YEAR-WISE AND SEMESTER-WISE DISTRIBUTION OF SUBJECTS
DEPARTMENT OF B.SC COMPUTER SCIENCE & CLOUD COMPUTING
FIFTH SEMESTER
ACADEMIC YEAR 2024-25 OF 2022-25 BATCH (CBCS)

Sl No.	Part	Subject Code	Title of the Subject	Hours /Week	Duration of Exam (hrs.)	Marks			Credits
						Internal	External	Total	
	THEORY								
1	II	CSCC24501A	Cryptography & Network Security(DSE1)	4	3	40	60	100	4
		CSCC24501B	Internet of Things(DSE1)						
2	II	CSCC24502	Cloud Based Application Development & Deployment (Core-14)	4	3	40	60	100	4
3	II	CSCC24503	Cloud Backup & Disaster Recovery (Core-15)	4	3	40	60	100	4
4	II	CSCC24504	DEVOPS (Core-16)	4	3	40	60	100	4
5	II	CSCC24505	Deep Learning (Core-17)	3	3	40	60	100	3
6	II	CSCC24506	Bigdata with SPARK(Core-18)	4	3	40	60	100	4
	PRACTICALS								
7	II	CSCC24507	Cloud Based Application Development & Deployment (Core-14)	2	3	40	60	100	1
8	II	CSCC24508	DEVOPS (Core-16)	2	3	40	60	100	1
9	II	CSCC24509	Deep Learning (Core-17)	2	3	40	60	100	1
	Total			**29**	**-**	**360**	**540**	**900**	**26**

***Generic Elective (GE) *Inter-Disciplinary Elective(IDE) *Discipline SpecifiElective(DSE)**

***Ability Enhancement Compulsory Course (AECC) *Skill Enhancement Course (SEC)**

CRYPTOGRAPHY AND NETWORK SECURITY
(Descipline Specific Elective-1)

Credits : 4 **Semester: V**
Course Code: CSCC24501A **No. of Lecture Hours: 60**

Objective: To provide issues related to security in modern Netwoi'kcd Computer Systems.

Course Outcomes:
CO1: Identify information security goals, classical encryption techniques and acquire fundamental knowledge on the concepts of finite fields and number theory.
CO2: Apply Public Key Cryptographic Technique for securing messages
CO3: Use an appropriate message authentication code.
CO4: Compare the performance of different message digest algorithms for verifying the integrity of varying message sizes
CO5: Compare different IEEE standards and electronic mail security

UNIT-I **12Hrs**

INTRODUCTION

1. Introduction to Security, Critical Characteristics of Information 1
2. The OSI Security Architecture, Security Attacks 1
3. Security Services and Mechanisms 1
4. A model for Network Sccurity 1
5. NSTISSC Security Model, Components of Information Security 2

CLASSICAL ENCRYPJ'ION TECHNIQUES

6. Symmetric cipher model 1
7. Substitution Techniques-Caesar Cipher, Mono alphabetic cipher 1
8. Play fair cipher, Hill cipher, Polyalphabetic cipher, Transposition Techniques 2
9. The DES encryption, Details of Single Round, Key Generation 1
10. DNS Decryption, The Avalanche. Effect, The Strengths of DES 1

UNIT-II **12Hrs**

MORE ON SYMMETRIC CIPHERS

1. Multiple Encryption and Triple DES 2
2. Key Distribution, Random Number Generation 2

PUBLIC-KEY CRYPTOGRAPHY AND RSA

3. The principles of public-key cryptosystems and essential steps of Public key Cryptosystems, Public key encryption to provide Authentication, Applications of Public key cryptosystems, Requirements for public-key cryptography, Public-key cryptanalysis. 3
4. The RSA algorithms-Description of algorithm, computational Aspects, key generation, and Security of RSA 2
5. RC4Stream Cipher 3

UNIT – III **12Hrs**

KEY MANAGEMENT

1. Distribution of public keys, public announcements of Public keys, publicly available directory, public-key Authority, public-key Certificates, Distribution of secret keys using public-key cryptography. 3
2. Diffe-Hellman key exchange 3

MESSAGE AUTHENTICATION

3. Authentication Requirements, Authentication Functions-Message Encryption, Message Authentication code, Hash Functions-Requirements for a hash function, Simple Hash Function, Birthday Attacks, Block Chaining Techniques. 3
4. Security of Hash Functions and MACS-Brute-Force attacks, Message Authentication Codes 3

UNIT – IV **12Hrs**

1. Secure Hash Algorithm (SHA), MD5 Algorithm. 3
2. Kerberos, X.509 Authentication Services. 3
3. Digital Signatures. 3
4. Whirlpool. 3

UNIT – V **12Hrs**

E-MAIL SECURITY

1. E-Mail System. 1
2. Pretty Good privacy, S/MIME. 3

IP SECURITY

3. Overview, Architecture, Authentication Header, Encapsulating security payload, combining security associations, key management. 3
4. Modes of IPSEC 2

WEB SECURITY

5. Web Security Considerations, Secure Socket Layers (SSL) and Transport Layer Security (TLS), Secure Electronic Transaction. 3

ESSENTIAL READING

1. Stallings, Williams. 2005. **Cryptography and Network Security Principles and Practices**. 4th Edition. New Delhi: Prentice Hall of India.

SUGGESTED READING

1. Forouzan, Behrouz A. 2008. **Cryptography and Network Secuirty**. Special Indian Edition. New Delhi: Tata McGraw-Hill.

