**Integral University, Lucknow**

| Effective from Session: 2020-21 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Course Code | CS-351 | Title of the Course | Cloud Technology | | L | T | P | C |
| Year | III | Semester | V | | 3 | 1 | 0 | 4 |
| Pre-Requisite | None | Co-requisite | None | | | | | |
| Course Objectives | • To understand cloud services and solutions.<br>• To understand the process and purposes of migrating into cloud.<br>• To understand the relevance of Cloud, SOA and benchmarks<br>• To Know about governance in cloud and Do's and Don'ts in cloud | | | | | | | |

| Course Outcomes | |
|---|---|
| CO1 | *State* various delivery models and service models of cloud computing |
| CO2 | *Explain* seven-step model for migrating into cloud |
| CO3 | *Illustrate* various considerations for selecting cloud solution |
| CO4 | *Analyze* importance of governance in cloud |
| CO5 | *Specify* the do's and don'ts of cloud computing. |

| Unit No. | Title of the Unit | Content of Unit | Contact Hrs. | Mapped CO |
|---|---|---|---|---|
| 1 | **Introduction** | Introduction to Cloud Computing, History and Evolution of Cloud Computing, Types of clouds, Private Public and hybrid clouds, Cloud Computing architecture, Cloud computing infrastructure, Merits of Cloud computing, , Cloud computing delivery models and services (IaaS, PaaS, SaaS), obstacles for cloud technology, Cloud vulnerabilities, Cloud challenges, Practical applications of cloud computing. | 6 | 1 |
| 2 | **Cloud Computing Companies and Migrating to Cloud** | Web-based business services, Delivering Business Processes from the Cloud: Business process examples, Broad Approaches to Migrating into the Cloud, The Seven-Step Model of Migration into a Cloud, Efficient Steps for migrating to cloud., Risks: Measuring and assessment of risks, Company concerns Risk Mitigation methodology for Cloud computing, Case Studies. | 8 | 2 |
| 3 | **Cloud Cost Management and Selection of Cloud Provider** | Assessing the Cloud: software Evaluation, System Testing, Seasonal or peak loading, Cost cutting and cost-benefit analysis, selecting the right scalable application. Considerations for selecting cloud solution. Understanding Best Practices used in selection of Cloud service and providers, Clouding the Standards and Best Practices Issue: Interoperability, Portability, Integration, Security, Standards Organizations 8and Groups associated with Cloud Computing, Commercial and Business Consideration | 10 | 3 |
| 4 | **Governance in the Cloud** | Industry Standards Organizations and Groups associated with Cloud Computing, Need for IT governance in cloud computing, Cloud Governance Solution: Access Controls, Financial Controls, Key Management and Encryption, Logging and Auditing, API integration. Legal Issues: Data Privacy and Security Issues, Cloud Contracting models, Jurisdictional Issues Raised by Virtualization and Data Location, Legal issues in Commercial and Business Considerations | 8 | 4 |
| 5 | **Ten Cloud DO and DONTS**: | Don't be reactive, do consider the cloud a financial issue, don't go alone, do think about your architecture, don't neglect governance, don't forget about business purpose, do make security the centerpiece of your strategy, don't apply the cloud to everything, don't forget about Service Management, do start with a pilot project. | 8 | 5 |

**Reference Books:**

Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, "Cloud Computing: Principles and Paradigms", John Wiley and Sons Publications, 2011

Christopher Barnett, "Brief Guide to Cloud Computing", Constable & Robinson Limited, 2010 BorivojeFurht, Armando Escalante, "Handbook on Cloud Computing" , Springer, 2010

**e-Learning Source:**

https://onlinecourses.nptel.ac.in/noc22_cs20/preview

| PO-PSO<br>CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 2 | | | 2 | | | | | | 3 | 1 | 2 | |
| CO2 | 3 | 3 | 2 | 3 | | 2 | | | | | | 3 | | 3 | |
| CO3 | 3 | 3 | 2 | 2 | 2 | | | | | | | 3 | 1 | | 1 |
| CO4 | 3 | 2 | 3 | 2 | | 1 | | | | | | 2 | 1 | | 1 |
| CO5 | 3 | 2 | 3 | | 2 | | | | | | | 2 | 1 | 2 | 1 |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

**Integral University, Lucknow**

| **Effective from Session:** 2020-21 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Course Code** | CS-363 | **Title of the Course** | Database Security | | **L** | **T** | **P** | **C** |
| **Year** | III | **Semester** | V | | 3 | 1 | 0 | 4 |
| **Pre-Requisite** | None | **Co-requisite** | None | | | | | |
| **Course Objectives** | ● Master the security architecture<br>● Master virtual private databases<br>● Master multilevel secure relational model<br>● Master auditing in relational databases<br>● Understand NoSQL databases and its differences with RDBMS<br>● Understand administration of users<br>● Understand the databases security models | | | | | | | |

| **Course Outcomes** | |
|---|---|
| **CO1** | *Identify* the schemas for security and concepts of symmetric Encryption. |
| **CO2** | *Explain* the different models in the Security Architecture |
| **CO3** | *Illustrate* auditing in relational database and demonstrate the authentication stored procedure by signature. |
| **CO4** | *Analyze* the concept of least privilege in information security and difference between classical DBMS with the NoSQL. |
| **CO5** | *Understand* auditing structure modification.configuring SQL server auditing. |

| Unit No. | Title of the Unit | Content of Unit | Contact Hrs. | Mapped CO |
|---|---|---|---|---|
| 1 | **Concepts of Database Security Management System** | Database security concept, Importance of data, Levels of data security, Authorization in databases, Issues in database security, Concept of Least Privilege in User ID for databases. Perimeter security, firewalls, intrusion detection, and intrusion prevention. | 6 | 1 |
| 2 | **Concepts of NoSQL** | No SQL databases introduction, Differences from classical DBMS concepts with NoSQL, Advantages of NoSQL like Elastic Scaling, Big Data, Goodbye DBAs', Economics/Cost, Flexible Data models. Non/ partial applicability of ACID (Atomicity, Consistency, Isolation, Durability), BASE Properties, CAP theorem, comparison to traditional RDBMS databases. Horizontal scalability, Benefits of NoSQL Databases compared to traditional Databases. Concept of UnSQL or Unstructured Query Language, Concept of Key Value & Tuple Store Databases, Concept of Graph Databases, Concept of Multimodel Databases | 8 | 2 |
| 3 | **Encryption and Permissions in SQL Server 2012** | Facility and Supply Recovery strategies. User Recovery strategies. Technical Recovery strategies, Data Recovery strategies, Activation Phase- Major Disaster or Disruption, Intermediate Disaster or Disruption, Minor Disaster, Activating BC/DR Teams, Developing Triggers, Transition Trigger. Defining BC/DR Team and Key Personnel, Defining Tasks, Assigning Resources, Communication Plan. | 8 | 3 |
| 4 | **Security of SQL Server 2012** | User authorization, authentication and security, protecting data using permissions, roles, schemas, SQL firewall, web application firewall, securing dynamic SQL from injections, protecting SQL server from DoS and injection attacks. | 7 | 4 |
| 5 | **SQL Server Auditing** | Auditing – Using the profiler to audit SQL server access, using DML trigger for auditing data modification, Using DDL triggers for auditing structure modification, configuring SQL server auditing, auditing and tracing user configurable events, policy based management, system centre advisor to analyze instances. | 6 | 5 |

**Reference Books:**

Handbook of database security: Applications and Trends Michael Gertz, Sushil Jajodia, Pub: Springer, 1st ed; 2008

Implementing database security and auditing, Ron Ben-Natan, Pub: Digital Press, 1st ed; 2005

**e-Learning Source:**

https://www.tutorialspoint.com/database-security-for-cyber-professionals/index.asp

