**BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE, PILANI**

**WORK INTEGRATED LEARNING PROGRAMMES**

**Digital**

Part A: Content Design

|  |  |
| --- | --- |
| **Course Title** | CLOUD COMPUTING |
| **Course No(s)** | SS ZG527 |
| **Credit Units** | 5 |
| **Credit Model** |  |
| **Content Authors** | Digambar Powar |

**Course Objectives**

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| --- | --- |
| **No** |  |
| **CO1** | To introduce - cloud computing from cloud provider and service provider’s perspectives. |
| **CO2** | To introduce the student the underlying infrastructure and architecture of clouds, techniques for enabling services and the quality of such services, as well as issues in designing clouds. |
| **CO3** | To provide learning to address specific issues in performance, security, and management |
| **CO4** | Providing case studies to illustrate the techniques and highlight the issues |

**Text Book(s)**

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| --- | --- |
| T1 | Dinkar Sitaram and Geetha Manjunath. Moving to the Cloud. Syngress (Elsevier) Pub, 2011 |
| T2 | Rajkumar Buyya, James Broburg & anderzej M.G, Cloud Computing – Principles and Paradigms. John Wiley Pub, 2011 |

**Reference Book(s) & other resources**

|  |  |
| --- | --- |
| R1 | Dan C. Marinescu, Cloud Computing Theory and practice, Elsevier, 2013 |
| R2 | Cloud Computing bible by Barrie Sosinsky, Wiley Publishers, 2010 |
| R3 | Cloud Computing bible by Barrie Sosinsky, Wiley Publishers, 2010 |
| R4 | Cloud security, a comprehensive guide to secure cloud computing, by Ronald L.Krutz et al, Wiley Publishers, 2010 |

**Learning Outcomes:**

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| --- | --- |
| No | Learning Outcomes |
| LO1 | Understanding cloud deployments and services |
| LO2 | Setting up the cloud deployment (private cloud) |
| LO3 | Understanding distributed file system and parallel process using Hadoop |
| LO4 | Understanding the importance of cloud storage and database |
| LO5 | Understanding the issues of multi-tenancy and cloud security |
| LO6 | Understanding the lifecycle of Service License Agreements (SLAs) in cloud |

**Part B: Learning Plan**

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| **Academic Term** | FIRST SEMESTER 2015-2016 |
| **Course Title** | CLOUD COMPUTING |
| **Course No** | SS ZG527 |
| **Lead Instructor** | Digambar Powar |

Contact Hour 1

|  |  |  |  |
| --- | --- | --- | --- |
| Type | Content Ref. | Topic Title | Study/HW Resource Reference |
| Pre CH |  |  |  |
| During CH |  | Introduction to the course.  Cloud and related technology.  Networked and Distributed Computing – Models | Lecture slides  T1 Ch 1. |
| Post CH |  |  |  |

Contact Hour 2

|  |  |  |  |
| --- | --- | --- | --- |
| Type | Content Ref. | Topic Title | Study/HW Resource Reference |
| Pre CH |  |  |  |
| During CH |  | Computing Paradigms:  Parallel computing, Supercomputing, etc.  Distributed computing: Clusters, Grids. | Lecture slides  T1 Ch 1. |
| Post CH |  |  |  |

Contact Hour 3

|  |  |  |  |
| --- | --- | --- | --- |
| Type | Content Ref. | Topic Title | Study/HW Resource Reference |
| Pre CH |  |  |  |
| During CH |  | Introduction to Cloud Computing – Origins and Motivation.  3-4-5 rule of cloud computing | T1 Ch 1.  T2. Ch 1. |
| Post CH |  |  |  |

Contact Hour 4

|  |  |  |  |
| --- | --- | --- | --- |
| Type | Content Ref. | Topic Title | Study/HW Resource Reference |
| Pre CH |  |  |  |
| During CH |  | Types of Clouds and Services  Cloud Infrastructure and Deployment | T1 Ch 1.  T2. Ch 1.  T2. Ch 6. |
| Post CH |  |  |  |