INTERNET OF THINGS
(Descipline Specific Elective-2)

Credits : 4 **Semester: V**
Course Code: CSCC24501B **No. of Lecture Hours: 60**

Objectives:

- To introduce the terminology, technology and its applications
- To introduce the concept of M2M(machine to machine) with necessary protocols
- To introduce the Raspberry PI platform, that is widely used in IoT devices
- To introduce the implementation of web based services on the IoT devices

Course Outcomes:

CO1: Identify the importance of IOT and its applications
CO2: Differentiate between IOT and M2M, SDN and NFV
CO3: Understand building of IOT devices and Raspberry PI
CO4: Explain working of WAMP server and AWS
CO5: Understand applications and analytics of IOT

UNIT – I **12Hrs**

INTRODUCTIVE AND CONCEPTS

1. Introduction to Internet of things – Definition and Characteristics of IoT 3
2. Physical Design of IoT, Logical Design of IoT 3
3. IoT Enabling Technologies 3
4. IoT Levels and Deployment Templates, Domain Specific IoTs – Home Automation Cities, Environment, Agriculture, Industry, health and lifestyle 3

UNIT – II **12Hrs**

IoT and M2M

1. IoT and M2M- Introduction to M2M, Difference between of IoT and M2M 2
2. SDN NFV For IoT 3

IoT SYSTEM MANAGEMENT WITH NETCONF– YANG

3. Need for IoT Systems Management, SNMP 2
4. Network Operator requirements, NETCONF, YANG 2
5. IoT systems management with NETCONF – YANG 1
6. IoT platforms design methodology: Introduction, IoT Design Methodology 2

UNIT – III **12Hrs**

IoT PHYSICAL DEVICES AND ENDPOINTS

1. Building blocks of IoT device 2
2. Raspberry Pi about the board, Linux on Raspberry Pi, Raspberry Pi Interfaces 3
3. Programming Raspberry PI with Python 5
4. Other IoT Devices 2

UNIT – IV **12Hrs**

IoT PHYSICAL SERVERS AND CLOUD OFFERINGS

1. Introduction to Cloud Storage models and Communication API 1
2. WAPM auto-bahn for IoT, Xively Cloud for IoT 3
3. Python web application framework – Django 3
4. Designing a RESTfull web API 3
5. Amazon web service for IoT

UNIT – V(Source code excluded) **12Hrs**

1. Python packages of Interest for IoT – JSON, XML, HTTPLib, URLLib, SMTPLib 2

Case studies illustrating IoT design

2. Home Automation – Smart Lighting, Home Intrusion Detection 2
3. Cities – Smart Parking 2

Data Analytics for IoT

4. Introduction, Apache Hadoop 2
5. Using Hadoop MapReduce for Batch Data Analysis 2
6. Apache spark 2

ESSENTIAL READING:

1. Bahga, Arshdeep and madisetti, vijay 2015 **Internet of things – A hands – on approach.** University press ISBN – 9788173719547
2. Richardson, Matt and Wallace Shawn. 2014**. Getting started with Raspberry PI.** O'Reilly (SPD). ISBN - 9789350239759

CLOUD BASED APPLICATION DEVELOPMENT AND DEPLOYMENT

Credits : 4 **Semester: V**
Course Code: CSCC24502 **No. of Lecture Hours: 60**

Objectives:

- To enable student to develop and launch applications in the cloud environment
- To understand the various frameworks and APIs that can be used for developing cloud based applications
- To use Cloud application management and management tools are used to analyze digital service ecosystems and digital product life-cycles

Course Outcomes:

CO1: Design, Develop & Deploy real-world applications in the cloud computing platforms they have learnt
CO2: Demonstrate the ability to access the various cloud platforms used.
CO3: Describe the standardization process of cloud platform and various API's
CO4: Describe the methods for managing the data in cloud and demonstrate the concepts of automation, provisioning using puppet tool.
CO5: Develop Applications in the cloud platform
CO6: Analyze and use of an appropriate framework and APIs for the task

UNIT-I **12hrs**

Basic concepts & techniques

1. Business case for implementing cloud application 2
2. Requirements collection for cloud application development 2
3. Cloud service models and deployment models 3
4. Open challenges in Cloud Computing: Cloud inter-operability and standards, scalability and fault tolerance, security, trust and privacy. 5

UNIT-II **12Hrs**

Application development framework

1. Accessing the clouds: Web application vs Cloud Application 2
2. Frameworks: Model View Controller (MVC), Struts, Spring 2
3. Cloud platforms in Industry – Google AppEngine, Microsoft Azure, Openshift, CloudFoundry 3

Cloud service delivery environment and API

4. Storing objects in the Cloud, Session management, 2
5. Working with third party APIs: Overview of interconnectivity in Cloud ecosystems. Facebook API, Twitter A 3

UNIT-III **12hrs**

Architecting for the Cloud : Best practices

1. Best practices in architecture cloud applications in AWS cloud 6
2. Amazon Simple Queue Service (SQS), RabbitMQ 6

UNIT-IV **12hrs**

Cloud applications

1. Amazon Simple Notification Service (Amazon SNS) 2
2. multi-player online game hosting on cloud resources 2
3. Building content delivery networks using clouds 2

Managing the data in cloud

4. Securing data in the cloud, ACL, OAuth, OpenID, XACML 3
5. Securing data for transport in the cloud, scalability of applications and cloud services. 3

UNIT-V **12hrs**

Automation and provisioning tool

1. Puppet and Chef – steps for automation: Introduction, files and packages. 5
2. services and subscriptions, exec and notify, facts, conditional statements and logging. 5
3. Recent Trends 2

