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List of Abbreviations

<table>
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<tr>
<th>Sr. No.</th>
<th>Abbreviation</th>
<th>Stands for:</th>
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<tbody>
<tr>
<td>1</td>
<td>DEC</td>
<td>Departmental Elective Course</td>
</tr>
<tr>
<td>2</td>
<td>PSC</td>
<td>Professional Science Course</td>
</tr>
<tr>
<td>3</td>
<td>PCC</td>
<td>Program Core Course</td>
</tr>
<tr>
<td>4</td>
<td>LC</td>
<td>Laboratory Course</td>
</tr>
<tr>
<td>5</td>
<td>HSSC</td>
<td>Humanities and Social Science Course</td>
</tr>
<tr>
<td>6</td>
<td>MLC</td>
<td>Mandatory Learning Course</td>
</tr>
<tr>
<td>8</td>
<td>LLC</td>
<td>Liberal Learning Course</td>
</tr>
<tr>
<td>9</td>
<td>BSC</td>
<td>Basic Science Course</td>
</tr>
</tbody>
</table>
Program Educational Objectives (PEOs):
1. To create graduates with sound knowledge of fundamentals of computer science and technology, who can contribute towards advancing science and technology.
2. To create graduates with sufficient capabilities in computer science and scientific computing who can become researchers and developers to satisfy the needs of the core computer technology industry.
3. To develop among students ability to formulate, analyse and solve real life problems faced in software industry.
4. To provide opportunity to students to learn the latest trends in computer technology and make them ready for life-long learning process.
5. To make the students aware of professional ethics of the Software Industry, and prepare them with basic soft skills essential for working in community and professional teams.
6. To prepare the students for graduate studies through competitive examinations, enabling them to reach higher echelons of excellence.

Program Outcomes (POs):
a. Graduates will demonstrate basic knowledge in fundamentals of programming, algorithms and programming technologies and fundamentals of Computer Science.
b. Graduates will demonstrate knowledge of fundamentals of hardware technology relevant to understanding Computer Science basics.
c. Graduates will have knowledge of the best practices in software development in industry.
d. Graduates will demonstrate the ability to design creative solutions to real life problems faced by the industry.
e. Graduates will demonstrate capability to work in teams and in professional work environments.
f. Graduates will be able to communicate technical topics in written and verbal forms.
g. Graduates will demonstrate an understanding of the problems most relevant in time to Computer Engineering.
h. Graduates will demonstrate their ability to use the state of the art technologies and tools including Free and Open Source Software (FOSS) tools in developing software.
i. Graduates will demonstrate good performance at the competitive examinations like GATE, GRE, CAT for higher education.
j. Graduates will demonstrate their qualities of learning and demonstrating latest technology.
k. Graduates will have developed the capability for self-learning.
CURRICULUM STRUCTURE OF B.TECH (Information Technology)
Effective from A. Y. 2014-2015

**VII Semester**

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Course Type/ code</th>
<th>Course</th>
<th>Contact hours</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>OEC /SEC/HSSC</td>
<td>Open Elective/Science Elective/ Humanities Course</td>
<td>3</td>
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</tr>
<tr>
<td>02</td>
<td>PCC</td>
<td>Information Security</td>
<td>3</td>
<td>3</td>
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<tr>
<td>03</td>
<td>PCC</td>
<td>Software Testing and Quality Assurance</td>
<td>3</td>
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<td>04</td>
<td>DEC</td>
<td>DE – 3</td>
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<td>05</td>
<td>DEC</td>
<td>DE – 4</td>
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<td>06</td>
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<td>Information Security Lab</td>
<td>3</td>
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<td>07</td>
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<td>08</td>
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<td>09</td>
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<td>10</td>
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<td>11</td>
<td>LLC</td>
<td>Liberal Learning Course</td>
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**Department Elective - 3**
- **AUP**: Advanced UNIX Programming
- **S&V**: Storage and Virtualization
- **AI**: Artificial Intelligence
- **ADBMS**: Advanced Database Management Systems
- **IBA**: Introduction to Business Analytics

**Subjects in Association with Industries**

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Course Type/ code</th>
<th>Course</th>
<th>Contact hours</th>
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<tr>
<td>15</td>
<td>14</td>
<td>23</td>
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**Department Elective - 4**
- **HPC**: High Performance Computing
- **MAN**: Mobile and Ad-hoc Networks
- **IR**: Information Retrieval
- **FF**: Foundation of Finance
- **GTA**: Graph Theory and Applications

**Subjects in Association with Industries**

* **Open Elective**: Intermediate Programming Concepts And Tools
### VIII Semester

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Course Type/ code</th>
<th>Course</th>
<th>Contact hours</th>
<th>Credits</th>
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<td>OEC</td>
<td>Open Elective</td>
<td>L 3 T 3 P 3</td>
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<tr>
<td>02</td>
<td>DEC</td>
<td>DE – 5</td>
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<td>L 3 T 3 P 3</td>
<td>3</td>
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<td>04</td>
<td>LC</td>
<td>DE – 5 Lab</td>
<td>L 2 T 1 P 1</td>
<td>1</td>
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<tr>
<td>05</td>
<td>LC</td>
<td>DE – 6 Lab</td>
<td>L 2 T 1 P 1</td>
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<td>06</td>
<td>PCC</td>
<td>Project Work</td>
<td>L 18 T 9 P 9</td>
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<tr>
<td>07</td>
<td>MLC</td>
<td>Intellectual Property Rights</td>
<td>L 1 T 1 P 1</td>
<td>1</td>
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<td></td>
<td></td>
<td></td>
<td>L 10 T 22 P 21</td>
<td>21</td>
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**Departmental Elective – 5:**
CB: Computational Biology  
EC: E-commerce  
GIS: Geographical Information Systems  
NLP: Natural Language Processing  
CSFLP: Cyber Security, Forensics and Legal Perspective  
**Subjects in Association with Industries**

**Departmental Elective – 6:**
MT: Multicore Technologies  
WST: Web Systems and Technologies  
SDP: Software Design Patterns  
OR: Operations Research  
SA: System Administration
PCC : INFORMATION SECURITY

Teaching Scheme
Lectures : 3 hrs/week

Examination Scheme
100 marks: Continuous evaluation
   Assignment/Quizzes – 40 marks
   End Sem Exam - 60 marks

Unit 1
(6 Hrs)
Introduction
Need of security, attributes of security, Active vs. Passive attacks, OSI Security Architecture
Worms, viruses, Trojans, one time passwords, A Model for Network security, Classical
Encryption Techniques like substitution ciphers, Transposition ciphers, Steganography.

Unit 2
(6 Hrs)
Symmetric Key Encryption
Modular Arithmetic, Euclid’s Algorithm, Block ciphers, Stream ciphers, Data Encryption
Standard,AES, Triple DES, RC5, RC4 Stream cipher.

Unit 3
(6 Hrs)
Public Key Cryptography
Introduction to Number Theory, Fermat’s and Euler’s Theorem, The Chinese Remainder
Theorem, RSA, Key Distribution and Management, Diffie-Hellman Key Exchange, Elliptic Curve
Cryptography, Message authentication and hash functions, Hash Algorithms: MD5 message
digest algorithm, secure hash algorithm, RIPEMD-160, HMAC.

Unit 4
(6 Hrs)
Authentication and Email Security
Digital Signatures, Authentication Protocols, Digital Signature Standards, Kerberos, X.509
Authentication service, Pretty Good Privacy, S/MIME.

Unit 5
(6 Hrs)
IP and Web Security
Internetworking and Internet protocols: IPv4, IPv6, IP security Architecture, Authentication
Header, Encapsulating Security Payload, Key Management, Web Security Considerations, Secure

Unit 6
(6 Hrs)
System Security
Intruders, Intrusion Detection, Password Management, Viruses, Virus Countermeasures,
Firewalls, Firewall Design Principles, Trusted Systems.

Text Books:
- Charlie Kaufman, Radia Perlman and Mike speciner, “Network security, Private communication in a Public World”

Reference Books:
- Christopher M. King, “Security architecture, design deployment and operations”, Curtis
  patton and RSA Press.
  Asia.
Outcomes:
This course aims at

- Understand the need of information security to the students
- Comprehend the history of computer security and how it evolved into information security
- Understand the threats posed to information security and the more common attacks associated with those threats
- Understand the concept of developing encryption and decryption algorithms
- Understand the various techniques of encryption, key management in security and its importance

DE : SOFTWARE TESTING AND QUALITY ASSURANCE

Teaching Scheme
Lectures : 3 hrs/week

Examination Scheme
100 marks: Continuous evaluation-
Assignment/Quizzes – 40 marks
End Sem Exam - 60 marks

Unit 1
Quality Assurance
QA vs QC, Basics in Statistics and their applications, Different types of probability distributions and their applications

Unit 2
Measurements, Metrics and Benchmarking, Various Theories of Quality – Juran, Demming, Ishikawa, Taguchi, Shingo, Crosby, Tom Peters, Watts Humphrey leading to CMMi, Six Sigma, ISO 9000, Total Quality Management, ISO 9126 / 25000 models

Unit 3
Project Management, Project Planning, Quality Management, Configuration Management, Process Improvement
Software Maintenance: Importance to business, Advantages to individuals, Maintenance lifecycle, Static and Dynamic Analysis tools

Unit 4
Testing

Unit 5
Test Level, Test Types, Static Techniques, Test Design Techniques, Specification-based or Black-box Techniques, Structure based or White-box Techniques
Unit 6  

Test Management, Test Planning and Estimation, Test Progress Monitoring and Control, Configuration Management, Tool Support for Testing.

