
**Superior University**

# Cloud Computing

Module Handbook

## Table of Contents

## 1. Course Delivery Arrangements

| | |
|---|---|
| **Course** | Cloud Computing |
| **Credit Hours** | 3 |
| **Lecture Duration** | 2:30 hours per week |
| **Semester Duration** | 15 weeks |

## 8 Course Instructors

| **Module Leader and Tutors** | |
|---|---|
| **Name** | S M Iftikhar Hussain |
| **Resource Persons** | S M Iftikhar Huusain |
| **Contact Information** | muhammad.iftikhar@superior.edu.pk |
| **Room and Building** | Department of CS & IT |
| **Consultation Hours** | 11:30 am - 1:00 pm |

## 9 Course Introduction

Cloud computing is a growing idea in the world of IT, born out of the necessity for computing on the go. Learning about its various principles will be helpful for student. This course is designed to equip students with the basic understanding of cloud computing. One of the biggest advantage of cloud computing is that all the smartness/complexity is shifted to the core (by the name of service) while the end user do not have to worry about any computations and just need to purchase a particular service to fulfill its requirement.

| | | | |
|---|---|---|---|
| **Program:** | BSSE,BSCS, BSIT, MIT and MCS | | |
| **Semester:** | BSCS7, BSIT 8, MCS/MIT 4, BSSE 8 | Session: | Spring 2017 |
| **Follow Up:** | --- | | |
| **Pre-requisites:** | Operating System Concepts<br>Data Communication and Network | | |
| **Reference Books** | • Handbook of Cloud Computing, Borko Furht. Springer (2010) or Latest Edition<br>• Distributed File Systems: Hadoop, Lustre, Google File System, Andrew File System, Off system, Distributed File System", Ceph. General books LLC. (2010) or Latest Edition<br>• Map Reduce Design Patterns, Donald Miner and Adam Shook. O' Reilly and Sons, (2012) or Latest Edition | | |

## 10 Course Objectives

1. To understand the concept of cloud computing.
2. To working of cloud computing.
3. Use case study to differentiate controls on user and cloud broker end.
4. To strengthen the concepts of SLA and SLO.
5. Customize hypervisor with respected to given need and requirement.
6. To learn about Big Data, MapReduce and Hadoop.
7. To introduce the basic concepts of DOS and DDOS.

## Course Coverage

- Introduction & History of Cloud Computing
- Cloud Computing Definition, Concern and Benefits
- Services technology, EAAS, XAAS

- SLA and SLO in cloud computing, Control difference
- Cloud Models
- Improvement factors and technological trends of cloud computing
- Cluster file system and Data flow framework
- Interactive Query Systems, DB in cloud Big Data
- Google file system
- Concept of MapReduce and Hadoop
- Geo distribution, Programming language in cloud computing
- Open source tool (customization)
- Network topologies and transport protocol and traffic management
- Particle deployment and implementation

## 11 Competitive Analysis

| Sr# | University Name | National/International | Course coverage | Value Additions |
|---|---|---|---|---|
| 1 | HEC | National | 100% | Open source tool customization<br>Concept of Big Data<br>Particle deployment and implementation |
| 2 | PUCIT | National | 100% | Open source tool customization<br>Concept of Big Data |
| 3 | Fast | National | 100% | Big Data<br>Open source tool Customization |
| 4 | University of Oxford | International | 90% | Cloud Computing and Big Data |
| 5 | Harvard University | International | 93% | AWS Identity Management and Security in the Cloud<br>OPSWorks<br>RESTFul WebServices |

## 12 Certification Relevance

| Sr# | Certification | % Relevance | Contents |
|---|---|---|---|
| 1 | HyperV | 75% | ✓ Cover almost all content except physical layout. |
| 2 | ESxi | 50% | ✓ Deployment and implementation |

## 13 Industrial Capabilities

- Physical layout designing of cloud
- configuration and implementation of cloud
- Build a small scale private cloud
- Resource sharing, management, traffic flow and data framework.
- How to define SLO and inculcate with SLA

Certified By: _____

Organization: _____

Designation: _____

## 9 Skill Portfolio

| Sr# | Skills Name | How to Achieve |
|---|---|---|
| **Technical Skills** | | |
| 1 | **Design of small scale private cloud** | Practice problem: Problem sets will be provided in class also uploaded at course portal.<br>Class tasks<br>Assignments<br>Simulations<br>Case study |
| 2 | **Major cloud techniques, improvement factors and technological trends** | Practice problem: Problem sets will be provided in class also uploaded at course portal.<br>Class tasks<br>Case study<br>Simulations |
| 3 | **Concept of Big Data and working of MapReduce and Hadoop** | Sample design pattern<br>Case study<br>Simulation |
| 4 | **Traffic management, Traffic Flow control and Data framework** | Lectures<br>Class tasks<br>Demonstration |
| 5 | **Concept of cluster file system and google file system** | Case Studies<br>Assignment<br>Design pattern |
| Soft Skills | | |
| 1 | Character Building | Through class lectures (some time of each lecture will spent in guiding them for empathy, moral values, ethics etc) |
| 2 | Team Building | Through group assignments and group projects |
| 3 | Presentation Skills | By presenting their projects |
| 4 | Communication Skills | Through presentations<br>Inter group communication for assignments and projects |
| 5 | Planning | Planning for assignments, task distributions, tasks integrations etc |
| 6 | Time Management | By meeting their deadlines of assignments and projects |

