DAYANANDA SAGAR UNIVERSITY

Shavige Malleshwara Hills, Kumaraswamy Layout, Bengaluru - 560078, Karnataka.

SCHOOL OF ENGINEERING

SCHEME & SYLLABUS
FOR
MASTER OF TECHNOLOGY (M.Tech) – 2016
COMPUTER SCIENCE & ENGINEERING

SPECIALIZATION: COMPUTER SCIENCE AND INFORMATION TECHNOLOGY

(With Effect from 2016-17)

SEMESTER I

SL. NO.	COURSE CODE	COURSE TITLE	CR/AU	NO. OF HOURS OF TEACHING				SCHEME OF EVALUATION	
				L	T	P	C	CIA	END EXAM
1	16CIT501	ADVANCED ALGORITHMS	CR	03	02	--	04	40	60
2	16CIT502	WEB TECHNOLOGIES	CR	03	-	--	03	40	60
3	16CIT503	VIRTUALIZATION & CLOUD COMPUTING	CR	03	-	--	03	40	60
4	16CITXXX	DEPARTMENT ELECTIVE	CR	03	--	02	04	40	60
5	16CITXXX	DEPARTMENT ELECTIVE	CR	03	--	02	04	40	60
6	16CIT571	WEB TECHNOLOGIES LAB	CR	--	--	04	02	40	60
7	16CIT572	VIRTUALIZATION &CLOUD COMPUTING LAB	CR	--	--	04	02	40	60
Grand Total 700				15	02	12	22	280	420

SEMESTER II

SL. NO.	COURSE CODE	COURSE TITLE	CR/AU	NO. OF HOURS OF TEACHING				SCHEME OF EVALUATION	
				L	T	P	C	CIA	END EXAM
1	16CIT504	DISTRIBUTED COMPUTING SYSTEMS	CR	03	--	--	03	40	60
2	16CIT505	CLOUD ARCHITECTURE	CR	03	--	02	04	40	60
3	16CIT506	ADVANCED DATABASE MANAGEMENT SYSTEMS	CR	03	--	--	03	40	60
4	16CITXXX	DEPARTMENT ELECTIVE	CR	03	--	02	04	40	60
5	16CITXXX	DEPARTMENT ELECTIVE	CR	03	--	02	04	40	60
6	16CIT573	DISTRIBUTED COMPUTING SYSTEMS LAB	CR	--	--	04	02	40	60
7	16CIT574	DBMS LAB	CR	--	--	04	02	40	60
Grand Total 700				15	00	14	22	280	420

SEMESTER III

SL. NO.	COURSE CODE	COURSE TITLE	CR/AU	NO. OF HOURS OF TEACHING				SCHEME OF EVALUATION	
				L	T	P	C	CIA	END EXAM
1	16CITXXX	DEPARTMENT ELECTIVE	CR	03	--	02	04	40	60
2	16IEE6XX	INSTITUTIONAL ELECTIVE	CR	03	--	--	03	40	60
3	16CIT681	DISSERTATION	CR	--	--	--	03	100	--
GRAND TOTAL 300				06	--	--	10	180	120

SEMESTER IV

SL. NO.	COURSE CODE	COURSE TITLE	CR/AU	NO. OF HOURS OF TEACHING				SCHEME OF EVALUATION	
				L	T	P	C	CIA	END EXAM
1	16CITXXX	DEPARTMENT ELECTIVE	CR	03	--	02	04	40	60
3	16CIT682	DISSERTATION	CR	--	--	--	06	200	100
Grand Total 400				03	00	02	10	240	160
Grand total 2000 Total credits 64									

Continuous evaluation: 1. 2 IA Tests (20), 2. Assignment or mini project (10 marks), 3. Any two of Self-study presentation, survey reports, quiz, Laboratory exercises, presentation in seminar & workshops (10 marks)

DEPARTMENTAL ELECTIVES		DEPARTMENTAL ELECTIVES	
16CIT527	ADVANCED COMPUTER NETWORKS	16CIT621	CLOUD NETWORKING & SECURITY
16CIT528	ADVANCED OS	16CIT622	INTERNET OF THINGS
16CIT529	SOFTWARE ARCHITECTURE	16CIT623	SOFT COMPUTING
16CIT530	PROBABILITY & STATISTICS FOR ANALYTICS	16CIT624	ENTERPRISE CLOUD COMPUTING
16CIT531	DATA MINING	16CIT625	PRODUCT DEVELOPMENT & MANAGEMENT
16CIT532	MACHINE LEARNING & AI	16CIT626	AGILE SOFTWARE DEVELOPMENT
16CIT533	ENTERPRISE DATA MANAGEMENT	16CIT627	STORAGE AREA NETWORKS
16CIT534	CLOUD STORAGE		
16CIT535	MOBILE COMPUTING		
16CIT536	DATA ANALYTICS & VISUALIZATION		
16CIT537	FORMAL METHODS IN SOFTWARE ENGINEERING		
16CIT538	HIGH PERFORMANCE COMPUTING		

INSTITUTIONAL ELECTIVES

COURSE CODE	COURSE TITLE	OFFERING DEPARTMENT
16IEE651	DIGITAL MARKETING	COMPUTER SCIENCE & ENGINEERING
16IEE652	PRODUCT LIFE CYCLE MANAGEMENT	MECHANICAL ENGINEERING
16IEE653	PROJECT MANAGEMENT	ELECTRONICS & COMMUNICATION ENGINEERING

SEMESTER/YEAR   **: I SEM**
COURSE CODE   **: 16CIT501**
TITLE OF THE COURSE   **: ADVANCED ALGORITHMS**
L: T/A: P: C   **: 3: 2: 0: 4**

COURSE OBJECTIVES:
1. To understand the design of advanced algorithms and data structures.
2. To understand the applications of algorithms in different fields such as geometry, number theory, signal processing and linear algebra.

COURSE OUTCOMES:
1. Skill of advanced algorithm design.
2. Knowledge of advanced data structures

MULTI-THREADED ALGORITHMS AND MATRIX OPERATIONS: The basics of dynamic multi-threading; multi-threaded versions of matrix multiplication, solution of linear equations, matrix inversion, and least squared approximation.

