## VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM

### SCHEME OF TEACHING AND EXAMINATION FOR M.TECH(COMPUTER SCIENCE and ENGINEERING)

#### I Semester  

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>Name of the Subject</th>
<th>Teaching hours/week</th>
<th>Duration of Exam in Hours</th>
<th>Marks for</th>
<th>Total Credits: 23</th>
</tr>
</thead>
<tbody>
<tr>
<td>14SCS11</td>
<td>Advances in Operating Systems</td>
<td>4</td>
<td>03</td>
<td>50</td>
<td>100</td>
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<tr>
<td>14SCS12</td>
<td>Cloud Computing</td>
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<td>2 * 03</td>
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<tr>
<td>14SCS13</td>
<td>Advances in Data Base Management System</td>
<td>4</td>
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<tr>
<td>14SCS14</td>
<td>Multi Core Architecture and Programming</td>
<td>4</td>
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<tr>
<td>14SCS15x</td>
<td>Elective – I</td>
<td>4</td>
<td>2</td>
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<tr>
<td>14SCS16</td>
<td>Advances in Operating Systems Laboratory</td>
<td>0</td>
<td>3</td>
<td>25</td>
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<tr>
<td>14SCS17</td>
<td>Seminar #</td>
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<td>3</td>
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<td><strong>13</strong></td>
<td><strong>18</strong></td>
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</table>

### Elective I:

- 14SCS151 Advances in Digital Image Processing
- 14SCS152 Advances in Storage Area Networks
- 14SCS153 Embedded Computing Systems
- 14SCS154 Advances in Computer Graphics
### VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
**SCHEME OF TEACHING AND EXAMINATION FOR M.TECH(COMPUTER SCIENCE and ENGINEERING)**

#### II Semester

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>Name of the Subject</th>
<th>Teaching hours/week</th>
<th>Duration of Exam in Hours</th>
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<tbody>
<tr>
<td>14SCS21</td>
<td>Managing Big Data</td>
<td>4 Lecture 2 *</td>
<td>03</td>
<td>50</td>
<td>100</td>
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<tr>
<td>14SCS22</td>
<td>Advances in Computer Networks</td>
<td>4 Lecture 2 *</td>
<td>03</td>
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<tr>
<td>14SCS23</td>
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<td>4 Lecture</td>
<td>03</td>
<td>50</td>
<td>100</td>
<td>150</td>
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<tr>
<td>14SCS24</td>
<td>Artificial Intelligence and Agent Technology</td>
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<td>03</td>
<td>50</td>
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<td>150</td>
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<td>14SCS25x</td>
<td>Elective – II</td>
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<td>14SCS26</td>
<td>Advanced Algorithms Laboratory</td>
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<td>14SCS27</td>
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<td>--</td>
<td>25</td>
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<td></td>
<td>** Project Phase I (6 Week Duration)**</td>
<td>-- Lecture</td>
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<td>--</td>
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<tr>
<td><strong>Total</strong></td>
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<td><strong>20 Lecture 13</strong></td>
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<td><strong>550</strong></td>
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**ELECTIVE- II**

- 14SCS251 Web Services
- 14SCS252 Information and Network Security
- 14SCS253 Pattern Recognition
- 14SCS254 Optical Networks

**Between the II Semester and III Semester after availing a vacation of 2 weeks.**
**VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM**

**SCHEME OF TEACHING AND EXAMINATION FOR M.TECH(COMPUTER SCIENCE and ENGINEERING)**

### III Semester: INTERNSHIP

**Total Credits: 20**

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>Name of the Subject</th>
<th>No. of Hrs./Week</th>
<th>Duration of Exam in Hours</th>
<th>Marks for Total Mark</th>
<th>Total Credits</th>
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<tr>
<td></td>
<td></td>
<td>Lecture</td>
<td>Practical / Fieldwork</td>
<td>L.A.</td>
<td>Exam</td>
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<tr>
<td>14SCS31</td>
<td>Seminar / Presentation on Internship (After 8 weeks from the date of commencement) *</td>
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<tr>
<td>14SCS32</td>
<td>Report on Internship **</td>
<td>--</td>
<td>--</td>
<td>--</td>
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<tr>
<td>14SCS33</td>
<td>Evaluation and Viva-voce</td>
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<td>--</td>
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*The student shall make a midterm presentation of the activities undertaken during the first 8 weeks of internship to a panel comprising Internship Guide, a senior faculty from the department and Head of the Department.*

# The College shall facilitate and monitor the student internship program.

The internship report of each student shall be submitted to the University.

**Between the III Semester and IV Semester after availing a vacation of 2 weeks.**
### IV Semester

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>Name of the Subject</th>
<th>Lecture</th>
<th>Fieldwork/Assignment/Tutorials</th>
<th>Duration of Exam in Hours</th>
<th>Marks for Total Marks</th>
<th>CREDITS</th>
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<tr>
<td>14SCS41</td>
<td>Machine Learning Techniques</td>
<td>4</td>
<td>2 *</td>
<td>03</td>
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<tr>
<td>14SCS42x</td>
<td>Elective-III</td>
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<td>2</td>
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<tr>
<td>14SCS43</td>
<td>Evaluation of Project Phase-II</td>
<td>0</td>
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<tr>
<td>14SCS44</td>
<td>Evaluation of Project Phase-III</td>
<td>0</td>
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<tr>
<td>14SCS45</td>
<td>Evaluation of Project Work and Viva-voce</td>
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<td><strong>Total</strong></td>
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<td>08</td>
<td>07</td>
<td>09</td>
<td>150 400</td>
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**Grand Total (I to IV Sem.)**

- Marks: 2400 ;
- Credits : 94

### Elective – III
- 14SCS421 Computer Vision
- 14SCS422 Business Intelligence and its Applications
- 14SCS423 Agile Technologies
- 14SCS424 Wireless Network and Mobile Computing

L- Lecture , T- Tutorial, P- Practical
Note:

*Lab Classes for these Core Subjects are Compulsory (Practical will be Evaluated for 20 marks and Internal assessment for 30 marks). Lab journals Should be Maintained.

# Seminar: Topics should be chosen from IEEE/ACM/Elsevier/Springer/any Refereed - Journals /Transactions. Encourage students to convert these seminar topics into a good survey paper or Technical paper.

1) Project Phase – I: 6 weeks duration shall be carried out between II and III Semester. Candidates in consultation with guide shall carryout literature survey / visit to Industries to finalize the topic of dissertation.

2) Internship: 24 weeks Duration in 3rd Semester, Evaluation of Marks - Presentation : 25 marks, Report writing and Submission :75 marks and At the end of Internship Viva-Voce Exams shall be conducted for 50 marks.

3) Project Work: 20 weeks duration in IV Semester carries total marks of 250.

4) Project Phase II: 4 days for project work in a week during IV Semester. Evaluation shall be taken during the 8th week of the IV Semester. Total Marks shall be 25.

5) Project Phase – III: Evaluation shall be taken up at the end of the IV Semester for 25 marks. After the Project report is submitted, Project Work Evaluation and Viva-Voce Examination shall be conducted. Total Marks Shall be 50+50+100=200 ( 50 Marks for Internal Guide,50 Marks for External and 100 for Viva-Voce ).

Marks of Evaluation of Project:

I) The I.A. Marks of Project Phase – II & III shall be sent to the University along with Project Work report at the end of the Semester.