## 14 Student Gain

| Classification | Teaching and learning methodology | Assessment |
|---|---|---|
| **Knowledge and Comprehension** | | |
| Students will be able to understand and comprehend:<br>• Design of small scale private cloud<br>• Major cloud techniques, improvement factors and technological trends<br>• Concept of Big Data and working of MapReduce and Hadoop<br>• Traffic management, Traffic Flow control and Data framework<br>• Concept of cluster file system and google file system | Students gain knowledge and understanding through lectures, case studies and self-directed study. Class activities will be used to enhance their understanding of the concepts. Comprehension will be improved through various written and oral tests. Simulation and design of current model | Students' knowledge and understanding will be assessed through: quizzes, tests, mid-term paper final term viva and exam paper.<br>Case studies and Design sample cloud lay out on different simulators. |
| **Application and Skills** | | |
| Students will be able to:<br>• Identify the potential problems in designing a cloud model.<br>• Apply all the knowledge gained in developing small scale private cloud.<br>• Understanding underlying mathematical models to better understand the Big Data, Traffic flow and data framework. | Written exercises and resource based learning will help students in strengthening their research skills and applying those skills to achieve various academic endeavors. | Students' practical skills will be assessed by viva, quizzes and final term paper and case study implementation. |
| **Analysis and Synthesis** | | |
| Students will be able to:<br><br>Analyze and understand the complete cloud architecture and deployment of cloud as cloud broker and cloud provider. | Students will learn summarizing and synthesizing skills through participating in lectures discussions. Analytical skills will be learnt through self-study, classroom activities and viva. | Students skills are measured through tests, viva and classroom activities. |

## 10 Teaching and Learning Methodology

| | | Objectives |
|---|---|---|
| **Lectures** | Theoretical discussion | addition to crucial background and factual knowledge |
| | Practical Implementation | Implementation of the concepts, theories, and application of the subject using relevant examples. |
| | Simulations, Case Study | Introductory simulations for imparting better knowledge of current topics.<br>Case study will help to design pattern of a cloud according to given need. |
| | Q & A Sessions | Short activities for confidence building<br>To discuss material from previous weeks. |
| | Practice design patterns | Design a practice lab to understand depth knowledge. |
| **Labs** | Lab Tasks | To focus on hands-on computer programming |
| | Troubleshooting | How to troubleshoot current situation within minimum time |
| **Assessments** | Assignments | To relate and implement topics being discussed in class |
| | Quizzes | To evaluate the performance of students<br>To help students to identify their problem areas |
| | Projects and case studies | To learn team building, meeting deadlines and accepting responsibilities |

### 14.1 Assessment Details and Policies

| Assessment | Weightage | Course Objectives Map |
|---|---|---|
| Pre-Mid Assignment/Quizzes | 10% | 1, 2, 3, 4 |
| Midterm | 20% | 1, 2, 3, 4, 5 |
| Post-Mid Assignment/Quizzes | 10% | 1, 2, 3, 4, 5,6 |
| Project | 10% | 1, 2, 3, 4, 5, 6 ,7 |
| Class Participation | 0% | - |
| Lab | 20% | 1, 2, 3, 4, 5, 6,7 |
| Final Term Exam | 30% | 5,6,7, |

### 14.2 Exam Papers

Mid and final term exams will be conducted in order to evaluate the students learning and their understanding of the concepts. Exam paper will help in assessing the knowledge, comprehension, analytical and synthesis skills of students (sample papers are attached in Section 14th). The detail of the content coverage in each term paper is discussed below:

| Content coverage | |
|---|---|
| **Mid Term Paper** | |
| | **Weightage** |
| Objective | 30% |
| Subjective | 70% |
| | |
| **Final-Term Paper** | |
| | **Weightage** |
| Objective | 30% |
| Subjective | 70 % |
| | |

### 14.3 Assignment

| Content coverage | |
|---|---|
| **Mid-Term/Final Term Assignment** | |
| | **Weightage** |
| Document | 40% |
| Viva | 60% |

**Note:**

- No makeup quizzes.
- Small variation in distribution of marks of assignments, quizzes and final report may be expected.
- Grading criteria may subject to changes.
- Syllabus may be changed by the instructor for better class performance.
- A faculty specific Assignment Cover Sheet is to be completed and attached to each assessment item (major assignment) to be submitted.
- The responsibility to get any information/announcement made in any of the lectures in which you fail to be in attendance lies solely with you.
- Plagiarism in assignments and project will result in severe penalties.

