

Nirma University  
**Institute of Technology**  
Information Technology Department

**Course Policy Document**

**B.Tech. Computer Engineering & Information Technology**

**Semester: VI, Academic Year: 2021-22, Term: Even**

<b><u>Course Code &amp; Name</u></b>	:	2CSDE67- Cloud Computing
<b><u>Credit Details</u></b>	:	3-0-1-4 [ L-T-P-C ]
<b><u>Course Co-ordinator</u></b>	:	Prof. Vivek Kumar Prasad
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<b><u>Office</u></b>	:	N-7, New Building
<b><u>Visiting Hours</u></b>	:	8:45 AM TO 4:00 PM
<b><u>Course Blog/Website</u></b>	:	<u>LMS</u>
<b><u>Course Faculty</u></b>	:	Dr Bela Shrimali
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<b><u>Office</u></b>	:	N6
<b><u>Visiting Hours</u></b>	:	8:45 AM TO 4:00 PM
<b><u>Course Blog/Website</u></b>	:	<b><u>LMS website will be updated soon</u></b>

**Introduction to Course:**

Cloud computing is not something that suddenly appeared overnight; in some form, it may trace back to a time when computer systems remotely time-shared computing resources and applications. More currently though, cloud computing refers to the many different types of services and applications being delivered in the internet cloud, and the fact that, in many cases, the devices used to access these services and applications do not require any special applications.

## **Programme Educational Objectives (PEOs):**

The Programme Educational Objectives of B.Tech. programmes are:

1. To prepare graduates who will be successful professionals in industry, government, academia, research, entrepreneurial pursuit and consulting firms
2. To prepare graduates who will contribute to society as broadly educated, expressive, ethical and responsible citizens with proven expertise
3. To prepare graduates who will achieve peer-recognition; as an individual or in a team; through demonstration of good analytical, design and implementation skills
4. To prepare graduates who will thrive to pursue life-long learning to fulfill their goals

## **Programme Outcomes (POs):**

Undergraduate engineering programmes are designed to prepare graduates to attain the following program outcomes:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

### **Course Learning Outcomes:**

After successful completion of this course, student will be able to:

1. Explain core concepts of cloud computing, its services and models
2. Discuss systems, hardware and application virtualization and outline their role in enabling cloud services
3. Explore the issues related to cloud computing and its application
4. Apply fundamental concepts in cloud infrastructures to build and deploy cloud applications.

### **Syllabus:**

#### **Syllabus**

#### **Teaching Hours**

##### **Unit I**

**Cloud Fundamentals and Virtualization:** Introduction and understanding of cloud computing, concepts and models, Cloud enabling technologies and fundamental cloud security and requirements, virtual machines and virtualization of clusters and data centres, Applications of Virtual Machines, Implementation levels of virtualization, Virtualization structures/Tools and Mechanism, Virtualization of CPUs, Memory and I/O devices.

**08**

##### **Unit II**

**Cloud delivery model:** IaaS, PaaS and SaaS, Cloud delivery model with the perspective of cloud provider and the cloud consumer.

**03**

##### **Unit III**

**Cloud Computing Mechanisms:** Cloud Infrastructure, Logical Network Perimeter, Virtual Server, Cloud Storage Device, Cloud Usage Monitor, Specialized Cloud Mechanisms, Load Balancer, SLA Monitor, Failover System, Hypervisor, Automated Scaling Cloud Management Mechanisms, Resource Management System, SLA Management System, CASE STUDY examples.

**07**

#### **Unit IV**

**Cloud Computing Architecture:** Fundamental cloud architecture, Dynamic Scalability Architecture, Elastic Resource Capacity Architecture, Service Load Balancing Architecture, Cloud Bursting Architecture, advanced cloud architecture, Zero Downtime Architecture, Resource Reservation Architecture, Dynamic Failure Detection and Recovery Architecture, Storage Workload Management Architecture.

**08**

#### **Unit V**

**Working with the cloud metrics:** Cost metrics and pricing models, , Cloud usages cost metrics and SLAs, service quality metrics, CASE STUDY examples

**08**

#### **Unit VI**

**Security:** Introduction, Cloud Storage: from LANs to WANs, Technologies for Data Security in Cloud Computing, Security Concerns, Legal issues and Aspects, Securing the Private and Public Cloud Architecture.

**06**

#### **Unit VII**

**Achieving production readiness for cloud services:** Industry Standards Organizations, Mapping Mechanisms to Characteristics, Cloud-Adapted Risk Management Framework, Cloud Business Case Template

**05**

#### **Self-Study:**

The self study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self study contents.