Text Books and Online References:

- Lecture Notes on Basics of Statistics, Jarkko Isotalo
- Thomas Pigoski,”SoftwareMaintnenance”,uhcl.edu/helm/SWEBOK_IEEE/data/swebok_chapter_06.pdf

Outcomes:
This course aims at

- To study fundamental concepts in software testing, including software testing objectives, process, criteria, strategies, and methods.
- To discuss various software testing issues and solutions in software unit test; integration, regression, and system testing.
- To learn how to planning a test project, design test cases and data, conduct testing operations, manage software problems and defects, generate a testing report.
- To expose the advanced software testing topics, such as object-oriented software testing methods, and component-based software testing issues, challenges, and solutions.
- To gain software testing experience by applying software testing knowledge and methods to practice-oriented software testing projects.
- To understand software test automation problems and solutions.
- To learn how to write software testing documents, and communicate with engineers in various forms.
- To gain the techniques and skills on how to use modern software testing tools to support software testing projects.
**DE : ADVANCED UNIX PROGRAMMING**

<table>
<thead>
<tr>
<th>Teaching Scheme</th>
<th>Examination Scheme</th>
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</thead>
<tbody>
<tr>
<td>Lectures : 3 hrs/week</td>
<td>100 marks: Continuous evaluation-</td>
</tr>
<tr>
<td></td>
<td>Assignment/Quizzes – 40 marks</td>
</tr>
<tr>
<td></td>
<td>End Sem Exam - 60 marks</td>
</tr>
</tbody>
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**Unit 1**  
(6 Hrs)

**Introduction:**  
Architecture of Unix OS, overview of file system, internal representation of files, Inodes, structure of Regular Files, Directories, data structures used for file handling.  
System Calls for File Handling: File Descriptors, open, creat, close, lseek, read, write, dup, fcntl, ioctl, stat, File Types, set-user-id, set-group-id, access permissions, access, umask, chmod, Sticky bit, chown, File Size, File truncation.

**Unit 2**  
(6 Hrs)

**Link and Directory Files:**  

**System Data Files and Information:**  
Introduction, Password File, Shadow Passwords, Group Files, Supplementary Group IDs, Login Accounting, System Identification, Time and Date Routines.

**Unit 3**  
(6 Hrs)

**UNIX Processes:**  
Context of a process, process states and Transitions, Environment of a UNIX Process main Function, Process Termination, Command-Line Arguments, Environment List, Memory Layout of a C Program, setjmp, longjmp,

**Process Control:**  
Processes Identifiers, fork, vfork, exit, wait, waitpid, Race Conditions, exec, Changing User IDs and Group IDs, Interpreter Files, system, Processes Accounting.

**Unit 4**  
(8 Hrs)

**Process Relationships:**  
Introduction, Terminal Logins, Network Logins, Process Groups, Sessions, Controlling Terminal, tcgetpgrp, tcsetpgrp, tcgetsid, Job Control, Shell Execution of Programs, Orphaned Process Groups,

**Daemon Processes:**  
Introduction, Daemon Characteristics, Coding Rules.

**Threads:**  
Concepts, Identification, Creation, Termination, Synchronization, Limits, Attributes.

**Unit 5**  
(8 Hrs)

**Signals:**  
Unit 6

(6 Hrs)

Interprocess Communication Pipe, popen, pclose, Coprocesses, FIFOs, System V IPC, Message Queues, Semaphores, Shared Memory, Sockets.

Text Books:

Reference Books:

Outcomes:
This course aims at
- Understand the role of Unix system calls as in files and internal data structures used by Unix.
- Able to identify the central role of concurrency in systems programming and produce programs which generate and control a process, establish relationship and communication between multiple processes.
- Learn the fundamentals of reliable signal handling and the related system calls.
- Develop short system utilities and applications using system calls.

DE : STORAGE AND VIRTUALIZATION

Teaching Scheme
Lectures : 3 hrs/week

Examination Scheme
100 marks: Continuous evaluation
Assignment/Quizzes – 40 marks
End Sem Exam - 60 marks

Unit 1
(8 Hrs)

Basic concepts for Systems and Storage
Storage Challenges and Issues- Data sources, challenges of data growth, availability, performance and managability requirements, data virtualization.

Unit 2
(6 Hrs)

Storage Hardware and SCSI Protocol,SAN, NAS, Fibre Channel and iSCSI
Storage Hardware Building Blocks - Device Types (Magnetic Disks, JBOD, SSD, Optical, WORM), HBA, switches, hubs, routers, GBIC . Introduction to various Storage Protocols- Serial, Parallel protocols. Overview of IDE, SAS, SATA, SCSI, FC, FCoE, iSCSI, Infiniband, FCP, FC-IP, iFCP, Fibre Channel Protocol Stack & Concepts- FC (Protocol stack, Exchange, Sequence, Frames,
Port types, Topologies, Login, FC-ID) Mapping Protocols - iSCSI, FCP- SCSI mapping to underlying transport, Connection Management, PDU, TOE.

Unit 3 (6 Hrs)
Storage Virtualization Concepts
Data Center End to End View- Overview of complete stack including Storage, Network, Host, Clustering, High Availability, Applications, Virtual Machines, Cloud Storage Storage Virtualization Basics- RAID levels, I/O stack, OS abstraction, Storage Pooling, Storage Provisioning, Online Grow/Shrink Storage Virtualization Advanced topics- Metadata management, Transaction consistency, I/O maps, I/O path considerations, Data consistency, Crash recovery, Application interfaces.

Unit 4 (8 Hrs)
Applications and Use Cases for Storage Virtualization
Data Replication- Off-host processing, RPO/RTO, Replication (sync, async, periodic, continuous), Snapshots Data Protection- Backup (full, incremental, differential, continuous), Restore, Archival, Compliance considerations.
Capacity Management- Storage provisioning, De-duplication, Thin provisioning, Storage Tiering, ILM, Data classification, Storage grid.

Unit 5 (8 Hrs)
Cloud Computing Basics
Characteristics of virtualized environments, taxonomy of virtualization techniques, virtualization cloud computing, Cloud Computing definition, basics, Cloud Architectures: basics, advanced, and specialized. Services and applications.

Unit 6 (8 Hrs)
Cloud Computing Advanced
Cloud Computing mechanisms, The MapReduce programming model, Benefits and challenges, Cloud resource management and scheduling: Transition management Cloud migration, Service management and SLAs, security, and monitoring, Cloud Platforms in industry, cloud applications.

Text Books:
- Storage Networks: The complete Reference. Robert Spalding TMH.
- Designing Storage Area Networks: A Practical Reference for Implementing Fibre Channel and IP SANs, Second Edition Publisher: Addison-Wesley Author: Tom Clark.

Reference Books:
Outcomes:
This course aims at
- This course is designed to introduce Introduction To Storage System, the fundamentals of Network Storage technologies, focusing on Storage Area Networks (SAN) and Network Attached Storage (NAS), Storage Related Services And Storage Grid.
- Understand the common terms and definitions of virtualization and cloud computing and be able to give examples.
- Understand the technical capabilities and business benefits of virtualization and cloud computing and how to measure these benefits.
- Describe the landscape of different types of virtualization and understand the different types of clouds.
- Understand the similarities and difference between cloud computing and outsourcing.

DE : ARTIFICIAL INTELLIGENCE

Teaching Scheme
Lectures : 3 hrs/week

Examination Scheme
100 marks: Continuous evaluation
Assignment/Quizzes – 40 marks
End Sem Exam - 60 marks

Unit 1
Introduction:

Unit 2
Heuristic search techniques:
Heuristic search, Hill Climbing, Best first search, mean and end analysis, Constraint Satisfaction, A* and AO* Algorithm, Knowledge Representation: Basic concepts, Knowledge representation Paradigms, Propositional Logic, Inference Rules in Propositional Logic, Knowledge representation using Predicate logic, Predicate Calculus, Predicate and arguments, ISA hierarchy, Frame notation, Resolution, Natural Deduction.

Unit 3
Logic Programming:
Introduction, Logic, Logic Programming, Forward and Backward reasoning, forward and Backward chaining rules.
Knowledge representation using non monotonic logic:
TMS (Truth maintenance system), statistical and probabilistic reasoning, fuzzy logic, structure knowledge representation, semantic net, Frames, Script, Conceptual dependency.

Unit 4
Learning:
What is Learning, Types of Learning (Rote, Direct instruction Analogy, Induction, Deduction)
Planning:
Block world, strips, Implementation using goal stack, Non linear planning with goal stacks, Hierarchical planning, Least commitment strategy.

Unit 5
Advance AI Topics

Unit 6
Neural Networks and Expert system
Introduction to neural networks and perception-qualitative Analysis, Neural net architecture and applications, Utilization and functionality, architecture of expert system, knowledge representation, two case studies on expert systems.

Text Books:
- Elaine Rich and Kerin Knight: “Artificial Intelligence.”
- Eugene, Charniak, Drew Mcdermott: “Introduction to artificial intelligence.”
- Kishen Mehrotra, Sanjay Rawika, K Mohan; “Artificial Neural Network.”

References:
- Rajendra Akerkar : “Introduction to Artificial Intelligence “,PHI Publication.

Outcomes:
This course aims at
- The student will learn the basics of the theory and practice of Artificial Intelligence as a discipline about intelligent agents capable of deciding what to do, and do it.
- The student will be introduced to Artificial Intelligence programming.
- The student will learn to apply knowledge representation techniques and problem solving strategies to common AI applications.
• The student will design simple software to experiment with various AI concepts and analyse results.
• The student will build self-learning and research skills to be able to tackle a topic of interest on his/her own or as part of a team.

DE : ADVANCED DATABASE MANAGEMENT SYSTEMS

Teaching Scheme
Lectures : 3 hrs/week

Examination Scheme
100 marks: Continuous evaluation-
Assignment/Quizzes – 40 marks
End Sem Exam - 60 marks

Unit 1
Parallel Databases
Introduction, I/O Parallelism, Inter-query and Intra-query Parallelism, Inter-operational and Intra-operational Parallelism, Design of Parallel systems.

Unit 2
Distributed Databases
Homogeneous and Heterogeneous databases, Storing data in distributed DBMS, Distributed catalog management.

Unit 3
Distributed Transactions
Distributed Transactions and Query processing, Distributed Concurrency and recovery.