Contact Hour 5

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| --- | --- | --- | --- |
| Type | Content Ref. | Topic Title | Study/HW Resource Reference |
| Pre CH |  |  |  |
| During CH |  | Introduction to Virtualization  Uses & Demerits of Virtualization  Examples | T1 Ch 9. |
| Post CH |  |  |  |

Contact Hour 6

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| --- | --- | --- | --- |
| Type | Content Ref. | Topic Title | Study/HW Resource Reference |
| Pre CH |  |  |  |
| During CH |  | Types of Virtualization  x86 Hardware Virtualization  Who manages the resources for the SaaS, PaaS and IaaS models | T1 Ch 9. |
| Post CH |  |  |  |

Contact Hour 7

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| --- | --- | --- | --- |
| Type | Content Ref. | Topic Title | Study/HW Resource Reference |
| Pre CH |  |  |  |
| During CH |  | Introduction to SaaS  Pros and Cons of SaaS model  Applications of SaaS | T1 Ch 4. |
| Post CH |  |  |  |

Contact Hour 8

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| --- | --- | --- | --- |
| Type | Content Ref. | Topic Title | Study/HW Resource Reference |
| Pre CH |  |  |  |
| During CH |  | Traditional packaged Software Vs SaaS  Examples of SaaS  Case study | Lecture slides  T1 Ch 4.  T2 Ch 9. |
| Post CH |  |  |  |

Contact Hour 9

|  |  |  |  |
| --- | --- | --- | --- |
| Type | Content Ref. | Topic Title | Study/HW Resource Reference |
| Pre CH |  |  |  |
| During CH |  | Introduction to IaaS  IaaS examples  Reference Model of AWS  Introduction to Amazon cloud services | T1 Ch 2.  Lecture slides |
| Post CH |  |  |  |

Contact Hour 10

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| --- | --- | --- | --- |
| Type | Content Ref. | Topic Title | Study/HW Resource Reference |
| Pre CH |  |  |  |
| During CH |  | Elastic IP Address  Region Vs Availability zones  AWS demo | T1 Ch 2.  Lecture slides |
| Post CH |  |  |  |

Contact Hour 11

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| --- | --- | --- | --- |
| Type | Content Ref. | Topic Title | Study/HW Resource Reference |
| Pre CH |  |  |  |
| During CH |  | AWS Storage Services  - Amazon S3  - Amazon Glacier  - Amazon EBS  - Amazon EBS  - AWS Import/Export  Amazon CloudFront | T1 Ch 2.  Lecture slides |
| Post CH |  |  |  |

Contact Hour 12

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| Type | Content Ref. | Topic Title | Study/HW Resource Reference |
| Pre CH |  |  |  |
| During CH |  | AWS Database Services  - Amazon RDS  - Amazon DynamoDB  AWS Compute and network  Amazon Virtual Private Cloud  Amazon route 53  Amazon AWS Demo | T1 Ch 2.  Lecture slides |
| Post CH |  |  |  |

Contact Hour 13

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| --- | --- | --- | --- |
| Type | Content Ref. | Topic Title | Study/HW Resource Reference |
| Pre CH |  |  |  |
| During CH |  | Virtual Machine Provisioning and Manageability  VM Provisioning Process  VIRTUAL MACHINE MIGRATION SERVICES | T2 Ch 5 |
| Post CH |  |  |  |

Contact Hour 14

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| --- | --- | --- | --- |
| Type | Content Ref. | Topic Title | Study/HW Resource Reference |
| Pre CH |  |  |  |
| During CH |  | Migrations Techniques  VM Provisioning and Migration in action  VM Life Cycle and VM Monitoring | T2 Ch 5 |
| Post CH |  |  |  |

Contact Hour 15

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| --- | --- | --- | --- |
| Type | Content Ref. | Topic Title | Study/HW Resource Reference |
| Pre CH |  |  |  |
| During CH |  | Private Cloud Computing deployment (Eucalyptus)  Eucalyptus architecture  Eucalyptus components | T2 Ch 5  www.eucalyptus.com |
| Post CH |  |  |  |