## 15 Lecture plan

<table>
<tr><th>Session</th><th>Topics</th><th>Session Objective</th><th colspan="2"></th><th>Lecture Break up</th></tr>
<tr><td colspan="2">Cloud computing</td><td>Student Gain</td><td>Course Gain</td><td>Deliverables</td><td></td></tr>
<tr><td rowspan="3">Week 1</td><td>• Cloud Computing Module Overview<br>• Cloud computing Definition<br>• Cloud Computing Concerns<br>• Security Benefits of Cloud Computing.</td><td>Students will be aware of cloud computing taxonomy, concern and security benefits.</td><td>Student will recognize cloud taxonomy.</td><td>• Question answer session on the basis of the pre-requisite concepts.</td><td rowspan="3">Lecture 1<br>Ice breaking session 10 min<br>Module discussion 10 min<br>Lecture 40 min<br>Question/Answers 10 min<br>Attendance 5 min<br>Lecture 2<br>Review of previous session 15 min<br>Lecture 45 min<br>Question/Answers 10 min<br>Attendance 5 min</td></tr>
<tr><td colspan="3">Class Activity: Lecture and Question answer session about cloud computing.</td></tr>
<tr><td colspan="3">Technical Skills: 1,2,3<br>Soft Skills: 1,2</td></tr>
<tr><td colspan="2">Cloud Services</td><td>Student Gain</td><td>Course Gain</td><td>Deliverables</td><td></td></tr>
<tr><td rowspan="3">Week 2</td><td>• Service Technology (SOA)<br>• Everything as a Service (EaaS)<br>• X as a service (XaaS)</td><td>Students will be enabled to understand the concept of cloud services .</td><td>Students will learn the major concept of Everything as a services.</td><td>• A short question answer session about the previous lecture delivered in last session.</td><td rowspan="3">Lecture 3<br>Review of previous session 15 min<br>Lecture 45 min<br>Question/Answers 10 min<br>Attendance 5 min<br>Lecture 4<br>Review of previous session 15 min<br>Lecture 45 min<br>Question/Answers 10 min<br>Attendance 5 min</td></tr>
<tr><td colspan="3">Class Activity: Lecture and Question answer session about EAAS</td></tr>
<tr><td colspan="3">Technical Skills: 1,2,3<br>Soft Skills: 1,2,3</td></tr>
</table>

| LAN and Error Recovery | | Student Gain | Course Gain | Deliverables | |
|---|---|---|---|---|---|
| **Week 3** | • Service Line Objective SLO<br>• Service Line Agreement SLA | Student would be learn about SLO and inculcate with SLA. | Students will easily define SLO and SLA. | • Discussion session about the current trends of programming languages. | **Lecture 5**<br>Review of previous session – 15 min<br>Lecture – 45 min<br>Question/Answers – 10 min<br>Attendance – 5 min<br>**Lecture 6**<br>Review of previous session – 15 min<br>Lecture – 45 min<br>Question/Answers – 10 min<br>Attendance – 5 min |
| | **Activity: Lecture and Question answer session about SLO and SLA** | | | | |
| | **Technical Skills: 2,3,4**<br>**Soft Skills: 3,4** | | | | |
| **Cloud Models** | | **Student Gain** | **Course Gain** | **Deliverables** | |
| **Week 4** | • Cloud Computing architecture<br>• Public Cloud Model<br>• Private Cloud Model<br>• Hybrid & Community Cloud Models | Students can learn about different models of cloud | Students will learn to implement the cloud model | • Oral quiz on the basis of the discussion on general concepts of previous lecture | **Lecture 7**<br>Review of previous session – 15 min<br>Lecture – 45 min<br>Question/Answers – 10 min<br>Attendance – 5 min<br>**Lecture 8**<br>Review of previous session – 15 min<br>Lecture – 45 min<br>Question/Answers – 10 min<br>Attendance – 5 min |
| | **Activity: Video , Lecture and Question answer session about Cloud Models** | | | | |
| | **Technical Skills: 3,4**<br>**Soft Skills: 2,3,4** | | | | |