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

**2- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

| Effective from Session: 2020-21 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Course Code** | CS-355 | **Title of the Course** | Ethical Hacking | | **L** | **T** | **P** | **C** |
| **Year** | III | **Semester** | V | | 3 | 1 | 0 | 4 |
| **Pre-Requisite** | None | **Co-requisite** | None | | | | | |
| **Course Objectives** | To enable students to better understand the Ethical hacking concepts and various phases of hacking along with the objective of providing an in-depth knowledge on Web Application vulnerabilities and exploitation techniques.<br><br>To familiarize them with the wide range of attacks in a Networking environment and to enable him/her to prepare a well-defined vulnerability reporting procedure along with the remediation techniques | | | | | | | |

| Course Outcomes | |
|---|---|
| **CO1** | Outline ethical considerations of hacking |
| **CO2** | Assess an environment using foot printing |
| **CO3** | Collect information using network scanning |
| **CO4** | Analyze social engineering methods |
| **CO5** | Understand cyber theft and IPC sec 378, IT Act 2008 – sections 43, 65 and 66 |

| Unit No. | Title of the Unit | Content of Unit | Contact Hrs. | Mapped CO |
|---|---|---|---|---|
| 1 | **Introduction to Ethical Hacking** | Hacking Methodology, Process of Malicious Hacking, and Foot printing and scanning: Foot printing, scanning. Enumeration: Enumeration. System Hacking and Trojans: System Hacking, Trojans and Black Box Vs. White Box Techniques | 8 | 1 |
| 2 | **Hacking Methodology** | Denial of Service, Sniffers, Session Hijacking and Hacking Web Servers: Session Hijacking, Hacking Web Servers. Web Application Vulnerabilities and Web Techniques Based Password Cracking: Web Application Vulnerabilities, Web Based Password Cracking Techniques. | 8 | 2 |
| 3 | **Web and Network Hacking** | SQL Injection, Hacking Wireless Networking, Viruses, Worms and Physical Security: Viruses and Worms, Physical Security. Linux Hacking: Linux Hacking. Evading IDS and Firewalls: Evading IDS and Firewalls. | 8 | 3 |
| 4 | **Report writing & Mitigation** | Introduction to Report Writing & Mitigation, requirements for low level reporting &high level reporting of Penetration testing results, Demonstration of vulnerabilities and Mitigation of issues identified including tracking. | 8 | 4 |
| 5 | **Ethical Hacking and Legal System**: | Overview of India's Information Technology Amendment Act 2008 (IT Act 2008), hacker vs cracker, liabilities – civil and penal, cyber theft and IPC sec 378, IT Act 2008 – sections 43, 65 and 66, how to file a complaint of suspected hacking, Case Studies, understanding how hacking is legally dealt with among BRICS countries | 8 | 5 |

**Reference Books:**

Gray Hat Hacking The Ethical Hackers Handbook, 3rd Edition Paperback – 1 Jul 2017 by Allen Harper, Shon Harris, Jonathan Ness, Chris Eagle, McGraw Hill Education; 3 ed (1 July 2017)

CEH v9: Certified Ethical Hacker Version 9 Study Guide by Sean-Philip Oriyano, Sybex; Stg edition (17 June 2016)

Hacking for Beginners: Ultimate 7 Hour Hacking Course for Beginners. Learn Wireless Hacking, Basic Security, Penetration Testing by Anthony Reynolds, CreateSpace Independent Publishing Platform (10 April 2017)

Hands-On Ethical Hacking and Network Defense by Michael T. Simpson | Kent Backman | James Corley, Cengage India 1st edition (2016)

The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made Easy by Patrick Engebretson, Syngress; 2 edition (12 September 2013)

An Ethical Guide To WI-FI Hacking and Security by Swaroop Yermalkar, BecomeShakespeare.com; First edition (15 August 2014)

Hacking With Python: The Complete Guide to Ethical Hacking, Basic Security, Botnet Attack, Python hacking and Penetration Testing Kindle Edition by John C. Smalls

**e-Learning Source:**

https://onlinecourses.nptel.ac.in/noc22_cs13/preview

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

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

| Effective from Session: 2020-21 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Course Code** | CS-357 | **Title of the Course** | Installation& Configuration of ServerSubject | **L** | **T** | **P** | **C** | |
| **Year** | III | **Semester** | V | 3 | 1 | 0 | 4 | |
| **Pre-Requisite** | None | **Co-requisite** | None | | | | | |
| **Course Objectives** | | To learn with paired demonstrations on how to configure, install, and monitor server 2012. | | | | | | |

| Course Outcomes | |
|---|---|
| CO1 | Be able to install configure, and monitor servers and local storage. |
| CO2 | Know how to configure servers for remote management. |
| CO3 | Create and configure virtual machine settings, storage, and networks. |
| CO4 | Review how to install domain controllers and create and manage group policy by understanding its processing. |
| CO5 | Understand working with Groups, function of Group types and group scope. |

| Unit No. | Title of the Unit | Content of Unit | Contact Hrs. | Mapped CO |
|---|---|---|---|---|
| 1 | **Creating and Configuring Virtual Network in Windows** | What is Virtual Networking, how to create New Virtual Switch, configuration of MAC Addresses, how to create Virtual Network Adapters, Synthetic Adaptors and Emulated Adapters, Configuration of Hardware Acceleration Setting and Advanced Network Adapter Features, Configure Virtual Network, Extending a Production Network into Virtual Space, creating an Isolated Network. | 6 | 1 |
| 2 | **Configuring IPv4 and IPv6 Addressing in Windows** | IPv4 Classful Addressing, Subnetting, Classless Inter-Domain Routing with Example, Public and Private IPv4 Addressing, Using Network Address Translation and Proxy Server, IPv4 Subnetting and Supernetting, Assigning IPv4 Addressing and Configuration, Dynamic Host Configuration Protocol, Automatic Private IP Addressing(APIPA), Introducing IPv6, IPv6 Address types, Global Unicast Addresses, Link-Local Unicast Addresses, Unique Local Unicast Addresses, Special, Multicast, Anycast Addresses, Assigning IPv6 Addresses, Manual IPv6 Address Allocation, Stateless IPv6 Address Auto configuration, Dynamic Host Configuration Protocol | 10 | 2 |
| 3 | **Deploying and Configuring the DHCP, DNS Service** | Understanding DHCP, DHCP Packets, DHCP message types option, pad option, option overload option, Vendor-Specific information Option, DHCP Communications and Lease Negotiation, DHCP Lease Renewal, Designing a DHCP Infrastructure, a Distributed DHCP and Centralised DHCP Infrastructures, a Hybrid DHCP Infrastructure and DHCP Network Traffic, How to create DNS Standard, how to create DNS Domain Hierarchy, Understanding DNS Communications, Comprehending DNS Server Caching, Understanding DNS Referrals and Queries, function of DNA Forwarders and Reverse Name Resolution, Designing DNS Deployment, Resolving Internet Names, Hosting internet Domains, Hosting Active Directory Domain, Integrating DHCP and DNS, Separating DNS Services | 8 | 3 |
| 4 | **Installing Domain Controllers** | Understanding Active Directory and Active Directory Architecture Functions, function of Objects and Attributes, Understanding Domains, Zooming in: Organizational Units, Zooming in: Groups, Zooming out: Domain Trees, Zooming out: Forests, Introducing LDAP, function of Replication, Installing the Active Directory Domain Services Role, Creating a New Forest, Adding a Domain Controller to an Existing Domain, Creating a New Child Domain in a Forest, Installing AD DS on Server Core, install from media(IFM), Upgrading Active Directory Domain Services, Removing a Domain Controller, configuring the Global Catalog. | 8 | 4 |
| 5 | **Creating and Managing Active Directory Groups and Organizational Units** | Designing an Internal Domain Structure, how Inheritance works, how organizational Units and Group objects, Working with Organizational Units, creating OUs, using OUs to Delegate Active Directory, Management Tasks, Working with Groups, function of Group types and group scopes, Domain Local Groups, Global Groups and universal Groups, Nesting groups, Creating groups from the command line, Managing Group Memberships, Managing Group Membership using Group Policy, Managing group objects with Dsmod.exe, converting Groups, Deleting a Group | 8 | 5 |