Unit 4
Data Warehouse and OLAP
Introduction to Decision Support, Data Warehousing, Creating and maintaining a warehouse. OLAP: Multidimensional data Model, OLAP Queries, Database design for OLAP, Implementation Techniques for OLAP Bitmap Indexes, Join Indexes, Views and decision support, Top N Queries, Online Aggregation.

Unit 5
XML

Unit 6
Advanced Topics
Hadoop / Map Reduce, No SQL Databases
Text Books:

Reference Books:

Outcomes:
This course aims at
- Understand concept and working of parallel database system.
- Study different types of distributed databases.
- Analyze Distributed Transactions and Query processing.
- List and describe the key characteristics of a data warehouse.
- Identify other data models such as object-oriented model and XML model.
- Exploit Big Data platforms such as Hadoop and NoSQL databases.

DE : INTRODUCTION TO BUSINESS ANALYTICS

Teaching Scheme
Lectures : 3 hrs/week

Examination Scheme
100 marks: Continuous evaluation-
Assignment/Quizzes – 40 marks
End Sem Exam - 60 marks

Unit 1
Fundamental of Business Analytics

Unit 2
Descriptive Analytics

Unit 3
Predictive Analytics
Data Mining: The Scope of Data Mining, Data Exploration and Reduction, Classification, Classification Techniques, Association Rule Mining, Cause-and-Effect Modeling

Unit 4
Prescriptive Analytics
Linear Optimization: Building Linear Optimization Models, Implementing Linear Optimization Models on Spreadsheets, Solving Linear Optimization Models, Graphical Interpretation of Linear Optimization, Using Optimization Models for Prediction and Insight, Applications of Linear Optimization: Types of Constraints in Optimization Models

Unit 5
Making Decisions
Making Decisions with Uncertain Information, Decision Trees, The Value of Information, Utility and Decision Making, Case Study

Text Books:
• James R. Evans, “Business Analytics: Methods, Models, and Decisions”, Pearson 2012

Reference Books:

Outcomes:
This course aims at
• Describe and interpret the basic concepts of Business Analytics (BA).
• Describe basic principles of data mining as a basic tool of Business Analytics.
• Evaluate business problems and determine suitable analytical methods.
• Evaluate the difficulties presented by massive, opportunistic data.
• Plan, organize and evaluate methods to prepare raw data for business analytics, including partitioning data and imputing missing values.
• Compare and contrast different BA techniques.
• Interpret, analyze and validate the results.
• Synthesis the types of questions Business Analytics using data mining can be answered.
• Evaluate different methods of data mining and how they compare.
DE : HIGH PERFORMANCE COMPUTING

Teaching Scheme
Lectures : 3 hrs/week

Examination Scheme
100 marks: Continuous evaluation-
Assignment/Quizzes – 40 marks
End Sem Exam - 60 marks

Unit 1
Overview of High Performance Parallel Processing Architectures
Necessity of high performance, Constraints of conventional architecture, Parallelism in uni-
processor system, Evolution of parallel processors, Architectural Classification: Flynn’s
Taxonomy, Different models of parallel computers, Applications of parallel processing,
Instruction Level Parallelism and Thread Level Parallelism and differences, Types of parallelism,
Case studies: Intel Itanium Processor, Explicitly Parallel Instruction Computing (EPIC)
Architecture. Principles of scalable performance: Moore’s Law, Performance Metrics and
Measures, Speedup Performance Laws.

Unit 2
Pipeline and Superscalar Architectures
Principles and implementation of Pipelining, Classification of pipelining processors, General
pipelining reservation table, Design aspect of Arithmetic and Instruction pipelining, Pipelining
hazards and resolving techniques, Data buffering techniques, Job sequencing and Collision,
Advanced pipelining techniques, loop unrolling techniques, out of order execution, software
scheduling, trace scheduling, Predicated execution, Speculative loading, Register, Software
pipelining, Very Long Instruction Word (VLIW) processor, Case studies: Superscalar
Architecture- Pentium, Ultra SPARC, Recent advances in pipelining.

Unit 3
Vector and SIMD Architectures-Graphics Processing Units
Basic vector architecture, Issues in Vector Processing, Vector performance modeling, vectorizers
and optimizers, Case study: Cray Arch. SIMD Computer Organization Masking and Data network
mechanism, Inter PE Communication, Interconnection networks of SIMD, Static Vs Dynamic
network, cube hyper cube and Mesh Interconnection networks.
Case Study: Heterogeneous computing, CPU/GPU architecture comparison, GPU architecture
details, Data parallelism and SPMD programming model, High level overview of CUDA basics,
Strength and limitation of GPU.

Unit 4
Multiprocessor Architectures
Loosely and Tightly coupled multiprocessors, Processor characteristics of multiprocessors, Inter
Processor communication network, Time shared bus, Crossbar switch, Multiport Memory Model,
Memory contention and arbitration techniques.
Cache coherency and bus snooping, Massively Parallel Processors (MPP), Case Study of IBM
Power4 Processor, Inter Processor Communication and Synchronization.
Unit 5
Multithreaded Architectures
Multithreaded processors, Latency hiding techniques, Principles of multithreading, Issues and solutions.
Parallel Programming Techniques: Shared Memory Programming, PThreads in shared memory systems, Data Parallel Programming, Message passing program development, Synchronous and asynchronous message passing, Message passing parallel programming.

Unit 6
Parallel Programming Environments and related Issues
Classification of parallel algorithms, Parallel algorithms for multiprocessors, Performance of parallel algorithms, Message passing libraries for parallel programming interface, Parallel Virtual Machine (in distributed memory system), Message Passing Interfaces (MPI), OpenMp shared Memory programming, Parallel Algorithm examples: Matrix Multiplication, Sorting, Parallel Programming Languages; Occam, C-Linda.
Cluster: COW’s and NOW’s (Cluster and Network of Workstations), Different ways of building a cluster.

Text Books:

Reference Books:

Outcomes:
This course aims at
- Understanding the design issues in advanced computer architectures.
- Different Parallel Programming environments.
- Understanding the fundamentals of high performance computing and their need.
- Understanding and differences between different paradigms: Shared memory, message passing.
- Use of the programming environment like pthreads, openMp and MPI, CUDA.
- Use of parallel programming benchmarks and performance measurements.
- Understanding the basics of Cluster and cluster building steps.
DE : MOBILE AND AD-HOC NETWORKS

Teaching Scheme
Lectures : 3 hrs/week

Examination Scheme
100 marks: Continuous evaluation-
Assignment/Quizzes – 40 marks
End Sem Exam - 60 marks

Unit 1
Introduction
Fundamentals of Wireless Communication Technology, Characteristics of the Wireless Channel,
Multiple Access Techniques, IEEE 802 Networking Standard, Wireless LANs and PANs, IEEE
802.11 Standard, IEEE 802.16 Standard, Bluetooth, HomeRF.

Unit 2
Cellular Wireless Networks And Wireless Internet
The Cellular Concept, Cellular Architecture, First-Generation Cellular Systems, Second-
Generation Cellular Systems, Third-Generation Cellular Systems, Wireless in Local Loop,
Wireless ATM, Wireless Internet, What is Wireless Internet, Mobile IP, TCP in Wireless Domain,
WAP, Optimizing Web Over Wireless.

Unit 3
Introduction To Ad-Hoc Networks
Introduction to Ad-hoc networks, characteristics, applications, Issues in Ad Hoc Wireless
Networks Medium Access Protocols: design issues, goals and classification. Contention based
protocols- with reservation, scheduling algorithms, protocols using directional antennas. IEEE
Standards: 802.11a, 802.11b, 802.11g, 802.15. HIPERLAN

Unit 4
Routing Protocols For Ad-Hoc Networks
Design issues, goals and classification. Proactive Vs reactive routing, Unicast routing algorithms,
Multicast routing algorithms, hybrid routing algorithm, Energy aware routing algorithm,
Hierarchical Routing, QoS aware routing

Unit 5
Other Features Of Ad-Hoc Networks

Unit 6
Wireless Sensor Networks
Text Books:
- C.Siva Ram Murthy and B.S.Manoj, Ad hoc Wireless Networks Architectures and protocols, 2nd edition, Pearson Education. 2007

Reference Books:

Outcomes:
This course aims at
- Have an understanding of the principles of mobile ad hoc networks and what distinguishes them from infrastructure-based networks.
- Have an understanding of the principles and characteristics of wireless sensor networks.
- Be able to understand how routing protocols function and their implications on data transmission delay and bandwidth consumption.
- Be familiar with the mechanisms for implementing security, transport layer and energy efficiency in MANETs.

DE : INFORMATION RETRIEVAL

Teaching Scheme
Lectures : 3 hrs/week

Examination Scheme
100 marks: Continuous evaluation - Assignment/Quizzes – 40 marks
End Sem Exam - 60 marks

Unit 1
Introduction
Data Retrieval Vs Information Retrieval, Goals and history of IR, The impact of the web on IR, The role of AI in IR, Applications of IR, Basic Models of IR: Boolean and vector-space retrieval models, ranked retrieval, weighting, cosine similarity.

Unit 2
Automatic Text Analysis and Classification
How the text of a document is represented inside a computer, Automatic classification methods in general and then takes a deeper look at the use of these methods in information retrieval.

Unit 3
File Structures and Search Strategies
File Structures from the point of view information retrieval, Search strategies when applied to document collections structured in different ways, Use of feedback.
Unit 4
Probabilistic Retrieval and Evaluation
Formal model for enhancing retrieval effectiveness by using sample information about the frequency of occurrence and co-occurrence of index terms in the relevant and non-relevant documents, Traditional view of measurement of effectiveness, theory of evaluation.

Unit 5
Multimedia IR and Digital Libraries
Models and languages, Including MULTOS and SQL3, Libraries and Bibliographical Systems, digital libraries, online systems and public access catalogs, Challenges for effective deployment of digital libraries.

Unit 6
Parallel and distributed IR and Searching the Web
Algorithms and architectures, Parallel computing, performance measure MIMD, SIMD Architectures, Distributed IR Collection Partitioning, Source Selection, Query Processing searching the web, challenges, characterizing the web, Search Engines, Ranking, Web crawlers.

