**Techno India NJR Institute of Technology**



**Course File**

**Cloud Computing (6CS4- 06)**

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**Course Overview:**

The course presents a top-down view of cloud computing, from applications and administration to programming and infrastructure. Its main focus is on parallel programming techniques for cloud computing and large scale distributed systems which form the cloud infrastructure. The topics include: overview of cloud computing, cloud systems, parallel processing in the cloud, distributed storage systems, virtualization, security in the cloud, and multicore operating systems. Students will study state-of-the-art solutions for cloud computing developed by Google, Amazon, Microsoft, Yahoo, VMWare, etc. Students will also apply what they learn in one programming assignment and one project executed over Amazon Web Services.

**Course Outcomes:**

|  |  |  |
| --- | --- | --- |
| **CO. NO.** | **Cognitive Level** | **Course Outcome**  |
| 1 | Synthesis | Students will be able to understand the fundamentals of cloud computing along with cloud computing design and challenges. |
| 2 | Synthesis | Students will be able to use relevant software tools used in cloud computing. Student will also differentiate between Parallel and Distributed Paradigms. |
| 3 | Analyze | Students will be able to gain the knowledge about virtualization and its needs in cloud computing. Students will be able to use the tools available for virtualization. |
| 4 | Analyze | Students will be able to understand the security issues and recovery methods associated with cloud computing  |
| 5 | Applications | Students will be able to write case studies on the tools available for industrial purpose to deploy clouds. Students will also develop understanding about cloud computing application areas. |

**Prerequisites:**

[1. Programming Skills](https://www.upgrad.com/blog/prerequisites-for-cloud-computing/#1_Programming_Skills)

[2. Familiarity with Databases](https://www.upgrad.com/blog/prerequisites-for-cloud-computing/#2_Familiarity_with_Databases)

[3. Basics of Security and Privacy](https://www.upgrad.com/blog/prerequisites-for-cloud-computing/#3_Basics_of_Security_and_Privacy)

[4. Knowledge of Agile Development](https://www.upgrad.com/blog/prerequisites-for-cloud-computing/#4_Knowledge_of_Agile_Development)

[5. Familiarity with Operating Systems](https://www.upgrad.com/blog/prerequisites-for-cloud-computing/#5_Familiarity_with_Operating_Systems)

[6. Understanding of Virtualization](https://www.upgrad.com/blog/prerequisites-for-cloud-computing/#6_Understanding_of_Virtualization)

[7. Basics of Networking](https://www.upgrad.com/blog/prerequisites-for-cloud-computing/#7_Basics_of_Networking)

**Course Outcome Mapping with Program Outcome:**

|  |  |
| --- | --- |
| **Course Outcome**  | **Program Outcomes (PO’s)** |
| **CO. NO.** | **Domain Specific (PSO)** | **Domain Independent (PO)** |
|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
| CO1 | 3 | 2 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| CO2 | 3 | 2 | 3 | 2 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| CO3 | 3 | 2 | 3 | 2 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| CO4 | 0 | 1 | 1 | 0 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 1 |
| CO5 | 1 | 1 | 2 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 1: Slight (Low) , 2: Moderate (Medium), 3: Substantial (High)  |

**Course Coverage Module Wise:**

|  |  |  |
| --- | --- | --- |
| **Lecture No.** | **Unit** | **Topic** |
|  | **1** | **Introduction:** Objective, scope and outcome of the course. |
|  | **2** | **Introduction Cloud Computing** |
|  | 2 | Nutshell of cloud computing,Enabling Technology, Historical development |
|  | 2 | Vision, feature Characteristics and components of Cloud Computing |
|  | 2 | Challenges,Risks and Approaches of Migration into Cloud |
|  | 2 | Ethical Issue in Cloud Computing |
|  | 2 | Evaluating the Cloud's Business Impact and economics, Future of the cloud |
|  | 2 | Networking Support for Cloud Computing |
|  | 2 | Ubiquitous Cloud and the Internet of Things |
|  | **3** | **Cloud Computing Architecture** |
|  | 3 | Cloud Reference Model, Layer and Types of Clouds, Services models |
|  | 3 | Data centre Design and interconnection Network |
|  | 3 | Architectural design of Compute and Storage Clouds. |
|  | 3 | Cloud Programming and Software. |
|  | 3 | Fractures of cloud programming. |
|  | 3 | Map Reduce, Hadoop |
|  | 3 | Probabilities, Bayesian Networks. |
|  | 3 | Programming of Google App engine. |
|  | **4** | **Virtualization Technology** |
|  | 4 | Implementation Level of Virtualization |
|  | 4 | Virtualization Structure/Tools and Mechanisms |
|  | 4 | Hypervisor |
|  | 4 | VMware, KVM, Xen |
|  | 4 | Virtualization: of CPU, Memory, I/O Devices. |
|  | 4 | Virtual Cluster and Resources Management |
|  | 4 | Virtualization of Server, Desktop |
|  | 4 | Virtualization of Network |
|  | 4 | Virtualization of data-centre. |
|  | **5** | **Securing the Cloud** |
|  | 5 | Cloud Information security fundamentals |
|  | 5 | Cloud security services, Design principles |
|  | 5 | Policy Implementation, Cloud Computing Security Challenges |
|  | 5 | Cloud Computing Security Architecture |
|  | 5 | Legal issues in cloud Computing |
|  | 5 | Data Security in Cloud |
|  | 5 | Business Continuity and Disaster Recovery |
|  | 5 | Risk Mitigation |
|  | 5 | Understanding and Identification of Threats in Cloud |
|  | 5 | SLA-Service Level Agreements, Trust Management |
|  |  **6** | **Cloud Platforms in Industry** |
|  |  6 | Amazon web services , Google App Engine, Microsoft Azure Design |
|  |  6 | Aneka: Cloud Application Platform |
|  |  6 | Protein structure prediction |
|  |  6 | Data Analysis, Satellite Image Processing |
|  |  6 | CRM |

