Guru Nanak Dev Engineering College, Bidar

Course Planning

STORAGE AREA NETWORKS (18CS822)

Credit: 3 **Hours: 40**

CONTENTS

Course Objectives: To

1 Evaluate storage architectures,

2.Define backup, recovery, disaster recovery, business continuity, and replication

3.Examine emerging technologies including IP-SAN

4.Understand logical and physical components of a storage infrastructure

5.Identify components of managing and monitoring the data center

6.Define information security and identify different storage virtualization technologies

Pre-requisites:
Students must have knowledge about computer networks, storage devices, Advanced Computer Architecture, And all fundamentals of a computer system processing

Linkages with other Courses:

1. Cloud Computing
2. Operating System
3. Computer Networks
4. Cryptography and network security

Course Policies and Procedures:
(Expectations from students, Rules for Student Assignments, Assignment Grading System, CIE and Semester End Examinations.)
Expectations from student:
1**.** Students should have the knowledge of pre-requisite
2. Students should complete all assignments in a time bound manner
Rules for assignments: At the end of every module, assignments in the form of question answers will be given and students have submit the same before last date
Assignment Grading System
Each assignment will be evaluated for 10 marks and final score for assignment will be the average marks scored in all the assignments.(Similarly other assignments like seminar, model making has to be evaluated using suitable rubrics)
CIE and Semester End Examinations: As per the VTU regulations.

Evaluation Policy (It is only indicative, may vary from course to course):

Level of Question	Approximate % of Question
Understanding	20
Apply	35
Analyze / Solve	35
Design	10

Lesson Plan

Module wise distribution of Classes	Topics	Class Number	Teaching Methodology
	Overview of course, Course Outcome its linkages with other courses and practical applications, expectations from students, Evaluation Policy etc.		Interactive Discussion
8	**Module 1:.Storage System** Introduction to evolution of storage architecture, key data center	1	Lecture /PPT
	elements, virtualization, and cloud computing. Key data center elements – Host	3	Lecture /PPT
	(or compute), connectivity, storage, and application in both classic and virtual	4	Lecture /PPT
	environments. RAID implementations, techniques, and levels along with the	5	Lecture /PPT
	impact of RAID on application performance.Components of intelligent storage	6	Lecture /PPT
	systems and virtual storage provisioning and intelligent storage system	7	Lecture /PPT
	implementations.	8	Revision / Quiz
8	**Module 2: Storage Networking Technologies and Virtualization** Fibre Channel SAN		Lecture /PPT
	components, connectivity options, and topologies including access protection	2	Lecture /PPT
	mechanism ‘zoning”, FC protocol stack, addressing a nd operations, SAN-based	3	Lecture /PPT
	virtualization and VSAN technology, iSCSI and FCIP protocols for storage	4	Lecture /PPT
	access over IP network, Converged protocol FCoE and its components, Network	5	Lecture /PPT

	Attached Storage (NAS) - components, protocol and operations, File level	6	Lecture /PPT
	storage virtualization,	7	Lecture /PPT
	Object based storage and unified storage platform.	8	Revision / Quiz
8	**Module 3: Backup, Archive, and Replication** This unit focuses on information availability	1	Lecture /PPT
	and business continuity solutions in both virtualized and non-virtualized	2	Lecture /PPT
	environments. Business continuity terminologies, planning and solutions,	3	Lecture /PPT
	Clustering and multipathing architecture to avoid single points of failure, Backup	4	Lecture /PPT
	and recovery - methods, targets and topologies, Data deduplication and backup in	5	Lecture /PPT
	virtualized environment, Fixed content and data archive, Local replication in	6	Lecture /PPT
	classic and virtual environments, Remote replication in classic and virtual	7	Lecture /PPT
	environments, Three-site remote replication and continuous data protection	8	Revision / Quiz
8	**Module 4: Cloud Computing Characteristics and benefits** This unit focuses on the	1	Lecture /PPT
	business drivers, definition, essential characteristics,	2	Lecture /PPT
	and phases of journey to the	3	Lecture /PPT
	Cloud. ,Business drivers for Cloud computing, Definition of Cloud computing,	4	Lecture /PPT
	Characteristics of Cloud computing, Steps involved in transitioning from Classic	5	Lecture /PPT

	data center to Cloud computing environment Services and deployment models,	6	Lecture /PPT
	Cloud infrastructure components,	7	Lecture /PPT
	Cloud migration considerations	8	Revision / Quiz
8	**Module 5: Securing and Managing Storage Infrastructure** This chapter focuses on framework and domains of storage security along with covering security	1	Lecture /PPT
	implementation at storage networking. Security threats, and countermeasures in	2	Lecture /PPT
	various domains Security solutions for FC-SAN, IP-SAN and NAS environments,	3	Lecture /PPT
	Security in virtualized and cloud environments,	4	Lecture /PPT
	Monitoring and managing various information infrastructure	5	Lecture /PPT
	components in classic and virtual environments,	6	Lecture /PPT
	Information lifecycle management (ILM) and storage tiering,	7	Lecture /PPT
	Cloud service management activities	8	Revision / Quiz