Text Books:

Outcomes:
This course aims at
- Understand and discuss current issues and research in searching and information retrieval.
- Appreciate the capabilities and limitations of information retrieval systems.
- Identify search concepts in an information request.
- Identify and exploit characteristics of reference and source databases and search systems for effective searching.
- Identify and discuss problems, issues, and future developments in information retrieval.
DE : FOUNDATIONS OF COMPUTATIONAL FINANCE

Teaching Scheme
Lectures : 3 hrs/week

Examination Scheme
100 marks: Continuous evaluation-
Assignment/Quizzes – 40 marks
End Sem Exam - 60 marks

Unit 1 (6 Hrs)
Financial Institutions: Functioning of financial institutions such as investment banks, brokerage houses, commercial banks, Insurance companies and employee benefit companies.

Unit 2 (4 Hrs)

Unit 3 (8 Hrs)
Introduction to Stocks, Futures and Options; Trading strategies involving options.

Unit 4 (6 Hrs)

Unit 5 (4 Hrs)
Introduction to Portfolio Theory and Capital Asset Management.

Unit 6 (8 Hrs)
Introduction to Time Series Analysis and Stochastic Calculus

Text Books:

Reference Books:
- Sheldon M. Ross, Stochastic Processes, Wiley India, ISBN 13 9788126517572
Outcomes:
This course aims at
- Introducing basics of finance
- Introducing the financial markets and financial institutions
- Studying valuation concepts and capital budgeting
- Introducing portfolio theory
- Introducing basics of mathematics of finance – time series analysis and stochastic calculus
- This course will prepare students to
  - work in software companies in finance domain
  - explore ‘finance’ as career and/or higher study option

DE : GRAPH THEORY AND APPLICATIONS

Teaching Scheme
Lectures : 3 hrs/week

Examination Scheme
100 marks: Continuous evaluation
Assignment/Quizzes – 40 marks
End Sem Exam - 60 marks

Unit 1 (2 Hrs)
Definitions of terms such as graph, vertex set, edge set, connected graphs, bipartite graphs, trees, path, cycle, graphic sequences etc.

Unit 2 (6 Hrs)
Paths, Cycles, Trees: Definitions and fundamental theorems related to these concepts.

Unit 3 (8 Hrs)
Matchings: perfect matching, matching in bipartite graphs, Berge’s theorem, Hall’s theorem, Konig-Egervary theorem, general matchings.

Unit 4 (8 Hrs)
Cuts and Connectivity, Flows in Directed Graphs, Connectivity and Menger’s Theorem, Edge-Connectivity, Blocks,K-connected Graphs and k-edge-connected Graphs, 2-connected Graphs, Applications of Menger’s Theorem.

Unit 5 (6 Hrs)
Independence and coloring: Brooks' theorem, Coloring maps, Greedy coloring algorithm Coloring edges - Vizing’s Theorem.

Unit 6 (6 Hrs)
Graph Algorithms: Discussion on implementation of algorithms related to matchings, network flows, connectivity, coloring etc.

Text Books:
- Reinhard Diestel, Graph Theory, Springer (India) Pvt. Ltd., ISBN-13 9788184890853
Reference Books:
- Bela Bollobas, Modern Graph Theory, Springer, ISBN 139788181283092

Outcomes:
This course aims at
- Introducing terminology of graph theory
- Studying fundamentals theorems in graph theory related to matching, coloring, connectivity etc
- Studying design and implementation of graph algorithms
- This course will expose students to different aspects of graph theory which would be useful in higher studies, research and working in different domains

DE : INFORMATION SECURITY LAB

Teaching Scheme
Lectures : 2 hrs/week

Examination Scheme
Term Work – 50 marks
Practical –50 marks

List of Assignments:
1. Write a program to find an IP address of a remote system.
2. Write a program to detect a Remote Firewall
3. Install a Proxy server and configure an application Gateway
4. Install, Configure and study a Intrusion detection system (IDS).
5. Implementation of MD5 hashing Technique.
7. Implementation of DES.
9. Implementation of email security using PGP( create yourself a 1024 bit PGP key. Use your name and email address for your key label. Use PGP to verify the signature on this assignment.)
10. Design an experiment to estimate the amount of time to
    Generate key pair (RSA)
    Encrypt n bit message (RSA)
    Decrypt n bit message (RSA)
    As function of key size, experiment with different n-bit messages. Summarize your conclusion.

Outcomes:
This course aims to
- Implementing the cryptographic algorithms using the language they have studied
- Demonstrate the practical importance of Information Security
- Analyze the implementations for time required to generate keys and encryption/decryption process also various possible attacks
- Installing and configuring the proxy server and IDS
DE : SOFTWARE TESTING AND QUALITY ASSURANCE LAB

Teaching Scheme
Lectures : 2 hrs/week

Examination Scheme
Term Work – 50 marks
Practical – 50 marks

List of Assignments:
11. Perform Verification & Validation & associated umbrella activities related to testing. Write the test cases for User Authentication for any application. The requirement is username should not be less than or equal to 7 characters. Valid password should be considered as combination of special characters, numbers, capital & small letters.
12. Write Master Test Plan for the system with sufficient complexity.
13. Discuss different testing strategies. Apply two suitable white box testing techniques.
14. Write test cases for intended functionality first i.e. for valid conditions according to requirements. Then write test cases for invalid conditions. This will cover expected as well unexpected behavior of application under test(AUT).
15. Identify and group test cases to perform regression testing.
16. Perform Black box testing for all the units contained in the architectural segments. Apply two suitable black box testing techniques. Prove the functionality with proper justification.
17. Applications requiring critical response time should be thoroughly tested for performance.

Outcomes:
This course aims to
- Students have an ability to apply software testing knowledge and engineering methods.
- Have an ability to design and conduct a software test process for a software testing project.
- Have an ability to identify the needs of software test automation, and define and develop a test tool to support test automation.
- Have an ability understand and identify various software testing problems, and solve these problems by designing and selecting software test models, criteria, strategies, and methods.
- Have an ability to use various communication methods and skills to communicate with their teammates to conduct their practice-oriented software testing projects.
- Have basic understanding and knowledge of contemporary issues in software testing, such as component-based software testing problems.
- Have an ability to use software testing methods and modern software testing tools for their testing projects.
DE : ADVANCED UNIX PROGRAMMING LAB

Teaching Scheme
Lectures : 2 hrs/week

Examination Scheme
Term Work – 50 marks
Practical – 50 marks

List of Assignments:
1. Exercise on using the system calls for regular files.
2. Exercises on using system calls on file attributes, symbolic links.
3. Exercises on using system calls on directory and device files.
4. Exercises on using system calls on process control.
5. Exercises on using system calls on exec and session.
6. Exercises on using system calls on signal.
7. Exercises on using system calls on sigaction, sigsetjmp.
8. Exercises on using system calls on IPC – pipe.

Text Book:

Outcomes:
This course aims to
- Have hands-on experience on developing utilities using system calls and testing with open-source operating system.

DE : STORAGE AND VIRTUALIZATION LAB

Teaching Scheme
Lectures : 2 hrs/week

Examination Scheme
Term Work – 50 marks
Practical – 50 marks

List of Assignments:
1. Setting Up an NFS Server.
2. Setting up an NFS Client.
3. Running IO over NFS share.
4. Create a Public Share on Samba.
5. Running IO over Samba share.
6. Implement FUSE.
7. Implement LoggedFS.
8. Implement TrueCrypt.
9. Implement EncFS.
Outcomes:
This course aims to

- This course is designed to introduce Introduction To Storage System, the fundamentals of Network Storage technologies, focusing on Storage Area Networks (SAN) and Network Attached Storage (NAS), Storage Related Services And Storage Grid.
- Understand the common terms and definitions of virtualization and cloud computing and be able to give examples.
- Understand the technical capabilities and business benefits of virtualization and cloud computing and how to measure these benefits.
- Describe the landscape of different types of virtualization and understand the different types of clouds.
- Understand the similarities and difference between cloud computing and outsourcing.

DE : ARTIFICIAL INTELLIGENCE LAB

Teaching Scheme
Lectures : 2 hrs/week

Examination Scheme
Term Work – 50 marks
Practical – 50 marks

List of Assignments:
1. Implement A* algorithm.
2. Implement AO* algorithm.
4. Implementation of Truth maintenance system using prolog.
5. Implementation of Min/Max search procedure for game Playing.

Outcomes:
This course aims to

- The student will learn the basics of the Artificial Intelligence as a discipline about intelligent agents capable of deciding what to do, and do it.
- The student will be introduced to Artificial Intelligence programming.
- The student will learn to apply knowledge representation techniques and problem solving strategies to common AI applications.
- The student will design simple software to experiment with various AI concepts and analyse results.
- The student will build self-learning and research skills to be able to tackle a topic of interest on his/her own or as part of a team.
DE : ADVANCED DATABASE MANAGEMENT SYSTEMS LAB

Teaching Scheme
Lectures : 2 hrs/week

Examination Scheme
Term Work – 50 marks
Practical – 50 marks

List of Assignments:
1. Assignment on implement fragmentation of database.
2. Assignment to implement Relational operation sort-merge join algorithm.
3. Design and Implement Web Based database using ASP/JSP/PHP.
4. Implementation of packages, procedures, functions, cursors and trigger in PL/SQL.
5. Exercises based on XML (Xml Schema, DTD, XSL Stylsheet).
6. Assignment using Hadoop/ Mapreduce.
7. Assignment on OLAP.
8. Design and Implement a small application for Android Tablet.

Outcomes:
This course aims to
- Understand creating and maintaining a data warehouse.
- Connect high level programming language with database through JDBC.
- Design client/server model for database application.
- Design object-oriented model and XML model.
- Implementation of Android based application.
- Analysis of Big Data.
- Implement parallel and distributed database concepts.