II) The Project Valuation and Viva-Voce will be conducted by a committee consisting of the following:

   a) Head of the Department (Chairman)
   b) Guide
   c) Two Examiners appointed by the university.(out of two external examiners at least one should be present).

| Course Title: Advances In Operating Systems | Course Code: 14SCS11 |
| Credits(L:T:P): 4:0:0                     | Core/Elective: Core |
| Type of Course: Lecture                  | Total Contact Hours: 50 Hrs |

COURSE OBJECTIVES:

- To learn the fundamentals of Operating Systems
- To gain knowledge on Distributed operating system concepts that includes architecture, Mutual exclusion algorithms, Deadlock detection algorithms and agreement protocols
- To gain insight on to the distributed resource management components viz. the algorithms for implementation of distributed shared memory, recovery and commit protocols
- To know the components and management aspects of Real time, Mobile operating Systems.

TOPICS:

MODULE I
Operating System Overview, Process description & control

10 Hours

Module II
Threads, SMP, and Microkernel, Virtual Memory.

10 Hours

Module III
Multiprocessor and Real-Time Scheduling
Multiprocessor Scheduling, Real-Time Scheduling, Linux Scheduling, UNIX Preclsl) Scheduling, Windows Vista Scheduling. Process Migration, Distributed Global States, Distributed Mutual Exclusion, Distributed Deadlock.

10 Hours

Module IV
Embedded Operating Systems

10 Hours

MODULE V
Kernel Organization
Using Kernel Services, Daemons, Starting the Kernel, Control in the Machine, Modules and Device Management, MODULE Organization, MODULE Installation and Removal, Process and Resource Management, Running Process

**The windows NT/2000/XP kernel:** Introduction, The NT kernel, Objects, Threads, Multiplication Synchronization, Traps, Interrupts and Exceptions, The NT executive, Object Manager, Process and Thread Manager, Virtual Memory Manager, I/o Manager, The cache Manager, Kernel local procedure calls and IPC, The native API, subsystems.

**Course Outcomes:**
The students should be able to:
- Demonstrate the Mutual exclusion, Deadlock detection and agreement protocols of Distributed operating system
- Learn the various resource management techniques for distributed systems
- Identify the different features of real time and mobile operating systems
- Modify existing open source kernels in terms of functionality or features used.

**Text Books:**

**Reference Books:**
Course Title: Cloud Computing
Course Code: 14SCS12
Credits(L:T:P): 3:0:1
Type of Course: Lecture & Practical
Total Contact Hours: 50 Hrs

Semester: I
Year: 2014-2015

COURSE OBJECTIVES
- To learn how to use Cloud Services.
- To implement Virtualization
- To implement Task Scheduling algorithms.
- Apply Map-Reduce concept to applications.
- To build Private Cloud.

Topics:

Module I
Introduction, Cloud Infrastructure
Cloud computing, Cloud computing delivery models and services, Ethical issues, Cloud vulnerabilities, Cloud computing at Amazon, Cloud computing the Google perspective, Microsoft Windows Azure and online services, Open-source software platforms for private clouds, Cloud storage diversity and vendor lock-in, Energy use and ecological impact, Service level agreements, User experience and software licensing. Exercises and problems.

10 Hours

Module II

10 Hours

Module III
Cloud Resource Virtualization.

10 Hours

Module IV
Cloud Resource Management and Scheduling.
Policies and mechanisms for resource management, Application of control theory to task scheduling on a cloud, Stability of a two-level resource allocation architecture, Feedback control based on dynamic thresholds, Coordination of specialized autonomic performance managers, A utility-based model for cloud-based Web services, Resourcing bundling: Combinatorial auctions for cloud resources, Scheduling algorithms for computing clouds, Fair queuing, Start-time fair queuing, Borrowed virtual time, Cloud scheduling subject to deadlines, Scheduling Map Reduce applications subject to deadlines, Resource management and dynamic scaling, Exercises and problems.

10 Hours

Module V
Cloud Security, Cloud Application Development.

10 Hours

LAB EXPERIMENTS

NOTE: Simulate using object oriented programming, any available cloud environment (Eg: Amazon cloud) and VM ware for resource virtualization.

1. Create a Collaborative learning environment for a particular learning topic using Google Apps. Google Drive, Google Docs and Google Slides must be used for hosting e-books, important articles and presentations respectively. The instructor must use the Google Sheets to convey the timetable for different events and for analyzing the scores for individual assignment submission.

2. Modeling and simulation Cloud computing environments, including Data Centers, Hosts and Cloudlets and perform VM provisioning using CloudSim: Design a host with two CPU cores, which receives request for hosting two VMs, such that each one requires two cores and plans to host four tasks units. More specifically, tasks t1, t2, t3 and t4 to be hosted in VM1, while t5, t6, t7, and t8 to be hosted in VM2. Implement space-shared allocation policy and time-shared allocation policy. Compare the results.

3. Model a Cloud computing environment having Data center that had 100 hosts. The hosts are to be modeled to have a CPU core (1000 MIPS), 2 GB of RAM and 1 TB of storage. Consider the workload model for this evaluation included provisioning requests for 400 VMs, with each request demanding 1 CPU core (250 MIPS), 256 MB of RAM and 1 GB of storage. Each VM hosts a web-hosting application service, whose CPU utilization distribution was generated according to the uniform distribution. Each instance of a webhosting service required 150,000 MIPS or about 10 minutes to complete execution assuming 100% utilization. Simulate Energy-conscious model for power consumption and power management techniques such as Dynamic Voltage and Frequency Scaling (DVFS). Initially, VMs are to be allocated according to requested parameters (4 VMs on each host). The Cloud computing architecture that is to be considered for studying energy conscious resource management techniques/policies included a data center, CloudCoordinator, and Sensor component. The CloudCoordinator and Sensor perform their usual roles. Via the attached Sensors (which are connected with every host), CloudCoordinator must periodically monitor the performance status of active VMs such as load conditions, and processing share. This real time information is to be passed to VMM, which can use it for performing appropriate resizing of VMs and application of DVFS and soft scaling. CloudCoordinator continuously has to adapt allocation of VMs by issuing VM migration commands and changing power states of nodes according to its policy and current utilization of resources.

4. Model and simulate the environment consisting of a data center with 10,000 hosts where each host was modeled to have a single CPU core (1200MIPS), 4GB of RAM memory and 2TB of storage. Consider the provisioning policy for VMs as space-shared, which allows one VM to be active in a host at a given instance of time. Make a request from the end-user (through the Datacenter Broker) for creation and instantiation of 50 VMs that had following constraints: 1024MB of physical memory, 1 CPU core and 1GB of storage. The application granularity was modeled to be composed of 300 task units, with each task unit requiring 1,440,000 million instructions (20 minutes in the simulated hosts) to be executed on a host. Minimal data transfer (300 KB) overhead can be considered for the task units (to and from the data center). After the creation of VMs, task units were submitted in small groups of 50 (one for each VM) at inter-arrival delay of 10 minutes.

5. Implement Map Reduce concept for
a. Strassen’s Matrix Multiplication for a huge matrix.
b. Computing the average number of citation index a researcher has according to age among some 1 billion journal articles. Consider a network of entities and relationships between them. It is required to calculate a state of each entity on
the basis of properties of the other entities in its neighborhood. This state can represent a distance to other nodes, indication that there is a neighbor with the certain properties, characteristic of neighborhood density and so on. A network is stored as a set of nodes and each node contains a list of adjacent node IDs. Mapper emits messages for each node using ID of the adjacent node as a key. Reducer must recompute state and rewrite node with the new state. Implement this scenario.

Course Outcomes:
The students should be able to:
- Demonstrate and experiment simple Cloud Applications
- Apply resource allocation, scheduling algorithms.
- Implement Map-Reduce concept.
- Create virtual machines from available physical resources.
- Setup a private cloud.
- Familiarize with Open Stack.