**Reference Books:**

Windows Server 2012: A Handbook for Professionals by Aditya Raj (Author)

MCSA 70-410 Cert Guide R2: Installing and Configuring Windows Server 2012 (Certification Guide) Hardcover – Import, 12 Sep 2014 by Don Poulton (Author), David Camardella (Author)

Installing and Configuring Widows Server 2012 by Craig Zacker

Mastering Windows Server 2012 R2 by Mark Minasi, Kevin Greene, Christian Booth, Robert Butler

**e-Learning Source:**

https://archive.nptel.ac.in/Harddisk/local_server.html

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

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

**Integral University, Lucknow**

| Effective from Session: 2020-21 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Course Code** | CS-361 | **Title of the Course** | Logical Reasoning and Thinking | | **L** | **T** | **P** | **C** |
| **Year** | III | **Semester** | V | | 2 | 1 | 0 | 3 |
| **Pre-Requisite** | None | **Co-requisite** | None | | | | | |
| **Course Objectives** | The subject aims to provide students with an understanding [L1: Knowledge]of the structure of arguments and reasoning. The subject will also help students develop [L3: Application]logical skills in rationally constructing, analyzing, justifying and criticizing arguments. | | | | | | | |

| Course Outcomes | |
|---|---|
| **CO1** | Identify the formula to apply as per the question, understand the trick of the question. |
| **CO2** | Recognize  the question pattern and the topic from which question has been asked for. |
| **CO3** | Calculate the question while applying the formula. |
| **CO3** | Solve the question through the shortcut method to save their time. |
| **CO4** | Diagram will be able to analyze the type of diagram in Data Interpretation section. |
| **CO5** | Create will be able to think about other method to solve the problem. |

| Unit No. | Title of the Unit | Content of Unit | Contact Hrs. | Mapped CO |
|---|---|---|---|---|
| 1 | **Verbal ability** | Synonyms**,** Antonyms and One word substitutes | 3 | 1 |
| 2 | **Basic quantitative aptitude** | Speed, Time and Distance, Time and Work, Linear Equations, Progressions (Sequences & Series), Permutation and Combination, Probability, Functions, Set Theory, Number Systems, LCM and HCF, Percentages, Collection and Scrutiny of data: Primary data, questionnaire and schedule; secondary data, their major sources including some government publications. | 8 | 2 |
| 3 | **Logical Reasoning - I** | Number and Letter Series, Calendars, Clocks, Cubes, Venn Diagrams, Binary Logic, Seating Arrangement, Logical Sequence, Logical Matching, Logical Connectives, Syllogism. Blood Relations; concept of a statistical population and sample from a population; qualitative and quantitative data. | 6 | 3 |
| 4 | **Measures of Central Tendency** | Objective of averaging, characteristics of good average, types of average, arithmetic mean of grouped and ungrouped data, correcting incorrect values, weighted arithmetic mean Median - median of grouped and ungrouped data merit andlimitation of median, computation of quartile, decile and percentile Mode - calculation of mode of grouped and ungrouped data, merits and limitation of mode, relationship between mean, median and mode. Geometric mean and Harmonic mean. | 10 | 4 |
| 5 | **Presentation of Data** | Construction of tables with one or more factors of classification; Diagrammatic and Graphical representation of non-frequency data; Frequency distribution, cumulative frequency distribution and their graphical representation - histogram, Column Graphs, Bar Graphs, Line Charts, Pie Chart, Data Interpretation – Introduction and approaches . | 8 | 5 |

| Reference Books: |
|---|
| Richard I Levin, David S. Rubin: Statistics for Management, Pearson Prentice Hall Education Inc. Ltd, NewDelhi, 5th Ed. 2007 |
| Bajpai, N. Business Statistics, Pearson, 2010 |
| Sharma J.K., Business Statistics, Pearson Education India, 2010. |
| Anderson; David R, Dennis J. Sweeney and Thomas A. Williams, Quantitative Methods for Business, Prentice-Hall, WestPublishing Company, 1996. |
| CAT Complete course, UPKAR publications |

| e-Learning Source: |
|---|
| https://onlinecourses.swayam2.ac.in/aic19_ma06/preview |

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

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

| Effective from Session: 2020-21 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Course Code** | CS-353 | **Title of the Course** | Storage Technologies | | **L** | **T** | **P** | **C** |
| **Year** | III | **Semester** | V | | **2** | **1** | **0** | **3** |
| **Pre-Requisite** | None | **Co-requisite** | None | | | | | |
| **Course Objectives** | • Provides a comprehensive view of storage and networking infrastructures for highly virtualized cloud ready deployments. <br><br> • To Understand the process of backup and recovery, local replication and remote replication. <br><br> • To know various RAID levels and their use cases. <br><br> • To understand the evolution of storage technologies. | | | | | | | |

| Course Outcomes | |
|---|---|
| **CO1** | State various key challenge in managing information |
| **CO2** | Explain storage network technologies |
| **CO3** | Compare various RAID levels |
| **CO4** | Differentiate between local and remote backup |
| **CO5** | Specify the components of storage system environment. |

| Unit No. | Title of the Unit | Content of Unit | Contact Hrs. | Mapped CO |
|---|---|---|---|---|
| 1 | **Introduction to Information storage and Management** | Information Storage: Data – Types of Data –Information - Storage , Evolution of Storage Technology and Architecture, Data Center Infrastructure - Core elementsKey Requirements for Data Center Elements - Managing Storage Infrastructure, Key Challenges in Managing Information, Information Lifecycle - Information Lifecycle Management - ILM Implementation -ILM Benefits. | 6 | 1 |
| 2 | **Storage System Environment** | Components of a Storage System Environment – Host –Connectivity – Storage, Disk Drive Components – Platter – Spindle - Read/Write Head - Actuator Arm Assembly - Controller - Physical Disk Structure - Zoned Bit Recording - Logical Block Addressing , Disk Drive Performance -1 Disk Service Time , Fundamental Laws Governing Disk Performance , Logical Components of the Host - Operating System - Device Driver - Volume Manager - File System – Application , Application Requirements and Disk Performance. | 8 | 2 |
| 3 | **RAID and Storage Networking Technologies** | Implementation of RAID - Software RAID - Hardware RAID -RAID Array Component - RAID Levels - Striping -Mirroring -Parity RAID 0 RAID 1 -Nested RAID -RAID 3-RAID 4-RAID 5-RAID 6 -RAID Comparison -RAID Impact on Disk-Performance - Application IOPS and RAID Configurations- Introduction to Direct Attached Storage – Types of DAS – Introduction to SAN – Components of SAN – FC connectivity – FC topologies – Introduction to NAS – NAS components – NAS Implementation – NAS File sharing | 8 | 3 |
| 4 | **Backup and Recovery** | Introduction to Business Continuity - Backup Purpose -Disaster Recovery - Operational Backup –Archival, Backup Considerations, Backup Granularity, Recovery Considerations, Backup Methods , Backup Process, Backup and Restore Operations, Backup Topologies - Server less Backup , Backup Technologies -Backup to Tape - Physical Tape Library - Backup to Disk - Virtual Tape Library . | 7 | 4 |
| 5 | **Replication – Local and Remote** | Source and Target -Uses of Local Replicas, Data Consistency - Consistency of a Replicated File System - Consistency of a Replicated Database , Local Replication Technologies - Host-Based Local Replication - Storage Array-Based Replication , Res tore and Restart Considerations - Tracking Changes to Source and Target , Creating Multiple Replicas, Management Interface – Remote Replication Modes – Remote Replication Technologies – Network Infrastructure | 6 | 5 |

**Reference Books:**

EMC Education Services, "Information Storage and Management: Storing, Managing, and Protecting Digital Information", Wiley Publishing Inc., 1st edition, 2009Bajpai, N. Business Statistics, Pearson, 2010.