FAST FOURIER TRANSFORMS AND NUMBER THEORETIC ALGORITHMS: Representation of polynomials, DFT and FFT;   efficient FFT implementation (sequential and parallel). Elementary number theoretic notions, greatest common divisor, modular arithmetic, solving modular linear equations, Chinese remainder theorem, powers of an element, RSA public crypto system, primality testing, and integer factorization.

STRING MATCHING ALGORITHMS: -Karp, Knuth-Morris-Pratt and Boyer-Moore string matching algorithms. Suffix trees and their applications in computational biology.

COMPUTATIONAL GEOMETRY AND PROBABILISTIC ANALYSIS: Line segment properties, determining whether pair of line segments intersects, finding the convex hull, finding the closest pair of points. Hiring problem, indicator random variables, randomized algorithms; probabilistic analysis and further uses of indicator random variables.

ADVANCED DATA STRUCTURES AND GRAPH ALGORITHMS: Fibonacci heaps, mergeable heap operations, decreasing a key and deleting a node, bounding the maximum degree. Van emdeboas tree. Data structures for disjoint sets, analysis of union by rank with path compression. Flow networks, Ford-Fulkerson method, maximum bipartite matching.

TEXT BOOK:
Thomas H. Cormen, Charles E Leiserson, Ronald L. Rivest, and Clifford Stein, Introduction to Algorithms. 3rd ed., The MIT Press, 2009.

REFERENCES:
,Donald E Knuth, Art of Computer Programming, Volumes 1-4A, Addison-Wesley, 2011.

SEMESTER/YEAR   : I SEM
COURSE CODE   : 16CIT502
TITLE OF THE COURSE   : WEB TECHNOLOGIES
L: T/A: P: C   : 3: 0: 0: 3

COURSE OBJECTIVES:

1. To understand Web Programming, SOA, Microservices and Web2.0 with applications.
2. To understand Advanced Web Programming Frameworks and algorithms for intelligent Web.

COURSE OUTCOMES:

1. Capability and skills to develop applications using Web programming tools as per SOA principles or microservices.
2. Capabilities, knowledge and skills to design & develop algorithms for making web applications intelligent.

Information Architecture for the World-wide Web: Basic Principles, Process and Methodology, Information Architecture in Practice, Case Studies

Web Programming Paradigm: Introduction, Web Servers, HTML, XHTML, Style Sheets, Java Script, Document Object Model, REST Services

Service Oriented Architecture (SoA): Fundamentals, common characteristics, tangible benefits, pitfalls, the web services framework, building SoA

Microservices: Need for breaking down monlithic apps into MicroServices. Event Store based Architecture. Building Microservices with Spring Boot. Deploying Microservices for testing and production, .Building microservices with Scala using Colossus

Web 2.0 and Rich Internet Application: Introduction - From browser to Rich Clients, AJAX - Basic, AJAX - Advanced, HTML5

Advanced Web Programming: Java, XML, JSON, Web Security. Web Frameworks- Spring, Django, Flask.

Algorithms for Intelligent Web: What is Intelligent Web, Searching, Creating Suggestions and Recommendations, Classifications and Combining Classifiers, Web Crawling.

TEXT BOOKS:

1. Haralambos M and D Bebenko, Algorithms of the Intelligent Web, Google Books
2. PeterMorville and Louis Rosenfied, Information Architecture for the World Wide WebOREILLY
3. Deitel and Deitel, Internet and World Wide Web-How to Program,   Google Books

SEMESTER/YEAR   : I SEM
COURSE CODE   : 16CIT503
TITLE OF THE COURSE   : VIRTUALIZATION & CLOUD COMPUTING
L: T/A: P: C   : 3: 0: 0: 3

COURSE OBJECTIVES:

1. To understand Virtualization concepts and different types of virtualization.
2. To understand cloud computing concepts, technologies and services.

COURSE OUTCOMES:

1. Conceptual and sound knowledge of virtualization and different types of virtualization.
2. Acquire knowledge of cloud computing, technologies and services.

Virtualization: Definition, benefits, Virtualization History, Virtualizing x86 Computer **virtualization:** MMU Virtualization, CPU Virtualization, IO Virtualization; Types of **Virtualization:** Binary Translation, Para Virtualization, Hardware Assisted, Networking in virtualized environment, Virtual Machines and Access Control.

Storage Virtualization: Introduction and Basic concepts, Storage Interconnect, Abstracting Physical Storage, Virtualization at the host, Virtualization at the Storage Target. **Server Virtualization:** Introduction, Types of Server Virtualization, Server Virtualization Concepts, Planning and other Uses of Server Virtualization, Planning for Deployment, Server Virtualization Platform Differences.

Introduction to Cloud Computing: History of Cloud, Cost angle and Usability angle, Capex to Opex, Cloud Deployment Models (Public, Private, Hybrid), Cloud Service Models (IaaS, PaaS, SaaS)

IaaS Deep Dive: Infrastructure as a service, Understanding of available IaaS models: AWS, Google Compute Engine, Azure, And OpenStack.

PaaS Deep Dive: Understanding of available PaaS models: Google App Engine, Elastic Bean Stack, RedHat OpenShift

MBaaS: Overview, MBaaS-Parse, MBaaS-AWS, Using MBaaS Services from Android. Introduction to Business Processes as a Service (BPaaS) and Analytics as a Service (AaaS)

Introduction to developing Cloud Services: Web-Based Application – Pros and Cons of Cloud Service Development – Types of Cloud Service Development – Software as a Service

–Platform as a Service – Web Services – On-Demand Computing – Discovering Cloud Services Development Services and Tools – Amazon Ec2 – Google App Engine – IBM Clouds.

TEXT BOOKS

1. D. Marshall, W. A. Reynolds, and D. Mc Corry, Advanced Server Virtualization, Aurbech Publications, 2006.
2. T. Clark, *Storage Virtualization: Technologies for Simplifying Data Storage and Management,* Addison-Wesley Professional, 2005.
3. Dan C Marinescu-Cloud Computing Theory and Practice. Elsevier(MK) 2013
4. Rajkumar Buyya , James Broberg, Andrzej Goscinski- Cloud Computing Principles and Paradigms, Willey 2014

SEMESTER/YEAR   **: I SEM**
COURSE CODE   **: 16CIT571**
TITLE OF THE COURSE   **: WEB TECHNOLOGIES LAB**
L: T/A: P: C   **: 0: 0: 4: 2**

COURSE OBJECTIVES:

1. To understand and use Web Programming, SOA, Micro services and Web2.0 in designing   applications.
2. To   use Advanced Web Programming Frameworks and algorithms for intelligent Web in designing and implementing applications.

