# CLOUD COMPUTING

## Programme Structure

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Lecture (L) Hours Per Week</th>
<th>Tutorial (T) Hours Per Week</th>
<th>Practical (P) Hours Per Week</th>
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<tbody>
<tr>
<td>CSE2353</td>
<td>Computer Networks</td>
<td>3</td>
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<tr>
<td>CSE2453</td>
<td>Distributed System</td>
<td>3</td>
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<tr>
<td>CSE2553</td>
<td>High Performance Computing</td>
<td>3</td>
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<tr>
<td>CSE2653</td>
<td>Information Storage Management</td>
<td>3</td>
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<tr>
<td>CSE2753</td>
<td>Interfacing with Virtualization</td>
<td>3</td>
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<tr>
<td>CSE2853</td>
<td>Cloud Computing Tools &amp; Techniques</td>
<td>3</td>
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COMPUTER NETWORKS

Course Objective:
The course provides a unified and fundamental view of the broad field of computer networks. Furthermore, the easy to understand and extremely relevant world of Computer Networking is introduced in a top down Approach. Introduction to intranets and intranet servers and browsers, networks and network servers, LANs/WANs, internetworking technologies, the OSI reference model for networking protocols, CSMA/CD, TCP/IP implementation

Course Contents:
Module I: Introduction

Module II: Local Area Network
LAN Architecture, LAN topologies- Bus/ Tree LAN, Ring LAN, Star LAN, Wireless LAN, Ethernet and Fast Ethernet, Token Ring

Module III: Application layer and data link layer
Application Layer Protocols: HTTP, FTP, SMTP, DNS
Data link layer design issues, Flow Control- Stop and Wait, Error Detection, Error Control, error detection and correction, data link layer protocols, sliding window protocols, example of data link protocol- HDLC

Module IV: Medium access layer
Channel allocation problem, multiple access protocols, Introduction to ALOHA, CSMA/CD, CSMA/CA

Module V: The network layer
Introduction, Routers, Network layer concepts, shortest path routing, flooding, distance vector routing, link state routing (without algorithms), congestion control and quality of service, internetworking, IP, Ipv4 Addressing vs Ipv6

Module VI: The transport layer
The transport layer services, elements of transport protocols, TCP and UDP, Brief introduction to presentation and session layer, E-mail

Examination Scheme:

<table>
<thead>
<tr>
<th>Components</th>
<th>A</th>
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<th>HA</th>
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<td>70</td>
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</tbody>
</table>
CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:

Text:
- Data Communication & networking: Forouzan, B. A.
- Data and Computer Communications, W. Stallings, Prentice Hall of India

References:
- Computer Networks: Tanenbaum, Andrew S, Prentice Hall
DISTRIBUTED SYSTEM

Course Code: CSE2453
Credit Unit: 03

Course Objective:
It serves as one of the important courses in terms of having an understanding about the basic concepts about distributed systems, their types or categories with some concepts about basic networking and various different directions in which it is useful and applicable. The outcome of the course implicitly and explicitly affects the abilities of students to have a good understanding of the upcoming other related courses.

Course Contents:
Module 1: Introduction to Distributed System

Module 2: Networking and Internetworking
Introduction to networking, Networking issues for distributed systems, Types of network (LAN, MAN, WAN, WLAN, WMAN, WWAN, internetworks), Network principles, Internet protocols, Basics of Inter-Process communication, Multicast Communication, Network virtualization: overlay networks, Remote invocation, Remote Procedure Call, Remote method invocation.

Module 3: Operating System Support, Web Services and Security
Introduction, Operating System layer, Operating System Architecture, Virtualization at Operating System level, Introduction to web services, Service descriptions and IDL for web services, Applications of web services, Overview of Security Techniques, Cryptographic algorithms, Digital signatures, Needham–Schroeder, Kerberos techniques.

Module 4: Distributed File Systems and Distributed Transactions
Introduction (URI, URL's ), Name services and the Domain Name System(NameSpace, Name Resolution, DNS), Directory services, Transactions, Nested transactions, Locks, Optimistic concurrency control, Flat and nested distributed transactions, Atomic commit protocols, Concurrency control in distributed transactions, Distributed deadlocks.

Module 5: Distributed Multimedia System and Distributed Algorithms
Characteristics of multimedia data, Quality of service management, Resource management, Stream adaptation, Introduction to communication protocols, Balanced sliding window protocol, Routing algorithms, Destination based routing, APP problem, Deadlock free Packet switching.

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Text & References:
Text:

References:
- Gerald Tel, "Distributed Algorithms", Cambridge University Press
HIGH PERFORMANCE COMPUTING

Course Code: CSE2553
Credit Units: 03

Course Objective:
This course gives an insight about Cluster and Grid computing. The major objective of this course is to provide a sound foundation to the students on the concepts, percepts and practices in a field that is of immense concern to the industry and business. This would be helpful to students for understanding a subject related to but a bit higher in its hierarchy.

