5L]

TEXT BOOKS:

Automatic Control Systems 8th edition– by B. C. Kuo 2003– John Wiley and son's.,

2. Control Systems Engineering – by I. J. Nagrath and M. Gopal, New Age International

(P) Limited, Publishers, 2nd edition.

REFERENCE BOOKS:

1. Modern Control Engineering – by Katsuhiko Ogata – Prentice Hall of India Pvt. Ltd., 3rd edition, 1998.
2. Control Systems Engg. by NISE 3rd Edition – John Wiley

Modelling & Simulation CS705D

Contracts: 3L Credits- 3

Module-I: Introduction to Modelling and Simulation :

Nature of Simulation. Systems , Models and Simulation, Continuous and Discrete Systems, system modelling, Components of a simulation study, Introduction to Static and Dynamic System simulation , Application areas, Advantages ,Disadvantages and pitfalls of Simulation. **6L**

Module –II : 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. **10L**

Module-III : Simulation of Queuing Systems and Discrete System Simulation :

6.Compute Process and Product Metrics (e.g, Defect Density, Defect Age, Productivity,Cost etc.)>Also by Cost Estimation models.

Pattern Recognition Lab CS793A
Contracts: 3L Credits- 2

Efficient algorithms for nearest neighbour classification, Example problem on Bayes classifier, Decision tree construction.
Implementation of Linear Discriminant Function, Implementation of Support Vector Machine.

Soft Computing Lab CS793B
Contracts: 3L Credits- 2

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.
A sample assignment list is given below:

FUZZY LOGIC:

1. Write a Matlab program to implement the different Fuzzy Membership functions.
2. Write a Matlab program to implement Fuzzy set operations and its properties.
3. Write a Matlab code to implement composition of Fuzzy and Crisp Relations.
4. Write Matalab code to implement Fuzzy Information System (develop the system using command line and GUI based Fuzzy toolbox)

Neural network:

5. Write Matlab code to implement McCulloh-Pitts neural network for generate AND, OR functions.
6. Write Matlab code to implement Perceptron learning for particular set of problem.
7. Write Matlab code for OR function with bipolar inputs and targets using Adaline network.
8. Write Matlab code for XOR function with bipolar inputs and targets using Madaline network.
9. Write C program to implement McCulloh-Pitts model to generate AND, OR functions.

Genetic Algorithm

10. Write a Matlab code for maximizing F(x)=x2, , where x ranges from say 0 to 31 using Genetic Algorithm.
11. Use of Genetic Algorithm toolbox in matlab for optimization problem solving.
12. Implantation Simple Genetic Algorithm in C for solving optimization problem.

Artificial Intelligence Lab CS793C
Contracts: 3L Credits- 2
Assignments to be framed
Programming Languages such as PROLOG & LISP

Image Processing Lab CS793D
Contracts: 3L Credits- 2

1. Display of Grayscale Images.
2. Histogram Equalization.
3. Non-linear Filtering.
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.

Internet Technology Lab CS795A

Contracts: 3L Credits- 2

Applet

1. Create a banner using Applet
2. Display clock using Applet
3. Create different shapes using Applet
4. Fill colors in shapes using Applet
5. Goto a link using Applet
6. Create an event listener in Applet
7. Display image using Applet
8. Open a link in a new window using Applet
9. Play sound using Applet
10. Read a file using Applet
11. Write to a file using Applet JavaScript
12. Validate the fields of a form using JavaScript.
13. Guess a number based on user input.
14. Program on image rollover using JavaScript.
15. Display clock using JavaScript.
16. Prompt, alert, array, looping in JavaScript.
17. Calculator using JavaScript.
18. Validate e-mail, phone no. using reg-ex in JavaScript. Perl
19. Write a perl script to implement associative array.
20. Write a perl script to implement the regular expression as follows:

a). If a string contains any vowel, count the total number of vowels. b). If a string starts with MCA and end with bw, print 1 else 0.

c). If string starts with 0 or any no. a's, then print 1 else 0.

21. Write an html code to call a perl script from cgi-bin.
22. Implement the following with regular expression in Perl:

a). a*bc

b). a* at least 2 b's c). a*exactly 3 b's

23. A simple File operation using Perl.

8. Using frames as an interface, create a series of web pages where the theme is to provide resources (internet, intranet, static HTML pages) pertaining to the subject of HTML. Ideally, your goal is to create a resource that you can use long after this module when needing information on HTML. As a minimum requirement to this assignment your webpage should:

- Consist of at least 3 frames.
- Contain at least 5 URLs to internet and/or intranet sites that you can reference as part of your job.
- Contain at least 5 references to documents that you have created that you use on a regular basis.
- Contain at least 5 references to documents others have created that you use on a regular basis.
- Be organized in a fashion that is logical and intuitive to you.
- Is done with enough quality that you would not be opposed to it being a link at another site.