Text Book:

REFERENCES:

Course Title: Advances in Database Management Systems                                      Course Code: 14SCS13
Credits(L:T:P):3:0:1                                                                              Core/Elective: Core
Type of Course: Lecture & Practical                                                          Total Contact Hours: 50 Hrs

COURSE OBJECTIVES:
• To acquire knowledge on parallel and distributed databases and its applications.
• To study the usage and applications of Object Oriented database
• To understand the basic concepts, principles of intelligent databases.
• To understand the advanced topics of data warehousing and mining .
• To learn emerging and advanced data models
• To acquire inquisitive attitude towards research topics in databases.

Topics:
MODULE I
Review of Relational Data Model and Relational Database Constraints: Relational model concepts; Relational model constraints and relational database schemas; Update operations, transactions and dealing with constraint violations.
Overview of Object-Oriented Concepts – Objects, Encapsulation, Polymorphism, Type and class hierarchies etc.

10 Hours

Module II
Object and Object-Relational Databases: Object Oriented Concepts: – Objects, complex objects; Object model of ODMG, Object definition Language ODL; Object Query Language OQL; Overview of C++ language binding; Conceptual design of Object database. Overview of object relational features of SQL; Object-relational features of Oracle; Implementation and related issues for extended type systems; The nested relational model.

10 Hours

Module III
Parallel and Distributed Databases: Architectures for parallel databases; Parallel query evaluation; Parallelizing individual operations; Parallel query optimizations; Introduction to distributed databases; Distributed DBMS architectures; Storing data in a Distributed DBMS; Distributed catalog management; Distributed Query processing; Updating distributed data; Distributed transactions; Distributed Concurrency control and Recovery.

10 Hours

Module IV
Data Warehousing, Decision Support and Data Mining: Introduction to decision support; OLAP, multidimensional model; Window queries in SQL; Finding answers quickly; Implementation techniques for OLAP; Data Warehousing; Views and Decision support, View materialization, Maintaining materialized views. Introduction to Data Mining; Counting co-occurrences; Mining for rules; Tree-structured rules; Clustering; Similarity search over sequences; Incremental mining and data streams; Additional data mining tasks.

10 Hours

Module V
Enhanced Data Models for Some Advanced Applications: Active database concepts and triggers; Temporal, Spatial, and Deductive Databases – Basic concepts. More Recent Applications: Mobile databases; Multimedia databases; Geographical Information Systems; Genome data management.

10 Hours

LABORATORY WORK:
(The following tasks can be implemented on Oracle or any other suitable RDBMS with support for Object features)

1. Develop a database application to demonstrate storing and retrieving of BLOB and CLOB objects.

2. Develop a database application to demonstrate the representation of multivalued attributes, and the use of nested tables to represent complex objects. Write suitable queries to demonstrate their use.

3. Design and develop a suitable Student Database application. One of the attributes to me maintained is the attendance of a student in each subject for which he/she has enrolled. Using TRIGGERS, write active rules to do the following:
   a. Whenever the attendance is updated, check if the attendance is less than 85%; if so, notify the Head of the Department concerned.
   b. Whenever, the marks in an Internal Assessment Test are entered, check if the marks are less than 40%; if so, notify the Head of the Department concerned.

4. Design, develop, and execute a program in a language of your choice to implement any one algorithm for mining association rules. Run the program against any large database available in the public domain and discuss the results.

**COURSE OUTCOMES:**
Upon completion of the course, the students will be able to
- Select the appropriate high performance database like parallel and distributed database
- Model and represent the real world data using object oriented database
- Embed the rule set in the database to implement data warehousing of mining
- Choose and design database for recent applications database for better interoperability

**TEXT BOOKS:**

**REFERENCE BOOKS:**
Course Objectives:
- To understand the recent trends in the field of Computer Architecture and identify performance related parameters
- To appreciate the need for parallel processing
- To expose the students to the problems related to multiprocessing
- To understand the different types of multicore architectures
- To understand the concepts of multi threading and OPENMP.

Topics:

**MODULE I**

10 Hours

**MODULE II**

10 Hours

**MODULE III**

10 Hours

**MODULE IV**
**OpenMP: A Portable Solution for Threading:** Challenges in Threading a Loop, Loop-carried Dependence, Data-race Conditions, Managing Shared and Private Data, Loop Scheduling and Portioning, Effective Use of Reductions, Minimizing Threading Overhead, Work-sharing Sections, Performance-oriented Programming, Using Barrier and No wait, Interleaving Single-thread and Multi-thread Execution, Data Copy-in and Copy-out, Protecting Updates of Shared...
Variables, Intel Task queuing Extension to OpenMP, OpenMP Library Functions, OpenMP Environment Variables, Compilation, Debugging, performance.

**MODULE V**


**Course Outcomes:**
The students should be able to:
- Identify the limitations of ILP and the need for multi-core architectures.
- Solve the issues related to multiprocessing and suggest solutions.
- Point out the salient features of different multi-core architectures and how they exploit parallelism.

**Text Book**

Course objectives:

- To understand the image fundamentals and mathematical transforms necessary for image processing and to study the image enhancement techniques.
- To understand the image segmentation and representation techniques.
- To understand how image are analyzed to extract features of interest.
- To introduce the concepts of image registration and image fusion.
- To analyze the constraints in image processing when dealing with 3D data sets.

Topics:

**MODULE I**


10 Hours

**MODULE II**


10 Hours

**MODULE III**


10 Hours

**MODULE IV**


10 Hours

**MODULE V:**
**Morphological Image Processing:** Preliminaries, Dilation and Erosion, Opening and Closing, The Hit-or-Miss Transformation, Some Basic Morphological Algorithms. **Image Segmentation:** Detection of Discontinuities, Edge Linking and Boundary Detection, Thresholding, Region-Based Segmentation.

**Course Outcomes:**
The students will be able to:

- Understand image formation and the role human visual system plays in perception of gray and color image data.
- Apply image processing techniques in both the spatial and frequency (Fourier) domains.
- Design image analysis techniques in the form of image segmentation and to evaluate the methodologies for segmentation.
- Conduct independent study and analysis of feature extraction techniques.
- Understand the concepts of image registration and image fusion.
- Analyze the constraints in image processing when dealing with 3D data sets and to apply image analysis techniques.
- Apply algorithms in practical applications.

**TEXT BOOKS**


**REFERENCES:**

Course Title: Advances in Storage Area Networks

Course Code: 14SCS152

Credits(L:T:P): 4:0:0

Core/Elective: Elective

Type of Course: Lecture

Total Contact Hours: 50 Hrs

Course Objectives:

- To understand the fundamentals of storage centric and server centric systems
- To understand the metrics used for Designing storage area networks
- To understand the RAID concepts
- To enable the students to understand how data centre’s maintain the data with the concepts of backup
  mainly remote mirroring concepts for both simple and complex systems

Topics:

MODULE I


10 Hours

MODULE II

I/O Techniques: The Physical I/O path from the CPU to the Storage System; SCSI; Fibre Channel Protocol Stack; Fibre Channel SAN; IP Storage. Network Attached Storage: The NAS Architecture, The NAS hardware Architecture, The NAS Software Architecture, Network connectivity, NAS as a storage system. File System and NAS: Local File Systems; Network file Systems and file servers; Shared Disk file systems; Comparison of fibre Channel and NAS.

10 Hours

MODULE III

Storage Virtualization: Definition of Storage virtualization ; Implementation Considerations; Storage virtualization on Block or file level; Storage virtualization on various levels of the storage Network; Symmetric and Asymmetric storage virtualization in the Network.

10 Hours

MODULE IV

SAN Architecture and Hardware devices: Overview, Creating a Network for storage; SAN Hardware devices; The fibre channel switch; Host Bus Adaptors; Putting the storage in SAN; Fabric operation from a Hardware perspective. Software Components of SAN: The switch’s Operating system; Device Drivers; Supporting the switch’s components; Configuration options for SANs.