| Factors and Trend | Student Gain | | Course Gain | Deliverables | |
|---|---|---|---|---|---|
| **Week 5** | • Improvement Factors, Scheduling Resource Management,<br>• Technology Trends, Consistency, Availability, Partitions | Students would be aware of the resource management, high-availability and redundancy | Students will learn to implement of latest trends and improved factors in cloud computing. | • Brief summary of the previous lectures in written form which will cover the whole topics. | |
| | **Activity: Lecture and Question answer session about latest trends** | | | | |
| | **Technical Skills: 3,4**<br>**Soft Skills: 3,4** | | | | |

| **Lecture 9** | |
|---|---|
| Review of previous session | 15 min |
| Lecture | 45 min |
| Question/Answers | 10 min |
| Attendance | 5 min |
| **Lecture 10** | |
| Review of previous session | 15 min |
| Lecture | 45 min |
| Question/Answers | 10 min |
| Attendance | 5 min |

| Case Study | Student Gain | | Course Gain | Deliverables | |
|---|---|---|---|---|---|
| **Week 6** | • Case study | Students would able to sketch out a 1st draft of cloud paradigm. | Students will learn to implement the cloud paradigm. | • Screen shots in printable forms of the programming examples studied in the previous lectures | |
| | **Activity: Lecture and discussion of case study** | | | | |
| | **Technical Skills: 3,4,5**<br>**Soft Skills: 4,5** | | | | |

| **Lecture 11** | |
|---|---|
| Review of previous session | 15 min |
| Lecture, case study | 45 min |
| Question/Answers | 10 min |
| Attendance | 5 min |
| **Lecture 12** | |
| Review of previous session | 15 min |
| Lecture, case study | 45 min |
| Question/Answers | 10 min |
| Attendance | 5 min |

<table>
<tr><th>Data Flow</th><th colspan="2">Student Gain</th><th>Course Gain</th><th>Deliverables</th><th></th></tr>
<tr><td rowspan="3">Week 7</td><td colspan="2">• Cluster File Systems,<br>• Data-flow Computation Frameworks, In-Memory Frameworks</td><td>This lecture would provide the awareness of data flow frame work.</td><td>Implementation of cluster file system.</td><td>• Brief summary of the previous lectures in written form which will cover the whole topics.</td><td rowspan="3"><table>
<tr><td colspan="2">Lecture 13</td></tr>
<tr><td>Review of previous session</td><td>15 min</td></tr>
<tr><td>Lecture</td><td>45 min</td></tr>
<tr><td>Question/Answers</td><td>10 min</td></tr>
<tr><td>Attendance</td><td>5 min</td></tr>
<tr><td colspan="2">Lecture 14</td></tr>
<tr><td>Review of previous session</td><td>15 min</td></tr>
<tr><td>Lecture</td><td>45 min</td></tr>
<tr><td>Question/Answers</td><td>10 min</td></tr>
<tr><td>Attendance</td><td>5 min</td></tr>
</table></td></tr>
<tr><td colspan="5">Activity: Quiz, Lecture and Question answer session about cluster file system</td></tr>
<tr><td colspan="5">Technical Skills: 2,3,4,5<br>Soft Skills: 4,5,6</td></tr>
<tr><td>Week 8</td><td colspan="5">Mid-Term Exam</td></tr>
<tr><td>DB</td><td colspan="2">Student Gain</td><td>Course Gain</td><td>Deliverables</td><td></td></tr>
<tr><td rowspan="3">Week 9</td><td colspan="2">• Key-Value Store and Interactive Query Systems,<br>• DBases in the Cloud, Big Data in the Clouds,</td><td>Students will get the awareness of the Big Data in cloud computing.</td><td>Understand the Routing and implementation of data and quires.</td><td>• Submit the midterm paper solution</td><td rowspan="3"><table>
<tr><td colspan="2">Lecture 17</td></tr>
<tr><td>Review of previous session</td><td>15 min</td></tr>
<tr><td>Lecture</td><td>35 min</td></tr>
<tr><td>Question/Answers</td><td>20 min</td></tr>
<tr><td>Attendance</td><td>5 min</td></tr>
<tr><td colspan="2">Lecture 18</td></tr>
<tr><td>Review of previous session</td><td>15 min</td></tr>
<tr><td>Lecture</td><td>35 min</td></tr>
<tr><td>Question/Answers</td><td>20 min</td></tr>
<tr><td>Attendance</td><td>5 min</td></tr>
</table></td></tr>
<tr><td colspan="5">Activity: Lecture and Question answer session about Big data</td></tr>
<tr><td colspan="5">Technical Skills: 2,3,4,5<br>Soft Skills: 3,4,5,6</td></tr>
</table>

| Google FS | | Student Gain | Course Gain | Deliverables | |
|---|---|---|---|---|---|
| **Week 10** | • Google file system<br>• Hadoop file system<br>• MapReduce | **Students will explore different strategies to implement MapReduce and Hadoop** | **Student will be able to develop simple tagged file system.** | • Oral quiz or question answer session of previous lectures | |
| | **Activity: Lecture and Question answer session about Google file system** | | | | |
| | **Technical Skills: 4,5**<br>**Soft Skills: 5,6** | | | | |