Robert Spalding , "Storage Networks: The Complete Reference ", Tata McGraw Hill Publication, 2003

**e-Learning Source:**

https://www.youtube.com/watch?v=Paqf7rFtek8

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

**3- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

**Integral University, Lucknow**

| Effective from Session: 2018 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Course Code** | CS-352 | **Title of the Course** | Cloud Technology Lab | | **L** | **T** | **P** | **C** |
| **Year** | III | **Semester** | V | | 0 | 0 | 2 | 1 |
| **Pre-Requisite** | None | **Co-requisite** | None | | | | | |
| **Course Objectives** | • To understand cloud services and solutions.<br>• To understand the process and purposes of migrating into cloud.<br>• To understand the relevance of Cloud, SOA and benchmarks<br>• To Know about governance in cloud and Do's and Don'ts in cloud | | | | | | | |

| Course Outcomes | |
|---|---|
| **CO1** | *State* various delivery models and service models of cloud computing |
| **CO2** | *Explain* seven-step model for migrating into cloud |
| **CO3** | *Illustrate* various considerations for selecting cloud solution |
| **CO4** | *Analyze* importance of governance in cloud |
| **CO5** | *Specify* the do's and don'ts of cloud computing. |

| S. No. | List of Experiments | Contact Hrs. | Mapped CO |
|---|---|---|---|
| 1 | Study the basic cloud architecture and represent it using a case study | 2 | 1 |
| 2 | Enlist Major difference between SAAS PAAS & IAAS also submit a research done on various companies in cloud business and the corresponding services provided by them , tag them under SAAS PAAS & IAAS. | 2 | 1 |
| 3 | Study and present a report on Jolly cloud. | 2 | 2 |
| 4 | Present a report on obstacles and vulnerabilities in cloud computing on generic level | 2 | 2 |
| 5 | Present a report on Amazon cloud services. | 2 | 3 |
| 6 | Present a report on Microsoft cloud services. | 2 | 4 |
| 7 | Present a report on cost management on cloud | 2 | 4 |
| 8 | Enlist and explain legal issues involved in the cloud with the help of a case study | 2 | 5 |
| 9 | Explain the process of migrating to cloud with a case study. | 2 | 5 |
| 10 | Present a report on google cloud and cloud services. | 2 | 5 |

**Reference Books:**

Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, "Cloud Computing: Principles and Paradigms", John Wiley and Sons Publications, 2011

Christopher Barnett, "Brief Guide to Cloud Computing", Constable & Robinson Limited, 2010 BorivojeFurht, Armando Escalante, "Handbook on Cloud Computing" , Springer, 2010

**e-Learning Source:**

https://onlinecourses.nptel.ac.in/noc22_cs20/preview

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

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

| Effective from Session: 2018 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Course Code | CS-356 | Title of the Course | Ethical Hacking Lab | | | L | T | P | C |
| Year | III | Semester | V | | | 0 | 0 | 2 | 1 |
| Pre-Requisite | None | Co-requisite | None | | | | | |
| Course Objectives | To enable students to better understand the Ethical hacking concepts and various phases of hacking along with the objective of providing an in-depth knowledge on Web Application vulnerabilities and exploitation techniques.<br><br>To familiarize them with the wide range of attacks in a Networking environment and to enable him/her to prepare a well-defined vulnerability reporting procedure along with the remediation techniques | | | | | | | |

| Course Outcomes | |
|---|---|
| CO1 | Outline ethical considerations of hacking |
| CO2 | Assess an environment using foot printing |
| CO3 | Collect information using network scanning |
| CO4 | Analyze social engineering methods |
| CO5 | Overview of IT ACT |

| S. No. | List of Experiments | Contact Hrs. | Mapped CO |
|---|---|---|---|
| 1 | Passive Reconnaissance using "Who is" and Online tools | 2 | 1 |
| 2 | Active Reconnaissance using "Sampad" and web site details | 2 | 1 |
| 3 | Full Scan, Half Open Scan and Stealth scan using "nmap" | 2 | 2 |
| 4 | UDP and Ping Scanning using "Advance Lan Scanner" and "Superscan" | 2 | 3 |
| 5 | Packet crafting using "Packet creator" tools | 2 | 3 |
| 6 | Exploiting NetBIOS vulnerability | 2 | 3 |
| 7 | Password Revelation from browsers and social networking application | 2 | 3 |
| 8 | Creating and analyzing spoofed emails | 2 | 4 |
| 9 | Creating and Analyzing Trojans | 2 | 4 |
| 10 | OS password cracking | 2 | 4 |

| Reference Books: |
|---|

Gray Hat Hacking The Ethical Hackers Handbook, 3rd Edition Paperback – 1 Jul 2017 by Allen Harper, Shon Harris, Jonathan Ness, Chris Eagle, McGraw Hill Education; 3 ed (1 July 2017)

CEH v9: Certified Ethical Hacker Version 9 Study Guide by Sean-Philip Oriyano, Sybex; Stg edition (17 June 2016)

Hacking for Beginners: Ultimate 7 Hour Hacking Course for Beginners. Learn Wireless Hacking, Basic Security, Penetration Testing by Anthony Reynolds, CreateSpace Independent Publishing Platform (10 April 2017)

Hands-On Ethical Hacking and Network Defense by Michael T. Simpson | Kent Backman | James Corley, Cengage India 1st edition (2016)

| e-Learning Source: |
|---|

https://onlinecourses.nptel.ac.in/noc22_cs13/preview

| PO-PSO<br>CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 2 | 1 | | | | | | | | 3 | 1 | 2 | 2 |
| CO2 | 3 | 3 | 3 | 2 | 1 | 1 | | | | | | 3 | | 1 | |
| CO3 | 3 | 3 | 2 | 1 | 2 | 1 | | | | | | 3 | 1 | | 1 |
| CO4 | 3 | 2 | 3 | 2 | 2 | 1 | | | | | | 2 | 2 | 2 | 2 |
| CO5 | 2 | 2 | 2 | 1 | 2 | 1 | | | | | | 2 | 1 | 2 | 2 |

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

| Effective from Session: 2018 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Course Code** | CS-358 | **Title of the Course** | Installation & Configuration of Server Lab | **L** | **T** | **P** | **C** |
| **Year** | III | **Semester** | V | 0 | 0 | 2 | 1 |
| **Pre-Requisite** | None | **Co-requisite** | None | | | | |
| **Course Objectives** | | To learn with paired demonstrations on how to configure, install, and monitor server 2012. | | | | | |

| Course Outcomes | |
|---|---|
| **CO1** | Be able to install configure, and monitor servers and local storage. |
| **CO2** | Know how to configure servers for remote management. |
| **CO3** | Create and configure virtual machine settings, storage, and networks. |
| **CO4** | Review how to install domain controllers and create and manage group policy by understanding its processing. |
| **CO5** | Understand working with Groups, function of Group types and group scope. |

| S. No. | List of Experiments | Contact Hrs. | Mapped CO |
|---|---|---|---|
| 1 | Installation windows Server 2012. | 2 | 1 |
| 2 | Configuration for Windows Server. | 2 | 1 |
| 3 | Configuration Local Storage for Windows Server. | 2 | 2 |
| 4 | Configuration File and Share Access for Windows Server. | 2 | 2 |
| 5 | Configuration Print and Document Services for Windows Server. | 2 | 3 |
| 6 | Configuration windows server for Remote Management. | 2 | 4 |
| 7 | Creating Virtual Machine in Windows Server. | 2 | 5 |
| 8 | Configuration and Setting Virtual Machine. | 2 | 5 |