DE : INTRODUCTION TO BUSINESS ANALYTICS LAB

Teaching Scheme
Lectures : 2 hrs/week

Examination Scheme
Term Work – 50 marks
Practical – 50 marks

List of Assignments:
1. List down various applications (min 5) of Analytics and give a case study from any domain in a group of two students.
2. Find out a problem definition and give a solution using any of the analytics technique which is relevant to that problem.
3. Prepare and give a presentation on the above assignments.

Outcomes:
This course aims to
- Describe and interpret the basic concepts of Business Analytics (BA).
- Describe basic principles of data mining as a basic tool of Business Analytics.
- Evaluate business problems and determine suitable analytical methods.
- Evaluate the difficulties presented by massive, opportunistic data.
Plan, organize and evaluate methods to prepare raw data for business analytics, including partitioning data and imputing missing values.
Compare and contrast different BA techniques.
Interpret, analyze and validate the results.
Synthesis the types of questions Business Analytics using data mining can be answered.
Evaluate different methods of data mining and how they compare.

DE : HIGH PERFORMANCE COMPUTING LAB

Teaching Scheme
Lectures : 2 hrs/week

Examination Scheme
Term Work – 50 marks
Practical – 50 marks

List of Assignments:
2. Study of Cluster building steps - MPI Cluster setup.
3. Program to execute gather and scatter operation using MPI routines.
4. Program to execute Sorting algorithm using MPI routines.
5. Program to execute Matrix Operations using MPI.
6. Case Study of GPU Architecture with CUDA.
7. Program to execute matrix multiplication using CUDA on GPU.
8. Program to understand shared memory paradigm using pthreads.
10. Study of parallel programming languages Occam, C-Linda.

Outcomes:
This course aims to
- Understanding the different benchmarks used in HPC.
- Understanding the difference in Shared Memory and Message Passing programming.
- Use of data parallel architecture and programming using GPU.
- Understanding the building blocks of cluster setup.
DE : MOBILE AND AD-HOC NETWORKS LAB

Teaching Scheme
Lectures : 2 hrs/week

Examination Scheme
Term Work – 50 marks
Practical – 50 marks

List of Assignments:
1. Set up an infrastructure wireless network consisting of multiple nodes and an access point. observing IEEE 802.11 traffic
2. Configure an ad hoc network, measure the throughput.
4. Configure Bluetooth piconets and analyse the interference with 802.11.
5. Configure the Mobile IP

Outcomes:
This course aims to
- Familiarize with the wireless devices
- Understand the configure and operation of infrastructure wireless networks, adhoc wireless networks, Bluetooth and Mobile IP
- Conduct simulations using network simulator

DE : INFORMATION RETRIEVAL LAB

Teaching Scheme
Lectures : 2 hrs/week

Examination Scheme
Term Work – 50 marks
Practical – 50 marks

List of Assignments:
1. To implement Conflation Algorithm.
2. Assignments based on classification.
3. To implement a program for graphic theoretic method for Clustering.
4. To implement a program Retrieval of documents using Cluster based search strategies.
5. Assignments based on Multimedia IR.
6. Assignments based on Digital Libraries.
7. Assignment based on Web search Engine.

Outcomes:
This course aims to
- Understand and discuss current issues and research in searching and information retrieval.
- Appreciate the capabilities and limitations of information retrieval systems.
- Identify search concepts in an information request.
- Identify and exploit characteristics of reference and source databases and search systems for effective searching.
- Identify and discuss problems, issues, and future developments in information retrieval.
DE : FOUNDATIONS OF COMPUTATIONAL FINANCE LAB

Teaching Scheme
Lectures : 2 hrs/week

Examination Scheme
Term Work – 50 marks
Practical –50 marks

List of Assignments:
1. Write a program for return calculations in R.
2. Write a program to compute optimized portfolios using R functions.
3. Analyze Time Series using R.

Tutorials:
1. Give a brief overview of R for financial computation.
2. Explain financial statement analysis with examples. Explore freely available tools for the same.

Outcomes:
This course aims to
- Introducing basics of finance
- Introducing the financial markets and financial institutions
- Studying valuation concepts and capital budgeting
- Introducing portfolio theory
- Introducing basics of mathematics of finance – time series analysis and stochastic calculus
- This course will prepare students to
  o Work in software companies in finance domain
  o Explore ‘finance’ as career and/or higher study option

PCC : GRAPH THEORY AND APPLICATIONS LAB

Teaching Scheme
Lectures : 2 hrs/week

Examination Scheme
Term Work – 50 marks
Practical –50 marks

List of Assignments:
(To be done in any higher level language such as Java/C++/C or a scripting language such as Python)
1. Decide whether a given degree sequence is graphical (that is, it corresponds to a simple graph)
2. Find out if the given graph is connected and also decide the number of connected components in the graph.
3. Find all directed circuits in a digraph.
4. Given a connected even graph G and a specified vertex u of G, find an Euler tour of G starting (and ending) at u using BFS (Breadth First Search) method
5. Find either a bipartition or an odd cycle in a given graph.
6. Find a maximal matching in a bipartite graph.
7. Color a graph using greedy method so that at most \((\Delta+1)\) colors are used (\(\Delta\) represents maximum degree of the graph).

8. Implement Ford-Fulkerson algorithm to compute maximum flow in a flow network

**Outcomes:**
These assignments will enable the students to
- Understand the nitty-gritty of some basic algorithms in Graph Theory
- Understand the implementation issues (such as choosing appropriate data structures, writing modular code etc) related to implementation of complex algorithms
- Get more proficiency in the language used for implementation

**OE : INTERMEDIATE PROGRAMMING CONCEPTS AND TOOLS**

<table>
<thead>
<tr>
<th>Teaching Scheme</th>
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<tr>
<td>Lectures: 2 hrs/week</td>
<td>100 marks: Continuous evaluation-</td>
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<td>Assignment/Quizzes – 40 marks</td>
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<td>End Sem Exam - 60 marks</td>
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**Unit 1**
**Introduction:**
Role of programming, need to study programming, applications of computer programming in industry.
Types of programming languages and paradigms.

**Unit 2**
**A review of fundamentals:**
What is algorithm, flowchart, binary numbers. Straight line code, Expressions and their types,
Decisions and conditional statements, Loops. Input-Output statements.
**Procedures:** Procedure call and return, recursive subprogram, Different parameter passing methods,
Scope, lifetime and visibility, Storage management (static and Dynamic), Exceptions and exception handling.
Modularity and reusability using procedures. Use of libraries and header files. Complex data types and moving towards object-orientation.

**Unit 3**
**Object Oriented Programming:** Design Principles: Objects, classes, Messages and methods,

**Unit 4**
**Object oriented programming with Java/Python/C++:** Program structure, Object and class declarations, constructors, inheritance, polymorphism, access specification, interfaces, packages, exception handling, I/O.
Unit 5


**Correctness:** Pragmatic and theoretical tests for correctness. Good programming practices. Debugging. Case studies.

Unit 6

**Introduction to concurrent programming:** Basic concepts of Concurrent Programming: processes, synchronization primitives, safety and liveliness properties, Parallelism in Hardware, streams, concurrency as interleaving, safe access to shared data.

**Text Books:**
- Cornell and Horstman, "Core Java vol 1", Prentice Hall

**Reference Books:**
- M. Ben Ari, "Principles of Concurrent Programming, 1989
- Seirra, Freeman, Bates "Head first design patterns". O’reilly

**Outcomes:**
This course aims at
- Revision of the Fundamentals of Computer Programming, for students from non-computing branches.
- To understand the different programming paradigms with special focus on Object Oriented programming.
- To get a feel of learning a new computing language based on general principles.
- To understand and practice good programming practices.
- To become familiar with debugging and program performance.
- To become familiar with fundamentals of program and application design.
DE : COMPUTATIONAL BIOLOGY

### Teaching Scheme

Lectures : 3 hrs/week

### Examination Scheme

100 marks: Continuous evaluation - Assignment/Quizzes – 40 marks
End Sem Exam - 60 marks

### Unit 1

(5 Hrs)
Computational Biology: Introduction, Scope, Objectives, Course Plan discussion
Biology Introduction: Cell, Nucleus, Genes, DNA, RNA, Proteins, Chemical Structure of DNA, RNA, Transcription and Translation Process.

### Unit 2

(5 Hrs)
Introduction to Bioinformatics: Protein Structure and Functions, Nature of Chemical Bonds
Molecular Biology tools, Polymerase chain reaction, Genomic Information Content.

### Unit 3

(7 Hrs)
Sequence Alignment: Simple alignments, Gaps, Scoring Matrices, Global and Local Alignments, Smith-Waterman Algorithm, Database Searches, BLAST and its relatives, FASTA and related Algorithms, Multiple sequence Alignments.

### Unit 4

(8 Hrs)

### Unit 5

(7 Hrs)
Phylogenticus: Neighbor’s relation method, Neighbor-joining method, Maximum likelihood Approaches, Multiple Sequence Methods
Structural Biology: Sequence, organisms, 3D structures, complexes, Assemblies, Cell structures Protein Structure, Amino acids, Nucleotides, Cysteine and disulphides, Peptide Units, Primary, Secondary, Tertiary, Quaternary Amino Acids, RNA Structure prediction, Case Studies, examples.

### Unit 6

(6 Hrs)
Next Gen Sequencing: Massively Parallel Signature Sequencing (MPSS)
Polony sequencing, SOLiD sequencing, DNA nanoball sequencing, Heliscope single molecule sequencing, Single molecule real time (SMRT) sequencing
Text Books:

Reference Books:

Outcomes:
This course aims at
- Describe how networks, algorithms, and models are employed in computational biology.
- Describe how DNA and proteins are manipulated to generate information from sequences and whole genomes.
- Describe how biological processes can be modeled using computer programming.
- Provide examples of the use of mathematics and statistics in evolution and behavior.
- Describe the current applications of computational biology.