#### **Laboratory Work:**

Laboratory work will be based on the above syllabus with minimum 10 experiments to be incorporated.

#### **Suggested Readings^:**

1. Rajkumar Buyya, James Broberg, Andrzej M Goscinski, Cloud Computing: Principles and Paradigms, Wiley publication
2. Thomas Erl, Zaigham Mahmood, and Ricardo Puttini, Cloud Computing Concepts, Technology & Architecture, PRENTICE HALL
3. Toby Velte, Anthony Velte, Cloud Computing: A Practical Approach, McGraw-Hill Osborne Media
4. George Reese, Cloud Application Architectures: Building Applications and Infrastructure in the Cloud, O'Reilly Publication
5. John Rhoton, Cloud Computing Explained: Implementation Handbook for Enterprises, Recursive Press
6. Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, Mastering Cloud Computing Foundations and Applications Programming, McGraw Hill

L=Lecture, T=Tutorial, P=Practical, C=Credit

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### **Component wise Continuous Evaluation & Semester End Examination weightage:**

<b>Component</b>	<b>Continuous Evaluation</b>			<b>LPW</b>		<b>SEE</b>
<b>Component weightage</b>	0.6			0		0.4
	Class Test I + Class Test II (30%)	Sessional Exam 40%	Special Assignment 30%- Term Paper	Continuous Evaluation 75%	Viva Voce 25%	

### **Lesson Plan**

#### **Course Learning Outcome:**

After successful completion of this course, student will be able to:

1. Explain core concepts of cloud computing, its services and models
2. Discuss systems, hardware and application virtualization and outline their role in enabling cloud services
3. Explore the issues related to cloud computing and its application
4. Apply fundamental concepts in cloud infrastructures to build and deploy cloud applications.

	<b>Sr.No.1</b>	<b>Sr.No.2</b>	<b>Sr.No.3</b>	<b>Sr.No.4</b>	<b>Sr.No.5</b>	<b>SL.No.6</b>	<b>SL.No.7</b>
<b>CLO1</b>	✓	✓	✓				
<b>CLO2</b>		✓		✓		✓	✓
<b>CLO3</b>	✓		✓	✓	✓		

<b>CLO4</b>					✓	✓	✓
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<b>SrNo.</b>	<b>Topics</b>	<b>Hours</b>	<b>CLO</b>	<b>Applications</b>
<b>1</b>	<p><b>Introduction to cloud and virtualization:</b></p> <p><b>Cloud Fundamentals and Virtualization:</b> Introduction and understanding of cloud computing, concepts and models, Cloud enabling technologies and fundamental cloud security and requirements, virtual machines.</p> <p>virtualization of clusters and data centres, Applications of Virtual Machines, Implementation levels of virtualization, Virtualization structures/Tools and Mechanism,</p> <p>Virtualization of CPUs, Memory and I/O devices</p>	<p><b>[08]</b></p> <p>3</p> <p>3</p> <p>1</p>	CLO1	<p>Google Cloud</p> <p>Middleware</p>
<b>2</b>	<p><b>Cloud delivery model:</b> IaaS, PaaS and SaaS.</p> <p>Cloud delivery model with the perspective of cloud provider and the cloud consumer.</p>	<p><b>[03]</b></p> <p>1</p> <p>2</p>	<p>CLO1,</p> <p>CLO2</p>	<p>Government e portals</p> <p>EC2 /Amazon cloud</p> <p>Google API's</p> <p>Microsoft Office 365</p> <p>Google Apps</p>