Contact Hour 16

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| Type | Content Ref. | Topic Title | Study/HW Resource Reference |
| Pre CH |  |  |  |
| During CH |  | Cloud Controller (CLC)  Walrus (W)  Cluster Controller (CC)  Storage Controller (SC)  Node Controller (NC) and  VMware Broker (optional)  Preparing for Installation | T2 Ch 5  www.eucalyptus.com  Lecture slides |
| Post CH |  |  |  |

Contact Hour 17

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| Type | Content Ref. | Topic Title | Study/HW Resource Reference |
| Pre CH |  |  |  |
| During CH |  | Capacity management and Scheduling  Virtual machine management  Distributed management of virtual machines  Reservation-based provisioning of virtualized resource | T2 Ch 6 |
| Post CH |  |  |  |

Contact Hour 18

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| --- | --- | --- | --- |
| Type | Content Ref. | Topic Title | Study/HW Resource Reference |
| Pre CH |  |  |  |
| During CH |  | Provisioning to meet SLA commitments  Stages of VM life cycle within OpenNebula  Network model for OpenNebula | T2 Ch 6 |
| Post CH |  |  |  |

Contact Hour 19

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| --- | --- | --- | --- |
| Type | Content Ref. | Topic Title | Study/HW Resource Reference |
| Pre CH |  |  |  |
| During CH |  | Introduction to PaaS  PaaS examples  Introduction Windows Azure, Drupal, Wolf Frameworks and Force.com PaaS | T1 Ch 3.  Lecture slides |
| Post CH |  |  |  |

Contact Hour 20

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| Type | Content Ref. | Topic Title | Study/HW Resource Reference |
| Pre CH |  |  |  |
| During CH |  | 5 Principles of UI Design - AWS PaaS  Introduction google app engine  Google app engine demo | T1 Ch 3.  Lecture slides |
| Post CH |  |  |  |

Contact Hour 21

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| --- | --- | --- | --- |
| Type | Content Ref. | Topic Title | Study/HW Resource Reference |
| Pre CH |  |  |  |
| During CH |  | Hadoop components and importance of MapReduce  Understanding MapReduce various logical steps | T1 Ch 3.  T1 Ch 5.  T2 Ch 14. |
| Post CH |  |  |  |

Contact Hour 22

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| Type | Content Ref. | Topic Title | Study/HW Resource Reference |
| Pre CH |  |  |  |
| During CH |  | Exploring the word count java program in detail  Summary of MapReduce facts | T1 Ch 3.  T1 Ch 5.  T2 Ch 14.  Lecture slides |
| Post CH |  |  |  |

Contact Hour 23

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| Type | Content Ref. | Topic Title | Study/HW Resource Reference |
| Pre CH |  |  |  |
| During CH |  | Introduction to file system  Distributed File System (DFS)  Case study: GFS | T1 Ch 3.  T1 Ch 6.  Lecture slides |
| Post CH |  |  |  |

Contact Hour 24

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| --- | --- | --- | --- |
| Type | Content Ref. | Topic Title | Study/HW Resource Reference |
| Pre CH |  |  |  |
| During CH |  | Case study: HDFS  MapReduce using HDFS  Cloud storage | T1 Ch 3.  T1 Ch 6.  Lecture slides |
| Post CH |  |  |  |

Contact Hour 25

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| Type | Content Ref. | Topic Title | Study/HW Resource Reference |
| Pre CH |  |  |  |
| During CH |  | Storage as Service (RAID)  RAID 0, RAID 1, RAID 0/1, RAID 1/0,  RAID 3 | Lecture slides |
| Post CH |  |  |  |

Contact Hour 26

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| Type | Content Ref. | Topic Title | Study/HW Resource Reference |
| Pre CH |  |  |  |
| During CH |  | RAID 5  RAID 6 | Lecture slides |
| Post CH |  |  |  |

Contact Hour 27

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| --- | --- | --- | --- |
| Type | Content Ref. | Topic Title | Study/HW Resource Reference |
| Pre CH |  |  |  |
| During CH |  | Multi-Tenancy,  4 levels of multi tenancy  Resource sharing | T1 Ch 6.  Lecture slides |
| Post CH |  |  |  |