| **Lecture 19** | |
|---|---|
| Review of previous session | 15 min |
| Lecture | 35 min |
| Question/Answers | 20 min |
| Attendance | 5 min |
| **Lecture 20** | |
| Review of previous session | 15 min |
| Lecture | 35 min |
| Question/Answers | 20 min |
| Attendance | 5 min |

| Open Stack | | Student Gain | Course Gain | Deliverables | |
|---|---|---|---|---|---|
| **Week 11** | • Geographical Distributed Storage, Programming Languages for the Cloud<br>• Open source PaaS Tools | Students will be aware of the working of open stack and customization. | Student will implement basic open source tools. | • Brief summary of the previous lectures in written form which will cover the whole topics | |
| | **Activity: Understanding Internet through Lecture and Question Answer Session** | | | | |
| | **Technical Skills: 4,5**<br>**Soft Skills: 5,6** | | | | |

| **Lecture 21** | |
|---|---|
| Review of previous session | 15 min |
| Lecture | 35 min |
| Question/Answers | 20 min |
| Attendance | 5 min |
| **Lecture 22** | |
| Review of previous session | 15 min |
| Lecture | 35 min |
| Question/Answers | 20 min |
| Attendance | 5 min |

| Networking | | Student Gain | Course Gain | Deliverables | |
|---|---|---|---|---|---|
| **Week 12** | • OSes and Clouds Networking: topologies<br>• Networking: Traffic Management, Networking: Transport Protocol<br>• OSes and Clouds Networking: topologies | Students would be able to learn the structure of networking topologies | Student will be able to implement network in cloud. | • Question answer session about the submitted summary of the lectures | **Lecture 23**<br>Review of previous session 15 min<br>Lecture 35 min<br>Question/Answers 20 min<br>Attendance 5 min<br>**Lecture 24**<br>Review of previous session 15 min<br>Lecture 35 min<br>Question/Answers 20 min<br>Attendance 5 min |
| | **Activity: Lecture and Question answer session about network its implementation and configuration.** | | | | |
| | **Technical Skills: 4,5**<br>**Soft Skills: 5,6** | | | | |
| **Deployment** | | **Student Gain** | **Course Gain** | **Deliverables** | |
| **Week 13** | • Particle Implementation, Final Term Case Study phase 1 ( To build up your cloud) | Students will able to build own cloud with the help of case study on open source tools phase 1. | Cloud deployment. . | • Screen shots in printable forms of the programming examples studied in the previous lectures | **Lecture 25**<br>Review of previous session 15 min<br>Lecture 35 min<br>Question/Answers 20 min<br>Attendance 5 min<br>**Lecture 26**<br>Review of previous session 15 min<br>Lecture 35 min<br>Question/Answers 20 min<br>Attendance 5 min |
| | **Activity: Practical work** | | | | |
| | **Technical Skills: 2,3,4,5**<br>**Soft Skills: 4,5,6** | | | | |

<table>
<tr><th colspan="2">Deployment</th><th>Student Gain</th><th>Course Gain</th><th>Deliverables</th><th></th></tr>
<tr><td rowspan="3">Week 14</td><td>• Particle Implementation, Final Term Case Study phase 2 ( To build up your cloud)</td><td>Students will able to build own cloud with the help of case study on open source tools phase 2.</td><td>Cloud Deployment</td><td>• Brief summary of the previous lectures in written form which will cover the whole topics</td><td rowspan="3"><table>
<tr><td colspan="2">Lecture 27</td></tr>
<tr><td>Review of previous session</td><td>15 min</td></tr>
<tr><td>Lecture</td><td>35 min</td></tr>
<tr><td>Question/Answers</td><td>20 min</td></tr>
<tr><td>Attendance</td><td>5 min</td></tr>
<tr><td colspan="2">Lecture 28</td></tr>
<tr><td>Review of previous session</td><td>15 min</td></tr>
<tr><td>Lecture</td><td>35 min</td></tr>
<tr><td>Question/Answers</td><td>20 min</td></tr>
<tr><td>Attendance</td><td>5 min</td></tr>
</table></td></tr>
<tr><td colspan="3">Activity: practical work</td></tr>
<tr><td colspan="3">Technical Skills: 1,2,3,4,5<br>Soft Skills: 1,2,3,4,5,6</td></tr>
<tr><td colspan="5">Final Project Revision Week</td></tr>
<tr><td>Week 15</td><td colspan="4">• Final Project submission, Viva<br>• Revision session</td></tr>
<tr><td colspan="6">Final-Term Exam</td></tr>
</table>