10 Hours

MODULE V

Use of SNMP, CIM and WBEM, Storage Management Initiative Specification (SMI-S), CMIP and DMI, Optional Aspects of the Management of Storage Networks, Summary

**Course Outcomes:**
The students should be able to:
- Identify the need for performance evaluation and the metrics used for it
- Apply the techniques used for data maintenance.
- Realize storage virtualization concept.
- Develop techniques for evaluating policies for LUN masking, file systems.

**Text Book:**
1. Ulf Troppens, Rainer Erkens and Wolfgang Muller: Storage Networks Explained, Wiley India, 2013.

**Reference Books:**
OBJECTIVES
- Provide a general overview of Embedded Systems
- Show current statistics of Embedded Systems
- Design a complete microprocessor-based hardware system
- Design, code, compile, and test real-time software
- Integrate a fully functional system including hardware and software
- Gain the ability to make intelligent choices between hardware/software tradeoffs.

Topics:

MODULE I
Introduction to embedded systems: Embedded systems, Processor embedded into a system, Embedded hardware units and device in a system, Embedded software in a system, Examples of embedded systems, Design process in embedded system, Formalization of system design, Design process and design examples, Classification of embedded systems, skills required for an embedded system designer.

7 Hours

MODULE II
Devices and communication buses for devices network: I/O types and example, Serial communication devices, Parallel device ports, Sophisticated interfacing features in device ports, Wireless devices, Timer and counting devices, Watchdog timer, Real time clock, Networked embedded systems, Serial bus communication protocols, Parallel bus device protocols-parallel communication internet using ISA, PCI, PCI-X and advanced buses, Internet enabled systems-network protocols, Wireless and mobile system protocols.

13 Hours

MODULE III
Device drivers and interrupts and service mechanism: Programming-I/O busy-wait approach without interrupt service mechanism, ISR concept, Interrupt sources, Interrupt servicing (Handling) Mechanism, Multiple interrupts, Context and the periods for context switching, interrupt latency and deadline, Classification of processors interrupt service mechanism from Context-saving angle, Direct memory access, Device driver programming.

10 Hours

MODULE IV
Interprocesses communication and synchronization of processes, Threads and tasks: Multiple process in an application, Multiple threads in an application, Tasks, Task states, Task and Data, Clear-cut distinction between functions. ISRS and tasks by their characteristics, concept and semaphores, Shared data, Inter-process communication, Signal function, Semaphore functions, Message Queue functions, Mailbox functions, Pipe functions, Socket functions, RPC functions.

10 Hours

MODULE V
Real-time operating systems: OS Services, Process management, Timer functions, Event functions, Memory management, Device, file and IO subsystems management, Interrupt routines in RTOS environment and handling of interrupt source calls, Real-time operating systems, Basic design using an RTOS, RTOS task scheduling models, interrupt latency and response of the tasks as performance metrics, OS security issues. Introduction to embedded...
software development process and tools, Host and target machines, Linking and location software.

10 Hours

Course Outcomes:
The students should be able to:
- Knowledge to distinguish the characteristics of embedded computer systems.
- Ability examines the various vulnerabilities of embedded computer systems.
- Ability to design embedded systems.
- Awareness of the changing landscape in embedded systems

Text Books:


Chapters: Chapter 1.1 to 1.5, 1.8 to 1.12, Chapter 3, 4, 7, 8 and 13.1 to 13.3.

References:

Course Title: Advances in Computer Graphics
Course Code: 14SCS154

Credits(L:T:P): 4:0:0
Core/Elective: Elective
Type of Course: Lecture
Total Contact Hours: 50 Hrs

Course Objectives:
- Learn basic and fundamental computer graphics techniques.
- Learn image synthesis techniques;
- Examine applications of modeling, design and visualization.
- Learn different color modeling and computer animation
- Learn hierarchical modeling and graphing file formats.

Topics:

MODULE I
Three-Dimensional Object Representations: Polyhedra, OpenGL Polyhedron Functions, Curved Surfaces, Quadric Surfaces, Super quadrics, OpenGL Quadric-Surface and Cubic-Surface Functions, Blobby Objects, Spline Representations, Cubic-Spline Interpolation Methods, Bezier Spline Curves, Bazier Surfaces, B-Spline Curves, B-Spline Surfaces, Beta- Splines, Rational Splines, Conversion Between Spline Representations, Displaying Spline Curves and faces, OpenGL Approximation-Spline Functions, Sweep Representations, Constructive Solid –Geometry Method, Octrees, BSP Trees, Fractal-Geometry Methods, Shape Grammars and Others Procedural Methods, Particle Systems, Physically Based Modeling, Visualization Of Data Sets.

10 Hours

MODULE II

10 Hours

MODULE III

10 Hours

MODULE IV
General computer-animation functions, Computer-animation languages, Key-frame systems, Motion specification, Articulated figure animation, Periodic motions, OpenGL animation procedures.

10 Hours

MODULE V
Hierarchical modeling and Graphics file formats: Basic modeling concepts, Modeling packages, General hierarchical modeling methods, Hierarchical modeling using OpenGL display list, Image-File configurations, Color-reduction methods, File-compression techniques, Composition of the major file formats.

10 Hours

COURSE OUTCOMES:
The students are able to:
- Represent and implement images and objects using 3D representation and OpenGL methodologies.
- Design develop surface detection using various detection methods
- Choose various illumination models for provides effective standards of objects.
- Design of develop effective computer animations.

Text Books:
   (Chapter 8,9,10,12,13,14,15)

Reference Books:

Course Title: Advances in Operating Systems Laboratory                                                                                      Course Code: 14SCS16
Credits(2) (L:T:P):0:0:3                                                                                                                  Core/Elective: Core
Type of Course: Practical                                                                                                               Total Contact Hours: 42 Hrs

COURSE OBJECTIVES:

- To implement the shell of Operating System.
- To implement distributed operating system concepts.
- To implement virus detection techniques.

LABORATORY WORK:

Note: The following programs can be executed on Java/C#/ any equivalent language or tool with suitable platform.

01. Design and Develop a shell that should support at least 20 commands.
02. Design and develop a program to implement lazy buddy system algorithm.
03. Write a multi-class multithreaded program that simulates multiple sleeping barbers, all in one barbershop that has a finite number of chairs in the waiting room. Each customer is instantiated from a single customer class; each barber is instantiated from a single Barber class.
04. Use ECOS operating system to develop a program for controlling accessing to a pool of resources using mutexes and condition variables.
05. Design and develop a program to realize the virus classification, such as boot sector infector, file infector and macro virus.

Course Outcomes:

The students should be able to:
- Demonstrate the shell.
- Demonstrate the Mutual exclusion, Deadlock detection and agreement protocols of Distributed operating system.
- Understand the various virus detection techniques.
Course Title: Managing Big Data
Course Code: 14SCS21
Type of Course: Lecture & Practical
Total Contact Hours: 50 Hrs

Course Objectives:
- To Understand big data for business intelligence
- To Learn business case studies for big data analytics
- To Understand Nosql big data management
- To manage Big data without SQL
- To understanding map-reduce analytics using Hadoop and related tools

TOPICS:

MODULE I
UNDERSTANDING BIG DATA 10 Hours

MODULE II
NOSQL DATA MANAGEMENT 10 Hours

MODULE III
BASICS OF HADOOP 10 Hours

MODULE IV
MAPREDUCE APPLICATIONS 10 Hours
MapReduce workflows – unit tests with MRUnit – test data and local tests – anatomy of MapReduce job run – classic Map-reduce – YARN – failures in classic Map-reduce and YARN – job scheduling – shuffle and sort – task execution – MapReduce types – input formats – output formats

MODULE V
HADOOP RELATED TOOLS 10 Hours

LAB Experiments

Exercise 1 --- HDFS
Start by reviewing HDFS. You will find that its composition is similar to your local Linux file system. You will use the hadoop fs command when interacting with HDFS.