DE : E-COMMERCE

Teaching Scheme
Lectures : 3 hrs/week

Examination Scheme
100 marks: Continuous evaluation-
Assignment/Quizzes – 40 marks
End Sem Exam - 60 marks

Unit 1
(6 Hrs)
E-Commerce: Meaning, advantages & disadvantages

Unit 2
(6 Hrs)
Legal issues of e-commerce
Laws for E-commerce: EDI Interchange Agreement. E-commerce in India – Laws for E-commerce in India.

Unit 3
(6 Hrs)
Ethical and other public policy issues related to Electronic Commerce: Protecting privacy, protecting Intellectual property, Copyright, trademarks and patents, Taxation and encryption policies
Unit 4  (6 Hrs)
E-Commerce Business Models:

Unit 5  (6 Hrs)

Unit 6  (6 Hrs)

Text Books:
- Kenneth C. Lauden, Carol G. Traver, "E-Commerce", Perason Education.

Reference Books:

Outcomes:
This course aims at
- Comprehend the underlying economic mechanisms and driving forces of E-Commerce.
- Understand the critical building blocks of E-Commerce and different types of prevailing business models employed by leading industrial leaders.
- Appraise the opportunities and potential to apply and synthesize a variety of E-Commerce concepts and solutions to create business value for organizations, customers, and business partners.
- Formulate E-Commerce strategies that lever firms’ core competencies, facilitate organizational transformation, and foster innovation.
- Undertake planning, organizing, and implementing of E-Commerce initiatives to effectively respond to dynamic market environments.
DE : GEOGRAPHICAL INFORMATION SYSTEMS

Teaching Scheme
Lectures : 3 hrs/week

Examination Scheme
100 marks: Continuous evaluation-
Assignment/Quizzes – 40 marks
End Sem Exam - 60 marks

Unit 1 (8 Hrs)
Introduction: Introduction to GIS and Digital Geographic Data & Maps.
Introduction to Digital Geographic Data: Introduction to Geographic Information Systems, Spatial Measurement, Spatial Location and Reference, Spatial Patterns, Geographic Data Collection.

Unit 2 (6 Hrs)
Input, Storage and Editing
The Input Subsystem : Primary Data, Input Devices, Vector Input, Raster Input, Remote Sensing Data Input, GPS Data Input, Metadata and Metadata Standards.
Data Storage and Editing : Storage of GIS Databases, Detecting and Editing Errors of Different Types, Dealing with Projection Changes, Edge Matching, Rubber Shifting.

Unit 3 (7 Hrs)
Analysis
Elementary Spatial Analysis : GIS Data Query, Defining Spatial Characteristics, Working with Higher–Level Objectives Measurement : Measuring Length of Linear Objectives, Polygons, Shape and Distance Classification: Classification Principal, Elements of Reclassification, Neighborhood Functions, Roving Windows, Buffers Statistical Surfaces: Surface Mapping, Sampling the Statistical Surface, The DEM, Raster Surface, Interpolation, Terrain Reclassification, Slicing the Statistical Surface, Cut and Fill Spatial Arrangement Point, Line and Area Arrangement, Point Patterns, Thiessen Polygons, Area Patterns, Distance and Adjacency, Polygon Arrangement Measures, Linear Patterns, Directionality of Linear and Areal Objective, Connectivity of Linear Objects, Gravity Model, Routing and Allocation

Unit 4 (5 Hrs)
The Cartographic Overlay, Point-in-Polygon, Line-in-Polygon, Polygon Overlay, Automating the Overlay, Types of Vector Overlay, CAD-Type Overlay, Dasymetric Mapping
Cartographic Modeling: Model Components, The Cartographic Models, Types of Cartographic Models, Inductive and Deductive Modeling, Factor Selection, model Flowcharting, Model implementation, Model Verification

Unit 5 (5 Hrs)
GIS Output
Two Case Studies on GIS, GIS application areas Urban management, Land resources, Environment, Transportation, Facilities management , Commercial applications, Public services, e-Government

Text Books:
• Michael N DeMers, “Fundamentals of Geographic Information Systems”, Wiley India Education.

Reference Books:

Outcomes:
This course aims at
• Have a basic, theoretical and practical understanding of GIS, and Be able to work independently with various types of geographical data in GIS.

DE : NATURAL LANGUAGE PROCESSING

Teaching Scheme
Lectures : 3 hrs/week

Examination Scheme
100 marks: Continuous evaluation-
Assignment/Quizzes – 40 marks
End Sem Exam - 60 marks

Unit 1
Introduction
Basic text processing: Review of Regular Expressions and Automata, word tokenization, word normalization, word level morphology, stemming -Porters algorithm, sentence segmentation, edit distances.

Unit 2
POS Tagging
Introduction to parts of speech and POS tagging, rule based and stochastic taggers, POS tagsets, Hidden Markov Model and Viterbi algorithm.

Unit 3
Language Modeling
Introduction to N-gram, probability estimation for n-gram, evaluation and perplexity, smoothing techniques, Named-Entity recognition.
Unit 4  (6 Hrs)

Parsing
Syntactic structure, co-reference resolution, parsing, parsing algorithms, parsing in case of ambiguity; probabilistic parsing , the CKY algorithm, Issues in parsing.

Unit 5  (6 Hrs)
Semantics
Word Senses, word relations, word similarity and thesaurus methods, Word sense disambiguation, Knowledge base and supervised WSD , WordNet , Unsupervised based WSD.

Unit 6  (4 Hrs)
Applications
Information extraction, Question answering system, Summarization, Sentiment analysis.

Text Books and References:
- Chris Manning and Hinrich Schuetze, Foundations of Statistical Natural Language Processing, MIT Press.

Outcomes:
This course aims at
- To study fundamentals of Natural language processing.
- To make the students understand the necessity of natural language processing in building an intelligent system.
- To make the Students understand the ambiguities that arises in natural language processing.
- To make the student familiar with basic language processing operations like : Morphological analysis , Parts-of-Speech tagging, Lexical processing , Semantic processing, Knowledge representation .
- At the end of this course, the student should be able to do the following:
  - Design the processing steps required for a NLP task.
  - Implement the processing techniques.
DE : CYBER SECURITY, FORENSICS AND LEGAL PERSPECTIVE

Teaching Scheme
Lectures : 3 hrs/week

Examination Scheme
100 marks: Continuous evaluation-
Assignment/Quizzes – 40 marks
End Sem Exam - 60 marks

Unit 1
(6 Hrs)
Concept of Cyberspace & Netizens, Objective & Scope of the Information Technology Act, Comparisons between traditional criminal techniques and Cyber Crime, Public and Private Societies face challenges in addressing cybercrime, Computer Hardware, Networks and Internet: An Introduction.

Unit 2
(6 Hrs)

Unit 3
(6 Hrs)
Cyber crime & Computer-based electronic and Digital evidence : Indian law perspective, Procedure for search & Seizure, Best practices for cyber crime Investigations involving the Computer, Internet and Networks : E-mail, Websites, Chatrooms, file sharing, Network Intrusion/Denial of Services, Messages boards, password breaking, keyloggers, IP tracing, etc. Case studies.

Unit 4
(6 Hrs)
Introduction to cyber forensic, Forensic Examination of Computer-based electronic and digital evidence, Evidence- Assessment, Acquisition, Examination, Handling real world investigations: email account hacking, Profile hacking social Networking site, Credit card fraud, source code and confidential information theft, Piracy, pornography, virus attacks, etc. Detailed Procedures for Obtaining a Bitstream Backup of a Hard Drive, Evidence collection and analysis Tools and Case studies.

Unit 5
(6 Hrs)
IT Act.2000, Jurisdiction under the IT Act-Territorial and Extra-Territorial Jurisdiction of the IT Act 2000, Intellectual Property Right issues in Cyberspace, Concept of property in Cyberspace. Copyright and related issues, Issues relating to Trademarks and Domain names. Liability for Hyperlinking and Metatags, Domain Name Dispute Resolution Policy, Role of ICANN.

Unit 6
(6 Hrs)
Security Technologies : IDS, IPS, Firewall, Antivirus, Access Control, Encryption etc., Ethical Hacking
References:
- Mr. Vakul Sharma - Handbook of Cyber Laws.
- Justice Yatindra Singh - Cyber Laws.
- Dr. Sundeep Oberoi - E-Security and you.

Legislative Texts:

Outcomes:
This course aims at
- Understand the investigation process in cyber crimes
- Understand various cyber crimes.

DE : MULTICORE TECHNOLOGY

Teaching Scheme
Lectures : 3 hrs/week

Examination Scheme
100 marks: Continuous evaluation- Assignment/Quizzes – 40 marks
End Sem Exam - 60 marks

Unit 1
(6 Hrs)
Introduction to Multi-Core Architecture

Unit 2
(6 Hrs)
System Overview of Threading
Defining Threads, System View of Threads, Threading above the Operating System, Threads inside the OS, Threads inside the Hardware, What Happens When a Thread Is Created, Application Programming Models and Threading.
Threading on Multi-Core Processors Hardware-based Threading, Threading from Intel, Hyper-Threading Technology, Difference between Multiprocessor and Hyper-Threading Technology, Hyper-Threading Technology Architecture, Multi-Core Processors, Architectural Details, Comparison between Multiprocessors and Multi-Core Processors, Multi-Core for Itanium Architecture
Unit 3  
(6 Hrs)
Parallel Programming constructs and Threading
POSIX Threads, Creating Threads, Managing Threads, Thread Synchronization, Signaling, Compilation and Linking.

Unit 4  
(6 Hrs)

Unit 5  
(6 Hrs)
Parallel Programming Problems and solutions

Unit 6  
(6 Hrs)
Combining OpenMP and MPI
Steps for building a hybrid cluster, MPI routines, differences in OpenMP and MPI, Examples like Searching, Sorting, Linear System Equations.

Text Books:

Reference Books:

Outcomes:
This course aims at
- Understanding the design issues in Multicore Architectures.
- Parallel Programming environments using threads and alternative solutions.
• Understanding the fundamentals of Multicore Architectures.
• Understanding and differences between Uniprocessor, Multiprocessor and Multicore.
• Use of the programming environment like pthreads, OpenMP.
• Understanding the parallel programming problems and their solutions.