## 16 Grading of course

| Sr.# | Contents | Weightage |
|---|---|---|
| **Pre-Mid Assessment** | | |
| **1** | Assignment | 10% |
| **2** | Mid Term Exam | 20% |
| **Post-Mid Assessment** | | |
| **3** | Final Project | 30% |
| **4** | Final Term Exam | 40% |
| **Overall Percentage** | | 100% |

| **Evaluation Criteria and Rubrics** | |
|---|---|
| **Learning Outcomes** | 1. Understanding basic Cloud Architecture<br>2. Understanding the working and deployment of own small scale private cloud<br>3. Working and integration of different open source tools.<br>4. Demonstration of a small business cloud. |
| **Grading Descriptors** | |
| **1. Understanding Concepts.**<br>• **Cloud Services**<br>• **SLO and SLA**<br>• **Cloud Models** | **Grading Range(1-5)**<br>**Satisfactory:** Definition is missing but Domain analysis is complete then it would be considered satisfactory<br>**Excellent:** performance will be considered Excellent if and only if all the sub-tasks are complete and of quality.<br>**Poor:** It would be graded as POOR if none of the sub-task is included in the project. |
| **2. Understanding the working and deployment of**<br>• **File system** | **Grading Range(1-5)**<br>A user friendly and fortified system design deserves the max 5 and vice versa.<br>**Satisfactory:** if Class Definition is not implemented in the assignment but Domain |

| | |
|---|---|
| • **Data Flow framework**<br>• **Controls**<br><br>**3. Open Source Tools**<br>• **Big Data**<br>• **Google File System**<br>• **Map Reduce and Hadoop**<br><br>**4. Demonstration of small business cloud** | analysis is complete then it would be considered satisfactory<br>**Excellent:** performance will be considered Excellent if and only if all the sub-tasks are complete and of quality.<br>**Poor:** It would be graded as POOR if none of the sub-task is included in the project.<br><br>**Grading Range(1-5)**<br>A user friendly and fortified system design deserves the max 5 and vice versa.<br><br>**Satisfactory:** if IDE is not implemented in the project but Domain analysis is complete then it would be considered satisfactory<br>**Excellent:** performance will be considered Excellent if and only if all the sub-tasks are complete and of quality.<br>**Poor:** It would be graded as POOR if none of the sub-task is included in the project.<br><br>**Grading Range(1-5)**<br>A Complete efficient submission deserves the max 5 and vice versa.<br>**Satisfactory:** if delivering of the contents is not enough then it would be considered satisfactory<br>**Excellent:** performance will be considered Excellent if and only if all the sub-tasks are complete and of quality with complete defense of the contents and development.<br>**Poor:** It would be graded as POOR if the participant could not be able to deliver it properly. |
| **Assignment Submission Guide Lines** | **When to Submit:**<br>Tentative (According to the session)<br>**How to submit:**<br>The process of assignment submission is including use of cover page, submission in hard and soft from. |

| | |
|---|---|
| | **Soft-Copy:** The assignment is to submit with the student information in the class in soft form. **Extension:** In-case of extension submission the student has to follow any particular method of submission instructed by the resource person. Late Approval will be signed by the Program Manager Office. |
| **Special Instruction / Other information if any** | **Following URL's can be consulted for further study:**<br>• **https://technet.microsoft.com/en-us/**<br>• http://www.vmware.com/help.html |

## 11 Semester Project

| | |
|---|---|
| **Project Description** | In this project the students are required to develop and configure own small business private cloud according to the requirement of given case study. |
| **Learning Out Comes** | 1. Understanding basic internet architecture<br>2. Understanding the working and configuration of internet protocol<br>3. Working and integration of different network simulators.<br>4. Demonstration of a small business LAN with WAN connectivity<br>5. Sever configuration and access policy implementation |
| **Time Duration** | After Mid-term Exam to the end of Semester (Almost 7 Weeks) |
| **Size of team** | 3-Mebers Team<br>• Team description is as follows: Member1 having CGPA above3<br>• Member2 having CGPA above 2.5<br>• Member3 having CGPA below 2.0 |
| **Evaluation Criteria and Rubrics** | |