9. Create a web page as you wish and the html elements of the page will be styled by CSS.

XML

1. Write a XML program that will create an XML document which contains your mailing address.

2. Write a XML program that will create an XML document which contains description of three book category.

3. Create an XML document that contains the name and price per pound of coffee beans.
   i) In your XML document mention all properties of XML declaration.
   ii) The root element has name <coffee_bean>
   iii) Create nested elements for different types of coffee.
   iv) Validate the document and if any parsing error is present, fix them.

4. Create an XML document that contains airline flight information.
   i) In your XML document mention all properties of XML declaration.
   ii) The root element has name <airlines>
   iii) Create three nested <carrier> elements for three separate airlines. Each element should include a name attribute.
   iv) Within each <carrier> nest at least two <flight> ,each of which contains departure_city, destination_ city, fl_no, dept_time.
   v) Validate the document and if any parsing error is present fix them.

5. Create an XML version of your resume. Include elements such as your name and position desired. Nest each of your former employers within an <employer> element. Also, nest your educational experience within an <education> element. Create any other nested elements that you deem appropriate, such as <references> or <spcl_skills> elements.

6. Create a DTD on product catalog.

Contracts: 3L Credits- 2
To be Implemented..

Control System Lab CS795C
Contracts: 3L Credits- 2

Sl.No.	Name of the Experiment	Periods
□	Familiarization with MATLAB Control System tool Box, MATLAB-SIMULINK tool box &pSPICE.	3
□	Determination of step response for 1st order & 2nd order system with amity feedback on CRO & calculation of control system specifications for variations of system design.	3
□	Simulation of step response & impulse response for Type-I & Type-II system with unity feedback using MATLAB &pSPICE.	3
□	Determination of root locus, Bode-plot, Nyquist Plot, using MATLAB control system toolbox for a given 2nd order transfer function & determination of different control system specifications.	6
□	Determination of PI, PD, and PID controller action on 1st order simulated process.	3
□	Determination of approximate transfer function experimentally using Bode Plot.	3
□	Evaluation of steady-state error, setting time, percentage peak overshoots, gain margin, phase margin with addition of lead compensator in forward path transfer functions using MATLAB & pSPICE.	3
□	Study of position control system using servomotor.	3
□	Design and hardware implementation of a temperature controller using microprocessor/microcontroller.	6

Modelling & Simulation Lab CS795D
Contracts: 3L Credits- 2

In this laboratory the students will develop different simulation models. Students also may use any standard software to develop the models.(Using MATLAB?SCILAB/Any other simulation package)
A sample assignment list is given below:

1. Simulate CPU scheduling algorithm using queuing system a) FCFS b) SJF c) Priority Algo
2. Simulate congestion control algorithms.

VIII Semester

Theory

Organisational Behaviour

HU801A

Contracts: 2L

Credits- 2

1. Organizational Behaviour: Definition, Importance, Historical Background, Fundamental Concepts of OB, Challenges and Opportunities for OB. **[2]**
2. Personality and Attitudes: Meaning of personality, Personality Determinants and Traits, Development of Personality, Types of Attitudes, Job Satisfaction. **[2]**
3. Perception: Definition, Nature and Importance, Factors influencing Perception, Perceptual Selectivity, Link between Perception and Decision Making. **[2]**
4. Motivation: Definition, Theories of Motivation - Maslow's Hierarchy of Needs Theory, McGregor's Theory X & Y, Herzberg's Motivation-Hygiene Theory, Alderfer's ERG Theory, McClelland's Theory of Needs, Vroom's Expectancy Theory. **[4]**
5. Group Behaviour: Characteristics of Group, Types of Groups, Stages of Group Development, Group Decision Making. **[2]**
6. Communication: Communication Process, Direction of Communication, Barriers to Effective Communication. **[2]**
7. Leadership: Definition, Importance, Theories of Leadership Styles. **[2]**
8. Organizational Politics: Definition, Factors contributing to Political Behaviour. **[2]**
9. Conflict Management: Traditional vis-a-vis Modern View of Conflict, Functional and Dysfunctional Conflict, Conflict Process, Negotiation – Bargaining Strategies, Negotiation Process. **[2]**
10. Organizational Design: Various Organizational Structures and their Effects on Human Behaviour, Concepts of Organizational Climate and Organizational Culture. **[4]**

References:

1. Robbins, S. P. & Judge, T.A.: Organizational Behavior, Pearson Education, 15thEdn.
2. Luthans, Fred: Organizational Behavior, McGraw Hill, 12thEdn.
3. Shukla, Madhukar: Understanding Organizations – Organizational Theory & Practice in India, PHI
4. Fincham, R. & Rhodes, P.: Principles of Organizational Behaviour, OUP, 4thEdn.
5. Hersey, P., Blanchard, K.H., Johnson, D.E.- Management of Organizational Behavior Edn Leading Human Resources, PHI, 10th