**Reference Books:**

Windows Server 2012: A Handbook for Professionals by Aditya Raj (Author)

MCSA 70-410 Cert Guide R2: Installing and Configuring Windows Server 2012 (Certification Guide) Hardcover – Import, 12 Sep 2014 by Don Poulton (Author), David Camardella (Author)

Installing and Configuring Widows Server 2012 by Craig Zacker

Mastering Windows Server 2012 R2 by Mark Minasi, Kevin Greene, Christian Booth, Robert Butler

**e-Learning Source:**

https://archive.nptel.ac.in/Harddisk/local_server.html

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

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

| Effective from Session: 2018 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Course Code | CS-354 | Title of the Course | Storage Technologies Lab | **L** | **T** | **P** | **C** | |
| Year | III | Semester | V | 0 | 0 | 2 | 1 | |
| Pre-Requisite | None | Co-requisite | None | | | | | |
| **Course Objectives** | <ul><li>Provides a comprehensive view of storage and networking infrastructures for highly virtualized cloud ready deployments.</li><li>To Understand the process of backup and recovery, local replication and remote replication.</li><li>To know various RAID levels and their use cases.</li><li>To understand the evolution of storage technologies.</li></ul> | | | | | | | |

| Course Outcomes | |
|---|---|
| CO1 | *State* various key challenge in managing information |
| CO2 | *Explain* storage network technologies |
| CO3 | *Compare* various RAID levels |
| CO4 | *Differentiate* between local and remote backup |
| CO5 | *Specify* the components of storage system environment. |

| S. No. | List of Experiments | Contact Hrs. | Mapped CO |
|---|---|---|---|
| 1 | Creating raw partitions and make a file system in server | 2 | 1 |
| 2 | Create volumes, extend and shrink the volumes | 2 | 1 |
| 3 | Configure RAID 1 (mirroring) that replicates the data in two different disks | 2 | 2 |
| 4 | Configure RAID 5 that shows the data striping with parity | 2 | 2 |
| 5 | Configure storage area network in server 2012 | 2 | 2 |
| 6 | Configure iSCSI in server 2012 | 2 | 3 |
| 7 | Configure and deploy NAS in server 2012 | 2 | 4 |
| 8 | Create and use the virtual hard disk in Windows 7 | 2 | 4 |
| 9 | Configuring the virtual disk to an existing virtual machine (VM) | 2 | 5 |
| 10 | Attaching different virtual disk formats in an existing VM with no downtime | 2 | 5 |

**Reference Books:**

EMC Education Services, "Information Storage and Management: Storing, Managing, and Protecting Digital Information", Wiley Publishing Inc., 1st edition, 2009Bajpai, N. Business Statistics, Pearson, 2010.

Robert Spalding , "Storage Networks: The Complete Reference ", Tata McGraw Hill Publication, 2003

**e-Learning Source:**

https://www.youtube.com/watch?v=Paqf7rFtek8

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

**4- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

| Effective from Session: 2020-21 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Course Code** | CS-373 | **Title of the Course** | Cloud Security | | **L** | **T** | **P** | **C** |
| **Year** | III | **Semester** | VI | | 2 | 1 | 0 | 3 |
| **Pre-Requisite** | None | **Co-requisite** | None | | | | | |
| **Course Objectives** | Introduces the basic concepts of security systems and cryptographic protocols. Multi tenancy operation, visualized infrastructure security. Improve virtualization security. | | | | | | | |

| Course Outcomes | |
|---|---|
| **CO1** | State the impact of virtualization in the context of security on business benefits. |
| **CO2** | Discuss various preventive, detective and corrective security controls for Cloud computing. |
| **CO3** | Demonstrate Business Continuity Management and Disaster Recovery in the Cloud. |
| **CO4** | Analyze security risk of cloud provider. |
| **CO5** | Compare traditional IT and Cloud Security with appropriate example. |

| Unit No. | Title of the Unit | Content of Unit | Contact Hrs. | Mapped CO |
|---|---|---|---|---|
| 1 | **Introduction to Virtualization Security** | Introduction to Virtualization, impact and business benefits of Virtualization in the context of Security, Risks of Virtualization including attacks on Virtualization infrastructure, Hyper jacking and Virtual Machine jumping. Hyper jacking attacks like Blue Pill, Sub Virt, Vitriol, attacks on Virtualization features and compliance and Management challenges. Strategies and counter measures for addressing Virtualization risks, securing hypervisors, virtual machines threats, vulnerabilities and mitigation measures. | 8 | 1 |
| 2 | **Introduction to Cloud Security** | Introduction to Cloud Computing, various Cloud Delivery models including Software as a Service (SaaS), Platform as a Service (PaaS) and Infrastructure as a Service (IaaS) in the context of Security, Cloud deployment models – public, private and hybrid in the context of Security, Trusted Cloud Initiative (TCI) and Cloud Trust Protocol (CTP), Transparency as a Service (TaaS) and Security as a Service (SecaaS), Cloud Security, Incident and Response (Cloud SIRT), Cloud Data Governance and Governance, Risk and Compliance (GRC) Stack, top threats to Cloud Security, comparison of traditional IT and Cloud Security | 9 | 2 |
| 3 | **Cloud Security Architecture** | Architectural considerations, Cloud storage and data security, identity management and access control, autonomic security, encryption and key strategies, secure connection, Privacy in Cloud, architecture changes for different Cloud deployment models, Business Continuity Management and Disaster Recovery in the Cloud, OpenStack Cloud Security, Cloud forensics. | 7 | 3 |
| 4 | **Cloud Security Controls** | Introduction to Cloud Controls Matrix, 13 domains of Security controls, fundamental security principles, deterrent, preventive, detective and corrective security controls for Cloud computing, assessing security risk of a cloud provider. | 5 | 4 |
| 5 | **Security of Cloud Services** | Cloud Platform and Infrastructure security-physical environment, networking, computing, virtualization, storage, risks and countermeasures, Cloud application security, Cloud secure development lifecycle, Cloud application architecture, multi-factor authentication, SSO, Understanding legal challenges involved in Cloud, liability, copyright, data protection, IPR, data portability, inter-country legal frameworks, personal data protection and privacy, data controller and processor, contracts, provider's insolvency risk. | 6 | 5 |

| Reference Books: |
|---|
| Virtualization Security: Protecting Virtualized Environments by Dave Shackleford |
| OpenStack Cloud Security by Fabio Alessandro Locati |
| Cloud Security – A comprehensive Guide to Secure Cloud Computing by Ronald L. Krutz and Russel Dean Vines |
| Cloud Security and Privacy by Mather Tim |
| Securing the Cloud: Cloud Computer Security Techniques and Tactics by Vic (J.R.) Winkler |
| Practical Cloud Security: A Cross-Industry View by Melvin B. Greer Jr. |
| Virtualization Security: Protecting Virtualized Environments by Dave Shackleford |

| e-Learning Source: |
|---|
| https://onlinecourses.nptel.ac.in/noc19_cs64/preview |