Reference Books

1. Rajkumar buyya, Christian vecchiola, S Thamarai Selvi , "**Mastering cloud computing**", Tata McGraw Hill Education Private Limited, 2013
2. Anthony T .Velte, Toby J. Velte, Robert Elsenpeter, "**Cloud Computing a Practical Approach**", Tata McGraw-HILL, 2010 Edition.
3. Barrie sosinsky, "**Cloud computing bible**", Wiley publishing
4. James Loope, "**Managing Infrastructure with puppet**", O'REILLY , June 2011
5. https://cloud.google.com/appengine/docs
6. https://www.chef.io/solutions/cloud-management/
7. https://aws.amazon.com/documentation
8. https://dev.twitter.com/overview/documentation
9. https://developers.facebook.com/
10. https://www.cloudfoundry.org/
11. https://puppet.com/blog/implement-a-message-queue-your-cloud-application

CLOUD BACKUP AND DISASTER RECOVERY

Credits : 4 **Semester: V**
Course Code: CSCC24503 **No. of Lecture Hours: 60**

COURSE OBJECTIVES:

- To understand the implementation and design Disaster recovery and business continuity in public clouds with on premise and within public cloud

COURSE OUTCOMES:

A student who successfully completes the course will have the ability to:

CO1: Understand about cloud architecture and deployment models
CO2: Analyze about broad perceptive of cloud services
CO3: Analyze about database management in cloud computing
CO4: Understand about resource management in cloud computing
CO5: Familiarize with various cloud security issues and research trends in cloud

UNIT-I **12Hrs**

Virtualization and Migration:

1. Concept, Benefits of Virtualization, 2
2. Challenges in Virtualization, Characteristics of Virtualized environments, 2
3. Virtualization Techniques, Hypervisor, Components of Virtualization, 3
4. Hot and Cold conversion, Resource Virtualization,Virtualization Platforms. 3
5. **Cloud Migration**: Migrating Strategies, Risk Associated, Precautions 2

UNIT-II **12Hrs**

Inter Cloud Computing/Federated Environment:

1. **Legal and Compliance Issues**- - Global Exchange of Cloud Resources, 1
2. Inter Cloud ResourceManagement, Service level Agreement management. 2
3. Cross Border Data Storage Issue, CloudGovernance Model, 2
4. Compliance monitoring, Ownership of Data, storage and backup policy. 2
5. **Federated Cloud**-Characteristics, Cloud Federation Stack, 2
6. Motivation for Cloud Interoperability, Cloud Interoperability Scenario, 1
7. Challenges, Inter cloud enabling techniques,Inter-Cloud Standards, 1
8. Inter-Cloud Project example 1

UNIT-III **12Hrs**

Threats, Security and Disaster Management in Cloud Computing:

1. **Cloud threats**- Threat actors in cloud, Current Threats in cloud, 1
2. Mitigation techniques for Cloud threats, Cloud Contracting models, 2
3. Methods for Data loss prevention, Viability of thirdparty services vendors. 2
4. **Data Security issues in Cloud storage**- Cloud Security Challenges, Security Governance, 1

5. Risk Management, Security Monitoring, Security Architecture Design, 2
6. Data in Rest, Data in Motion, Identity and Access Management, 2
7. Authentication Services in cloud. 2

UNIT-IV **12Hrs**

Disaster Management:

1. Disaster recovery as a service model **(DRaaS**), Recovery Point Objectives, 2
2. Recovery Time Objectives, Monitoring, Load Balancing, 2
3. Database Recovery, Business Continuity. 2

Resource Management in Cloud Computing, Case Studies, Advance Topics:

4. Performance and Scalability of Cloud Services, Data Centre, Components, Architecture with Reference 3
5. Model, Resource Provisioning and allocation approaches, Challenges in Resource Management. 3

UNIT-V **12Hrs**

Cloud Platforms:

1. **Case studies on Cloud Platforms** - Amazon web services, Google App Engines, Microsoft Azure, Salesforce Cloud. 6
2. Cloud Application Development, Green Computing, Fog Computing, Big Data application on Cloud, Cloud Mining, Mobile Cloud. 6

BOOKS RECOMMENDED:

1. Rajkumar Buyya; **Cloud Computing Principles and Paradigms;** John Wiley & Sons 2011.
2. Rajkumar Buyya; **Mastering Cloud Computing;** Elsevier Inc 2013.
3. **Cloud Computing Bible,** Barrie Sosinsky, Wiley-India, 2010.
4. Toby Velte, Anthony Velte, Robert Elsenpeter, **"Cloud Computing, A Practical Approach"**McGraw-Hill Osborne Media; 1 edition [ISBN: 0071626948], 2009.
5. Dimitris N. Chorafas, **"Cloud Computing Strategies"** CRC Press; 1 edition [ISBN: 1439834539],2010.

DEVOPS

Credits: 4 **Semester: V**
Course code: CSCC24504 **No.of lecture hours: 60**

Objectives: The main objectives of this course are to:

- Understand the skill sets and high-functioning teams involved in DevOps and related methods to reach a continuous delivery capability.
- Implement automated system update and DevOps lifecycle.

Course Outcomes: On successful completion of this course, students will be able to:

CO1: Identify components of Devops environment.
CO2: Apply different project management, integration, testing and code deployment tool.
CO3: Investigate different DevOps Software development models.
CO4: Assess various Devops practices.
CO5: Collaborate and adopt Devops in real-time projects.