DE : WEB SYSTEMS AND TECHNOLOGIES

Teaching Scheme
Lectures : 3 hrs/week

Examination Scheme
100 marks: Continuous evaluation
Assignment/Quizzes – 40 marks
End Sem Exam - 60 marks

Unit 1
Introduction

Unit 2
Markup languages
An Introduction to HTML, Fundamental HTML Elements head, body etc. Basic XHTML Syntax and Semantics. Document publishing
Style sheets
Introduction to Cascading Style Sheets, CSS features, CSS syntax, Style properties of text, box, layout, list, table, cursor etc. User defined classes, inheritance.

Unit 3
Client-Side Programming
Host Objects
Document Object Model (DOM), Document tree, DOM event handling, Browsers.

Unit 4
Server-Side Programming
Java servlet - architecture, life cycle. The Client Request – form data, request headers. The Server Response - HTTP Status Codes, HTTP Response Headers. Sessions, Cookies, URL Rewriting, Concurrency in servlets
Separating Programming and Presentation
Java server pages, Basic JSP, JavaBeans Classes and JSP, JSF, Java Database Connectivity (JDBC)

Unit 5
Representing Web Data
XML – Namespaces, AJAX – Overview, basics, toolkits, security, DOM based XML processing, XSL, X Path, XSLT
Unit 6

**Web Services**
Web service concepts, creating, publishing, testing and describing a Web Service, WSDL, Representing Data Types: XML Schema, Communicating Object Data: SOAP, REST

**Text Books:**

**Reference Books:**

**Outcomes:**
This course aims at
- Learn the basic request and response between the web client and the web server.
- Understand the presentation techniques of a web application.
- Study the web client side programming.
- Study the web server side programming.
- Study the data handling in web systems.
- Study the web services.

**DE : SOFTWARE DESIGN PATTERNS**

**Teaching Scheme**
Lectures : 3 hrs/week

**Examination Scheme**
100 marks: Continuous evaluation
Assignment/Quizzes – 40 marks
End Sem Exam - 60 marks

**Unit 1**
(6 Hrs)
Introduction:
What is a design Pattern? Design patterns in smalltalk MVC, Describing Design patterns, the catalog of design patterns, organizing the catalog, How design patterns solve design problems, how to select a design pattern, how to use a design pattern.

**Unit 2**
(6 Hrs)
A case Study: Designing a document editor:
Design Problems, Document Structure, formatting, Embellishing the User Interface, Supporting Multiple Look-and-Feel Standards, supporting multiple window system, user operations, spelling checking and hyphenation.
Unit 3
Creational Patterns: 
Object creational: Abstract Factory, builder, factory Method, prototype, Singleton.

(6 Hrs)

Unit 4
Structural Patterns: 
Object Structural: Adapter, bridge, composite, decorator, façade, flyweight, proxy.

(6 Hrs)

Unit 5
Behavioral Patterns: 
Object Behavioral: Chain of Responsibility, command, interpreter, iterator, mediator, memento, observer, state, strategy, template method, visitor.

(6 Hrs)

Unit 6
Patterns and Software Architecture: 
Architectural pattern, Difference between design patterns and architectural patterns,different architectural patterns ,relation between software architecture and patterns.

(6 Hrs)

Text Books:

Reference Books:

Outcomes:
This course aims at
- Students will master common patterns in Software Design.
- Will be familiar with alternative development process.
- Will learn different software architectures and their relation with design patterns.
DE : OPERATIONS RESEARCH

Teaching Scheme
Lectures : 3 hrs/week

Examination Scheme
100 marks: Continuous evaluation-
Assignment/Quizzes – 40 marks
End Sem Exam - 60 marks

Unit 1
(6 Hrs)

Unit 2
(6 Hrs)

Unit 3
(7 Hrs)
Queuing system, queuing problem, Transient and steady States, List of symbols, Utilization factor, Elements of Queuing models, Generalized poisson queuing model, Specialized Poisson Queues, M/G/1 formula, Role of exponential distribution in queuing systems, Birth and Death Models, Queuing decision models, Review of recent advances in the subject.

Unit 4
(7 Hrs)
Job sequencing: Introduction, Terminology and Notions, Principal Assumptions, Solution of sequencing problem, Project Management: Applications and basic steps in PERT/CPM techniques, Network diagrams with time estimates and analysis, resource allocation, Processing n jobs with 2 machines, processing 2 jobs with m machines, Processing n jobs with m machines, Problem of dimensionality, Inventory Models.

Unit 5
(6 Hrs)

Unit 6
(6 Hrs)
Concept of dynamic programming, Deterministic dynamic programming, Forward and Backward recursion, Minimum path problem, models of single additive constraint, Multiplicatively
Separable return, Applications of dynamic programming in production, linear programming and reliability, Decision trees and Bellman’s principal of optimality, Recursive nature of computations in dynamic programming, Equipment replacement problem, Investment models, Expectation of a random variable. Problem of dimensionality, Inventory Models.

**Text Books:**

**Reference Books:**

**Outcomes:**
This course aims at
- Be able to solve linear programming problems.
- Be able to build and solve Transportation Models and Assignment Models.
- Be able to design new simple models, like: CPM, MSPT to improve decision –making and develop critical thinking and objective analysis of decision problems.
- Be able to understand the characteristics of different types of decision-making environments and the appropriate decision making approaches and tools to be used in each type.

DE : SYSTEM ADMINISTRATION

**Teaching Scheme**
Lectures : 3 hrs/week

**Examination Scheme**
100 marks: Continuous evaluation-
Assignment/Quizzes – 40 marks
End Sem Exam - 60 marks

**Unit 1**
**Basic System Administration**
Partitioning, Installation of multiple operating systems on Desktops, Various Unix Shells, Bash Shell, Windows Shell, Shell Programming; Various operating system services: cron, cpu usage, system load management, user management, backup, log management, boot loader, process management, file system namespace, ; Initialisation scripts; Kernel upgrade.

**Unit 2**
**Network Administration**
Unit 3
Filesystem Administration
Formatting, Partitioning, Defragmentation, Quotas, Journal, Logical Volume Management, Disk layouts, File System Check, SAN, NAS; Case Studies: ext2, ext4, ntfs, samba, cifs, nfs, btrfs, lvm, fat32.

Unit 4
Security Administration
GNU/Linux security architecture, SE Linux, Authentication Mechanisms, LDAP, Firewall, Firewall policies, Proxy Servers, SOCKS Proxy server.

Unit 5
Devices Administration
Installing and configuring printers, scanners, PCI devices, LAN cards, Troubleshooting, Plug and Play devices

Unit 6
Various Server Administration
Apache web server configuration, IIS web server configuration, Printers, Network printer setup, Mysql server, POSTGRES server

Text Books and References:

Online References:
- Various HOWTOs available on http://linux265.rwc.uc.edu/
- Linux Network Administrator's Guide http://linux265.rwc.uc.edu/nag/node1.html#SECTION001000000
- Linux File System's HOWTO http://linux265.rwc.uc.edu/HOWTO/Filesystms HOWTO.html
- Linux Firewall and Proxy Server HOWTO http://linux265.rwc.uc.edu/HOWTO/Firewall-HOWTO.html
- Linux Printing Usage HOWTO http://linux265.rwc.uc.edu/HOWTO/Printing-Usage-HOWTO.html
- Linux Installation and getting Started http://linux265.rwc.uc.edu/igs-guide/index.html
Outcomes:
This course aims at
- Students will be able to carry out following tasks, with special emphasis on GNU/Linux based systems.
- Install various Linux distributions and Windows based servers and desktop systems on commodity hardware, and carry out basic administration tasks of user, network, process, storage management.
- Set a LAN based laboratory using DHCP.
- Install and configure a web server, database server, DNS, NFS, NIS, LDAP based system secure a Desktop and a server system completely using existing tools.

DE : COMPUTATIONAL BIOLOGY LAB

Teaching Scheme
Lectures : 2 hrs/week

Examination Scheme
Term Work – 50 marks
Practical –50 marks

List of Assignments:
1. Study any biological database freely available on Internet; prepare a detailed report of it. Upload the same here
2. Select any string matching algorithm from available ones. You can select the algorithm based on time & space complexity. Implement the same using preferably in perl language. Upload the code with description of your selected algorithm.
3. Design and implement Smith-Waterman pairwise sequence alignment algorithm using any language (C, C++, Java, python, etc.) and test it for some arbitrary sequences of Protein.
4. Design and implement Needleman-Wunsch pairwise sequence alignment algorithm using any language (C, C++, Java, python, etc.) and test it for some arbitrary sequences of Protein.
5. Sequence alignment tools:
6. Bioinformatics tools other than BLAST and FASTA Assignment
7. Assignment on Multiple sequence alignment tool ClustalW2
8. Data mining using Clementine

Outcomes:
By the end of this course, students should be able to perform the following tasks:
- Working with biological databases
- Working with sequence alignment tools
- Working with phylogenomics tools
- Apply statistical and computational methods for genomic data
DE : E-COMMERCE LAB

Teaching Scheme
Lectures : 2 hrs/week

Examination Scheme
Term Work – 50 marks
Practical –50 marks

List of Assignments:
19. Creation of the SQL server Database, Creation of the ODBC connectivity.
20. Insertion/ modification of data with ASP, Selection of data using Record sets.
22. Mini Project

Outcomes:
This course aims to
• Comprehend the underlying economic mechanisms and driving forces of E-Commerce.
• Understand the critical building blocks of E-Commerce and different types of prevailing business models employed by leading industrial leaders.
• Appraise the opportunities and potential to apply and synthesize a variety of E-Commerce concepts and solutions to create business value for organizations, customers, and business partners.
• Formulate E-Commerce strategies that lever firms’ core competencies, facilitate organizational transformation, and foster innovation.
• Undertake planning, organizing, and implementing of E-Commerce initiatives to effectively respond to of dynamic market environments.