**TEXT/REFERENCE BOOKS**

1. **Cloud Computing: Concepts, Technology & Architecture**by **Thomas Erl**
2. **A Brief Guide to Cloud Computing: An Essential Guide to the Next Computing Revolution** by **Christopher Barnatt**
3. **Cloud computing: From Beginning to End** by **Ray Rafels**
4. **Cloudonomics: The Business Value of Cloud Computing**by **Joe Weinman**

**Course Level Problems (Test Items):**

|  |  |
| --- | --- |
| S.no | Lab Experiment |
| 1 | Use gcc to compile c-programs. Split the programs to different modules and create an application using make command |
| 2 | Use version control systems command to clone, commit, push, fetch, pull, checkout, reset, and delete repositories |
| 3 | Install VirtualBox/VMware Workstation with different flavours of Linux or windows OS on top of windows 7 or 8. |
| 4 | Install a C compiler in the virtual machine created using virtual box and execute Simple Programs |
| 5 | Install Google App Engine. Create hello world app and other simple web applications using python/java. |
| 6 | Use GAE launcher to launch the web applications |
| 7 | Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim. |
| 8 | Find a procedure to transfer the files from one virtual machine to another virtual machine |
| 9 | Find a procedure to launch virtual machine using trystack (Online Openstack Demo Version) |
| 10 | Install Hadoop single node cluster and run simple applications like word count |

**Assessment Methodology:**

1. MCQ after every module completion.
2. Practical exam in lab where they have to write code on C compiler for the given problem statement. (Once in a week)
3. Assignments one from each unit.
4. Midterm subjective paper where they have to write algorithms to perform different operations on different data structures as mentioned in the modules. (Twice during the semester)
5. Final paper at the end of the semester subjective.

**Teaching and Learning resources unit-wise:**

**Unit-1**

**Introduction Cloud Computing**

Video Tutorials : <https://youtu.be/NzZXz3fJf6o>

 Theory concepts: <https://www.javatpoint.com/cloud-computing-tutorial>

Sample Quiz: <https://www.sanfoundry.com/cloud-computing-questions-answers-introduction/>

**Unit-2**

**Cloud Computing Architecture**

Video Tutorials: <https://youtu.be/4xrYN2Ecmas>

 Theory concepts: <https://www.javatpoint.com/cloud-computing-architecture>

 Sample Quiz: <https://www.sanfoundry.com/cloud-computing-questions-answers-cloud-computing-stack-1/>

**Unit-3**

**Virtualization Technology**

Video Tutorials: <https://youtu.be/R4spydpBbYk>

 Theory concepts: <https://www.javatpoint.com/virtualization-in-cloud-computing>

 Sample Quiz: <https://www.sanfoundry.com/cloud-computing-questions-answers-virtualization-technologies/>

**Unit-4**

**Securing the Cloud**

Video Tutorials: <https://youtu.be/9Btb72NZwg4>

Theory concepts:

<https://www.tutorialspoint.com/cloud_computing/cloud_computing_security.htm>

 Sample Quiz: <https://www.sanfoundry.com/cloud-computing-questions-answers-cloud-security/>

**Unit-5**

**Cloud Platforms in Industry**

Video Tutorials: <https://youtu.be/TOOSVsxEIpo>

Theory concepts: <https://www.javatpoint.com/cloud-service-provider-companies>

 Sample Quiz: <https://www.sanfoundry.com/cloud-computing-aws-interview-questions-answers/>

Previous year papers