UNIT-I **12Hrs**

1. **DevOps-** Introduction to DevOps, Working of DevOps 2
2. Advantages of DevOps for the Customer and Developer 2
3. DevOps Architecture and Principles- Continuous Improvement, Release, Planning, Continuous Integration, Continuous Delivery, Continuous Testing Continuous Monitoring and Feed Back 4
4. Performance Measurement through KPIS and Metrics 2
5. Agile vs DevOps 2

UNIT-II **12Hrs**

INTRODUCTION TO CI-CD & DEVOPS DEPLOYMENT

1. Introduction to CI-CD Pipeline, Stages of CI-CD Pipeline 2
2. Traditional and Cloud based Ci-CD Pipelines 2
3. Deployment Automation and Release Management 2
4. Cloud and DevOps, Full Stack Development, Cloud Service Models for DevOps 3
5. Uses of DevOps- Mobile Applications, ALM Processes, Scaling Agile, Multiple-Tier Applications, Enterprise, SupplyChains and IOT 3

UNIT-III **12Hrs**

GIT & JIRA : DEVOPS TOOLS

1. GIT- Introduction to Version Control, Working 2
2. GIT- Pull, Push Commands and Commits 3
3. GIT- Branching and Headers 2
4. Online Repositories, Introduction to GitHub, Using Git for CI-CD 2
5. Introduction to Jira, Team Collaboration using Jira, Jira Interface, Tools and Integrations 3

UNIT IV- DOCKER **12Hrs**

1. Docker- Introduction to Docker, understanding of docker images and containers 2
2. Docker- Share and copy a Container, Container Life Cycle, Base Image and Customization, Creation of Docker file , publishing Image to Docker Hub 3
3. Docker Networking – Types of Networks, Container Networking, Docker Compose - Introduction 3
4. Docker Swarm – Creating Compose, Containers on a Cluster and Creating And Scaling Applications 2
5. Docker file best practices, Optimising Images, Monitoring and Logging 2

UNIT V- Kubernetes Developer **12Hrs**

1. Introduction to Kubernetes , minikube setup your practice cluster, Kubernetes api primitives, creating pods, namespaces, configmaps 4
2. security contexts, resource requirements, secrets, service accounts, Liveliness and readiness probes, container logging, metrics server, monitoring applications. 4
3. Debugging, Labels, selectors, annotations, rolling updates and rollback, jobs and cronjobs, services and network polices 4

ESSENTIAL READING

1. Sanjeev Sharma & Berny Coyne **DevOps for Dummies** 2nd IBM Limited Edition
2. **Kubernetes developer** : the Kubernetes for Application Developers eBook
3. KalloriVikraman**, "Introduction to Devops",** 1st Edition, 2016.
4. Paul Swartout **"Continuous Delivery and Devops : A quickstart guide"**
5. **Docker Deep Dive** by Nigel Poulton
6. Jonny Schneider, **"Understanding Design Thinking, Lean, and Agile"** O'Reilly Media 2017.
7. https://blogs.bmc.com/ci-cd-pipeline-setup/?print-posts=pdf
8. Git, Github and Zira Documentation

DEEP LEARNING

Credits: 3 **Semester: V**
Course code: CSCC24505 **No.of lecture hours: 45**
Prerequisites: Machine Learning

Course Objective:

- The main objective of this course is to give a practical introduction to Deep Learning using Keras. It covers the concepts of deep learning and their implementation.

Course Outcomes:

At the end of the course the student will be able to

CO1: Understand the basics of deep learning
CO2: Understand the usage of tensors in deep learning
CO3: Understand the LSTM and GRU layers
CO4: Apply Python deep-Learning framework Keras, with Tensor-Flow as backend engine.
CO5: Apply Auto encoders

Unit-I **9Hrs**

1. **Introduction** : History, Hardware, Data, Algorithms Neural Networks, Data representations for neural networks, Scalars (0D tensors) 2
2. Vectors(1D tensors), Matrices (2D tensors), 3D tensors and higher-dimensional tensors, Key attributes. 2
3. Manipulating tensors in Numpy, The notion of data batches, Real-world examples or data tensors 2
4. Vector data, Time series data or sequence data, Image data, Video data 3

Unit-II **9Hrs**

1. Tensor operations: Element-wise operations 2
2. Broadcasting, Tensor dot, Tensor reshaping 2
3. Geometric interpretation of tensor operations 2
4. A geometric interpretation of deep learning 3

Unit-III **9Hrs**

1. Gradient-based optimization, Derivative of a tensor operation 2
2. Stochastic gradient descent. 2
3. Chaining derivatives: the Back propagation algorithm. 2
4. Neural networks: Anatomy, Layers, Models, Loss functions and optimizers 3

Unit-IV	**9Hrs**
1. Introduction to Keras,Keras, Tensor Flow	2
2. Theano and CNTK	2
3. Recurrent neural networks: A recurrent layer in Keras	2
4. Understanding the LSTM and GRU layers	3

Unit-V	**9Hrs**
1. Auto encoders: Types of Auto Encoders and its applications	3
2. Generative Adversarial Networks: Generative Adversarial Network	3
3. Deep Convolutional Generative Adversarial Networks	3

Essential Reading

1. Francois Chollet. **Deep Learning with Python**. Manning Publications, 2018

Suggested Reading:

1. AuréIienGéron. **Hands on Machine Learning with SciKit-Learn, Keras and Tensor Flow**. O'Reily, 2019
2. Goodfellow, I. , Bengio,Y., and Courville, A**., Deep Learning**, MIT Press, 2016.
3. Aston Zhang, Zachary C. Lipton, Mu Li, and Alexander J. Smola, **Dive into Deep Learning**,2020 Link: Dive into Deep Learning- Dive into Deep Learning 0.16.6 documentation(d2l.ai)

BIGDATA WITH SPARK

Credits: 4 **Semester: V**
Course code: CSCC24506 **No.of lecture hours: 60**

Objectives:

- To understand and learn about Big Data.
- To learn the analytics of Big Data.
- To understand MapReduce fundamentals.
- Processing of Big Data with Advanced architectures like Spark.