DE : GEOGRAPHICAL INFORMATION SYSTEMS LAB

Teaching Scheme
Lectures : 2 hrs/week

Examination Scheme
Term Work – 50 marks
Practical –50 marks

List of Assignments:
23. Study of Basics of any open source GIS Tool (eg. wxgis)
25. Working with Tables, Queries, and Basic Geoprocessing Tools .
27. Study and Implementation of Interpolation and Surface Modeling.
29. Implementation of Mini project.

Outcomes:
This course aims to
• Have a basic, theoretical and practical understanding of GIS, and Be able to work independently with various types of geographical data in GIS.
DE : NATURAL LANGUAGE PROCESSING LAB

Teaching Scheme
Lectures : 2 hrs/week

Examination Scheme
Term Work – 50 marks
Practical –50 marks

List of Assignments:
30. Basic Text Processing Assignment.
33. Designing an N-gram language model.
34. Designing the CYK parsing algorithm.
35. Finding word senses using WordNet.
36. Building an application.

Outcomes:
This course aims to
- To study fundamentals of Natural language processing.
- To make the students understand the necessity of natural language processing in building an intelligent system.
- To make the Students understand the ambiguities that arises in natural language processing.
- To make the student familiar with basic language processing operations like: Morphological analysis, Parts-of-Speech tagging, Lexical processing, Semantic processing, Knowledge representation.
- At the end of this course, the student should be able to do the following:
  o Design the processing steps required for a NLP task
  o Implement the processing techniques.

PCC : CYBER SECURITY, FORENSICS AND LEGAL PERSPECTIVE LAB

Teaching Scheme
Lectures : 2 hrs/week

Examination Scheme
Term Work – 50 marks
Practical –50 marks

List of Assignments:
1. Evolution of WWW (Browser level)
2. Linux Vs Windows OS (Technology, Security Management etc.)
3. Study of Storage Devices, e.g. HDD, CD, Flash drive, Any other Semiconductor devices, Write a detail technical report on all File systems used for storing files.
4. Assignments on following various tools such as
Name of available tools
  Index.dat Analyser
  dtSearch
  winHex
  Nmap
  SATAN (Security Administrator Tool for Analyzing Networks)
Outcomes:
These assignments will enable the students to
- Understand the investigation process in cyber crimes
- Understand various cyber crimes.

DE: MULTICORE TECHNOLOGY LAB

Teaching Scheme
Lectures: 2 hrs/week

Examination Scheme
Term Work – 50 marks
Practical – 50 marks

List of Assignments:
1. Program for matrix vector multiplication using pthreads on Multicore architecture.
2. Shared Memory Programming OpenMP – Study of OpenMP clauses.
3. Program to execute bubble sort using OpenMP.
4. Program to execute odd-even sort using OpenMP.
5. Program to perform matrix multiplication using OpenMP.
6. Installation of OpenMP-MPI cluster and performance considerations.
7. Understanding Intel Threading building blocks.
8. Understanding threading from Intel.

Outcomes:
This course aims to
- Understand the shared memory programming using pthreads and OpenMP.
- Program different problems using OpenMP.
- Setup OpenMP-MPI cluster.
- Intel Threading Model.
DE : WEB SYSTEMS AND TECHNOLOGIES LAB

Teaching Scheme
Lectures : 2 hrs/week

Examination Scheme
Term Work – 50 marks
Practical –50 marks

List of Assignments:
1. Study and compare features of 3 open source web servers.
2. Create a web page and study different HTML tags.
3. Create a website with attractive UI using the CSS.
4. Create a website that accepts the form filled by user and check for syntax validity of every field.
5. Write a Java servlet to perform the server side processing. Connect to the database.
6. Create an interactive multiple-choice quiz using HTML, JavaScript and AJAX and servlet.
7. Create a website using JSP and java beans that tracks the session activities.
   Observe the request and response objects.
8. URL rewriting - Create a website where user can view some data but cannot view its true URL.
9. Create a web service using Apache axis / Netbeans.
10. Mini project. Make sure of browser compatibility.

Outcomes:
This course aims to
- Learn the basic request and response between the web client and the web server.
- Understand the presentation techniques of a web application.
- Study the web client side programming.
- Study the web server side programming.
- Study the data handling in web systems.
- Study the web services.

DE : SOFTWARE DESIGN PATTERNS LAB

Teaching Scheme
Lectures : 2 hrs/week

Examination Scheme
Term Work – 50 marks
Practical –50 marks

List of Assignments:
1. Applications to be designed by using different software design pattern and architectures.

Links:
- http://www.tutorialspoint.com/design_pattern/index.htm
Outcomes:
This course aims to
- Students will be able to design patterns in Software Design.
- Students will be able to implement software architectures.

PCC : OPERATIONS RESEARCH LAB

Teaching Scheme
Lectures : 2 hrs/week

Examination Scheme
Term Work – 50 marks
Practical –50 marks

List of Assignments:
Implementation of following algorithms in any higher level language such as Java, C++, C or any scripting language such as Python:

9. Simplex method
10. Transportation algorithm using (a) Northwest-corner method and (b) Vogel approximation method
11. Hungarian method for solving assignment problem
12. Critical Path Method (CPM)
13. Goal programming algorithms (a) weights method (b) preemptive method
14. Integer programming algorithm using branch and bound method to solve TSP (traveling salesperson problem)

Outcomes:
These assignments will enable the students to
- Understand the nitty-gritty of some basic algorithms in Operations Research
- Understand the implementation issues (such as choosing appropriate data structures, writing modular code etc) related to implementation of complex algorithms
- Understand and appreciate how complex real life problems can be solved using computers
- Get more proficiency in the language used for implementation

DE : SYSTEM ADMINISTRATION LAB

Teaching Scheme
Lectures : 2 hrs/week

Examination Scheme
Term Work – 50 marks
Practical –50 marks

List of Assignments:
1. Set a desktop with following software configuration options: triple boot with Windows, Ubuntu and Fedora operating systems; Grub timeout set to 5 seconds with default Fedora Linux; Each step of boot process secured with passwords; Software updates set to use COEP mirrors; One administrative and one normal user account in each operating system; Following software installed in each OS: office, internet browser, c compiler, terminal, ssh server, telnet server, web server, database server
2. Set up a LAN based computer laboratory with 5 computers - using DHCP first and then using static IPs; one of the machines should work as DHCP server; set up NIS+NFS and LDAP+NFS based authentication for managing single identity on all computers; setup quotas on NFS systems
3. Demonstrate use of three-tier architecture using LAMP and WAMP suite using same code base
4. Demonstrate file system corruption and recovery on Ubuntu systems
5. Setup a disk management system using LVM such that all options of LVM are demonstrated; setup quotas;
6. Setup a network based printer and demonstrate its use
7. Write a program to browse an ext4 file system and locate data of a deleted file
8. Setup a proxy server and firewall with set of policies to block video content in the network.
9. Setup apache web server to serve 3 websites, with 3 domain names at a time from a single machine; demonstrate the use of at least 5 configuration options of apache
10. Setup an email server and demonstrate use of at least 3 email clients to send email using it
11. Setup a Point to point protocol network between two computers
12. Setup SE Linux
13. Given a desktop system with some unknown problem in it's working, solve the problem completely and bring the system to completely running configuration
14. Write a initialization shell script on Ubuntu Linux to check to prepare a report of useful system statistics for the administrator

Outcomes:
This course aims to
- Students will be able to carry out following tasks, with special emphasis on GNU/Linux based systems.
- Install various Linux distributions and Windows based servers and desktop systems on commodity hardware, and carry out basic administration tasks of user, network, process, storage management.
- Set a LAN based laboratory using DHCP.
- Install and configure a web server, database server, DNS, NFS, NIS, LDAP based system secure a Desktop and a server system completely using existing tools.
Annexure I

List of Open Elective/Professional Science courses offered by ALL Departments

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Department</th>
<th>Course</th>
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<tbody>
<tr>
<td>1</td>
<td>Civil</td>
<td>Finite Elements in Engineering</td>
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<tr>
<td>2</td>
<td>Mechanical</td>
<td>1. Unconventional Machining Processes</td>
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<td>2. Modern Control Systems</td>
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<td></td>
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<td>3. Power Plant Engineering</td>
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<td>3</td>
<td>Electrical</td>
<td>1. Industrial Drives</td>
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<td></td>
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<td>2. Control System Engineering</td>
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<tr>
<td>4</td>
<td>Electronics and Telecommunication</td>
<td>Electronic Communication Systems</td>
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<td>5</td>
<td>Metallurgy and Material Science</td>
<td>Composite Materials</td>
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<tr>
<td>6</td>
<td>Instrumentation and Control</td>
<td>Industrial Automation</td>
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<tr>
<td>7</td>
<td>Production</td>
<td>Introduction to ERP &amp; Operations Efficiency</td>
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<tr>
<td>8</td>
<td>Computer Engineering</td>
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<td>9</td>
<td>Information Technology</td>
<td>Information Systems</td>
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<tr>
<td>10</td>
<td>Applied Science</td>
<td>1. Humanities Course</td>
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<td>2. Constitution of India</td>
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<tr>
<td>11</td>
<td>Innovation Centre</td>
<td>Liberal Learning Course</td>
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</tbody>
</table>
Annexure II

List of Liberal Learning courses offered at Institute Level

- **Agricultural** – Animal Science, Forestry, Horticulture, Floriculture, Sustainable Agriculture, Veterinary
- **Arts** – Graphic Design, Interior Design, Fashion Design
- **Basic Sciences** – Astronomy, Astro-Physics, Biology, Genetics, Kinesiology, Microbiology, Neuro Sciences.
- **Business** – Administration, Communication, Entrepreneurial studies, Hostel Management, Marketing.
- **Education** - Education policies, Engineering Education, Teacher Training.
- **Environmental Sciences** – Ecology, Meteorology
- **Linguistics** – Word Language
- **Medicine** – Health Studies Nutrition and dietetics
- **Performing Arts** - Music, Dance Theatre, Cinema
- **Philosophy** - Religious Studies
- **Sports and Athletics**