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

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

| Effective from Session: 2020-21 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Course Code** | CS-379 | **Title of the Course** | Cyber Security Incident Response Management | | **L** | **T** | **P** | **C** |
| **Year** | III | **Semester** | VI | | 3 | 1 | 0 | 4 |
| **Pre-Requisite** | None | **Co-requisite** | None | | | | | |
| **Course Objectives** | To get an overview of the cyber incidents.<br>To acquire knowledge and skills for responding to a cyber-incidents<br>To understand various solution to recover from cyber-security incidents<br>To learn various laws that can be applied on a given scenario of cyber incident | | | | | | | |

| Course Outcomes | |
|---|---|
| **CO1** | Define the importance and identify the need of CSIRM. |
| **CO2** | Apply the security concepts to Handle a Cyber Security Incident. |
| **CO3** | Illustrate the solution to Recovering from Cyber Security Incidents |
| **CO4** | Design the Cyber Security Incidents responses through Scenarios |
| **CO5** | Create Flow chart of scenario and personal files stored in Cloud |

| Unit No. | Title of the Unit | Content of Unit | Contact Hrs. | Mapped CO |
|---|---|---|---|---|
| 1 | **Need for CSIRM** | Differences between an event, incident and disaster, what are cyber security incidents, need for CSIRM, policy, plan and procedure, importance of communication protocol, key internal and external stakeholders, law enforcement, role of media, team structure and roles – important considerations. | 9 | 1 |
| 2 | **Handling a Cyber Security Incident** | Incident response lifecycle, incident handling infrastructure and facilities requirements, detection and analysis, process, tools and techniques, attack vectors, recognizing signs of an incident, precursors, indicators and historical organization data, incident correlation, review of logs and vital system parameters, incident handling checklist, documentation and reporting | 8 | 2 |
| 3 | **Recovering from Cyber Security Incidents** | Nature of incidents and the type of resources it affects, assessment of an incident's impact on business, IT operations and information, determining the amount of time and resources needed in recovering from an incident, prioritization, incident notification structure, containment, eradication and recovery – choosing a containment strategy, evidence gathering and handling, identifying the attack hosts, eradication and recovery, post-incident analysis, evidence retention and lessons learned. | 9 | 3 |
| 4 | **Preventing Cyber Security Incidents** | Incident analytics as input to proactive security measures to prevent incidents, risk assessment, host security, network security, malware prevention, user awareness and training, analysis of cost of control versus cost of incident impact, best practices. | 8 | 4 |
| 5 | **Cyber Security Incidents Analysis through Scenarios** | Flow chart of scenario questions, scenarios – DoS attack on DNS server, worm and DDoS agent infestation, military-classified documents stolen by an insider, compromised database server, unauthorized access to payroll records, identities and credentials stolen by hackers, antisocial propaganda in media through compromised home wifi network, personal files stored in Cloud are compromised, remote hacking of smart home network, malware infection in home and office network simultaneously, large scale of citizens' biometric data stolen by cyber war groups. | 6 | 5 |

| Reference Books: |
|---|
| Information Systems Security: Security Management, Metrics, Frameworks and Best Practices by Nina Godbole |
| Network Security Bible by Eric Cole |

| **e-Learning Source:** |
|---|
| https://nptel.ac.in/courses/106106129 |

| PO-PSO<br>CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 2 | | | | | | | | | 3 | 2 | | 2 |
| **CO2** | 3 | 3 | 2 | 1 | 2 | | | | | | | 3 | 1 | 3 | |
| **CO3** | 3 | 3 | 2 | 2 | 2 | | | | | | | 3 | | | |
| **CO4** | 3 | 2 | 3 | 2 | 2 | | | | | | | 2 | 1 | 1 | 1 |
| **CO5** | 3 | 2 | 3 | 2 | 3 | | | | | | | 2 | | 2 | 1 |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

**Integral University, Lucknow**

| Effective from Session: 2020-21 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Course Code** | CS-375 | **Title of the Course** | Infrastructure Solutions on Cloud | | | **L** | **T** | **P** | **C** |
| **Year** | III | **Semester** | VI | | | 2 | 1 | 0 | 3 |
| **Pre-Requisite** | None | **Co-requisite** | None | | | | | | |
| **Course Objectives** | To Understand Microsoft Azure and Azure Storage.<br><br>Creating a SQL, SQL DB, Tables and adding data to the table in Microsoft Azure<br><br>To gain basic understanding of Azure storage and networking. | | | | | | | | |

| Course Outcomes | |
|---|---|
| **CO1** | DescribeAzure AD and list its advantages |
| **CO2** | Discuss various best practices for azure storage |
| **CO3** | Build  configure and use load balances in Azure |
| **CO4** | Analyze the identity and authentication in public cloud |
| **CO5** | Create SQL tables in Microsoft Azure and adding data to it. |

| Unit No. | Title of the Unit | Content of Unit | Contact Hrs. | Mapped CO |
|---|---|---|---|---|
| 1 | **Getting Started with Azure** | Overview of Cloud Computing – Various Cloud Offerings – Azure Basics – Azure Services – Azure Portals – Preview Portal, Management Portal, Subscription Management – Billing – Pricing Calculator - Azure Virtual Machines :Virtual Machine(VM) Basics – Status, IP Address, Creating and Configuring Virtual Machines – Configuring VM disks – Virtual Machine Management | 8 | 1 |
| 2 | **Azure Storage** | Storage Basics – Storage Types – Azure Storage Offerings – Understanding Azure Regions – Using Storage Accounts – Enabling Larger and Faster Storage – Resizing Azure Disks – Using Premium Storage – Monitoring Azure Storage Accounts – Best Practices for Azure Storage – Azure VM Storage Types – Azure Files – Managing Azure Storage. | 8 | 2 |
| 3 | **Azure Networking** | Basics of Virtual Networks – Address Spaces, Subnets, DNS Servers – Creating and Using Virtual Networks – Network Security Groups – Virtual Appliances – Load Balancer basics – Configuring Load Balancers – Creating and Using Load balancers – Azure VPN | 8 | 3 |
| 4 | **Azure Active Directory** | Introduction to Active Directory(AD), Identity and Authentication in Public Cloud – Introduction to Azure AD – Extending Active Directory into Azure – Azure AD and applications – Reporting and Monitoring Azure AD. | 5 | 4 |
| 5 | **Azure Databases** | SQL Azure: Creating a SQL Server - Creating a SQL DB - Creating Tables - Adding Data to the Table - View Connection Strings - Security Configurations - Migrating on premise DB to SQL Azure.<br><br>**Azure Websites:** Creating a Website, Settingdeployment credentials -Choosing a platform - Setting up Default page for website - Scaling - Auto Scaling by Time -Auto Scaling by Metric - Difference between Free, Shared, Basic and Standard websites - Creating a website using Visual studio | 6 | 5 |

| Reference Books: |
|---|
| Michael Collier, Robin Shahan, "Fundamentals of Azure – Microsoft Azure Essentials", Microsoft Press, 2015. |
| Michael W, "Implementing Microsoft Azure Infrastructure Solutions", Phi Learning Pvt Ltd, 2009 |
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| |

| e-Learning Source: |
|---|
| https://www.youtube.com/watch?v=JBo2vV5SpOM |
| |
| |
| |
| |

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

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

| Effective from Session: 2020-21 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Course Code** | CS-374 | **Title of the Course** | Principles of Virtualization | | **L** | **T** | **P** | **C** |
| **Year** | III | **Semester** | VI | | 3 | 1 | 0 | 4 |
| **Pre-Requisite** | None | **Co-requisite** | None | | | | | |
| **Course Objectives** | This course focuses on the challenges in setting up a data center. Resource monitoring using hypervisors and access control to virtual machines will be covered in depth in this course. Setting up of a virtual data center and how to manage them with software interfaces will be discussed in detail. | | | | | | | |

| Course Outcomes | |
|---|---|
| **CO1** | Identify various constraints and challenges in setting up a data center |
| **CO2** | Demonstrate Enterprise level virtualization and access control in virtual machines |
| **CO3** | Perform Resource monitoring and execute backup and recovery of virtual machines. |
| **CO4** | Analyze desktop Web Access and configuring client setting |
| **CO5** | Create list of virtualization Software available and monitor |