COURSE OUTCOMES:

1. Acquire capability and skills to develop applications using Web programming tools as per SOA principles or micro services
2. Acquire knowledge and skills to design & develop algorithms for making web applications intelligent.
   i)   Creating Web Services (using Java/Python) such as a) Tax computation, b) Student Information processing, c) payroll processing.
   ii)   Building micro services with Scala for application
   iii)   Designing an application for Web Crawling
   iv)   Mini projects

SEMESTER/YEAR   : I SEM
COURSE CODE   : 16CIT572
TITLE OF THE COURSE : VIRTUALIZATION & CLOUD COMPUTING LAB

L: T/A: P: C   : 0: 0: 4: 2

COURSE OBJECTIVES:

1. To create a cloud computing environment, set it up in the Lab and understand on demand provisioning on the cloud.
2. To work on some of the cloud environments (Amazon, IBM, Google Compute,) and get knowledge of components and activities of such environments.

COURSE OUTCOMES:

1. Conceptual and sound knowledge of virtualization and different types of virtualization.
2. Acquire knowledge of cloud computing, technologies and services.

1. **Overview of OpenStack IaaS, a PaaS and a Hypervisor (to be decided)**
   a) Students will set up cloud environment using OpenStack in the lab to create and destroy virtual machines and installing DevStack and hypervisor on the VM. This will help them to understand the dynamic, "on-demand" provisioning concept on the cloud.
   b) The same exercise will be repeated with IBM cloud also, where they will use Horizon dashboard to create/destroy VMs.

2. **Overview with practical demonstration of Amazon Cloud**
   Students will be made familiar with the look and feel and management tools of AWS. They will have understanding of following components of AWS: a) Compute, S3, b) Elastic beanstalk, c) Cloud Front, c) AWS IAM, d) ELB using AWS APIs in Java/ Python, Elastic Volumes

3. **Overview with practical demonstration of Google Compute Engine**
   Students will be made familiar with the look and feel and management tools of Google Cloud. They will have understanding of following components and activities of Google Compute Engine: a) Creating a VM, b) Attaching a disk, c) Auto scaling using GCE APIs / SDKs in Java, Python, and GCE Load Balancer.

4. **Application development on Cloud**
   Detailed understanding with practical demonstration of a development platform on Cloud.

SEMESTER/YEAR   : II SEM
COURSE CODE   : 16CIT504
TITLE OF THE COURSE   : DISTRIBUTED COMPUTING SYSTEMS

L: T/A: P: C   : 3: 0: 0: 3

COURSE OBJECTIVES:

1. To understand the systems requirements for distributed computing and distributed storage.
2. To understand distributed processing and processing of large data clusters, Hadoop and security issues.

COURSE OUTCOMES:

1. Acquire capabilities to implement distributed applications.
2. Will get the implementation knowledge of data processing on large clusters, and different alternate techniques.

Introduction, Google's Paper "Introduction to Distributed System Design", Implementing Remote Procedure Calls.

Time, Clocks, and Global States - Ordering of Events in a Distributed System, Determining Global States of Distributed Systems, Network Time Protocol, Concurrency Control and Recovery. Consensus - Loosely-Coupled Distributed Systems and introduction to Locking service.

Distributed Storage: Challenges – Scale-out (Elasticity), High Availability, Reliability vs Cost.Performance Metrics – Storage Efficiency, Saturation Throughput, Mean Time to Data Loss, Sequential Read/Write Bandwidth. Popular Storage Stacks – Hadoop (HDFS), Spanner, DynamoDB.

Distributed Processing: Data Processing on Large Clusters (mapReduce).Distributed Algorithms. Introduction to Hadoop Ecosystem – Hbase, Hive, Pig, Zookeeper.

MPP (Massively Parallel Processing): Scatter and Gather; An alternative to MapReduce. Massively Parallel Processing and In-Memory Databases

Security in Distributed Systems: Practical Byzantine Fault Tolerance. A Logic of Authentication.

TEXTBOOK

1. Andrew Tannenbaum and Maarten van Steen, ``Distributed Systems: Paradigms and Principles'', Prentice-Hall, 2002.

2. Tom White, Hadoop: The Definitive Guide, 3rd Edition - O'Reilly Media

SEMESTER/YEAR   : II SEM
COURSE CODE   : 16CIT505
TITLE OF THE COURSE   : CLOUD ARCHITECTURE

L: T/A: P: C   : 3: 0: 2: 4

COURSE OBJECTIVES:

1. To know the cloud architecture, application development, and security issues.
2. To understand the design differences for developing applications on the cloud versus traditional on premise.
3. To know the cloud management and cloud services management.

COURSE OUTCOMES:

1. Acquire the knowledge of cloud architecture, and development of applications for cloud.
2. Acquire capabilities to manage cloud services.

Cloud Architecture: Benefits and challenges to cloud architecture. Application availability, performance, security and recovery.

Cloud Applications: Technologies and the processes required when deploying web services; Deploying a web service from inside and outside a cloud architecture, advantages and disadvantages.

Application Development: Service creation environments to develop cloud based applications. Development environments for service development; Technologies required when deploying web services or applications, – openstack, Amazon, Google compute engine. How to decide if the cloud is right for your requirements, TCO. Frameworks used – Spring/Django/Flask etc.

Cloud Applications and Security issues – Understanding security issues and threats SQL Injection, XSS, XSRF, Session hijacking, Secure session management and session integrity, Use of tokens, cookies, expiry times, caching, redirect in HTTP
Using encryption algorithms - DES, RSA, AES, Hashing - Message Digest, Secure Hashing Algorithm, Randomization, Authentication and identity

Cloud Services Management: Reliability, availability and security of services deployed on the cloud. Performance and scalability of services, tools and technologies used to manage cloud services deployment;). Provisioning, Asset Management, Cloud Governance. Cloud Economics: Cloud Computing infrastructures available for implementing cloud based services. Economics of choosing a Cloud platform for an organization, based on application requirements, economic constraints and business needs (e.g. Amazon, Microsoft and Google, Salesforce.com). Charging Models, Usage Reporting, Billing and Metering

Next generation Cloud Applications.