1. Review the commands available for the Hadoop Distributed File System:
2. Copy file foo.txt from local disk to the user’s directory in HDFS
3. Get a directory listing of the user’s home directory in HDFS
4. Get a directory listing of the HDFS root directory
5. Display the contents of the HDFS file user/fred/bar.txt
6. Move that file to the local disk, named as baz.txt
7. Create a directory called input under the user’s home directory
8. Delete the directory input old and all its contents
9. Verify the copy by listing the directory contents in HDFS:

**Exercise 2 --- MapReduce**

1. Create a JOB and submit to cluster
2. Track the job information
3. Terminate the job
4. Counters in MR Jobs with example
5. Map only Jobs and generic map examples
6. Distributed cache example
7. Combiners, Secondary sorting and Job chain examples

**Exercise 3 --- MapReduce (Programs)**

Using movie lens data
1. List all the movies and the number of ratings
2. List all the users and the number of ratings they have done for a movie
3. List all the Movie IDs which have been rated (Movie Id with at least one user rating it)
4. List all the Users who have rated the movies (Users who have rated at least one movie)
5. List of all the User with the max, min, average ratings they have given against any movie
6. List all the Movies with the max, min, average ratings given by any user

**Exercise 4 – Extract facts using Hive**

Hive allows for the manipulation of data in HDFS using a variant of SQL. This makes it excellent for transforming and consolidating data for load into a relational database. In this exercise you will use HiveQL to filter and aggregate click data to build facts about user’s movie preferences. The query results will be saved in a staging table used to populate the Oracle Database.

The moveapp_log_json table contains an activity column. Activity states are as follows:
1. RATE_MOVIE
2. COMPLETED_MOVIE
3. PAUSE_MOVIE
4. START_MOVIE
5. BROWSE_MOVIE
6. LIST_MOVIE
7. SEARCH_MOVIE
8. LOGIN
9. LOGOUT
10. INCOMPLETE_MOVIE
hive> SELECT * FROM movieapp_log_json LIMIT 5;
hive> drop table movieapp_log_json;
hive> CREATE EXTERNAL TABLE movieapp_log_json ( custId INT, movield INT, genreId INT, time STRING, recommended STRING, activity INT, rating INT, price FLOAT ) ROW FORMAT SERDE 'org.apache.hadoop.hive.contrib.serde2.JsonSerde' LOCATION '/user/oracle/moviework/applog/';
hive> SELECT * FROM movieapp_log_json LIMIT 20;
hive> SELECT MIN(time), MAX(time) FROM movieapp_log_json

1. PURCHASE_MOVIE
Hive maps queries into Map Reduce jobs, simplifying the process of querying large datasets in HDFS. HiveQL statements can be mapped to phases of the Map Reduce framework. As illustrated in the following figure, selection and transformation operations occur in map tasks, while aggregation is handled by reducers. Join operations are flexible: they can be performed in the reducer or mappers depending on the size of the leftmost table.
1. Write a query to select only those clicks which correspond to starting, browsing, completing, or purchasing movies. Use a CASE statement to transform the RECOMMENDED column into integers where ‘Y’ is 1 and ‘N’ is 0. Also, ensure GENREID is not null. Only include the first 25 rows.

2. Write a query to select the customer ID, movie ID, recommended state and most recent rating for each movie.

3. Load the results of the previous two queries into a staging table. First, create the staging table:

4. Next, load the results of the queries into the staging table.

Exercise 5 Extract sessions using Pig

While the SQL semantics of HiveQL are useful for aggregation and projection, some analysis is better described as the flow of data through a series of sequential operations. For these situations, Pig Latin provides a convenient way of implementing data flows over data stored in HDFS. Pig Latin statements are translated into a sequence of Map Reduce jobs on the execution of any STORE or DUMP command. Job construction is optimized to exploit as much parallelism as possible, and much like Hive, temporary storage is used to hold intermediate results. As with Hive, aggregation occurs largely in the reduce tasks. Map tasks handle Pig’s FOREACH and LOAD, and GENERATE statements. The EXPLAIN command will show the execution plan for any Pig Latin script. As of Pig 0.10, the ILLUSTRATE command will provide sample results for each stage of the execution plan.

In this exercise you will learn basic Pig Latin semantics and about the fundamental types in Pig Latin, Data Bags and Tuples.

1. Start the Grunt shell and execute the following statements to set up a dataflow with the click stream data. Note: Pig Latin statements are assembled into Map Reduce jobs which are launched at execution of a DUMP or STORE statement.

2. Group the log sample by movie and dump the resulting bag.
3. Add a GROUP BY statement to the sessionize.pig script to process the click stream data into user sessions.

**Course Outcomes:**
The students should be able to:
- Describe big data and use cases from selected business domains
- Explain NoSQL big data management
- Install, configure, and run Hadoop and HDFS
- Perform map-reduce analytics using Hadoop
- Use Hadoop related tools such as HBase, Cassandra, Pig, and Hive for big data Analytics

**TEXT BOOKS:**

**REFERENCES:**
Course Title: Advances in Computer Networks
Course Code: 14SCS22
Credits(L:T:P):3:0:1
Core/Elective: Core
Type of Course: Lecture & Practical
Total Contact Hours: 50 Hrs

Course Objectives:
- To become familiar with the basics of Computer Networks
- To understand various Network architectures
- Concepts of fundamental protocols
- To understand the network traffic, congestion, controlling and resource allocation.

Topics:

MODULE I
Foundation
T1: Chapter 1.1, 1.2, 1.5.1, 1.5.2, 2.1, 2.5 T2: Chapter 4
10 Hours

MODULE II
Internetworking - I
Switching and Bridging, Datagram’s, Virtual Circuit Switching, Source Routing, Bridges and LAN Switches, Basic Internetworking (IP), What is an Internetwork ?, Service Model, Global Addresses, Datagram Forwarding in IP, subnetting and classless addressing, Address Translation(ARP), Host Configuration(DHCP), Error Reporting(ICMP), Virtual Networks and Tunnels.
T1: Chapter 3.1, 3.2, T2: Chapter 4
10 Hours

MODULE III
Internetworking - II
Network as a Graph, Distance Vector(RIP), Link State(OSPF), Metrics, The Global Internet, Routing Areas, Routing among Autonomous systems(BGP), IP Version 6(IPv6), Mobility and Mobile IP
T1: Chapter 3.3, 4.1.1, 4.1.3 T2: Chapter 13.1 to 13.18, Ch 18.
10 Hours

MODULE IV
End-to-End Protocols
Simple Demultiplexer (UDP), Reliable Byte Stream(TCP), End-to-End Issues, Segment Format, Connecting Establishment and Termination, Sliding Window Revisited, Triggering Transmission, Adaptive Retransmission, Record Boundaries, TCP Extensions, Queuing Disciplines, FIFO, Fair Queuing, TCP Congestion Control, Additive Increase/Multiplicative Decrease, Slow Start, Fast Retransmit and Fast Recovery.
T1: Chapter 5.1, 5.2.1 to 5.2.8, 6.2, 6.3
10 Hours

MODULE V
Congestion Control and Resource Allocation
Congestion-Avoidance Mechanisms, DEC bit, Random Early Detection (RED), Source-Based Congestion Avoidance. The Domain Name System(DNS), Electronic Mail(SMTP, POP, IMAP, MIME), World Wide Web(HTTP), Network Management(SNMP).
T1: Chapter 6.4 T2: Chapter 23.1 to 23.16, Chapter 24, Chapter 25, Chapter 27.1 to 27.8
10 Hours
Laboratory Work:

PART A: Implement the following using C/C++:

1. Write a program to transfer the contents of a requested file from server to the client using TCP/IP Sockets (using TCP/IP Socket programming).
2. Write a program to archive Traffic management at Flow level by implementing Closed Loop Control technique. (Leaky Bucket Algorithm)
3. Write a program to implement dynamic routing strategy in finding optimal path for data transmission. (Bellman ford algorithm).
4. Write a program to implement Link State Routing (Dijkstra Algorithm).
5. Write a program for implementing the error detection technique while data transfer in unreliable network code using CRC (16-bits) Technique.
6. Write a program for providing security for transfer of data in the network. (RSA Algorithm)
7. Write a program for encrypting 64 bit playing text using DES algorithm.