Course Outcome: Students will be able to

CO1: Explain the motivation for big data systems and identify the main sources of BigData inthe real world.
CO2: Develop technical skills in predicative and prescriptive modeling to support businessdecision-making.
CO3: Implement several Data Intensive tasks using the Map Reduce Paradigm.
CO4: Understand Hadoop ecosystem such as YARN and HIVE-QL for structured databases.
CO5: Demonstrate an ability map-reduce programming using PIG and Basics of SPARK Framework

UNIT-I	**12 Hrs**
Getting an Overview of Big Data:	
1. What is Big Data?, History of Data Management-Evolution of Big Data	1
2. Structuring Big Data, Elements of Big Data	1
3. Big Data Analytics, Careers and Future of Big Data	1
Exploring the Use of Big Data in Business Context:	
4. Use of Big Data in Social Networking	1
5. Preventing Fraudulent Activities	1
Introducing Technologies for Handling Big Data:	
6. Distributed and Parallel Computing for Big Data	2
7. Introducing Hadoop, Cloud Computing and Big Data	2
Understanding Big Data Technology Foundations:	
8. Exploring the Big Data Stack, Virtualization and Big Data	2
9. Virtualization Approaches	1

UNIT-II **12 Hrs**

Understanding Hadoop EcoSystem

1. Hadoop Ecosystem 2
2. Hadoop Distributed File System 4
3. HBase -Architecture, Regions 2

Understanding MapReduce Fundamentals and HBase

4. The Map Reduce Framework, Uses of MapReduce 2
5. Role of HBase in Big Data Processing 2

UNIT-III **12 Hrs**

Processing your Data with MapReduce

1. Developing Simple MapReduce Application 2

Customizing MapReduce Execution and ImplementingMapReduce program

2. Controlling MapReduce Execution with InputFormat 1
3. Reading Data with Custom Record Reader 2
4. Organizing Output Data with Output Format 2
5. Customizing Data with RecordWriter 2
6. Optimizing MapReduce Execution with Combiner 2
7. Controlling Reducer Execution with Partitioner 1

UNIT-IV **12 Hrs**

Understanding Hadoop YARN Architecture

1. Background and Advantages of YARN 2
2. YARN Architecture,Working of YARN, YARN Schedulers 2
3. YARN Configurations,YARNCommands,YARN Containers 2

Exploring HIVE

4. Introducing Hive,Getting started with Hive 2
5. Data Types and Built-in functions in Hive,Hive DDL 2
6. Data manipulation in Hive,Data Retrieval Queries,Using Joins in Hive 2

UNIT-V **12 Hrs**

Analyzing Data with Pig

1. Introducing Pig, Running Pig 1
2. Getting Started with Pig Latin 1
3. Working with Operators in Pig 1
4. Working with Functions in Pig 1
5. Debugging Pig, Error Handling in Pig 1

Introduction to SPARK Frame Work

6. Overview of Spark, Hadoop vs Spark 1
7. Cluster Design, Cluster Management, performance, Application Programming interface(API): Spark Context, Resilient Distributed Datasets 2
8. Creating RDD, RDD Operations, Saving RDD - Lazy Operation – Spark Jobs 2

Data Analysis with Spark Shell

9. Writing Spark Application - Spark Programming in Python, Java - Application Execution. 2

ESSENTIAL READING

1. DT Editorial Services. 2016. **Big Data Black Book**. Dreamtech Press.
2. Mike Frampton, "**Mastering Apache Spark**", Packt Publishing, 2015.
3. Mohammed Guller, **Big Data Analytics with Spark**, Apress,2015

SUGGESTED READING

1. White, Tom. 2012. **Hadoop: The Definitive Guide**. 3rd Edition. O'Reilly Media.

CLOUD BASED APPLICATION DEVELOPMENT AND DEPLOYMENT PRACTICALS

Credits: 1 **Semester: V**
Course code: CSCC24507 **No.of lecture hours: 30**

Software / API / Tools
JDK 1.7/1.8, Eclipse IDE, Dropbox API, Apache tomcat server 7.0/8.0, Google AppEngine API, Servlets, Spring framework.

1. Design and Development of Web applications using MVC Framework.
2. Installing and Configuring required platform for Google App Engine
3. Studying the feature of GAE PaaS model.
4. Creating and running Web applications (Guest book, MVC) on local host and deploying the same in Google App Engine
5. Design and Development of Web applications using Spring framework.
6. Developing an ASP.NET based web application on Azure platform
7. Creating an application in Dropbox to store data securely. Develop a source code using Dropbox API for updating and retrieving files.