REFERENCE BOOKS:

1. Michael J. Kavis Architecting the Cloud: Design Decisions for Cloud Computing Service Models (SaaS, PaaS, &IaaS) by, Published January 2014
2. G. Reese, *Cloud Application Architectures Building Applications and Infrastructure in the Cloud,* O'Reilly Media, 2009.
3. T. Velte, A. Velte, R. Elsenpeter, *Cloud Computing: A Practical Approach,* Springer, 2013.
4. D. N. Chorafas, *Cloud Computing Strategies*, CRC Press, 2010.
5. B. Wilder, *Cloud Architecture Patterns Using Microsoft Azure,* O'Reilly Media, 2012.
6. G. Shroff, *Enterprise Cloud Computing Technology Architecture Applications,* Cambridge University Press, 2010-10-14.

COURSE CODE   : 16CIT506
TITLE OF THE COURSE   : ADVANCED DATABASE MANAGEMENT SYSTEMS

L: T/A: P: C   **: 3: 0: 0: 3**

COURSE OBJECTIVES:

1. To understand advanced Data base concepts, query optimization.
2. To understand Data Warehouse, ETL and OLAP, Data Base Architecture, OO data bases and document data bases.

COURSE OUTCOMES:

1. Understanding advanced concepts in DBMS and query optimization.
2. Understand and develop skills to handle data warehouse, OO data bases and document data bases.

Database Concepts and SQL: Advanced SQL - Join Operations, Union, GroupBy, Having clauses, Subqueries, Indexes

Stored Procedures and Triggers - Stored Procedures, Stored Functions, Constraints and Triggers. Concurrency, Recovery and Query Optimization:

Transactions and the ACID Property of Transactions, Serializability, Two-Phase Locking, Deadlocks, Multiversion Concurrency Control

Failure Recovery: Roll forward/Rollback

Query Optimization: Stages in Query Processing, Query Processing   Algorithms,   Query Plan Execution, Cost-Based Query Optimization

Data Warehousing: Definition and Terminology, Characteristics of Data warehouses, Data Modeling for data warehouses, Architectural components, ETL and OLAP

Database System Architectures: Centralized and Client-Server Systems, Server-System Architectures, Distributed Databases, Graph databases

Advances in Databases: Beyond RDBMS, Object-Oriented and Object-Relational Databases - Query Processing in Object-Oriented Databases,

Storage Structures for Object-Oriented Databases, Object-Relational Model

Document Databases - XML Databases, BLOB data storage systems, No-SQL Datastores, Time Series Databases

TEXT BOOK

1. Hector Garcia-Molina, Jeffrey D. Ullman, and Jennifer Widom,   Database Systems: The Complete Book
2. Ramez Elmasri and Shamkant Navathe, Database Systems – Models, Languages, Design and Application Programming –– Pearson
3. Shashank Tiwari, Professional No-SQL , Publisher: Wiley / Wrox

SEMESTER/YEAR   : II SEM
COURSE CODE   : 16CIT573
TITLE OF THE COURSE   : DISTRIBUTED COMPUTING SYSTEMS LAB

L: T/A: P: C   : 0: 0: 4: 2

COURSE OBJECTIVES:

1. To understand the systems requirements for distributed computing and distributed storage by designing applications in Client-server mode, and message order.
2. To understand distributed processing and processing of large data clusters, Hadoop and security issues by designing programs.

COURSE OUTCOMES:

1. Acquire capabilities to implement distributed applications.
2. Will get the implementation knowledge of data processing on large clusters, and different alternate techniques.

1. Experiments on Client Server model: Students will be implementing clients and servers to simulate distributed system's use of the client-server model of interaction. This exercise will illustrate two of the common mechanisms for this in Java, namely: sockets and Remote Method Invocation. Each student will be supplied with working code which implements a very simple two node interaction. Student should be able to, first demonstrate to himself how the interactions achieved, and then modify it to multi-client interaction.

2. Message Ordering: The student needs to implement the following message ordering schemes (listed here from the tightest to the loosest consistency) a. consistent ordering, b. causal ordering, c. first-in-first-out ordering

3. Distributed File System: Student will have to design and implement a very simple distributed file system using Java RMI.
This project consists of three tasks:
a. State-transition diagram for both client and server , b. Cache maintained by the server to know which clients are sharing the same file, c. Both server and client need to call each other's RMI functions.

4. MPP programming: Students will need to write a program in which 2 processes (process 0 and process 1), simultaneously calculate the mean of the even and odd positions in an array of integers of arbitrary length. The size of the array will be very very large and the contents of the array will be randomly generated.

5. Hands on Hadoop and writing MapReduce jobs in Java.

SEMESTER/YEAR   : II SEM
COURSE CODE   : 16CIT574
TITLE OF THE COURSE   : DBMS LAB

L: T/A: P: C   : 0: 0: 4: 2

COURSE OBJECTIVES:

1. To have practical exposure to advanced Data base concepts, query optimization and concurrency control.
2. To design Relational Data bases for a few applications and carry out various activities.
3. To implement a graph algorithms as applicable in Social Networks.

COURSE OUTCOMES:

1. Understanding advanced concepts in DBMS and query optimization.
2. Understand and develop skills to handle data warehouse, OO data bases and document data bases.

1. Query Optimizer: Students will implement a query optimizer on top of Simple DB. The main tasks include implementing a selectivity estimation framework and a cost-based optimizer. Collect statistics about tables to estimate costs of different query plans and use these statistics to order joins and selections in an optimal way, and to select the best implementation for join algorithms from amongst several alternatives.

2. Concurrency and Locking:
Students will implement a simple locking-based transaction system in Simple DB. The task here is to add lock and unlock calls at the appropriate places, as well as to track the locks held by each transaction and grant locks to transactions as they are needed.

3. Relational Database Design: In this exercise students will be designing a relational database schema and reliable and scalable architecture for modeling a real-world application: a ride-sharing application. They will design the schema to capture the constraints of the application and write several SQL queries to support required functionality for this application. Finally, they will create OLAP cubes for hourly, daily and monthly business reporting.

