

Lovely Professional University, Punjab

| Course Code | Course Title | Course Planner | Lectures | Tutorials | Practicals | Credits |
|---------------------------|--|--------------------|----------|-----------|------------|---------|
| CSE507 | STORAGE TECHNOLOGY FOUNDATION LABORATORY | 17783::Komal Arora | 0 | 0 | 2 | 1 |
| Course Weightage | ATT: 5 CAP: 45 ETP: 50 | | | | | |
| Course Orientation | NA | | | | | |

Course Outcomes :Through this course students should be able to

CO1 :: Demonstrate the installation and configuration of FreeNAS using console and web Interface.

CO2 :: Demonstrate the Creation and Visualization of RAID groups using FreeNAS emulator

CO3 :: Demonstrate the Addition of different storages to FreeNAS system.

CO4 :: understand Creating and working with ZFS pools.

CO5 :: Demonstrate the recovery from certain storage Failures through backups and replication techniques

CO6 :: Demonstrate Sharing of storage on the network, Hosting virtual machines and jails with FreeNAS

| | Reference Books (R) | | |
|-------|---|------------------------------------|-----------------------|
| Sr No | Title | Author | Publisher Name |
| R-1 | BUILDING STORAGE NETWORKS | MARC FARLEY OSBORNE | MCGRAW HILL EDUCATION |
| R-2 | STORAGE NETWORKS: THE COMPLETE REFERENCE | ROBERT SPALDING | MCGRAW HILL EDUCATION |
| R-3 | DATABASE CLOUD STORAGE: THE ESSENTIAL GUIDE TO ORACLE AUTOMATIC STORAGE MANAGEMENT | NITIN VENGURLEKAR, PRASAD BAGAL | MCGRAW HILL EDUCATION |
| R-4 | INFORMATION STORAGE AND MANAGEMENT: STORING, MANAGING, AND PROTECTING DIGITAL INFORMATION IN CLASSIC, VIRTUALIZED, AND CLOUD ENVIRONMENTS | EMC EDUCATION SERVICES | WILEY |

Other Reading (OR)

| Sr No | Journals articles as Compulsary reading (specific articles, complete reference) |
|-------|---|
| OR-1 | https://www.ixsystems.com/documentation/freenas/8.3.0/freenas8.3_guide.pdf , |

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|--------------------------|--|---|
| OR-2 | https://www.ixsystems.com/documentation/freenas/11.2/FreeNAS.pdf , | |
| Relevant Websites (RW) | | |
| Sr No | (Web address) (only if relevant to the course) | Salient Features |
| RW-1 | https://www.freenas.org/ | It provides all the information about the tool used in this Practical course. |

***Each experiment of the lab will be evaluated using following relative scheme:**

| Component | Weightage (%) |
|--|---------------|
| Performance/Job evaluation/conduct/skill execution/demonstration | 50 |
| Viva | 50 |

Detailed Plan For Practicals

| Practical No | Broad topic | Subtopic | Other Readings | Learning Outcomes |
|--------------|---|--|----------------------|---|
| Practical 1 | Installation and configuration of FreeNAS and understanding of its console and web Interface. | Installation of FreeNAS. | OR-1 OR-2 | Student will get to know about installation and configuration of FreeNAS using console and web Interface. |
| | Installation and configuration of FreeNAS and understanding of its console and web Interface. | Understanding Console and Web Interface | OR-1 OR-2 | Student will get to know about installation and configuration of FreeNAS using console and web Interface. |
| | Installation and configuration of FreeNAS and understanding of its console and web Interface. | System Configuration | OR-1 OR-2 | Student will get to know about installation and configuration of FreeNAS using console and web Interface. |
| Practical 2 | Working with Storage Volume, Understanding of RAID and RAID groups. | Creation of RAID groups for a storage Volume. | OR-1 OR-2 RW-1 | student will get to know about the Creation and Visualization of RAID groups and Volumes using FreeNAS emulator |
| | Working with Storage Volume, Understanding of RAID and RAID groups. | Importing Volumes, Volume Manager, Creating, Adding and Modifying Datasets, Deduplication, Compression | OR-1 OR-2 RW-1 | student will get to know about the Creation and Visualization of RAID groups and Volumes using FreeNAS emulator |
| | Working with Storage Volume, Understanding of RAID and RAID groups. | Storage-swap, Space pools, Importing a disk, Import Information from other disks | OR-1 OR-2 RW-1 | student will get to know about the Creation and Visualization of RAID groups and Volumes using FreeNAS emulator |