DEVOPS PRACTICALS

Credits: 1 **Semester: V**
Course code: CSCC24508 **No.of lecture hours: 30**

Objective: To learn Git and Github. To deploy Infrastructure as Code (IaC) using Docker

Course Outcome: Students will be able to deploy containers and understand basic concepts of Git

List of Experiments

GIT & GITHUB

1. Create Github Account, Create a repository and fetch a link
2. Download and Install Git Bash, Initialize Git
3. Clone a Repository, Connect using Github Credentials
4. Add and Commit a Code to Git
5. Git Branching, Revert and Rebase
6. Git Stash
7. Git Pull and Push to a Repository, Manage Conflicts
8. Git LFS, Working with Large Binary Files
9. Git Ignore, Reset, Fetch

DOCKERS- INFRASTRUCTURE AS CODE

10. Download and set up Docker
11. Create a Container
12. Containerize an Application
13. Update the Application
14. Share the Application
15. Persist the DB

REFERENCES:

1. https://git-scm.com/doc -Git Documentation
2. https://docs.docker.com/get-started/ - Docker

DEEP LEARNING LAB

Credits: 1 **Semester: V**
Course Code: CSCC24609 **No.of practical hours:30**

COURSE OBJECTIVES

1. To Build The Foundation of Deep Learning.
2. To Understand How To Build The Neural Network.
3. To enable students to develop successful machine learning concepts.

COURSE OUTCOMES

Upon the Successful Completion of the Course, the Students would be able to:

1. Learn The Fundamental Principles Of Deep Learning.
2. Identify The Deep Learning Algorithms For Various Types of Learning Tasks in various domains.
3. Implement Deep Learning Algorithms And Solve Real-world problems.

EXERCISES

1. Setting up the Spyder IDE Environment and Executing a Python Program
2. Installing Keras, Tensorflow and Pytorch libraries and making use of them
3. Applying the Convolution Neural Network on computer vision problems
4. Image classification on MNIST dataset (CNN model with Fully connected layer)
5. Applying the Deep Learning Models in the field of Natural Language Processing
6. Train a sentiment analysis model on IMDB dataset, use RNN layers with LSTM/GRU notes
7. Applying the Autoencoder algorithms for encoding the real-world data
8. Applying Generative Adversial Networks for image generation and unsupervised tasks.

TEXT BOOKS

1**. Deep Learning** by Ian Goodfellow, Yoshua Bengio and Aaron Courville, MIT Press.

2. **The Elements of Statistical Learning** by T. Hastie, R. Tibshirani, and J. Friedman, Springer.

3. **Probabilistic Graphical Models**. Koller, and N. Friedman, MIT Press.

REFERENCE BOOKS

1. Bishop, C, M., **Pattern Recognition and Machine Learning**, Springer, 2006.

2. Yegnanarayana, B., **Artificial Neural Networks** PHI Learning Pvt. Ltd, 2009.

3. Golub, G.H., and Van Loan C.F., **Matrix Computations**, JHU Press, 2013.

4. Satish Kumar, **Neural Networks: A Classroom Approach**, Tata McGraw-Hill Education, 2004.

EXTENSIVE READING

1. http://www.deeplearning.net
2. https://www.deeplearningbook.org/
3. https://developers.google.com/machine-learning/crash-course/ml-intro
4. www.cs.toronto.edu/~fritz/absps/imagenet.pdf
5. http://neuralnetworksanddeeplearning.com/

YEAR-WISE AND SEMESTER-WISE DISTRIBUTION OF SUBJECTS
DEPARTMENT OF B.SC COMPUTER SCIENCE & CLOUD COMPUTING
SIXTH SEMESTER
ACADEMIC YEAR 2024-25 OF 2022-25 BATCH (CBCS)

Sl. No.	Part	Subject Code	Title of the Subject	Hours /Week	Duration of Exam (hrs.)	Marks			Credits
						Internal	External	Total	
	THEORY								
1	II	CSCC24601	Cloud Strategy & Planning Management (Core-19)	4	3	40	60	100	4
2	II	CSCC24602	Cyber Security (Core-20)	4	2	40	60	100	4
3	II	CSCC24603	Software Testing (Core-21)	4	3	40	60	100	4
	PRACTICALS								
7	II	CSCC24604	Cyber Security (Core-20)	2	3	40	60	100	1
8	II	CSCC24605	Major Project (DSE-2)	15	3	40	60	100	6
	Total			**29**	**-**	**200**	**300**	**500**	**19**

Generic Elective (GE) ***Inter-Disciplinary Elective(IDE)**

***Ability Enhancement Compulsory Course (AECC)** ***Skill Enhancement Course (SEC)**

***Discipline Specific Elective(DSE**

CLOUD STRATEGY AND PLANNING MANAGEMENT

Credits : 4 **Semester: VI**
Course Code: CSCC24601 **No. of Lecture Hours: 60**

Course Objectives:

- This course deals with the concepts and technological advances fueling the rapid adoption of cloud computing today.
- This course provides the students with the skills and knowledge required to plan and manage a Cloud Computing strategy within an organization.
- This course will enable students to evaluate the strategic value of Cloud Computing using IT Governance and Compliance.

Course Outcomes:

CO1: Strategically assess how cloud computing enables IT Transformation and business value in an Organization.
CO2: Analyze the role that cloud computing can play in the business process.
CO3: Critically appraise how the incorporation of cloud computing in an IT strategy can deliver on strategic business objectives.
CO4: Evaluate how cloud computing and Service Oriented Architecture (SOA) can deliver business agility.
CO5: Implement IT governance to manage business realization from cloud IT services.