4. Social Network Analysis using Graph Database: Given a social network, students will find out who should a user befriend if they are friend of his friends and share the same interest. Implement various existing graph algorithms to find out the best path to get introduced to these strangers.

5. Mini Projects on a few real life problems.

SEMESTER/YEAR : I/II SEM
COURSE CODE : 16CIT527
TITLE OF THE COURSE : ADVANCED COMPUTER NETWORKS

L: T/A: P: C **: 3: 0: 2: 4**

COURSE OBJECTIVES:

 1. To understand advanced topics such as Intra and Inter Network protocols, TMN, SNMP V3, QoS, Traffic Engineering, MPLS & VPN.

 2. To understand need of IOT, it's definition and applications in different industry domains.

COURSE OUTCOMES:

 1. Design and implementation aspects of Network Management, Inter and Intra network protocols, MPLS, VPN and importance of QoS.

 2. Understand and appreciate importance of IOT and its applications.

TMN and Network Management: Network management Overview, Network Management, SNMP and Network Management, TMN, Network Management Applications, Management of Heterogeneous Network with Intelligent Agents, Network Security Management, Internet Management

Routing Protocols, BGP& Traffic Engineering: Intra and inter-domain internet routing, Border Gateway Protocols, QoS and Traffic Engineering

MPLS & VPN: Role of MPLS, MPLS operations, Labels, FECs, LSPs & Labels, Label Distribution, VPNs.

IOT: Introduction to IOT,   Putting the Internet of Things Forward to the Next Level, The Internet of Things Today, The Internet of Things Tomorrow, Potential Success Factors.

Internet of Things Strategic Research and Innovation Agenda: Internet of Things Vision, Internet of Things Common Definition, IoT Strategic Research and Innovation Directions,   IoT Applications and Use Case Scenarios, IoT Functional View:

Application Areas: IoT Smart-X Applications, Smart Cities, Smart Energy and the Smart Grid, Smart Mobility and Transport , Smart Home, Smart Buildings and Infrastructure, Smart Factory and Smart Manufacturing ,

TEXT BOOKS:

1. William Stallings ,High-Speed Networks and Internets, Performance and Quality of Service, , Second Edition, PHI

2. D E Comer, Automated Network Management Systems, Pearson/ Prentice Hall ,

SEMESTER/YEAR   : I/II SEM
COURSE CODE   : 16CIT534
TITLE OF THE COURSE   : CLOUD STORAGE

L: T/A: P: C   : 3: 0: 2: 4

COURSE OBJECTIVES:

1. To understand Information Storage and Management.

2. To understand Storage Technology, Storage virtualization, and storage management on the cloud.

COURSE OUTCOMES:

At the end of the course the students will be able to:

1. Design and implementation aspects of Information and Management.

2. Understand different types of Storage technology.

3. Know the basics of Storage virtualization and advanced concepts, and know the storage management on the cloud.

Introduction to Information Storage and Management

- o Concepts of Information and Data; Different types of storage for structured, unstructured and metadata
- o Components of a storage system environment
- o Disk Storage Fundamentals
- o Information Lifecycle Management

Storage Technology:

- o Data organization - File Vs. Block, Object data Store
- o Direct Attached Storage (DAS)
- o Storage Area Network (SAN)
- o Network Attached Storage (NAS)
- o RAID and RAID Levels
- o Storage Interfaces and Protocols - SCSI, SATA, IDE
- o Content-addressed storage (CAS)

Storage Virtualization Basics

- o Forms and levels of storage Virtualization
- o SNIA Storage virtualization taxonomy

- o Storage Virtualization configuration and Challenges
- o Types of storage virtualization (Block level and File level)
- o Storage Virtualization industry overview (VMWare and EMC)
- o Review of cloud storage - Google FS
- o Review of cloud storage - Amamzon S3

Storage Virtualization - Advanced Concepts

- o Storage Security Management
- o Storage Backup and Recovery
- o Business Continuity
- o Data Footprint Reduction
- o Infrastructure Resource Management - Metrics and Measurement for Situational Awareness

Storage Management on the Cloud

- o Monitoring the Storage Infrastructure
- o Storage Management Activities
- o Storage Infrastructure Management Challenges
- o Developing an Ideal Solution

TEXT BOOKS:

1. Information Storage and Management G. Somasundaram, Alok Shrivastava, John Wiley & Sons, 2010.
2. Cloud and Virtual Data Storage Networking Hardcover - Greg Schulz, CRC Press, 2012.

REFERENCE BOOKS:

1. Storage Networks Explained - Ulf Troppen, Rainer Erkens, Wolfgang Muller
2. Introduction to Storage Area Networks - IBM Redbooks
3. Storage Area Network Essentials. A Complete Guide to Understanding and Implementing SANs. Veritas

SEMESTER/YEAR   : I/II SEM
COURSE CODE   : 16CIT535
TITLE OF THE COURSE   : MOBILE COMPUTING

L: T/A: P: C   : 3: 0: 2: 4

COURSE OBJECTIVES:

1. To understand about the architecture for Mobile Computing.
2. The course aims to provide basic understanding about Mobile Communication, Mobile Hardware, and Mobile Software.
3. To understand the basics of Android devices and Platform.
4. Impart knowledge on basic building blocks of Android programming Activities, Services, Broadcast Receivers and Content providers.

COURSE OUTCOMES:

1. Have good understanding of Mobile architecture, Mobile Computing- both hardware and software aspects.
2. Technical competency and skills in developing applications using Android.

Enterprise Mobile Application Development
Characteristics and advantages of mobile communication, types of mobile applications – development approaches, overview of IBM mobile strategy and designing mobile solutions. Introduction to IBM Worklight V6.0, Worklight Studio, Worklight Studio Plug-in's, Worklight project structure, building, testing an application on a simulator. Client-side core APIs, Local storage APIs – Encrypted cache, JSONStore, working with UI frameworks, Apache Cordova.

Using Adapters and Security
Integration Adapters – Overview, SQL, HTTP, Cast Iron adapter, Adapter procedures, invoking adapter procedures from java code, using worklight integration adapters, Native page and web page integration. Using worklight native APIs, Security-securing an application.