PART B: Simulation Programs using OPNET /NS2 or any other equivalent software

1. Simulate a 3 node point to point network with duplex links between them. Set the Queue size and vary the bandwidth and find the number of packets dropped.
2. Simulate a four-node point-to-point network, and connect the links as follows: n0->n2, n1->n2 and n2->n3. Apply TCP agent changing the parameters and determine the number of packets sent/received by TCP/UDP.
3. Simulate the different types of internet traffic such as FTP and TELNET over network and analyze the throughput.

Course Outcomes:
The students should be able to:
- List and classify network services, protocols and architectures, explain why they are layered.
- Choose key Internet applications and their protocols, and apply to develop their own applications (e.g. Client Server applications, Web Services) using the sockets API.
- Explain develop effective communication mechanisms using techniques like connection establishment, queuing theory, recovery Etc.
- Explain various congestion control techniques.

Text books:

References:
1. **Uyless Black** “Computer Networks, Protocols , Standards and Interfaces” 2nd Edition - PHI
Course Title: Advanced Algorithms
Course Code: 14SCS23
Credits(L:T:P): 4:0:0
Type of Course: Lecture
Core/Elective: Core
Total Contact Hours: 50 Hrs

Semester: II
Year: 2014-2015

COURSE OBJECTIVES

- To learn the graph search algorithms.
- To study network flow and linear programming problems.
- To learn the hill climbing and dynamic programming design techniques.
- To develop recursive backtracking algorithms.
- To get an awareness of NP completeness and randomized algorithms.

Topics:

MODULE I

10 Hours

MODULE II
Graph Algorithms: Bellman - Ford Algorithm; Single source shortest paths in a DAG; Johnson’s Algorithm for sparse graphs; Flow networks and Ford-Fulkerson method; Maximum bipartite matching.
Polynomials and the FFT: Representation of polynomials; The DFT and FFT; Efficient implementation of FFT.

10 Hours

MODULE III
Number -Theoretic Algorithms: Elementary notions; GCD; Modular Arithmetic; Solving modular linear equations; The Chinese remainder theorem; Powers of an element; RSA cryptosystem; Primality testing; Integer factorization.

10 Hours

MODULE IV
String-Matching Algorithms: Naïve string Matching; Rabin - Karp algorithm; String matching with finite automata; Knuth-Morris-Pratt algorithm; Boyer – Moore algorithms.

10 Hours

MODULE V
Probabilistic and Randomized Algorithms: Probabilistic algorithms; Randomizing deterministic algorithms, Monte Carlo and Las Vegas algorithms; Probabilistic numeric algorithms.

10 Hours

Course Outcomes:
Upon completion of the course, the students will be able to
- Design and apply iterative and recursive algorithms.
- Design and implement optimization algorithms in specific applications.
- Design appropriate shared objects and concurrent objects for applications.

TEXT BOOKS:

REFERENCE BOOKS:
Course Objectives:
- To Apply a given AI technique to a given concrete problem
- To Implement non-trivial AI techniques in a relatively large system
- To understand uncertainty and Problem solving techniques.
- To understand various symbolic knowledge representation to specify domains and reasoning tasks of a situated software agent.
- To understand different logical systems for inference over formal domain representations, and trace how a particular inference algorithm works on a given problem specification.
- To understand various learning techniques and agent technology.

TOPICS:

MODULE I
What is Artificial Intelligence: The AI Problems, The Underlying assumption, What is an AI Technique?, The Level of the model, Criteria for success, some general references, One final word and beyond.
Problems, problem spaces, and search: Defining, the problem as a state space search, Production systems, Problem characteristics, Production system characteristics, Issues in the design of search programs, Additional Problems.
Text Book 1: Chapter 1 & 2       Text Book 2: Chapter 2     10 Hours

MODULE II
Heuristic search techniques: Generate-and-test, Hill climbing, Best-first search, Problem reduction, Constraint satisfaction, Mean-ends analysis.
Using predicate logic: Representing simple facts in logic, representing instance and ISA relationships, Computable functions and predicates, Resolution, Natural Deduction.
Logical Agents: Knowledge –based agents, the Wumpus world, Logic-Propositional logic, Propositional theorem proving, Effective propositional model checking, Agents based on propositional logic.
Text Book 1: Chapter 3, 4 & 5   Text Book 2: Chapter 6      10 Hours

MODULE III
Text Book 1: Chapter 7 & 8   Text Book 2: Chapter 13       10Hours

MODULE IV
Weak Slot-and-filter structures: Semantic Nets, Frames.
Strong slot-and –filler structures: Conceptual dependency, scripts, CYC.
**Adversarial Search:** Games, Optimal Decision in Games, Alpha-Beta Pruning, Imperfect Real-Time Decisions, Stochastic Games, Partially Observable Games, State-Of-The-Art Game Programs, Alternative Approaches, Summary

**Text Book 1:** Chapter 9 & 10  **Text Book 2:** Chapter 5  
**10 Hours**

**MODULE V**

**Learning From examples:** Forms of learning, Supervised learning, Learning decision trees, Evaluating and choosing the best hypothesis, The theory of learning, PAC, Regression and Classification with linear models, Nonparametric models, Support vector machines, Ensemble learning.

**Learning Probabilistic Models:** Statistical learning, learning with complete data, learning with hidden variables: The EM algorithm.

**Text Book 2:** Chapter 18 & 20  
**10 Hours**

**COURSE OUTCOMES:**

The students are able to:
- Design intelligent agents for problem solving, reasoning, planning, decision making, and learning. specific design and performance constraints, and when needed, design variants of existing algorithms.
- Apply AI technique on current applications.
- Problem solving, knowledge representation, reasoning, and learning.

**Text Books.**


**Reference Books:**

### Course Title: Web Services

<table>
<thead>
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<th>Course Title:</th>
<th>Course Code:</th>
<th>Credits(L:T:P):</th>
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<td>Web Services</td>
<td>14SCS251</td>
<td>4:0:0</td>
<td>Elective</td>
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#### Course objectives:
- To provide an in-depth knowledge of Web Services.
- To understand the fundamental concepts of Web services.
- To understand the fundamental concepts of WSDL Web Services.
- To design Web service Architecture.
- To Study Building Blocks of Web services.

#### TOPICS:

**MODULE I**
**Middleware:** Understanding the middle ware, RPC and Related Middleware, TP Monitors, Object Brokers, Message-Oriented Middleware.  
10 Hours

**MODULE II**
**Web Services:** Web Services Technologies, Web Services Architecture.  
10 Hours

**MODULE III**
**Basic Web Services Technology:** WSDL Web Services Description Language, UDDI Universal Description Discovery and Integration, Web Services at work interactions between the Specifications, Related Standards.  
10 Hours

**MODULE IV**
**Service Coordination Protocols:** Infrastructure for Coordination Protocols, WS-Coordination, WS-Transaction, Rosetta Net and Other Standards Related to Coordination Protocols.  
10 Hours

**MODULE V**
**Service Composition:** Basic of Service Composition, A New Chance of Success for Composition, Services Composition Models, Dependencies between Coordination and Composition, BPEL: Business Process Execution Language for Web Services, Outlook, Applicability of the Web Services, Web services as a Problem and a Solution: AN Example.  
10 Hours

#### Course Outcomes:
- The students should be able to:
  - Bind and unbind services in UDDI.
  - Develop WSDL document
  - Implement web service client to call public service.
  - Implement a service and exposing it as public service.