| Learning Outcomes | Grading Descriptors |
|---|---|
| **Understanding Concepts.**<br>• **Cloud Services**<br>• **SLO and SLA**<br>• **Cloud Models** | **Grading Range(1-5)**<br>An absolute and ample system analysis deserves the max 5 and vice versa.<br>**Satisfactory:** if Resource Locator Definition is missing in the project but Domain analysis is complete then it would be considered satisfactory<br>**Excellent:** performance will be considered Excellent if and only if all the sub-tasks are complete and of quality.<br>**Poor:** It would be graded as POOR if none of the sub-task is included in the project. |
| **Understanding the working and deployment of**<br>• **File system**<br>• **Data Flow framework**<br>• **Controls** | **Grading Range(1-5)**<br>A user friendly and fortified system design deserves the max 5 and vice versa.<br>**Satisfactory:** if Class Definition is not implemented in the project but Domain analysis is complete then it would be considered satisfactory<br>**Excellent:** performance will be considered Excellent if and only if all the sub-tasks are complete and of quality.<br>**Poor:** It would be graded as POOR if none of the sub-task is included in the project. |
| **Open Source Tools**<br>• **Big Data**<br>• **Google File System**<br>• **Map Reduce and Hadoop** | **Grading Range(1-5)**<br>A user friendly and fortified system design deserves the max 5 and vice versa.<br>**Satisfactory:** if IDE is not implemented in the project but Domain analysis is complete then it would be considered satisfactory<br>**Excellent:** performance will be considered Excellent if and only if all the sub-tasks are complete and of quality.<br>**Poor:** It would be graded as POOR if none of the sub-task is included in the project. |

| | |
|---|---|
| **Demonstration of small business cloud** | **Grading Range(1-5)**<br>A Complete efficient presentation deserves the max 5 and vice versa.<br>**Satisfactory:** if Communication and delivering of the contents is not enough then it would be considered satisfactory<br>**Excellent:** performance will be considered Excellent if and only if all the sub-tasks are complete and of quality with complete defense of the contents and development.<br>**Poor:** It would be graded as POOR if the participant could not be able to deliver it properly. |

## 17 Academic & Disciplinary Policies

## 18 Late Submission:

According to the University policy, an assignment submitted after the due date, without an approved extension, will be penalized at the rate of 20% deduction of the possible maximum marks of the assessment item. This policy is applicable till the next working day after due date and time of assignment. Assignments submitted after this will be awarded zero marks.

### 18.1 Absenteeism:

Late coming and shortage in attendance i.e. 3 continual absents from class, ensurethat students will be struck off from the relevant subject. It is not acceptable for you to disturb the class by entering late. If you are unavoidably late, then please wait outside until the lecturer indicates you may come in.

### 18.2 Scholastic Honesty:

Superior University expects each student to do his/her own work. The University has "zero tolerance" for cheating, plagiarism, unauthorized collaboration on quizzes and papers, using "notes" during exams, submitting someone else's work as one's own, submitting work previously submitted for another course, or facilitating acts of academic dishonesty by others. The penalties are severe!

### 18.3 Plagiarism

University policy prohibits students plagiarizing, collusion, copying and ghost writing any material under any circumstances. A student plagiarizes if he or she presents the thoughts or works of another as one's own. This definition may include:

- Using another's ideas without due acknowledgement;
- Working with others without permission and presenting the resulting work as though it was completed independently.
- Aiding another student to plagiarize is also a violation of the plagiarism Policy and may invoke a penalty.

## 19 Class Rules and Regulations

- All mobile phones must remain switched off (not kept on silent / vibration mode) for the entire duration of a class. Any breach of this rule will lead to immediate confiscation of the phone, which will only be returned after the semester is over.
- No food, drinks, bubble gum or beetle-nut will be allowed inside the classroom.
- In order to maintain the sanctity and decorum on the University Campus, all male and female students are required to be dressed in a decent and appropriate manner. Please note carefully that under no circumstances you will be allowed to attend classes in a casual and shabby getup, for example, dirty and unironed clothes. The University shall take a particularly stern view of any kind of immodest and revealing clothes, such as shalwar-qameez with long slits, shirts with low necklines, skirts and tight or torn jeans. Male students may wear shalwar-qameez with waist-coat and sandals with straps.
- Cheating, plagiarism, offensive language and disruptive behavior will be addressed according to policies for academic misconduct mentioned in the Students' Handbook.
- A student must have maximum participation in class lecture and activities. He/she should think critically to make effective arguments during the class.
- Give respect to your class mates in terms of their opinions and arguments. A student is encouraged to make opposing argument but maintain class decorum cannot be ignored.
- A 15-minute break will be given. Any student coming late or returning late after the break will be considered absent for that day.
- In case of cancellation / makeup of a class you shall be notified through the program manager or class coordinator.

- If you fail to attend at least 80% of the sessions you will receive an F grade for the module

## 20 Assessment GPA and Percentages

**(80-100%)** This is an outstanding standard indicating comprehensive knowledge and understanding of the relevant materials; demonstration of an outstanding level of academic ability; mastery of skills (as identified in the assessment task); and achievement of all assessment objectives.

**(70-79%)** This is an excellent standard indicating a very high level of knowledge and understanding of the relevant materials; demonstration of a very high level of academic ability; sound development of skills (as identified in the assessment task); and achievement of all assessment objectives.