Introduction to Android
Android: Introduction, trends, platforms, Android Development Setup like, Android Studio, Eclipse, ADT, Android SDK, tools. Emulator setup. Application framework basics: resources, layout, values, asset XML representation, generated R.Java file, Android manifest file.
Activities, Intent and UI Design: Introduction to activities, activities life-cycle-User Interface INTENT – intent object, intent filters, linking activities, user interface design.

Android Components
Fragments, basic views, list views, picker views ,adapter views, Menu, Action Bar etc, layouts, basics of screen design, registering listeners and different event Listeners. Creating application using multiple activities- views with different layouts

Data Persistence
Shared preferences- Managing data using SQLite database. Content Providers – user content provider, android provided content providers. Creating a simple applications using content provider and persisting data into database

TEXT BOOKS:

1. Marko Gargenta, Learning Android by O'reilly Publications.
2. IBM Courseware.
3. Reto Meier, Professional Android™ Application Development, Wrox Publications.

REFERENCE BOOKS

1. Jonathan Simon, Head First Android Development, O'reilly Publications.
2. N. N. Jani, Mobile Computing: Technologies and Applications S Chand2009.
3. B. M. Hirwani- Android programming Pearson publications-2013.

SEMESTER/YEAR   : III & IV SEM
COURSE CODE   : 16CIT621
TITLE OF THE COURSE   : CLOUD SECURITY

L: T/A: P: C   **: 3: 0: 2: 4**

COURSE OBJECTIVES:

1. The course on cloud security introduces the basic concepts of security systems and Cryptographic protocols, which are widely used in the design of cloud security.
2. The issues Related multi tenancy operation, virtualized infrastructure security and methods to improve Virtualization security are also dealt with in this course.

COURSE OUTCOMES:

After the course, the students must be able to:

1. Compare modern security concepts as they are applied to cloud computing

2. Assess the security of virtual systems

3. Evaluate the security issues related to multi-tenancy

4. Appraise compliance issues that arise from cloud computing

Module I (10 hours)

Security Concepts: Confidentiality, privacy, integrity, authentication, non-repudiation, Availability, access control, defense in depth, least privilege, how these concepts apply in the Cloud, what these concepts mean and their importance in PaaS, IaaS and SaaS. e.g. User Authentication in the cloud; Cryptographic Systems: Symmetric cryptography, stream Ciphers, block ciphers, modes of operation, public-key cryptography, hashing, digital Signatures, public-key infrastructures, key management, X.509 certificates, OpenSSL.

Module II (9 hours)

Multi-tenancy Issues: Isolation of users/VMs from each other. How the cloud provider can provide this; Virtualization System Security Issues: e.g. ESX and ESXi Security, ESX file

System security, storage considerations, backup and recovery; Virtualization System Vulnerabilities: Management console vulnerabilities, management server vulnerabilities, Administrative VM vulnerabilities, guest VM vulnerabilities, hypervisor vulnerabilities, Hypervisor escape vulnerabilities, configuration issues, malware (botnets etc).

Module III (7 hours)

Virtualization System-Specific Attacks: Guest hopping, attacks on the VM (delete the VM, Atta, k on the control of the VM, code or file injection into the virtualized file structure), VM migration attack, hyper jacking.

Module IV (9 hours)

Technologies for Virtualization-Based Security Enhancement: IBM security virtual server

Protection, virtualization-based sandboxing; Storage Security: HIDPS, log management,

Data Loss Prevention. Location of the Perimeter.

Module V (10 hours)

Legal and Compliance Issues: Responsibility, ownership of data, right to penetration test. Local laws, examination of modern Security Standards (eg PCIDSS), Standards to deal with cloud services and virtualization, compliance for the cloud provider vs. compliance for the customer.

TEXT BOOK:

1. Tim Mather, Subra Kumaraswamy, ShahedLatif, Cloud Security and Privacy: An Enterprise

Perspective on Risks and Compliance, O'ReillyMediaInc, 2009

REFERENCES:

1. Tim Mather, Subra Kumaraswamy, ShahedLatif, Cloud Security and Privacy: An

Enterprise Perspective on Risks and Compliance [ISBN: 0596802765]

2. Ronald L. Krutz, Russell Dean Vines, Cloud Security [ISBN: 0470589876]

3. John Rittinghouse, James Ransome, Cloud Computing [ISBN: 1439806802]

4. J.R. ("Vic") Winkler, Securing the Cloud [ISBN: 1597495921]

5. Cloud Security Alliance 2009, Security Guidance for Critical Areas of Focus in

Cloud Computing

6. vmware VMware Security Hardening Guide

7. Cloud Security Alliance 2010, Top Threats to Cloud Computing

8. NIST Guidelines on Security and Privacy in Public Cloud Computing

9. NIST Guide to Security for Full Virtualization Technologies

10. NIST The NIST Definition of Cloud Computing

11. William Hau, Rudolph Araujo et al How Virtualization Affects PCI DSS

www.mcafee.com/us/resources/.../wp-how-virt-affect-pci-dss-part-1.pdf

12. Chenxi Wang Compliance with Clouds: Caveat Emptor

SEMESTER/YEAR   : III & IV SEM
COURSE CODE   : 16CIT627
TITLE OF THE COURSE : STORAGE AREA NETWORKS

L: T/A: P: C   : 3: 2: 0: 4

COURSE OBJECTIVES:

This course will enable students to:

i)   Define and contrast storage centric and server centric systems,
ii) Define metrics used for Designing storage area networks
iii) Illustrate RAID concepts
iv) Demonstrate, how data centers maintain the data with the concepts of backup mainly remote mirroring concepts for both simple and complex systems.

Illustrate RAID concepts

1. Demonstrate, how data centers maintain the data with the concepts of backup mainly remote mirroring concepts for both simple and complex systems Illustrate RAID concepts.

2. Demonstrate, how data centers maintain the data with the concepts of backup mainly remote mirroring concepts for both simple and complex systems.