Or

Project Management
HU801B
Contracts: 2L
Credits- 2

1. Project Management Concepts: Concept and Characteristicsof a Project, Importance of Project Management.**[1]**
2. Project Planning: Project Evaluation, Financial Sources, Feasibility Studies. **[4]**
3. Project Scheduling: Importance of Project Scheduling, Work Breakdown Structure and Organization Breakdown Structure, Scheduling Techniques – Gantt Chart and LOB, Network Analysis – CPM/PERT. **[6]**
4. Time Cost Trade-off Analysis – Optimum Project Duration. **[2]**
5. Resource Allocation and Leveling. **[2]**
6. Project Life Cycle. **[2]**
7. Project Cost – Capital & Operating Costs, Project Life Cycle Costing, Project Cost Reduction Methods. **[2]**
8. Project Quality Management: Concept of Project Quality, TQM in Projects, Project Audit. **[1]**
9. Software Project Charateristics and Mangement**[2]**
10. IT in Projects: Overview of types of Softwares for Projects, Major Features of Project Management Softwares like MS Project, Criterion for Software Selection. **[2]**

References

1. Gopalkrishnan P. and Rama Mmoorthy: Text Book of Project Management, Macmillan
2. Nicholas John M.: Project Management for Business and Technology – Principles and Practice, Prentice Hall India, 2nd Edn.
3. Levy Ferdinand K., Wiest Jerome D.: A Management Guide to PERT/CPM with GERT/PDM/DCPM and other networks, Prentice Hall India, 2nd Edn.
4. Mantel Jr., Meredith J. R., Shafer S. M., Sutton M. M., Gopalan M. R.: Project Management: Core Text Book, Wiley India, 1st Indian Edn.
5. Maylor H.: Project Management, Pearson, 3rd Edn.
6. Nagarajan K.: Project Management, New Age International Publishers, 5th Edn.
7. Kelkar. S.A, Sotware Project Management: A concise Study, 2nd Ed., PHI

Advanced Computer Architecture
CS801A
Contracts: 3L
Credits- 3

Computer Architecture and Organization-Review, Fundamentals of Computer Design, Technology Trends Cost Performance Analysis (3L)
Parallel Processing Architectures- Taxonomy- SISD, MISD, SIMD,MIMD, PRAM models (3L)
Data and Resource Dependencies, Program Partitioning and Scheduling, Control Flow vs. Data Flow (3L) Network topologies-Static, Dynamic, Types of Networks (3L)
RISC vs. CISC, Memory Hierarchy, Virtual Memory (4L)

Concepts of Pipelining, Instruction Pipelining, dynamic pipelining, arithmetic pipelines. (4L) Multiprocessors- Multistage Networks, Cache Coherence, Synchronization, Message- passing (4L) Vector Processing Principles- Instruction types, Compound, Vector Loops, Chaining (4L)
Array Processors- Structure, Algorithms (3L)
Data Flow Architecture- Graphs. Petri Nets, Static and Dynamic DFA, VLSI Computations (4L) Parallel Programming Models, Languages, Compilers (4L)

Books:
Computer Architecture and Parallel Processing- Kai Hwang and A. .Brigggs International Edition, McGraw Hill Advanced Computer Architecture: D. Sima, T. fountain, P. Kacsuk, Pearson
Parallel Computer Architecture: D. Culler, J.P.Singh, A.Gupta, Elsevier

Parallel Computing
CS801B
Contracts: 3L
Credits- 3

37L
Module I
Introduction.-Parallel Processing Environment- Pipelining and Data Parallelism, Scalability, Flynn's Taxonomy,. (3L) Parallel Processing organization- Mesh, Hyper-tree, Pyramid, Butterfly, Hypercube network (4L) **Module II**
Parallel Algorithms –Structure, cost, Analysis ;Elementary Algorithms: Broadcast, Prefix sums, All sums (4L) Algorithms on Selection problem, Merging-Odd-even merging network, CREW Merging, N-ary searching (6L)
Matrix Transposition ,Matrix Multiplications- 2D Mesh SIMD ,Hypercube SIMD, Shuffle-Exchange SIMD models. Discrete Fourier Transform, Fast Fourier Transform (6L)
Module III
Linear system of equations- Gaussian Elimination, Gauss-Seidel algorithm, Jacobi algorithm (3L) Sorting – Enumeration sort, Odd-even transposition sort, Bitonic merge
Ellis's Algorithm (3L)
Module IV
Graph Algorithms, Spanning Tree Algorithms, (4L)
Parallel Programming Languages –FORTRAN 90, OCCAM(4L)

Books for reference:

1. Parallel Computing –Theory and Practice -Michael J. Quinn (McGraw Hill Inc.)
2. Design and Analysis of Parallel Algorithms- S.G. Akl (PH)

Natural Language Processing
CS801C
Contracts: 3L
Credits- 3