3	<p><b>Cloud Computing Mechanisms:</b> Cloud Infrastructure, Logical Network Perimeter, Virtual Server, Cloud Storage Device, Cloud Usage Monitor, Specialized Cloud Mechanisms, Load Balancer, SLA Monitor, Failover System.</p> <p>Hypervisor, Automated Scaling Cloud Management Mechanisms, Resource Management System, SLA Management System,</p> <p>CASE STUDY examples.</p>	<p>[07]</p> <p>3</p> <p>3</p> <p>1</p>	<p>CLO1,</p> <p>CLO3</p>	<p>Railway reservation storage (Data storage as a services)</p> <p>Hospital database management (e health)</p> <p>Amazon Web Services (AWS)-VM,</p> <p>Google Compute Engine (GCE)</p>
4	<p><b>Cloud Computing Architecture:</b> Fundamental cloud architecture, Dynamic Scalability Architecture, Elastic Resource Capacity Architecture.</p> <ul style="list-style-type: none"> <li>• Service Load Balancing Architecture, Cloud Bursting Architecture, advanced cloud architecture.</li> <li>• Zero Downtime Architecture, Resource Reservation Architecture,</li> <li>• Dynamic Failure Detection and Recovery Architecture, Storage Workload Management Architecture..</li> </ul>	<p>[08]</p> <p>2</p> <p>2</p> <p>2</p> <p>2</p>	<p>CLO2,</p> <p>CLO3</p>	<p>Amazon cloud</p> <p>Microsoft Windows Azure</p> <p>Salesforce</p> <p>AWS Elastic Beanstalk</p> <p>Microsoft Azure</p>
5	<p><b>Working with the cloud metrics:</b></p> <p>Cost metrics and pricing models, Cloud usages cost metrics</p> <p>SLAs, service quality metrics, CASE STUDY examples</p>	<p>[8]</p> <p>4</p> <p>4</p>	<p>CLO3,</p> <p>CLO4</p>	<p>SLA management</p>

6	<b>Security:</b> <ul style="list-style-type: none"> <li>• Introduction, Cloud Storage: from LANs to WANs, Technologies for Data Security in Cloud Computing,</li> <li>• Security Concerns, Legal issues and Aspects, Securing the Private and Public Cloud Architecture</li> </ul>	<b>[06]</b>  <b>3</b>    <b>3</b>	CLO2,  CLO4.	Reduction in the DDOS Security in private cloud SLO's / SLA's <a href="http://searchcloudsecurity.techtarget.com/guides/Cloud-application-security-best-practices">http://searchcloudsecurity.techtarget.com/guides/Cloud-application-security-best-practices</a>  <a href="http://searchcloudcomputing.techtarget.com/tip/Cloud-computing-and-application-security-Issues-and-risks">http://searchcloudcomputing.techtarget.com/tip/Cloud-computing-and-application-security-Issues-and-risks</a>
7	<b>Achieving production readiness for cloud services:</b> <ul style="list-style-type: none"> <li>• Industry Standards Organizations, Mapping Mechanisms to Characteristics,</li> <li>• Cloud-Adapted Risk Management Framework, Cloud Business Case Template</li> </ul>	<b>[05]</b>  <b>3</b>    <b>2</b>	CLO2 ,  CLO4	Cloud Working and its policies
	<b>Total</b>	<b>45</b>		



## **List of Practical**

<b>1</b>	<p>Getting acquainted with the simulator such as cloud analyst and cloud report, to analyse its result based on the response time, scheduling, tasks and number of data centre available and its distance.</p> <p>Useful links:-  <a href="http://cloudsim-setup.blogspot.com/2013/01/running-and-using-cloud-analyst.html#:~:text=Cloud%20Analyst%20is%20a%20tool,of%20users%20and%20data%20centers.">http://cloudsim-setup.blogspot.com/2013/01/running-and-using-cloud-analyst.html#:~:text=Cloud%20Analyst%20is%20a%20tool,of%20users%20and%20data%20centers.</a>  <a href="http://www.cloudbus.org/reports/CloudAnalyst2009.pdf">http://www.cloudbus.org/reports/CloudAnalyst2009.pdf</a></p>	<b>2 Hrs</b>
<b>2</b>	<p>Working with an IaaS Cloud Computing: Using AWS (Amazon Web Services) to understating the following concept.</p> <p>Working with an IAM (Identity Access Management): AWS Identity and Access Management (IAM) enables you to manage access to AWS services and resources securely. Using IAM, you can create and manage AWS users and groups, and use permissions to allow and deny their access to AWS resources</p> <p><a href="https://aws.amazon.com/iam/">https://aws.amazon.com/iam/</a>  <a href="https://www.youtube.com/watch?v=DXNS-EP9sXM">https://www.youtube.com/watch?v=DXNS-EP9sXM</a>  <a href="https://www.youtube.com/watch?v=z9MOPMxnCjY&amp;t=377s">https://www.youtube.com/watch?v=z9MOPMxnCjY&amp;t=377s</a></p>	<b>2 Hrs</b>
<b>3</b>	<p>Working with an IaaS Cloud Computing: Using AWS (Amazon Web Services) to understating the following concept.</p> <p>Creating the instances, do remote login and hosting the web page</p> <p><a href="https://www.youtube.com/watch?v=PHOo3Ekb_Ys">https://www.youtube.com/watch?v=PHOo3Ekb_Ys</a></p>	<b>2 Hrs</b>
<b>4</b>	<p>Working with an IaaS Cloud Computing: Using AWS (Amazon Web Services) to understating the following concept.</p> <p>Do load balancing in amazon EC2</p> <p><a href="https://www.youtube.com/watch?v=CoN1nZOd9Bo">https://www.youtube.com/watch?v=CoN1nZOd9Bo</a>  <a href="https://www.youtube.com/watch?v=5lseIQ1lZlw">https://www.youtube.com/watch?v=5lseIQ1lZlw</a></p>	<b>2 hrs</b>
<b>5</b>	<p>Working with an IaaS Cloud Computing: Using AWS (Amazon Web Services) to understating the following concept.</p> <p>Auto-scaling in amazon</p>	<b>2 hrs</b>