#### Text Books:
Course Title: Information And Network Security
Course Code: 14SCS252
Credits(L:T:P):4:0:0
Type of Course: Lecture
Core/Elective: Elective
Total Contact Hours: 50 Hrs

Course Objectives:
- To understand the fundamentals of Cryptography
- To acquire knowledge on standard algorithms used to provide confidentiality, integrity and authenticity.
- To understand the various key distribution and management schemes.
- To understand how to deploy encryption techniques to secure data in transit across data networks
- To design security applications in the field of Information technology

TOPICS:

MODULE I
Classical Encryption Techniques
Symmetric Cipher Model, Cryptography, Cryptanalysis and Brute-Force Attack, Substitution Techniques, Caesar Cipher, Monoalphabetic Cipher, Playfair Cipher, Hill Cipher, Polyalphabetic Cipher, One Time Pad. Block Ciphers and the data encryption standard: Traditional block Cipher structure, stream Ciphers and block Ciphers, Motivation for the feistel Cipher structure, the feistel Cipher, The data encryption standard, DES encryption, DES decryption, A DES example, results, the avalanche effect, the strength of DES, the use of 56-Bit Keys, the nature of the DES algorithm, timing attacks, Block cipher design principles, number of rounds, design of function F, key schedule algorithm.

10 Hours

MODULE II
Public-Key Cryptography and RSA: Principals of public-key cryptosystems. Public-key cryptosystems. Applications for public-key cryptosystems, requirements for public-key cryptosystems, public-key cryptanalysis. The RSA algorithm, description of the algorithm, computational aspects, the security of RSA. Other Public-Key Cryptosystems: Diffie-hellman key exchange, The algorithm, key exchange protocols, man in the middle attack, Elgamal Cryptographic systems, Elliptic curve arithmetic, abelian groups, elliptic curves over real numbers, elliptic curves over Zp, elliptic curves overGF(2m), Elliptic curve cryptography, Analog of Diffie-hellman key exchange, Elliptic curve encryption/ decryption, security of Elliptic curve cryptography, Pseudorandom number generation based on an asymmetric cipher, PRNG based on RSA.

10 Hours

MODULE III

10 Hours

MODULE IV

10 Hours

**MODULE V**

**Electronic Mail Security**: Pretty good privacy, notation, operational; description, S/MIME, RFC5322, Multipurpose internet mail extensions, S/MIME functionality, S/MIME messages, S/MIME certificate processing, enhanced security services, Domain keys identified mail, internet mail architecture, E-Mail threats, DKIM strategy, DKIM functional flow.


10 Hours

**Course Outcomes:**

- The students be able to
- Analyze the vulnerabilities in any computing system and hence be able to design a security solution.
- Identify the security issues in the network and resolve it.
- Evaluate security mechanisms using rigorous approaches, including theoretical.

**Text Books:**


**References**

Course Objectives:
- To study the mathematical morphology necessary for Pattern recognition.
- To introduce the student to various Pattern recognition techniques.
- To study the Representation and description and feature extraction.
- To study the principles of decision trees and clustering in pattern recognition.

TOPICS:

MODULE I
**Introduction:** Definition of PR, Applications, Datasets for PR, Different paradigms for PR, Introduction to probability, events, random variables, Joint distributions and densities, moments. Estimation minimum risk estimators, problems.  
10 Hours

MODULE II
**Representation:** Data structures for PR, Representation of clusters, proximity measures, size of patterns, Abstraction of Data set, Feature extraction, Feature selection, Evaluation.  
10 Hours

MODULE III
**Nearest Neighbor based classifiers & Bayes** classifier: Nearest neighbor algorithm, variants of NN algorithms, use of NN for transaction databases, efficient algorithms, Data reduction, prototype selection, Bayes theorem, minimum error rate classifier, estimation of probabilities, estimation of probabilities, comparison with NNC, Naive Bayes classifier, Bayessian belief network.  
10 Hours

MODULE IV
**Decision Trees:** Introduction, DT for PR, Construction of DT, Splitting at the nodes, Over-fitting & Pruning, Examples.  
10 Hours

MODULE V
**Clustering:** Hierarchical (Agglomerative, single/complete/average linkage, wards, Partitional (Forgy’s, k-means, Iso-data), clustering large data sets, examples.  
10 Hours

COURSE OUTCOMES:
Upon Completion of the course, the students will be able to
- Develop and analyze decision tress.
- Design the nearest neighbor classifier.
- Develop algorithms for Pattern Recognition.

Text Books:

References
Course Title: Optical Networks
Course Code: 14SCS254
Credits(L:T:P): 4:0:0
Type of Course: Lecture
Core/Elective: Elective
Total Contact Hours: 50 Hrs

Course Objectives:
- To learn the basic elements of optical fiber transmission link, fiber modes configurations and structures
- To understand the different kind of losses, signal distortion in optical wave guides and other signal degradation factors
- To learn the various optical source materials, LED structures, quantum efficiency, Laser diodes
- To learn the fiber optical receivers such as PIN APD diodes, noise performance in photo detector, receiver operation and configuration
- To learn the fiber optical network components, variety of networking aspects, FDDI, SONET/SDH and operational principles WDM

Topics:

MODULE I

10 Hours

MODULE II
WDM Network Elements

10 Hours

MODULE III
Control and Management

10 Hours

MODULE IV
Basic Concepts, Protection in SONET/SDH:

10 Hours
MODULE V
WDM Network Design:

10 Hours

COURSE OUTCOMES:
The students will be able to:
- Gain Knowledge on fundamentals of optical network.
- Explore optical network architectures ranging from optical access networks to backbone optical transport networks.
- Choose approaches and methodologies of optical network for design effective optimization;
- Apply Techniques of optical network survivability.
- Gain knowledge on Problem solving skills and critical thinking in the discipline of optical networks.

Text Books:

References:

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<th>Course Code: 14SCS26</th>
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<td>Type of Course: Practical</td>
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COURSE OBJECTIVES

- To implement the graph search algorithms.
- To implement the string matching algorithms.
- To implement the modular linear equation algorithms.

LABORATORY WORK:

Note: The following programs can be executed on Java/C#/any equivalent tool/language by adapting exception handling technique wherever it is suitable.

1. Design, develop, and write a program to implement the Bellman-Ford algorithm and determine its performance. Give its applications.

2. Design, develop, and write a program to implement a Monte Carlo algorithm to test the primality of a given integer and determine its performance.

3. Design, develop, and write a program to solve string matching problem using naïve approach and the KMP algorithm. Compare their performances.

4. Design, develop, and write a program to solve String matching problem using Finite Automata and determine its performance.

5. Design, develop, and write a program to solve String matching problem using Robin Karp algorithm and determine its performance.

Course Outcomes:

Upon completion of the course, the students will be able to
- Design and apply graph search algorithms.
- Design and implement string matching algorithms.
- Design modular linear equation algorithms.

