**Title of Subject : Cloud Computing (SW-425)**

**Discipline :** Software Engineering (8th Semester)

**Effective :** F16 Batch & onwards

**Pre-requisite :** Operating Systems

**Assessment :** Theory**:** 20% Sessional, 80% Written Semester Examination

## (20% Mid, 60% Final)

Practical: 40% Sessional, 60% Final Examination

**Credit Hours :** 03 + 01 **Marks:** 100 +50

**Minimum Contact Hours:** 45 + 45

**COURSE LEARNING OUTCOMES:**

Upon successful completion of the course, the student will be able to:

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| --- | --- | --- | --- |
| **CLOs** | **Description** | **Taxonomy level** | **PLO** |
| 1 | Explain concepts of cloud computing and get familiar with different cloud computing technologies. | C3 | 1 |
| 2 | Analyze the role of various technologies and architectures (web services, JSPs, Servlets, Spring Framework) for enterprise level distributed applications | C4 | 2 |
| 3 | Devise cloud environment on different platform and deploy applications | C5 | 3 |
| 4 | Design and develop cloud applications | P4 | 5 |

**PROGRAM LEARNING OUTCOMES (PLOs):**

The course is designed so that students will achieve the following PLOs:

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| --- | --- | --- | --- | --- | --- |
| 1 | Engineering Knowledge: | ☑ | 7 | Environment and Sustainability: | ☐ |
| 2 | Problem Analysis: | ☑ | 8 | Ethics: | ☐ |
| 3 | Design/Development of Solutions: | ☑ | 9 | Individual and Team Work: | ☐ |
| 4 | Investigation: | ☐ | 10 | Communication: | ☐ |
| 5 | Modern Tool Usage: | ☑ | 11 | Project Management: | ☐ |
| 6 | The Engineer and Society: | ☐ | 12 | Lifelong Learning: | ☐ |

**Course outline:**

Cloud Systems, Cloud Systems Characteristics, Goals and Challenges, Cloud Data, Cloud processing system, Resource brokerage, Resource monitoring, Load balancing Resource clustering, Distributed Data Bases, Distributed Transactions, Connections Pooling, Types of Cloud Computing, SaaS, PaaS and IaaS, Sample Applications, Grid Computing & Parallel Processing, Grid v/s Cluster Computing, Application Servers, Enterprise Technologies, Enterprise Architecture & Platform, Enterprise Development Issues.

**THREADS AND PARALLELISM**

Storage elements, Flynn’s Taxonomy, Levels of Parallelism, Multithreading, Thread Programming Models, Thread synchronization: Event synchronization, Asynchronous v/s Synchronous Operations, Blocking, Deadlocks and Timeouts.

**DISTRIBUTED COMPUTING USING RMI**

The RMI Architecture: (The Stubs and Skeleton Layers, Remote Reference Layer, Transaction Layer), Locating Remote or Distributed Objects, Passing Method Parameters (Primitive and Object Parameters), Object Parameters and Serialization, Distributed Garbage Collector

Application Development using RMI:

Defining Remote Interface, Implementing Remote Interface, Writing Client Object, Generating Stubs & Skeletons, Running Clients & Server, Registering Distributed Object.

**RMI OTHER CONSIDERATIONS AND CORBA**

RMI over IIOP, RMI Callbacks, CORBA, CORBA vs. RMI-IIOP

**NAMING & DIRECTORY SERVICES**

Introduction to Naming & Directory Services, Introduction to Java Naming & Directory Services (JNDI) & LDAP, Storing & Searching the Distributed Objects using JNDI & LDAP.

**DISTRIBUTED DEVELOPMENT USING JEE**

Spring Framework Architecture and Modules Spring MVC lifecycle, Directory structure, Sample application, Application Development using Spring MVC: Applications using Multiple View Pages, Multiple Controllers, Model Interface, Introduction to Spring JDBC Template and Sample application using CRUD.

**VIRTUALIZATION AND PRIVACY IN CLOUD COMPUTING**

# Implementing virtualization in cloud computing environment. Identifying security and privacy

# issues in cloud computing

# Practical Work to be carried out:

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|  |  |
| 1 | To work with Remote Method Invocation (RMI) API |
| 2 | To work with Remote Method Invocation (RMI) Object Serialization |
| 3 | To work with Remote Method Invocation (RMI) Callbacks |
| 4 | To work with RMI-IIOP |
| 5 | To implement multithreading |
| 6 | To work with MVC architecture for Enterprise level applications |
| 7 | To implement preserving user state in distributed applications |
| 8 | To work with Spring framework |
| 9 | To work with JDBC template of Spring framework |
| 10 | To work with cloud computing using Microsoft Azure |
| 11 | To work with Amazon web services (AWS) |
| 12 | Develop distributed applications using Amazon web services |
| 13 | To become familiar with Amazon's AWS Identity Management and Security in the Cloud |
| 14 | To make Amazon's RESTFul WebServices |
| 15 | Case study |

# Recommended Books:

* 1. Cloud Computing: Concepts, Technology & Architecture 2013 (The Prentice Hall Service Technology Series by Thomas Erl), Latest Edition
  2. Cloud Computing: From Beginning to End Paperback by [Mr. Ray J Rafaels](https://www.amazon.com/s/ref=dp_byline_sr_book_1?ie=UTF8&field-author=Mr.+Ray+J+Rafaels&text=Mr.+Ray+J+Rafaels&sort=relevancerank&search-alias=books), Latest Edition
  3. Distributed systems: Principles and Paradigms by Andrew S. Tanenbaum, Latest Edition

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| **Approval:** |  | |
| **Board of Studies:** | **Resolution No. 02** | **Dated: 29-08-2019** |
| **Board of Faculty:** | **Resolution No. 01** | **Dated: 07-10-2019** |
| **Academic Council:** | **Resolution No. 96.10** | **Dated: 07-10-2019** |