UNIT I - ACHIEVING BUSINESS VALUE FROM IT TRANSFORMATION **12Hrs**

1. Moving to a cloud architecture and strategy to achieve business value. 4
2. BPM, IS, Porter's Value chain model and BPR as a means of delivering business value; 4
3. **Developing Business Strategy:** Investigate business strategy models to gain competitive advantage for organizations, 4

UNIT II - STRATEGIC IT LEADERSHIP IN THE ORGANIZATION **12Hrs**

1. Emphasize the roles of the strategic IS/IT leaders such as Chief Information Officer (CIO) and the Chief Technology Officer 6
2. (CTO) in planning and managing IT Strategic development in the organization. 6

UNIT III - PLANNING A CLOUD COMPUTING BASED ITSTRATEGY **12Hrs**

1. Develop an IT strategy to deliver on strategic business objectives in the business strategy. 6
2. IT Project planning in the areas of ITaaS, SaaS, PaaS and IaaS are essential in delivering a successful strategic ITPlan. 6

UNIT IV - SOA AND BUSINESS AGILITY **12Hrs**

1. Shared services delivered by a Service Oriented Architecture (SOA) in a Private or Public Cloud. Services, Databases and Applications on demand. 6
2. The effect on Enterprise Architecture and its traditional frameworks such as Zachman and The Open Group Architecture Frame work(TOGAF). 6

UNIT V - BENEFIT REALIZATION AND IT GOVERNANCE **12Hrs**

1. Managing resources (people, process, technology), to realize benefit from Private/Public Cloud IT services (IaaS, PaaS, PraaS,SaaS) 6
2. Gartner's 5 pillars of benefit realization. IT governance as a service in measuring the delivery of IT Strategy from Cloud IT Services using Sarbannes Oxley (CobiT) and other commonly-used approaches. 6

REFERENCES

1. Arnold J Cummins, "**Easiest Ever Guide to Strategic ITPlanning***"* http://strategicitplanningguide.com/.
2. Andy Mulholland, Jon Pyke, Peter Finger, *"**Enterprise Cloud Computing - A Strategy Guide for Business and Technology Leaders"***, Meghan Kiffer [ISBN: 0929652290],2010.
3. David S. Linthicum, "***Cloud Computing and SOA Convergence in Your Enterprise****"*, Addison Wesley [ISBN:0136009220],2009.
4. Charles Babcock, "***Management Strategies for the Cloud Revolution****"*, 1st Ed., Tata McGraw/Hill [ISBN:0071740759],2010.
5. Mark I. Williams, "***A Quick Start Guide to Cloud Computing: Moving Your Business into the Cloud****"* Kogan Page[ISBN:0749461306],2010.
6. Website: "*Whitepapers and news for the CIO"*www.cio.com.
7. Website: "*Gartner Research Website"*www.gartner.com.

CYBER SECURITY

Credits : 4 **Semester: VI**
Course Code: CSCC24602 **No. of Lecture Hours: 60**

Course objectives:

- To understand various types of cyber-attacks and cyber-crimes
- To learn threats and risks within context of the cyber security
- To have an overview of the cyber laws & concepts of cyber forensics
- To study the defensive techniques against these attacks

Course Outcomes:

CO1: Analyze and evaluate the cyber security needs of an organization.
CO2: Understand Cyber Security Regulations and Roles of International Law.
CO3: Understand Security for Mobile and Wireless Devices.
CO4: Design and develop a security architecture for an organization.
CO5: Understand fundamental concepts of data privacy attacks

UNIT – I **12Hrs**

Introduction to Cyber Security:

1. Basic Cyber Security Concepts, layers of security, Vulnerability,threat, Harmful acts 4
2. Internet Governance – Challenges and Constraints, Computer Criminals, CIATriad, Assets and Threat, motive of attackers, active attacks, passive attacks, Software attacks, hardware attacks 4
3. Cyber Threats-Cyber Warfare, Cyber Crime, Cyber terrorism, Cyber Espionage, etc., Comprehensive Cyber Security Policy. 4

UNIT – II **12Hrs**

Cyberspace and the Law & Cyber Forensics:

1. Introduction, Cyber Security Regulations, Roles of International Law. 2
2. The INDIAN Cyberspace, National Cyber Security Policy. 2
3. Introduction, Historical background of Cyber forensics, Digital Forensics Science 2
4. The Need for Computer Forensics, Cyber Forensics and Digital evidence, Forensics Analysis of Email 3
5. Digital Forensics Lifecycle, Forensics Investigation, Challenges in Computer Forensics 3

UNIT – III **12Hrs**

Cybercrime: Mobile and Wireless Devices:

1. Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility 2
2. Credit card Frauds in Mobile and Wireless Computing Era
   Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices 5
3. Authentication service Security, Attacks on Mobile/Cell Phones,
   Organizational security Policies and Measures in Mobile Computing Era, Laptops. 5

UNIT- IV **12Hrs**

Cyber Security: Organizational Implications:

1. Introduction, cost of cybercrimes and IPR issues, webthreats for organizations,
   security and privacy implications 6
2. social media marketing: security risks and perils for organizations,
   social computing and the associated challenges for organizations 6

UNIT – V **12Hrs**

Privacy Issues:

1. Basic Data Privacy Concepts: Fundamental Concepts, Data Privacy Attacks 3
2. Data linking and profiling, privacy policies and their specifications,
   privacy policy languages, privacy in different domains- medical, financial, etc 2

Cybercrime: Examples and Mini-Cases

3. **Examples:** Official Website of Maharashtra Government Hacked, 4
   Indian Banks Lose Millions of Rupees, Parliament Attack,
   Pune City Police Bust Nigerian Racket, e-mail spoofing instances.
4. **Mini-Cases:** The Indian Case of online Gambling,
   An Indian Case of Intellectual Property Crime, Financial Frauds in Cyber Domain. 3

ESSENTIAL READINGS:

1. Nina Godbole and Sunit Belpure, **Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives**, Wiley

2. B.B. Gupta, D.P. Agrawal, Haoxiang Wang, **Computer and Cyber Security: Principles, Algorithm, Applications, and Perspectives,** CRC Press, ISBN 9780815371335,2018.

SUGGESTED READINGS:

1**. Cyber Security Essentials**, James Graham, Richard Howard and Ryan Otson, CRC Press.

2. **Introduction to Cyber Security**, Chwan-Hwa(john) Wu,J. David Irwin, CRC Press T&F Group.

SOFTWARE TESTING

Credits : 4 **Semester: VI**
Course Code: CSCC24603 **No. of Lecture Hours: 60**

Course Objectives:

- To help the students understand the importance and need of testing through testing cycles.
- To learn various testing techniques which are required for any software product.
- To introduce Quality assurance concepts and activities**.**

Course Outcomes: Students will be able to

CO1: **Analyze** importance of testing in software development process, apply glass-box testing,black- box testing, and how to report and analyze bugs
CO2: **Identify** problem tracking system, different types of testing and test case design.
CO3: To **understand** how to build testing strategy, establishing software testing methodologyand software testing techniques.
CO4: **Explain** the definition of quality, metrics for software quality and inspection techniques.
CO5: **Classify** software configuration management, software reengineering and softwarerestructuring techniques.

UNIT-I	**12hrs**
1. Example Test Series – First Cycle	1
2. Second Cycle, Subsequent Cycles	1
3. Objectives and Limits of Testing	1
4. Testing in Software Development Process- Planning Process – Planning Stage	1
5. Design Stage Testin	1
6. Glass Box Code Testing	1
7. Black Box Testing	1
8. Software Errors	1
9. Reporting and Analyzing Bugs – Problem Report, Contents Characteristics	1
10. Analysis of Reproducible Bug	1
11. Tactics for Analyzing a Reproducible Bug Making a Bug Reproducible	2

UNIT-II	**12hrs**
1. Problem Tracking Systems – Objectives, Tasks.	2
2. Overview, Users.	2
3. Mechanics, Further Thoughts on Problem Reporting	2
4. Test Case Design – Characteristics of Good Test	1
5. Equivalence Classes and Boundary Values	1
6. Visible State Transitions, Race Conditions, Load Testing, Error Guessing	1
7. Function Equivalence Testing	1
8. Regression Testing, Executing the Tests	2

UNIT-III	**12hrs**
1. Building a Software Testing Strategy	3
2. Establishing a Software Testing Methodology	2
3. Determining a Software Testing Techniques	3
4. Eleven Steps for Software Testing Process – Overview	2
5. Assess Project Management	2

UNIT-IV	**12hrs**
1. Product Metrics - Software Quality, Framework for Product Metrics	2
2. Metrics for Process and Products - Software Measurement	3
3. Metrics for Software Quality	2
4. Quality Management – Quality Concepts, Software Quality Assurance	2
5. Software Reviews, Formal Technical Reviews, Software Reliability	3

UNIT-V	**12hrs**
1. Change Management - Software Configuration Management	3
2. SCM Repository, SCM Process	3
3. Reengineering – Software Reengineering	3
4. Reverse Engineering, Restructuring	3

ESSENTIAL READING

1. CemKaner, Jack Falk, Hung Quocguyen. 1998. **Testing Computer Software.** Comdex.
2. William Perry.2000. **Effective Methods for Software Testing**. Wiley.
3. Pressman Roger, S. **Software Engineering – A Practioner's Approach.** 6th Edition**.**McGraw Hill International Edition.

CYBER SECURITY LAB

Credits : 1 **Semester: VI**
Course Code: CSCC24604 **No. of Lecture Hours: 30**

Prerequisites: A course on "Network Security and Cryptography".

Course Objective:
- To get practical exposure of Cyber security threats and Forensics tools.

Course Outcome:
CO1: Get the skill to identify cyber threats/attacks.
CO2: Get the knowledge to solve security issues in day to day life.
CO3: Able to use Autopsy tools.
CO4: Perform Memory capture and analysis.
CO5: Demonstrate Network analysis using Network miner tools.

List of Experiments

1. Perform an Experiment for port scanning with nmap
2. Set Up a honeypot and monitor the honeypot on the network
3. Install Jscript/Cryptool tool (or any other equivalent) and demonstrate Asymmetric, Symmetric crypto algorithm, Hash and Digital/PKI signatures.
4. Generate minimum 10 passwords of length 12 characters using open SSL command
5. Perform practical approach to implement Footprinting-Gathering target information using Dmitry-Dmagic, UAtester
6. Working with sniffers for monitoring network communication (Wireshark).
7. Using Snort, perform real time traffic analysis and packet logging.
8. Perform email analysis using the Autopsy tool.
9. Perform Registry analysis and get boot time logging using process monitor tool
10. Perform File type detection using Autopsy tool
11. Perform Memory capture and analysis using FTK imager tool
12. Perform Network analysis using the Network Miner tool

ESSENTIAL READINGS:

1**. Real Digital Forensics for Handheld Devices**, E. P. Dorothy, Auerback Publications, 2013.
2. **The Basics of Digital Forensics: The Primer for Getting Started in Digital Forensics**, J.Sammons, Syngress Publishing, 2012.

SUGGESTED READINGS:

1**. Handbook of Digital Forensics and Investigation**, E. Casey, Academic Press, 2010.
2. **Malware Forensics Field Guide for Windows Systems: Digital Forensics Field Guides,** C. H.Malin, E. Casey and J. M. Aquilina, Syngress, 2012.
3. **The Best Damn Cybercrime and Digital Forensics Book Period**, J. Wiles and A. Reyes, Syngress, 2007.