COURSE OUTCOMES:

The students should be able to:

i)   Identify the need for performance evaluation and the metrics used for it
ii) Apply the techniques used for data maintenance.
iii) Realize strong virtualization concepts
iv) Develop techniques for evaluating policies for LUN masking, file systems

UNIT 1: Introduction: 09 Hours

Server Centric IT Architecture and its Limitations; Storage – Centric IT Architecture and its advantages. Case study: Replacing a server with Storage Networks The Data Storage and Data Access problem; The Battle for size and access. Intelligent Disk Subsystems: Architecture of Intelligent Disk Subsystems; Hard disks and Internal I/O Channels; JBOD, Storage virtualization using RAID and different RAID levels; Caching: Acceleration of Hard Disk Access; Intelligent disk subsystems, Availability of disk subsystems.

MODULE 2: I/O Techniques: 09 Hours

The Physical I/O path from the CPU to the Storage System; SCSI; Fibre Channel Protocol Stack; Fibre Channel SAN; IP Storage. Network Attached Storage: The NAS Architecture,

The NAS hardware Architecture, The NAS Software Architecture, Network connectivity, NAS as a storage system. File System and NAS: Local File Systems; Network file Systems and file servers; Shared Disk file systems; Comparison of fibre Channel and NAS

MODULE 3: Storage Virtualization: **09 Hours**

Definition of Storage virtualization; Implementation Considerations; Storage virtualization on Block or file level; Storage virtualization on various levels of the storage Network; Symmetric and Asymmetric storage virtualization in the Network

MODULE 4: SAN Architecture and Hardware devices: **09 Hours**

Overview, Creating a Network for storage; SAN Hardware devices; The fibre channel switch; Host Bus Adaptors; Putting the storage in SAN; Fabric operation from a Hardware perspective. Software Components of SAN: The switch's Operating system; Device Drivers; Supporting the switch's components; Configuration options for SANs.

MODULE 5: Management of Storage Network: **09 Hours**

System Management, Requirement of management System, Support by Management System, Management Interface, Standardized Mechanisms, Property Mechanisms, In-band Management, Use of SNMP, CIM and WBEM, Storage Management Initiative Specification (SMI-S), CMIP and DMI, Optional Aspects of the Management of Storage Networks

TEXT BOOKS:

1. Ulf Troppens, Rainer Erkens and Wolfgang Muller: Storage Networks Explained, Wiley India,2013.

REFERENCE BOOKS:

1. Robert Spalding: "Storage Networks The Complete Reference", Tata McGraw-Hill, 2011.

2. Marc Farley: Storage Networking Fundamentals – An Introduction to Storage Devices, Subsystems, Applications, Management, and File Systems, Cisco Press, 2005.

3. Richard Barker and Paul Massiglia: "Storage Area Network Essentials A Complete Guide to understanding and Implementing SANs", Wiley India, 2006

SEMESTER/YEAR   : II SEM
COURSE CODE   : 16IE651
TITLE OF THE COURSE : DIGITAL MARKETING

L: T/A: P: C   : 3: 0: 0: 3

COURSE OBJECTIVE:

To learn how to do marketing online- Boost website traffic, generate potential leads & increase sales revenue with better brand awareness using internet platforms like Social Media, Email Marketing, Mobile Marketing, Ecommerce Marketing and Affiliate Marketing.

COURSE OUTCOME:

After completion of the program the students will be able to plan, conceptualize and implement Digital Marketing strategy for client requirements.

UNIT-1

Digital Marketing Overview   **7 hrs**

Introduction, Key terms and concepts, what is marketing? What is digital marketing? Why Digital Marketing wins over traditional Marketing, Understanding marketing strategy, the building blocks of marketing,

Understanding Digital Marketing Process: Increasing Visibility, Visitors engagement

UNIT-2

Search Engine Optimization and Search Markets   **10 hrs**

Stakeholders in Search, Customer Insights, O n & off-page Optimization, Meta Tags, Layout, Content Updates, Inbound Links & Link Building, Goal Configuration &Funnels, Intelligence Reporting, Conversions, Bounce Rate, Traffic Sources, Scheduling etc.

UNIT-3

Social Media   **10 hrs**

What is Social Media Marketing? Overview of Facebook, Twitter, LinkedIn, Blogging, YouTube and Flickr, building Brand Awareness Using Social Media, Social Media Management, Insights and Analytics, Best Practice Examples & case Studies.

UNIT-4

Website Analytics   **9 hrs**

Goal Configuration &Funnels, Intelligence Reporting, Conversions, Bounce Rate, Traffic Sources, Scheduling etc

UNIT-5

Email and Mobile Marketing   **8 hrs**

User Behaviour, Segmentation, Key Metrics, Best Practice Case Studies, Split Testing, Campaign Process Optimisation, SMS Strategy, Mobile Advertising, Mobile Optimized Websites, 7 Step Process for Mobile Apps, Proximity Marketing, Strategic Steps, Review & Testing.

TEXT BOOKS:

1. Digital Marketing, Vandana Ahuja,   Oxford University Press

2. The Art of Digital Marketing: The Definitive Guide to Creating Strategic, Targeted, and Measurable Online Campaigns, Ian Dodson, Wiley 2016

SEMESTER/YEAR : II SEM
COURSE CODE : 16ESE652
TITLE OF THE COURSE : PRODUCT LIFE CYCLE MANAGEMENT

L: T/A: P: C : 3: 0: 0: 3

COURSE OBJECTIVE:
1. To understand various aspects of Product Life Cycle Management.
2. To understand Digital Manufacturing.

COURSE OUTCOME:

1. Students should be able to use methods, tools and technique taught in the Product Life Cycle Management.

UNIT-1

Introduction to Product Life Cycle Management (PLM)   **10 hrs**

Definition, PLM Lifecycle model, Threads of PLM, Need for PLM, Opportunities and benefits of PLM, Views, Components and Phases of PLM, PLM feasibility study, PLM visioning.

PLM Concepts, Processes and Workflow -Characteristics of PLM, Environment driving PLM, PLM Elements, Drivers of PLM, Conceptualization, Design, Development, Validation, Production, Support of PLM.

UNIT-2

Product Data Management (PDM) Process and Workflow   10 hrs

PDM systems and importance, reason for implementing a PDM system, financial justification of PDM implementation. Versioning, check-in and checkout, views, Metadata, Lifecycle, and workflow. Applied problems and solution on PDM processes and workflow.

