I Sem M.TECH (CSE)


<table>
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<tr>
<th>Course Title: Advances In Operating Systems</th>
<th>Course Code: 14SCS11</th>
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<tr>
<td>Credits(L:T:P): 4:0:0</td>
<td>Core/Elective: Core</td>
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<tr>
<td>Type of Course: Lecture</td>
<td>Total Contact Hours: 50 Hrs</td>
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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 PreclS1) 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


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                                                                                                      Core/Elective: Core
Type of Course: Lecture & Practical                                                                 Total Contact Hours: 50 Hrs

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 continuously1 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 re compute 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.
  04 Hours

Module II
Object and Object-Relational Databases: Overview of Object-Oriented Concepts – Objects, Encapsulation, Type and class hierarchies, 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.
  12 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.
  12 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.
  14 Hours

MODULEV
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.

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
Introduction to Multi-core Architecture: Motivation for Concurrency in software, Parallel Computing Platforms, Parallel Computing in Microprocessors, Differentiating Multi-core Architectures from Hyper-Threading Technology, Multi-threading on Single-Core versus Multi-Core Platforms

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,

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 Title: Advances in Digital Image Processing  
Course Code: 14SCS151  
Credits(L:T:P):4:0:0  
Core/Elective: Elective  
Type of Course: Lecture  
Total Contact Hours: 50 Hrs

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**


**MODULE II**


**MODULE III**


**MODULE IV**

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**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.

**10 Hours**

**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
- 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
Introduction: Server Centric IT Architecture and its Limitations; Storage – Centric IT Architecture and its advantages. Case study: Replacing a server with Storage Networks The Data Storage and Data Access problem; The Battle for size and access. Intelligent Disk Subsystems: Architecture of Intelligent Disk Subsystems; Hard disks and Internal I/O Channels; JBOD, Storage virtualization using RAID and different RAID levels; Caching: Acceleration of Hard Disk Access; Intelligent disk subsystems; Availability of disk subsystems.

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

10 Hours

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:
Course Title: Embedded Computing Systems  
Course Code: 14SCS153  
Credits(L:T:P): 4:0:0  
Core/Elective: Elective  
Type of Course: Lecture  
Total Contact Hours: 50 Hrs

COURSE 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
Interprocess 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, Retional Splines, Conversion Between Spline Representations, Displaying Spline Curves and surfaces, 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

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:
2. James D Foley,Andries van dam,Steven K Feiner,John F Hughes, Computer graphics, Pearson Education

Reference Books:
1. Edward Angel: Interactive Computer graphics a top-down approach with OpenGL
Semester: I  

Course Title: Advances in Operating Systems Laboratory  
Course Code: 14SCS16  
Credits (2) (L:T:P): 0:0:3  
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.