| Unit No. | Title of the Unit | Content of Unit | Contact Hrs. | Mapped CO |
|---|---|---|---|---|
| 1 | **Basics of Virtualization** | Understanding Virtualization, Need of Virtualization and Virtualization Technologies: Server Virtualization, Storage Virtualization, I/O Virtualization, Network Virtualization, Client Virtualization, Application virtualization, Desktop virtualization, Understanding Virtualization Uses: Studying Server Consolidation, Development and Test Environments , Helping with Disaster Recovery. | 8 | 1 |
| 2 | **Deploying and Managing an Enterprise Desktop Virtualization Environment** | Configure the BIOS to support hardware virtualization; Install and configure Windows Virtual PC: installing Windows Virtual PC on various platforms (32-bit, 64-bit), creating and managing virtual hard disks, configuring virtual machine resources including network resources, preparing host machines; create, deploy, and maintain images. | 8 | 2 |
| 3 | **Deploying and Managing an Enterprise Desktop Virtualization Environment** | Prepare and manage remote applications: configuring application sharing, package applications for deployment by using Remote App, installing and configuring the RD Session Host Role Service on the server. | 8 | 3 |
| 4 | **Accessing Published Applications** | Access published applications: configuring Remote Desktop Web Access, configuring role-based application provisioning, and configuring Remote Desktop client connections. Configure client settings to access virtualized desktops: configuring client settings. | 8 | 4 |
| 5 | **Understanding Virtualization Software** | List of virtualization Software available .Vmware- introduction to Vsphere, ESXi, VCenterServer and Vsphere client. Creating Virtual Machine. Introduction to HYPER-V role. Create Virtual Machines. Create Hyper-v virtual networking, Use virtual Machine Snapshots. Monitor the performance of a Hyper-v server, Citrix XEN Desktop fundamentals. | 8 | 5 |

**Reference Books:**

Virtualization with Microsoft Virtual Server 2005 by TwanGrotenhuis, RogierDittner, Aaron Tiensivu, Ken Majors, Geoffrey Green, David Rule, Andy Jones, Matthijs ten Seldam, Syngress Publications, 2006

Virtualization: From the Desktop to the Enterprise, Chris Wolf, Erick M. Halter, EBook, 2005

Virtualization--the complete cornerstone guide to virtualization best practices, Ivanka Menken, Gerard Blokdijk, Lightning Source Incorporated, 2008

**e-Learning Source:**

https://www.cse.iitd.ac.in/~sbansal/csl862-virt/lec/intro.pdf

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

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

| Effective from Session: 2020-21 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Course Code** | CS-372 | **Title of the Course** | Theory of Automata and Complier | | | **L** | **T** | **P** | **C** |
| **Year** | III | **Semester** | VI | | | 3 | 1 | 0 | 4 |
| **Pre-Requisite** | None | **Co-requisite** | None | | | | | | |
| **Course Objectives** | Demonstrate different language processing abstract machines.<br><br>Explain relationship between different languages and automata<br><br>Design automata and language under specific criteria. | | | | | | | | |

| **Course Outcomes** | |
|---|---|
| **CO1** | State procedure to convert regular expression to NFA and NFA to DFA |
| **CO2** | Discuss properties of different grammars and languages |
| **CO3** | Solve problems related to string membership to an automata and respective Language |
| **CO4** | Analyze importance of governance in cloud |
| **CO5** | Create grammar for specific language. |

| Unit No. | Title of the Unit | Content of Unit | Contact Hrs. | Mapped CO |
|---|---|---|---|---|
| 1 | **IIntroduction to Compiler, Phases and passes, Bootstrappingm** | Formal Language and Regular Expressions: Languages, Definition Languages regular expressions, Finite Automata DFA, NFA. Conversion of regular expression to NFA, NFA to DFA. Applications of Finite Automata to lexical analysis, lex tools. Context Free grammars and parsing: Context free grammars, derivation, parse trees, ambiguity LL(K) grammars and LL( 1) parsing | 8 | 1 |
| 2 | **S R Parsers** | Bottom up parsing handle pruning LR Grammar Parsing, LALR parsing, parsing ambiguous grammars, YACC programming specification. Semantics: Syntax directed translation, S-attributed and L-attributed grammars, Intermediate code – abstract syntax tree, translation of simple statements and control flow statements. Context Sensitive features – Chomsky hierarchy of languages and recognizers. Type checking, type conversions, equivalence of type expressions, overloading of functions and operations. | 8 | 2 |
| 3 | **Push Down Automata (PDA)** | Description and definition, Instantaneous Description, Language of PDA, Acceptance by Final state, Acceptance by empty stack, Deterministic PDA, Equivalence of PDA and CFG, CFG to PDA and PDA to CFG, Two stack PDA | 7 | 3 |
| 4 | **Turing machines (TM)** | Basic model, definition and representation, Instantaneous Description, Language acceptance by TM, Variants of Turing Machine, TM as Computer of Integer functions, Universal TM, Church's Thesis, Recursive and recursively enumerable languages, Halting problem, Introduction to Undecidability, Undecidable problems about TMs. Post correspondence problem (PCP), Modified PCP, Introduction to recursive function theory. | 9 | 4 |
| 5 | **Code generation** | Machine dependent code generation, object code forms. Code optimization: Machine-Independent Optimizations, Loop optimization, DAG representation of basic blocks, value numbers and algebraic laws, Global Data-Flow analysis. | 8 | 5 |

**Reference Books:**

Aho, Sethi & Ullman, "Compilers: Principles, Techniques and Tools", Pearson Education

V Raghvan, " Principles of Compiler Design", TMH Hopcroft and Ullman, "Introduction to Automata Theory Languages and Computation",Addison Wesley.

Mishra & Chandrasekhar, "Theory of Computer Sciences", PHI.

Martin, "Introduction to Languages & Theory of Computation", TMH.

**e-Learning Source:**

https://nptel.ac.in/courses/106105196#:~:text=The%20automata%20theory%20is%20the,throughout%20in%20easily%20comprehensible%20ways.

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

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

**Integral University, Lucknow**

| Effective from Session: 2020-21 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Course Code** | CS-371 | **Title of the Course** | Web Technology | | **L** | **T** | **P** | **C** |
| **Year** | III | **Semester** | VI | | 3 | 1 | 0 | 4 |
| **Pre-Requisite** | None | **Co-requisite** | None | | | | | |
| **Course Objectives** | To get familiar with basics of the Internet Programming.<br><br>To acquire knowledge and skills for creation of web site considering both client and server side programming<br><br>To gain ability to develop responsive web applications<br><br>To explore different web extensions and web services standards | | | | | | | |

| Course Outcomes | |
|---|---|
| **CO1** | Define of Internet and the World Wide Web and to design and interactive web page(s) using HTML, CSS. |
| **CO2** | Describe and differentiate different Web Extensions and Web Services. |
| **CO3** | Design a responsive web site using HTML5 and CSS3 |
| **CO4** | Design Dynamic web site using server side PHP Programming and Database connectivity. |
| **CO5** | Design Web Servers and browsers tools . |

| Unit No. | Title of the Unit | Content of Unit | Contact Hrs. | Mapped CO |
|---|---|---|---|---|
| 1 | **Introduction to the Internet and the World Wide Web** | Introduction, History of internet, Internet Design Principles, Internet Protocols - FTP, TCP/IP, SMTP, Telnet, etc., Client Server Communication, Web System architecture. Evolution of the Web, Web architectures, Web clients and servers, Static and Dynamic Web Applications, Front end and back end web development. HTML, CSS, JS, XML; HTTP, secure HTTP, etc; URL, Web Services – SOAP, REST | 8 | 1 |
| 2 | **HTML & CSS** | Introduction to Html, Html Document structure, Html Editors, Html element/tag & attributes, Designing simple page - Html tag, Head tag, Body tag; More Html tags - Anchor tag, Image tag, Table tag, List tag, Frame tag, Divtag ; Html forms - Input type, Text area, Select , Button, Images. Introduction to CSS, Syntax, Selectors ,Embedding CSS to Html, Formatting fonts, Text & background colour, Inline styles, External and Internal Style Sheets, Borders & boxing. | 10 | 2 |
| 3 | **XML and HTML5, CSS3** | Introduction to XML, Difference b/w Html & XML, XML editors, XML Elements & Attributes XML DTD, XML Schema, XML Parser, Document Object Model (DOM), XML DOM. Introduction to HTML5,CSS3, New features, Local storage, Web Sockets, Server events, Canvas, Audio & Video, Geolocation, Microdata, Drag and Drop. Browser life cycle and browser rendering stages. Service workers. | 8 | 3 |
| 4 | **PHP Server side scripting** | Introduction to PHP, Basic Syntax, Variables, constants and operators, Loops, Arrays and Strings, Environment &environment variables, responding to HTTP requests, Files, Cookies, Sessions, Examples. | 7 | 4 |
| 5 | **Practical website development** | Commonly used Web Servers and browsers, Setting up a server and domain name, website types and structures, web authoring tools, Web hosting, website maintenance, generating traffic to your website. | 7 | 5 |

**Reference Books:**

Introducing Web Development, Jorg Krause. Apress 2017.