UNIT-3

Tools of Communication for collaborative work   10 hrs

Creation of 3DXML and CAD drawing using CAD software. Creation of an animation for assembly instructions on 3D via composer, creation of an acrobat 3D document. Applied problems and solutions on tools of communication for collaborative work.

Collaborative Product Development-Digital mock-up and prototype development, design for environment, virtual testing and validation, marketing collateral

UNIT-4

Developing a PLM strategy and conducting a PLM assessment   **7 hrs**

Strategy, Impact of strategy, implementing a PLM strategy, PLM initiatives to support corporate objectives. Infrastructure assessment, assessment of current systems and applications.

UNIT-5

Digital Manufacturing – PLM   **8 hrs**

Digital manufacturing, benefits manufacturing, manufacturing the first-one, Ramp up, virtual learning curve, manufacturing the rest, production planning.

TEXT BOOKS:

1. Product Lifecycle Management: Grieves, Michael, McGraw-Hill Edition 2006
2. Product Data Management: Burden, Rodger, Resource Pub,2003

REFERENCE BOOKS:

1. Fabio Guidice, Guido La Rosa, Product Design for the environment-A lifecycle approach, Taylor and Francis
2. Hartman, Product Lifecycle Management with SAP,2006
3. Robert J Thomas, NDP: Managing and forecasting for strategic processes

SEMESTER/YEAR   : II SEM
COURSE CODE   : 16ESE653
TITLE OF THE COURSE   : PROJECT MANAGEMENT

L: T/A: P: C   : 3: 0: 0: 3

COURSE OBJECTIVE:

1. To understand various aspects of project management

2. To understand role of project manager

COURSE OUTCOME:

1. Students should be able to use project management methods, tools and technique

UNIT I

THE PROJECT MANAGEMENT FRAMEWORK –INTRODUCTION   **8 Hrs**

What is a Project? What is project Management? Relationship among Project management, Program management and Portfolio Management, Project Management and Operations Management, Role of a Project Manager.

UNIT II

THE PROJECT MANAGEMENT FRAMEWORK-PROJECT LIFE CYCLE AND ORGANISATION   **6 Hrs**

The project Life Cycle Overview, Project vs. Operational work, Stakeholders, Organizational Influences on Project Management.

UNITIII

THE STANDARD FOR PROJECT MANAGEMENT OF A PROJECT: **11Hrs**

Project Management Process for a Project: Common Project Management Process Interactions, Project Management Process Groups, Initiating Process Group, Planning Process Group, Executing Process Group, Monitoring and Controlling Process Group, and Closing Process Group.

UNIT IV

THE PROJECT MANAGEMENT KNOWLEDGE AREAS: PART I   **10Hrs**

Project Integration Management, Project Scope Management, Project Time Management Project Cost Management, Project Quality Management.

UNIT V:

THE PROJECT MANAGEMENT KNOWLEDGE AREAS: PART II   **10Hrs**

Project Human Resource Management, Project Communications Management, Project Risk Management, Project Procurement Management.

TEXT BOOK:

1. A Guide to the Project Management Body of Knowledge (PMBOK® Guide)—Fifth Edition (ENGLISH)

REFERENCES:

2. http://www.pmi.org/

SEMESTER/YEAR   **: II SEM**
COURSE CODE   **: 16CIT681**
TITLE OF THE COURSE   **: DISSERTATION**

L: T/A: P: C   **: 0: 0: 0: 3**

COURSE OBJECTIVES:
1. To develop the work practice in students to apply theoretical and practical tools/techniques
2. To improve the professional competency
3. To improve research aptitude by touching the areas which otherwise not covered by theory or laboratory classes.
4. To solve real life problems related to industry and current research.

COURSE OUTCOMES:
1. Solving of real time problems not necessarily new line of enquiry, but shows that student has mastered research and synthesizing skills in producing a contribution to knowledge.
2. Builds competency and research aptitude.

The thesis shall consist of research work done by the candidate or a comprehensive and critical review of any recent development in the subject of specialization or a detailed report of project work consisting of experimentation/numerical work, design and or development work that the candidate has executed.

SEMESTER/YEAR : II SEM
COURSE CODE : 16CIT682
TITLE OF THE COURSE : DISSERTATION

L: T/A: P: C : 0: 0: 0: 6

COURSE OBJECTIVES:

The dissertation demonstrates the student's mastery of relevant resources and methods.
1. An ordered, critical exposition of knowledge gained through student's own effort.
2. Demonstrates sound under-standing of research process.
3. Demonstrates knowledge of appropriate methodology.
4. Demonstrates ability to present study in a disciplined way in scholarly conventions of the discipline.
5. Ability to make critical use of published work.

COURSE OUTCOMES:
1. Improves the professional competency and research.
2. Develops the work to apply theoretical and practical tools/techniques
3. Solve problems related to industry and current research.
4. Possible publication in journal or conferences.

THE REPORT GENERALLY CONTAINS:

1. Cover
2. Title page
3. Certificate(s)
4. Acknowledgements
5. Abstract
6. Contents page
7. List of figures or Tables
8. Introduction
9. Literature survey
10. Methodology
11. Results and Discussion
12. Conclusion and scope of future work.
13. Reference list / Bibliography
14. Appendices.

Avoiding plagiarism

1. Plagiarism is taking the words, theories, or ideas of another person and passing them off as your own.

2. [Plagiarism](#) can be copying **inadvertently/advertently** a passage from a book or journal or pasting something from the internet into report without referencing the original source.

3. [Plagiarism](#) can also result from wrong **referencing.**

Avoiding plagiarism

The guide/supervisor shall certify that the report is checked for plagiarism and is within 25% of the content.

The thesis shall consist of research work done by the candidate or a comprehensive and critical review of any recent development in the subject of specialization or a detailed report of project work consisting of experimentation/numerical work, design and or development work that the candidate has executed. It is expected that students should refer national and international journals, proceedings of national and international seminars. Emphasis should be given to the introduction to the topic, literature review, and scope of the proposed work along with some preliminary work/experimentation carried out on the thesis topic. Student should submit the thesis covering the content discussed above and highlighting the features of work to be carried out in the thesis. Student should follow standard practice of thesis writing. At the end of successfully finishing the work he/she has to submit a detailed report and has to present for a viva–voce.