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| Practical 3 | Understanding and Configuring Virtual Machines, ZFS | Creation of ZFS pool, Creating and Configuring Virtual Machines, adding Devices to VMs, Docker Host VMs | OR-1 OR-2 RW-1 | Student will get to know about Creating and working with ZFS pools. |
| Practical 4 | Understanding and Configuring Virtual Machines, ZFS | Creation of ZFS pool, Creating and Configuring Virtual Machines, adding Devices to VMs, Docker Host VMs | | Student will get to know about Creating and working with ZFS pools. |
| Practical 5 | Configuring Snapshots | Periodic Snapshot Task, Browsing a Snapshot Collection, VMware-Snapshots | | Creation and managing snapshot for the purpose of recovery in case of any failure |
| Practical 6 | Replication Tasks | Configure PUSH-PULL, Common Configuration:-Alpha (Source) - Beta (Destination), Example: FreeNAS to FreeNAS Semi-Automatic Setup, Dedicated User Replication, Other Systems, Manual Setup | | Student will get to know Creation and managing replicas for the purpose of recovery in case of any Failure |
| Practical 7 | Replication Tasks | Encryption Keys, Replication Options, Replication Encryption, Limiting Replication Times, Troubleshooting Replication | OR-1 OR-2 RW-1 | Student will get to know Creation and managing replicas for the purpose of recovery in case of any Failure |
| Practical 8 | Replacing a Failed Disk | Recovering from storage failures, Replacing a Failed Drive or ZIL Device, Replacing an Encrypted Disk, Removing a Log or Cache Device, Replacing Disks to Grow a Pool | OR-1 OR-2 RW-1 | Student will get to know how to replace a failed disk or any other type of disk in case of any need. |
| Practical 9 | Sharing Storage on the Network | Sharing Storage on the Network, Shared storage for Groups, Managing Users and Groups, Managing Services | OR-1 OR-2 RW-1 | Student will get to know about Sharing Storage on the Network, Shared storage for Groups, Managing Users, Groups and other services. |
| Practical 10 | Sharing Configuration | Apple (AFP) Shares, Unix (NFS) Shares, WebDAV Shares | OR-1 OR-2 RW-1 | Student will get to know about Apple (AFP) Shares, Unix (NFS) Shares, WebDAV Shares |
| Practical 11 | Sharing Configuration | Windows (CIFS) Shares, Windows (SMB) Shares | OR-1 OR-2 RW-1 | Student will get to know about Windows (CIFS) Shares, Windows (SMB) Shares |
| Practical 12 | Jails and Plugins | Installation, Update, Deletion and Creation of Plugin, Test a Plugin, Official Plugins | OR-1 OR-2 RW-1 | Student will get to know about Installation, Update, Deletion and Creation of Plugin, Test a Plugin, Official Plugins |
| Practical 13 | Jails and Plugins | Jail Storage, Creating and Managing Jails, Managing iocage Jails | OR-1 OR-2 RW-1 | Student will get to know about Jail Storage, Creating and Managing Jails, Managing iocage Jails |

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| Practical 14 | iSCSI (Block Sharing) | Target Global Configuration, Portals, Initiators, Authorized Accesses, Targets, Extents, Associated Targets, Connecting to iSCSI share, Growing LUNs, Zvol Based LUN, File Extent Based LUN, Time Machine Shares | OR-1 OR-2 RW-1 | Student will get to know about iSCSI(block sharing) and its management |
| | SPILL OVER | | | |
| Practical 15 | Spill Over | | | |