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<td>Total Contact Hours: 50 Hrs</td>
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**COURSE OBJECTIVES:**

- To understand the basic concepts of learning and decision trees.
- To understand the neural networks and genetic algorithms
- To understand the Bayesian techniques
- To understand the instant based learning
- To understand the analytical learning and reinforced learning

**TOPICS:**

**MODULE I**
**INTRODUCTION, CONCEPT LEARNING AND DECISION TREES**

**MODULE II**
**NEURAL NETWORKS AND GENETIC ALGORITHMS**

**MODULE III**
**BAYESIAN AND COMPUTATIONAL LEARNING**

**MODULE IV**
**INSTANT BASED LEARNING AND LEARNING SET OF RULES**

**MODULE V**
**ANALYTICAL LEARNING AND REINFORCED LEARNING**

**LABORATORY WORK**
(The following tasks can be implemented in a language of your choice or any tools available)
1) Implement the CANDIDATE – ELIMINATION algorithm. Show how it is used to learn from training examples and hypothesize new instances in Version Space.
2) Implement the FIND–S algorithm. Show how it can be used to classify new instances of target concepts. Run the experiments to deduce instances and hypothesis consistently.)
3) Implement the ID3 algorithm for learning Boolean–valued functions for classifying the training examples by searching through the space of a Decision Tree.

4) Design and implement the Back-propagation algorithm by applying it to a learning task involving an application like FACE RECOGNITION.

5) Design and implement Naïve Bayes Algorithm for learning and classifying TEXT DOCUMENTS.

COURSE OUTCOMES:
On Completion of the course, the students will be able to
- Choose the learning techniques with this basic knowledge.
- Apply effectively neural networks and genetic algorithms for appropriate applications.
- Apply bayesian techniques and derive effectively learning rules.
- Choose and differentiate reinforcement and analytical learning techniques

TEXT BOOK:

REFERENCES:
Course Title: Computer Vision
Course Code: 14SCS421
Credits(L:T:P): 4:0:0
Core/Elective: Elective
Type of Course: Lecture
Total Contact Hours: 50 Hrs


Course Objectives:
- To review image processing techniques for computer vision
- To understand shape and region analysis
- To understand Hough Transform and its applications to detect lines, circles, ellipses
- To understand three-dimensional image analysis techniques
- To understand motion analysis
- To study some applications of computer vision algorithms

TOPICS:

MODULE I

10 Hours

MODULE II

10 Hours

MODULE III

10 Hours

MODULE IV

10 Hours

MODULE V
Account, Analytical Photogrammetry, An Application: Mobile Robot Localization, **Model-Based Vision:** Initial Assumptions, Obtaining Hypotheses by Pose Consistency, Obtaining Hypotheses by Pose Clustering, Obtaining Hypotheses Using Invariants, Verification, Application: Registration In Medical Imaging Systems, Curved Surfaces and Alignment.

**Course Outcomes:**
Upon completion of the course, the students will be able to
- Implement fundamental image processing techniques required for computer vision
- Perform shape analysis
- Implement boundary tracking techniques
- Apply chain codes and other region descriptors
- Apply Hough Transform for line, circle, and ellipse detections.
- Apply 3D vision techniques.
- Implement motion related techniques.
- Develop applications using computer vision techniques.

**TEXT BOOKS**

**REFERENCES:**
Course Objectives:
- To Implement the key elements of a successful business intelligence (BI) program
- To Apply a BI meta model that turns outcomes into actions
- To Extract and transform data from an operational data to a data business data
- To Exploit business analytics and performance measurement tools

TOPICS:

MODULE I

10 Hours

MODULE II
Managing The BI Project, Defining And Planning The BI Project, Project Planning Activities, Roles And Risks Involved In These Activities, General Business Requirement, Project Specific Requirements, Interviewing Process

10 Hours

MODULE III
Differences in Database Design Philosophies, Logical Database Design, Physical Database Design, Activities, Roles And Risks Involved In These Activities, Incremental Rollout, Security Management, Database Backup And Recovery

10 Hours

MODULE IV

10 Hours

MODULE V
Business View of Information technology Applications: Business Enterprise excellence, Key purpose of using IT, Type of digital data, basics f enterprise reporting, BI road ahead.

10 Hours

Course Outcomes:
Upon completion of the course, the students will be able to
- know the complete life cycle of BI/Analytical development
- Understand the technology and processes associated with Business Intelligence framework
- Given a business scenario, identify the metrics, indicators and make recommendations to achieve the business goal.

**Text Books:**

**Reference Books:**

<table>
<thead>
<tr>
<th>Course Title: Agile Technologies</th>
<th>Course Code: 14SCS423</th>
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<tr>
<td>Type of Course: Lecture</td>
<td>Total Contact Hours: 50 Hrs</td>
</tr>
</tbody>
</table>

COURSE OBJECTIVES

- To understand how an iterative, incremental development process leads to faster delivery of more useful software
- To understand the essence of agile development methods
- To understand the principles and practices of extreme programming
- To understand the roles of prototyping in the software process
- To understand the concept of Mastering Agility

TOPICS:

MODULE I

Why Agile?: Understanding Success, Beyond Deadlines, The Importance of Organizational Success, Enter Agility, **How to Be Agile?:** Agile Methods, Don’t Make Your Own Method, The Road to Mastery, Find a Mentor

10 Hours

MODULE II

Understanding XP: The XP Lifecycle, The XP Team, XP Concepts, **Adopting XP:** Is XP Right for Us?, Go!, Assess Your Agility

10 Hours

MODULE III

Practicing XP:


10 Hours

MODULE IV

Mastering Agility

**Values and Principles:** Commonalities, About Values, Principles, and Practices, Further Reading, **Improve the Process:** Understand Your Project, Tune and Adapt, Break the Rules, **Rely on People:** Build Effective Relationships, Let the Right People Do the Right Things, Build the Process for the People, **Eliminate Waste:** Work in Small, Reversible Steps, Fail Fast, Maximize Work Not Done, Pursue Throughput

10 Hours

MODULE V
**Deliver Value**: Exploit Your Agility, Only Releasable Code Has Value, Deliver Business Results, Deliver Frequently, **Seek Technical Excellence**: Software Doesn’t Exist, Design Is for Understanding, Design Trade-offs, Quality with a Name, Great Design, Universal Design Principles, Principles in Practice, Pursue Mastery

10 Hours

**COURSE OUTCOMES**

Students should be able to

- Understand The XP Lifecycle, XP Concepts, Adopting XP
- Work on Pair Programming, Root-Cause Analysis, Retrospectives, Planning, Incremental Requirements, Customer Tests
- Implement Concepts to Eliminate Waste

**Text Books:**


**Reference Books:**

COURSE OBJECTIVES

- To introduce the concepts of wireless communication.
- To understand various propagation methods, Channel models, capacity calculations multiple antennas and multiple user techniques used in mobile communication.
- To understand CDMA, GSM, Mobile IP, WiMax
- To understand Different Mobile OS
- To learn various Markup Languages
- CDC, CLDC, MIDP; Programming for CLDC, MIDlet model and security concerns

TOPICS:

MODULE I


10 Hours

MODULE II


10 Hours

MODULE III


10 Hours

MODULE IV

Building, Mobile Internet Applications: Thin client: Architecture, the client, Middleware, messaging Servers, Processing a Wireless request, Wireless Applications Protocol (WAP) Overview, Wireless Languages: Markup Languages, HDML, WML, HTML, cHTML, XHTML, VoiceXML.

10 Hours
MODULE V

J2ME: Introduction, CDC, CLDC, MIDP; Programming for CLDC, MIDlet model, Provisioning, MIDlet life-cycle, Creating new application, MIDlet event handling, GUI in MIDP, Low level GUI Components, Multimedia APIs; Communication in MIDP, Security Considerations in MIDP.

10 Hours

COURSE OUTCOMES:
The student should be able to:
- Work on state of art techniques in wireless communication.
- Explore CDMA, GSM, Mobile IP, WiMax
- Work on Different Mobile OS
- Develop program for CLDC, MIDlet model and security concerns

TEXT BOOKS:

REFERENCE BOOKS: