DISCIPLINE SPECIFIC CORE COURSE – 16: Cloud Computing

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Cloud Computing	**4**	**3**	**0**	**1**	**Class XII pass with Mathematics**	**NIL**

Learning Objectives:

1. *To provide the students basic understanding about cloud and virtualization along with it how one can migrate over it.*
2. *To provide students concepts of security and privacy in a cloud.*

Learning Outcome:

1. *The fundamental ideas behind Cloud Computing, the evolution of the paradigm, its applicability; benefits, as well as current and future challenges;*
2. *The basic ideas and principles in data center design; cloud management techniques and cloud software deployment considerations;*
3. *Different CPU, memory and I/O virtualization techniques that serve in offering software, computation and storage services on the cloud; Software Defined Networks (SDN) and Software Defined Storage (SDS);*
4. *Could storage technologies and relevant distributed file systems, NoSQL databases and object storage;*
5. *The variety of programming models and develop working experience in several of them.*

Unit I **(7 Hours)**

Evolution of Cloud Computing: Trends of computing, Introduction to distributed computing, cloud computing, Cloud Based Application Development Approach Vs. Traditional Application Development Approach, What's cloud computing, Properties & Characteristics, Service models, Deployment models, SLA(Service Level Agreements), SLA at various levels, SOA(Service oriented Architecture), SOA characteristics

Unit II **(8 Hours)**

Cloud Computing Architectural Framework: Infrastructure as a Service (IAAS), Platform as a Service (PAAS), Software as a Service (SAAS), cloud computing vendors, Cloud Computing threats, Cloud Reference Model, The Cloud Cube Model, issues in Cloud Computing ,Managing and administrating the cloud services and cloud resources, Virtualization -Hypervisor Architecture, Hardware Virtualization, Software Virtualization, Memory Virtualization, Storage Virtualization, Data Virtualization, Network Virtualization,
Virtualization Security Recommendations

Unit III **(8 Hours)**

Security in Cloud: Infrastructure security: Network Level, Host Level and Application Level

Security and Storage: Aspects of Data Security, Data control, Network Security, Host Security, Data Security Mitigation, Encryption, storage- confidentiality, integrity, and availability.
Security Management in the Cloud: Security Management Standards, Availability Management- PAAS, SAAS, IAAS, Access Control, Security Vulnerability, Patch and Configuration Management.

Unit IV **(7 Hours)**

Privacy in Cloud: Data Life-Cycle, Key Privacy Concerns in the Cloud, Responsibility for protecting Privacy, Risk Management and Compliance in relation to Cloud Computing, Legal and Regulatory Implications. Disaster Recovery: Disaster recovery planning, Disaster in Cloud, Disaster Management

Unit V **(15 Hours)**

Case study: Hadoop- architecture, Hadoop Distributed file system, map- reduce model, getting started with the Hadoop, Amazon EC2 / S3 and EC2 Commands. Introduction of MS Windows Azure, Google Apps / Google Docs.

Reference Books:

1. Tim Mather, Subra Kumaraswamy, Shahed Latif, "Cloud Security and Privacy," O Reilly
2. George Reese, "Cloud Application Architectures," O Reilly
3. David S. Linthicum, "Cloud Computing and SOA Convergence in your Enterprise, A Step by Step Guide, "Pearson
4. Dr. Gautam Shroff,"Enterprise Cloud Computing Technology, Architecture, Applications", Cambridge University Press.

List of practicals (30 Hours)

1. What are the fundamental differences between centralized and distributed computing?
2. How do elasticity and scalability differ in the context of cloud computing?
3. How to set up an Amazon EC2 instance?
4. Design a basic service-oriented architecture for a simple e-commerce website?
5. Explain the role of firewalls in cloud network security.
6. Launch a Linux Virtual Machine
7. Host a Static Website
8. Create an Amazon Elastic Kubernetes Service (EKS) and S3 Bucket
9. Writing IAM Policies: How to Grant Access to an Amazon S3 Bucket

DISCIPLINE SPECIFIC CORE COURSE – 17: Information Security

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Information Security	**4**	**3**	**0**	**1**	**Class XII pass with Mathematics**	DSC-12

Learning Objectives:

1. *To make a student learn basic principles of information security.*
2. *To familiarize students with cryptography, authentication and access control methods along with software security.*
3. *To touch upon the implications of security in cloud and Internet of Things (IoT).*
4. *To discuss potential security threats and vulnerabilities of systems along with their impacts and countermeasures.*

Learning Outcome:

1. *Identify the major types of threats to information security*
2. *Describe the role of cryptography in security*
3. *Discover the strengths and weaknesses of private and public key cryptosystems*
4. *Identify and apply various access control and authentication mechanisms*
5. *Discuss data and software security and, related issues*
6. *Explain network security threats and attacks*

Unit I **(5 Hours)**

Overview Computer Security Concepts, Threats, Attacks, Security Functional Requirements,Fundamental Security Design Principles, Attack Surfaces and Attack Trees.

Unit II **(10 Hours)**

Cryptographic tools Confidentiality with Symmetric Encryption, Message Authentication and Hash Functions, Public-Key Encryption, Digital Signatures and Key Management, Random and Pseudorandom Numbers, DES (Data Encryption Standard), RSA , Diffie-Hellman key exchange, Post quantum cryptography.

Unit III **(5 Hours)**

Data Security User authentication and Access Control, Database and Data Center Security

Unit IV **(12 Hours)**

Software Security Types of Malicious Software, Threats, Viruses, Worms, SPAM E-Mail, Trojans, Payload, System Corruption, Payload, Attack Agent, Zombie, Bots, Payload, Information Theft, Key-loggers, Phishing, Spyware, Payload Stealthing Backdoors, Rootkits, Countermeasures. Overflow Attacks - Stack Overflows, Buffer Overflows. Handling Program Input, Writing Safe Program Code, Interacting with the Operating System and Other Programs.

Unit V **(13 Hours)**

Network Security Denial-of-Service Attacks, Flooding Attacks, Distributed Denial-of-Service Attacks, Overview of Intrusion Detection, Honeypots, Firewalls, Secure Email and S/MIME, Secure Sockets Layer (SSL) and Transport Layer Security (TLS), HTTPS, IPv4 and IPv6 Security, Public-Key Infrastructure.

References:

1. Stallings, W. and Brown L. (2018) Computer Security: Principles and Practice, Fourth edition, Pearson Education.

2. Pfleeger, C.P., Pfleeger, S.L., & Margulies, J. (2015). Security in Computing. 5th edition. Prentice Hall

3. Lin, S. & Costello, D. J. (2004). Error Control Coding: Fundamentals and applications. 2nd edition. Pearson Education

List of Practicals **(30 hours)**

1. Demonstrate the use of Network tools: ping, ipconfig, ifconfig, tracert, arp, netstat,whois
2. Use of Password cracking tools : John the Ripper, Ophcrack. Verify the strength of passwords using these tools.
3. Use nmap/zenmap to analyse a remote machine.
4. Use Burp proxy to capture and modify the message.
5. Demonstrate sending of a protected word document.
6. Demonstrate sending of a digitally signed document.
7. Demonstrate sending of a protected worksheet.
8. Demonstrate use of gpg utility for signing and encrypting purposes.

DISCIPLINE SPECIFIC CORE COURSE – 18: MINOR PROJECT-2

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
MINOR PROJECT-2	**4**	**0**	**0**	**4**	**Class XII pass with Mathematics**	**DSC-15**

Learning Objectives:

The students will undergo one semester of project work based on the concepts studied in a subject of their choice. The objective is to train the students for the industry by exposing them to prototype development of real life software.

Learning Outcomes:

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

1. *Develop a project plan based on informal description of the project.*
2. *Implement the project as a team.*
3. *Write a report on the project work carried out by the team and defend the work done by the team collectively.*
4. *Present the work done by the team to the evaluation committee.*

Each student shall carry out a minor project in the sixth semester that can be a continuation of advancement in Minor Project-1 or can be done from scratch. The students will work on any project based on the concepts studied in core/elective/ skill based elective courses. Specifically, the project could be a research study, or a software development project.

In case the student is opting for research project, students are required to select a relevant topic, carryout a detailed literature review followed by a critical analysis or implementation. The conclusions drawn from the analysis/ implementation must also be brought out in the form of a research paper.

PROJECT GROUP ORGANIZATION/PLAN

- Students will initially prepare a synopsis (500 words) and submit it to their respective department/supervisor. Only after obtaining the approval of supervisor the student can initiate the Project work.
- For a given project, the group size could be a maximum of four (04) students.
- Each group will be assigned a teacher as a supervisor who will be responsible for their lab classes.
- A maximum of four (04) projects would be assigned to one teacher.

PROJECT EVALUATION

The project will be evaluated as follows:

(a) Mid-semester evaluation 25% weightage

(b) End-semester evaluation

(i) External Examination 50% weightage

Thesis/Project report - 25% of total marks.

Software Coding

i) Documentation - 10% of total marks.

ii) Software - 15% of total marks.

(ii) Viva-voce **25% weightage**

- Practical/discussion sessions based on the area of the project. Work carried out in each lab session will be assessed out of five marks (zero for being absent). Finally, the marks obtained will be scaled out of a maximum marks of mid-semester evaluation (i.e. 25% of total marks).
- The end-**semester evaluation marks** to be awarded jointly by the examiner and supervisor / mentor.
- The **Mid-semester evaluation** to be awarded by the supervisor/mentor. Work carried out in each lab session will be assessed.
- The students will submit both the soft copy and the hard copy of the report.
- The reports may be retained by the examiners.

PROJECT REPORT

Two copies of the Project Report certified by the supervisor shall be submitted to the Department. The format of report can be downloaded from the website/guide/ coordinator.