Course Teaching Materials:

Teaching materials such as Notes, PPT, Videos, etc. to be attached

Module No.	Course Teaching Materials
1	Notes
	PPT
	Videos
2	Notes
	PPT
	Videos
3	Notes
	PPT
	Videos
4	Notes
	PPT
	Videos
5	Notes
	PPT
	Videos

Question Bank:

1. Module wise Question bank to be enclosed

Module 1.

1.What are types of data? Explain the Key characteristics of data centre elements.

2.Describe RAID levels with reference to RAID 0, RAID 1 and nested RAID, with neat diagram.

3.Explain two types of RAID implementation and also components of RAID array.

4.With diagram discuss the components of Disk Drive.

5.Describe the logical components of the Host.

6.Briefly explain RAID 4, RAID 5, RAID 6 level implementation with suitable figure.

7.Explain key management activities involved in managing modern data centre also explain key challenges in managing information.

8.With Example of Order Processing System explain the core elements of Data Center Infrastructure.

9.Describe Evolution of Storage Technology

10.Briefly explain three main components in a storage system environment.

Module 2.

1.Explain FC connectivity options with relevant diagrams.

2.Explain block - level storage virtualization with neat diagram .Explain VSAN in brief.

3.What is FCoE?Explain the components of FCoE with neat diagram.

4.What is NAS?Explain the benefits of NAS.

5.explain with neat diagram the components of fibre Channel(FC)storage area networks.

6.what is zonning?Explain its types.

7.Discuss different iSCSI topologies with neat diagram.

8.Write short notes on Fiber Channel Over Ethernet(FCOE).

9.List and explain FC connectivity options with neat diagram .

10.With diagram explain ISCSI implementation.

11.what is NAS ?Explain NAS implementation in detail.

12.List the key features of Content Addressed storage (CAS).Illustrate with neat block diagram the unified storage for CAS system.

Module 3.

1.Identify key areas to monitor in a data center for different components

2.Understand the different networked storage options for different application environments.

3. Differentiate between business continuity (BC) and disaster recovery (DR).

4.Define planned and unplanned outages in SAN.
5.Understand the different networked storage options for different application environments.

6.Understand the different backup and recovery topologies and their role.

Module 4.

1.What is cloud computing ?Explain the characteristics and benefits of cloud computing.

2.Explain the various cloud service models available.

3. Explain the public cloud and private cloud deployment models in cloud computing.

4.Explain the cloud computing infrastructure in detail.

5.Explain the characteristics of cloud computing.

6.Discuss cloud Deployment models.

7.Explain Cloud computing Infrastructure.

8.Discuss the steps involved in transitioning from classic data center to cloud computing Environment service.

9)Write short notes on the following:

i)Business drives for cloud computing

ii)Cloud migration considerations

Module 5.

1.Explain FC SAN security architecture with neat diagram.

2.Explain the concept of Kerberos with neat diagram .

3.Explain th estorage management activities in detail .

4.Explain Information Life Cycle Management(ILM) in detail with challenges .

5.Explain different types of security threats .

6.Discuss security solutions for FC SAN and IP –SAN .

7.Explain the various information infrastructure components in classic and virtual environments.

8.Write short notes on the following:

i) Information Life Cycle Management (ILM)

ii)Storage Tiring .

Text Books:

1.Information Storage and Management,Author :EMC Education Services, Publisher: Wiley ISBN: 9781118094839

2.Storage Virtualization, Author: Clark Tom, Publisher: Addison Wesley Publishing Company ISBN : 9780321262516

Reference Books:NIL

Web Resources:

VTU E-learning Resources

Storage-Area-Networks

Blogs:

san-vs-nas

NPTEL/MOOCS:

Storage_Area_Network

Software: All relevant network softwares, knowledge about computer hardware driver softwares

Research Organizations / Industries in the field: .

Internetworking_the_Storage_Area_Networks

storage-area-network-SAN

Course Outcomes:

CO1: Identify key challenges in managing information and analyze different storage networking technologies and virtualization

CO2: Explain components and the implementation of NAS

CO3: Describe CAS architecture and types of archives and forms of virtualization

CO4: Ilustrate the storage infrastructure and management activities

CO 5: Design of security implementation at storage network.

CO-PO Matrix:

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