**(60-69%)** This is a very good standard indicating a high level of knowledge and understanding of the relevant materials; demonstration of a high level of academic ability; reasonable development of skills (as identified in the assessment task); and achievement of all assessment objectives.

**(50-59%)** This is a satisfactory standard indicating an adequate knowledge and understanding of the relevant materials; demonstration of an adequate level of academic ability; satisfactory development of skills (as identified in the assessment task); and achievement of most assessment objectives.

**Fail (less than 50%)**

This is an unsatisfactory standard indicating an inadequate knowledge and understanding of the relevant materials; insufficient evidence of academic ability;failure to develop skills (as identified in the assessment task); and failure to achieve assessment objectives.

# 21 Outline

## 21.1 HEC

Datacenter Architectures, Cloud Stack , Technology Trends, Consistency, Availability, Partitions, Cluster File Systems, Data-flow Computation Frameworks, Key-Value Store and Interactive Query Systems, Big Data in the Clouds, Geographic distributed Storage, Programming Languages for the Cloud, DBases in the Cloud, In-Memory Frameworks, Google file system, Hadoop file system, MapReduce, OSes and Clouds Networking: topologies, Networking: Traffic Management, Networking: Transport Protocol Improvements, Security, Scheduling and Resource Management in clouds, Software Level Agreements.

## 21.2 PUCIT

System virtualization, cloud plateform architecture, data center topologies and networking, cloud programming models (MapReduce) and real time hands on experience on amazon web services (AWS) infrastructure. By the end of this course, students will not only have a deep understanding of how existing datacenters like Google, Amazon, Yahoo, Ebay work, but also a taste of cloud based services ranging from internet-based software suites (Google Docs), to plateform-based systems (Miscrosoft's Azure environment) to cloud-based infrastructure (Amazon Web Services - AWS).

## 21.3 FAST

Introduction to Cloud Computing, Server Virtualization (Memory, I/O, and Storage Virtualization),Network Virtualization, Services Oriented Architecture (WSDL and SOAP standards for Web services), Web Services Composition (WS-BPEL), Overview of Windows AZURE and AWS platforms.

## 21.4 Oxford

Origins and background of Cloud Computing Grids, Parallel computing, Functional programming, Infrastructure as a Service
Using Cloud services Amazon EC2 fundamentals, Concepts of IaaS, Openstack and Private Cloud
Map-reduce and Big Data analytics Map-reduce theory, Hadoop, Hive and Pig, Functional decomposition
Theory of Cloud Computing CAP Theorem, Eventual Consistency, Shared Nothing architectures, Dynamo algorithm; Amdahl’s law, Gustafson’s Law, Karp-Flatt Metric; Lambda Architecture, Multi-tenancy, PaaS and SaaS models
NoSQL databases and scalable data storage alternatives, graph databases, Mongo and Cassandra
Case studies and examples
Futures and alternatives to Map Reduce Real time stream analytics, Generalized functional decomposition, Apache Spark and Storm, Futures

### 21.5 Harvard

Cloud computing: General Benefits and Architecture, Business Drivers, Main players in the Field, Overview of Security Issues, XaaS Cloud Based Service Offerings.
Overview of key Amazon offerings: EC2, SimpleDB, S3, Simple Queue, Simple Relational Database, Elastic MapReduce, Virtual Amazon Cloud. S3 Command Line tool.
Bundling Amazon instances: Amazon instances with command line tools.
Elastic bloc storage: EBS provides us with persistence storage in the cloud. Java AWS DK, S3 API, Relational Database Service, SimleDB Service ,
NoSQL Databases. Messaging in the Cloud. We will review details of AWS Simple Notification and Simple Queuing Service.
RESTFul WebServices. AWS APIs are sufficiently rich to allow you easy interaction with AWS service. However, in order to establish connectivity between your own modules in the Cloud you should use RESTFul Web
Services. Elastic Load Balancing and Auto Scaling allow us to automate resource manipulation including bringing resources up and down.
Introduction to Microsoft Cloud. Microsoft offers a set of resources and features that are of great utility to those who are restricted to programming in .Net Environment.
Advanced features of Microsoft Cloud and Cloud Architectural Patterns. MapReduce performs large distributed computation as a set of distributed operations on data sets composed of key-value pairs producing a reduced set of key-value pairs. We will learn the basics of Hadoop, an open source implementation of MapReduce, and it's Java API. HDFS features.
Pig Latin is a convent SQL like language that allow us to write procedural scripts that run atop of Hadoop.
OPSWorks is an application management service that provides an integrated experience for overseeing the complete application lifecycle. With AWS
OpsWorks, we can provision AWS resources, supervise their configuration, deploy applications to those resources, and monitor their health.
AWS Identity Management and Security in the Cloud.