	<a href="https://www.youtube.com/watch?v=7SfVZqOVcCI">https://www.youtube.com/watch?v=7SfVZqOVcCI</a>	
6	<p>Understanding the working of the Amazon S3 (Simple Storage Service) and implementing the concepts of the version control using remote storage/Amazon S3.</p> <p>Useful links</p> <p><a href="https://www.qwiklabs.com/">https://www.qwiklabs.com/</a></p> <p><a href="https://www.qwiklabs.com/focuses/15683?catalog_rank=%7B%22rank%22%3A2%2C%22num_filters%22%3A0%2C%22has_search%22%3Atrue%7D&amp;parent=catalog&amp;search_id=8471362">https://www.qwiklabs.com/focuses/15683?catalog_rank=%7B%22rank%22%3A2%2C%22num_filters%22%3A0%2C%22has_search%22%3Atrue%7D&amp;parent=catalog&amp;search_id=8471362</a></p>	2 hrs
7	<p>Understanding PaaS: To run the application(hosting the web page) on the platform provided by IBM blueMiX</p> <p><a href="https://console.bluemix.net/docs/runtimes/nodejs/getting-started.html#getting-started">https://console.bluemix.net/docs/runtimes/nodejs/getting-started.html#getting-started</a></p>	2 hrs
8	<p>Understanding the concept of Hadoop and MapReduce framework and running a word count problem (Single Node Cluster).</p> <p><a href="https://www.michael-noll.com/tutorials/running-hadoop-on-ubuntu-linux-single-node-cluster/">https://www.michael-noll.com/tutorials/running-hadoop-on-ubuntu-linux-single-node-cluster/</a></p>	2 hrs
9	<p>Understanding the architecture and workflow of the cloud sim and workflow sim and analyzing its results to understand load balancing, scheduling and failure handling techniques.</p> <p>Useful link:-</p> <p><a href="http://www.cloudbus.org/cloudsim/">http://www.cloudbus.org/cloudsim/</a></p>	2 hrs
10	<p>To Build your own private cloud by setting up via Eucalyptus/open nebula, creating the image and performing operation on this.</p> <p>Useful link:</p> <p><a href="http://opensourceforu.com/2014/03/build-private-cloud-eucalyptus/">http://opensourceforu.com/2014/03/build-private-cloud-eucalyptus/</a></p>	2 hrs
11*	<p>Installing Open stack to create public cloud and use this to host the website.</p> <p>*Optional</p>	2 hrs
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## **Course Assessment Schemes**

**Continuous Evaluation:** Class Test, Sessional Exam, Innovative Assignment

**Semester End Evaluation:** Semester End Examination (SEE)

## **Teaching-learning methodology:**

- Lectures: Use of Black board, PPT, Discussion etc.
- Tutorial: implement mathematical function on simulation and tools

## **Active learning techniques**

- One minute paper/Flipped Class-room
- Muddiest Points

## **Types of Special/Innovative Assignments, Term Papers, mini Projects etc.**

Innovative assignment/ Mini projects will be given by taking definition or topics from students. They have to present their work at end of semester and evaluation will be on the base of their performance and contribution towards work.

## **Course Material:**

Following material available on course website:

<https://sites.google.com/a/nirmauni.ac.in/it662-cloud-computing-even-2018/>

- Course Policy
- PPTs, Notes, other Material
- Assignments, Tutorials
- Question bank
- Web-links, Blogs, Video Lectures, Journals
- Animations /SimulationsSoftware
- Advanced topics
- Industries/Organizations

## **Course Outcome Attainment:**

- Use of formal evaluation components of continuous evaluation, Innovative assignment, laboratory work, semester end examination
- Informal feedback during course conduction
- Surveys & Peer observation