Course Contents:
Module 1: Parallel and Distributed Programming Models

Module 2: Overview of Cluster Computing

Module 3: Introduction of Grid Computing

Module 4: Integrating task parallelism with data parallelism
Introduction and motivation, A model for integrating task parallelism into data parallel programming platforms, Integration of the model into ARC, Design and implementation applications, performance analysis, guidelines for composing user programs, related work. Anonymous remote computing and communication model: Introduction, Location in dependent inter task communication with DP, DP model of iterative grid computations, Design and implementation of distributed pipes.

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Text & References:

Text:
- “Grid Computing a Research Monograph” by D. Janakiram, Tata McGraw hill publications

References:
- Joshy Joseph & Craig Fellenstein, “Grid Computing”, Pearson Education
- “Grid Computing: A Practical Guide to technology and Applications” by Ahmar Abbas, Charles River media
INFORMATION STORAGE MANAGEMENT

Course Code: CSE2653 Credit Units: 03

Course Objective:
The course provides detailed knowledge, practical training and insight into the implementation and management of various storage technologies with a focus towards applying these technologies in an information lifecycle paradigm. This course focuses on evolution of storage and implementation models, Storage devices principles, Storage classes (SAN, NAS. CAS) and Backup, Business Continuity, and Disaster Recovery principles.

Course Contents:
Module 1: Introduction to Storage Technology
Information Storage - Data, Types of Data, Information, Storage, Evolution of Storage Technology and Architecture, Data Center Infrastructure, Key Challenges in Managing Information, Information Lifecycle - Information Lifecycle Management, ILM Implementation, ILM Benefits.

Module 2: Data Protection & Intelligent Storage System

Module 3: Storage Networking Technologies & Virtualization
Direct-Attached Storage and Introduction to SCSI- Types of DAS, DAS Benefits and Limitations, Disk Drive Interfaces, Introduction to Parallel SCSI, Storage Area Networks- Fibre Channel: Overview, SAN and its evolution, Components of SAN, Network-Attached Storage- General Purpose Servers vs. NAS Devices, Benefits of NAS, Components of NAS.

Module 4: CAS and Business Continuity

Module 5: Backup, Recovery & Replication

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Text & References:
Text:

References:
- Marc Farley Osborne, "Building Storage Networks", Tata McGraw Hill
INTERFACING WITH VIRTUALIZATION

Course Objective:
This course gives students an insight into the basics of cloud computing along with virtualization, cloud computing is one of the fastest growing domain from a while now. It will provide the students basic understanding about cloud and virtualization along with it how one can migrate over it.

Course Contents:

Module-I: Introduction to Virtualization
Virtualization and cloud computing - Need of virtualization – cost, administration, fast deployment, reduce infrastructure cost – limitations
Types of hardware virtualization: Full virtualization - partial virtualization - para virtualization
Desktop virtualization: Software virtualization – Memory virtualization - Storage virtualization – Data virtualization – Network virtualization

Module-II: Hypervisors and Virtual machines
Server Virtualization: Understanding Server Virtualization, types of server virtualization, Virtual machine basics, types of virtual machines, hypervisor concepts and types

Module-III: Virtualization Solutions

Module-IV: Migrating into a Cloud
Introduction, Challenges while migrating to Cloud, Broad approaches to migrating into the cloud-why migrate -deciding on cloud migration, the Seven-step model of migration into a cloud, Migration Risks and Mitigation, Enterprise cloud computing paradigm, relevant Deployment Models for Enterprise Cloud Computing, Adoption and Consumption Strategies, issues for enterprise applications on the cloud

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Text & References:

Text:
- David Marshall, Wade A. Reynolds, Advanced Server Virtualization: VMware and Microsoft Platform in the Virtual Data Center, Auerbach

References:
CLOUD COMPUTING TOOLS AND TECHNIQUES

Course Code: CSE2853  Credit Units: 03

Course Objective:
This course gives students an insight into the basics of cloud computing along with virtualization, cloud computing is one of the fastest growing domain from a while now. It will provide the students basic understanding about cloud and virtualization along with it how one can migrate over it.

Course Contents:
Module-I: Cloud Computing Overview
Origins of Cloud computing – Cloud components - Essential characteristics – On-demand self-service, Broad network access, Location independent resource pooling ,Rapid elasticity , Measured service, Comparing cloud providers with traditional IT service providers, Roots of cloud computing.

Module-II: Cloud Insights

Module-III: Cloud Architecture- Layers and Models
Layers in cloud architecture, Software as a Service (SaaS), features of SaaS and benefits, Platform as a Service ( PaaS ), features of PaaS and benefits, Infrastructure as a Service ( IaaS), features of IaaS and benefits, Service providers, challenges and risks in cloud adoption.

Module-IV: Cloud Simulators- CloudSim and GreenCloud
Introduction to Simulator, understanding CloudSim simulator, CloudSim Architecture(User code, CloudSim, GridSim, SimJava) Understanding Working platform for CloudSim, Introduction to GreenCloud

Module-V: Introduction to VMWare Simulator
Basics of VMWare, advantages of VMware virtualization, using Vmware workstation, creating virtual machines-understanding virtual machines, create a new virtual machine on local host, cloning virtual machines, virtualize a physical machine, starting and stopping a virtual machine.

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References:
- Cloud Computing (Principles and Paradigms), Edited by Rajkumar Buyya, James Broberg, Andrzej Goscinski, John Wiley & Sons, Inc. 2011