HTML & CSS: The Complete Reference, Thomas Powell. McGraw Hill, Fifth Edition, 2010

Creating a Website: The Missing Manual, 3rd Edition, Mathew Macdonald. O'Reilly

Web Technologies - HTML, JavaScript, PHP, Java, JSP, ASP.NET, XML and Ajax Black, Kogen Learning Systems (Dreamtech Press), 5th Edition 2009.

HTML, XHTML & CSS Bible, Brian Pfaffenberger, Steven M.Schafer, Charles White, Bill Karow- Wiley Publishing Inc, 2010

HTML5 & CSS3 for the Real World, 2 Edition, Alexis Goldstein, Estelle Weyl, Louis Lazaris. Apress 2015.

HTML5 & CSS3 for Dummies, Andy Harris. Wiley 2014.

Learning PHP A Gentle Introduction to the Web's Most Popular Language, David Sklar. O'Reilly 2016.

Build Your Own Database Driven Web Site Using PHP & MySQL, Kevin Yank. Sitepoint , 4th Edition, 2009.

**e-Learning Source:**

https://onlinecourses.swayam2.ac.in/nou20_cs05/preview

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

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

**Integral University, Lucknow**

| Effective from Session: 2018 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Course Code | CS-376 | **Title of the Course** | Infrastructure Solutions on Cloud Lab | **L** | **T** | **P** | **C** |
| Year | III | **Semester** | VI | 0 | 0 | 2 | 1 |
| Pre-Requisite | None | **Co-requisite** | None | | | | |
| **Course Objectives** | To Understand Microsoft Azure and Azure Storage.<br><br>Creating a SQL, SQL DB, Tables and adding data to the table in Microsoft Azure<br><br>To gain basic understanding of Azure storage and networking. | | | | | | | |

| Course Outcomes | |
|---|---|
| CO1 | DescribeAzure AD and list its advantages |
| CO2 | Discuss various best practices for azure storage |
| CO3 | Build  configure and use load balances in Azure |
| CO4 | Analyze the identity and authentication in public cloud |
| CO5 | Create SQL tables in Microsoft Azure and adding data to it. |

| S. No. | List of Experiments | Contact Hrs. | Mapped CO |
|---|---|---|---|
| 1 | Create and document the process of creating a windows azure account | 2 | 1 |
| 2 | Create a virtual machine from available releases of windows server images | 2 | 1 |
| 3 | Create a virtual machine using the option "quick Create" | 2 | 2 |
| 4 | Create a custom VM and Capture the image | 2 | 2 |
| 5 | Create a vm from a captured image | 2 | 2 |
| 6 | Add a VMs to a cluster and deploy load balancer on the same | 2 | 3 |
| 7 | Create and publish / host a webpage in windows azure | 2 | 3 |
| 8 | Create a website using Visual studio | 2 | 4 |
| 9 | Create a SQL server DB , Create tables and add data to the table | 2 | 4 |
| 10 | Test basic sql commands on the table created in the previous step. | 2 | 5 |
| 11 | Migrate an on premise DB to Azure | 2 | 5 |
| 12 | Create a storage account in Azure | 2 | 5 |

**Reference Books:**

Michael Collier, Robin Shahan, "Fundamentals of Azure – Microsoft Azure Essentials", Microsoft Press, 2015.

Michael W, "Implementing Microsoft Azure Infrastructure Solutions", Phi Learning Pvt Ltd, 2009

**e-Learning Source:**

https://www.youtube.com/watch?v=JBo2vV5SpOM

| PO-PSO<br>CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | | | | | | 3 | | | 2 | 1 | 1 | 1 |
| CO2 | 3 | 3 | 2 | 3 | | | | | 3 | | | 3 | | 2 | |
| CO3 | 3 | 3 | 2 | | | | | | 3 | | | 2 | 1 | | 1 |
| CO4 | 3 | 2 | 3 | 3 | | | | | | | | 3 | | | |
| CO5 | 3 | 3 | 3 | | | | | | | | | 2 | 1 | | 1 |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

**Integral University, Lucknow**

| Effective from Session: 2018 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Course Code** | CS-377 | **Title of the Course** | Principles of Virtualization Lab | | **L** | **T** | **P** | **C** |
| **Year** | III | **Semester** | VI | | 0 | 0 | 2 | 1 |
| **Pre-Requisite** | None | **Co-requisite** | None | | | | | |
| **Course Objectives** | This course focuses on the challenges in setting up a data center. Resource monitoring using hypervisors and access control to virtual machines will be covered in depth in this course. Setting up of a virtual data center and how to manage them with software interfaces will be discussed in detail. | | | | | | | | |

| Course Outcomes | |
|---|---|
| **CO1** | Identify various constraints and challenges in setting up a data center |
| **CO2** | Demonstrate Enterprise level virtualization and access control in virtual machines |
| **CO3** | Perform Resource monitoring and execute backup and recovery of virtual machines. |
| **CO4** | Analyze desktop Web Access and configuring client setting |
| **CO5** | Create list of virtualization Software available and monitor |

| S. No. | List of Experiments | Contact Hrs. | Mapped CO |
|---|---|---|---|
| 1 | Installing VMware ESXi server. | 2 | 1 |
| 2 | Accessing ESXi through vSphere Client and Uploading ISO Images of OS into the Datastore of ESXi Server. | 2 | 1 |
| 3 | Creating Virtual machines in the ESXi Server | 2 | 2 |
| 4 | Monitoring the performance of ESXi Server. | 2 | 2 |
| 5 | Preparing Domain for vCenter Server as prerequisite. | 2 | 3 |
| 6 | Installing vCenter Server | 2 | 3 |
| 7 | Creating Datacenter and adding ESXi Server as Host to vCenter Server. | 2 | 4 |
| 8 | Cloning a Virtual Machine and Creating a Virtual Machine from cloned VM Template. | 2 | 4 |
| 9 | Configuring vNetwork Distributed Switch using vCenter Server. | 2 | 5 |
| 10 | Assigning permissions to users on Datacenter | 2 | 5 |

**Reference Books:**

Virtualization with Microsoft Virtual Server 2005 by TwanGrotenhuis, RogierDittner, Aaron Tiensivu, Ken Majors, Geoffrey Green, David Rule, Andy Jones, Matthijs ten Seldam, Syngress Publications, 2006

Virtualization: From the Desktop to the Enterprise, Chris Wolf, Erick M. Halter, EBook, 2005

Virtualization--the complete cornerstone guide to virtualization best practices, Ivanka Menken, Gerard Blokdijk, Lightning Source Incorporated, 2008

**e-Learning Source:**

https://www.cse.iitd.ac.in/~sbansal/csl862-virt/lec/intro.pdf

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

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**