Contact Hour 28

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| --- | --- | --- | --- |
| Type | Content Ref. | Topic Title | Study/HW Resource Reference |
| Pre CH |  |  |  |
| During CH |  | Data customization  Multi-tenant models for cloud services | T1 Ch 6. |
| Post CH |  |  |  |

Contact Hour 29

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| --- | --- | --- | --- |
| Type | Content Ref. | Topic Title | Study/HW Resource Reference |
| Pre CH |  |  |  |
| During CH |  | Introduction network security  Introduction to cloud security  Cloud security Issues | T1 Ch 7.  T2 Ch 23. |
| Post CH |  |  |  |

Contact Hour 30

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| --- | --- | --- | --- |
| Type | Content Ref. | Topic Title | Study/HW Resource Reference |
| Pre CH |  |  |  |
| During CH |  | Cloud security threat Model  Top 5 cloud security threats  Who is responsible for managing security | T1 Ch 7.  T2 Ch 23.  Lecture slides |
| Post CH |  |  |  |

Contact Hour 31

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| --- | --- | --- | --- |
| Type | Content Ref. | Topic Title | Study/HW Resource Reference |
| Pre CH |  |  |  |
| During CH |  | Service License Agreements: Lifecycle and Management  TRADITIONAL APPROACHES TO SLO MANAGEMENT  –TYPES OF SLA’s  –LIFE CYCLE OF SLA | T2 Ch 16 |
| Post CH |  |  |  |

Contact Hour 32

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| Type | Content Ref. | Topic Title | Study/HW Resource Reference |
| Pre CH |  |  |  |
| During CH |  | SLA MANAGEMENT IN CLOUD  AUTOMATED POLICY-BASED MANAGEMENT  Managing Clouds: Services and Infrastructure  –Managing IaaS  –Managing PaaS  –Managing SaaS | T2 Ch 16  T1 Ch 8 |
| Post CH |  |  |  |

**Evaluation Scheme**:

Legend: EC = Evaluation Component; AN = After Noon Session; FN = Fore Noon Session

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| --- | --- | --- | --- | --- | --- |
| No | Name | Type | Duration | Weight | Day, Date, Session, Time |
| EC-1 | Quiz-I | Online | - | 5% | August 20-30, 2015 |
|  | Quiz-II |  |  | 5% | September 20-30, 2015 |
|  | Quiz-III |  |  | 5% | October 20-30, 2015 |
| EC-2 | Mid-Semester Test | Closed Book | 2 hours | 35% | 20/09/2015 (FN) 10 AM – 12 Noon |
| EC-3 | Comprehensive Exam | Open Book | 3 hours | 50% | 08/11/2015 (FN) 9 AM – 12 Noon |

Syllabus for Mid-Semester Test (Closed Book): Topics in Session Nos. 1 to 16

Syllabus for Comprehensive Exam (Open Book): All topics (Session Nos. 1 to 32)

**Important links and information:**

Elearn portal: https://elearn.bits-pilani.ac.in

Students are expected to visit the Elearn portal on a regular basis and stay up to date with the latest announcements and deadlines.

Contact sessions: Students should attend the online lectures as per the schedule provided on the Elearn portal.

Evaluation Guidelines:

1. EC-1 consists of three Quizzes. Students will attempt them through the course pages on the Elearn portal. Announcements will be made on the portal, in a timely manner.
2. For Closed Book tests: No books or reference material of any kind will be permitted.
3. For Open Book exams: Use of books and any printed / written reference material (filed or bound) is permitted. However, loose sheets of paper will not be allowed. Use of calculators is permitted in all exams. Laptops/Mobiles of any kind are not allowed. Exchange of any material is not allowed.
4. If a student is unable to appear for the Regular Test/Exam due to genuine exigencies, the student should follow the procedure to apply for the Make-Up Test/Exam which will be made available on the Elearn portal. The Make-Up Test/Exam will be conducted only at selected exam centres on the dates to be announced later.

It shall be the responsibility of the individual student to be regular in maintaining the self study schedule as given in the course handout, attend the online lectures, and take all the prescribed evaluation components such as Assignment/Quiz, Mid-Semester Test and Comprehensive Exam according to the evaluation scheme provided in the handout.