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Vishwavidyanilaya Karyasoudha
Crawford Hall, Mysuru- 570 005

(Re-accredited by NAAC with 3.01 CGPA of 4.0 Scale)
(NIRF-2021 Ranked 19 in University Category & 34 in Overall Category)

No.: PMEB/AC10/759(1)/2019-20

Date: 10-01-2022

NOTIFICATION

- Sub.: Introduction of **BCA (Cloud Computing and Digital Science)** course under Specialized Programmes from the academic year 2021-22-reg.
- Ref.: 1. Decision of the BOS Meeting held on 17-07-2021.
2. Decision of the Faculty of Science & Technology meeting held on 20-12-2021.
3. Decision of the Academic Council meeting held on 23-12-2021.

The Board of Studies in **BCA (Cloud Computing and Digital Science) (UG)** at its meeting held on 17-07-2021 has recommended to introduce **BCA (Cloud Computing and Digital Science)** course in University of Mysore under specialized/specified programs. The Regulations, Syllabus and Scheme of Examination was approved from the academic year 2021-22.

The Faculty of Science & Technology and the Academic Council at their meetings held on 20-12-2021 and 23-12-2021 respectively, are also approved the above said proposal and the same is hereby notified.

The Regulations, Syllabus and Scheme of Examination of **BCA (Cloud Computing and Digital Science)** course is uploaded in University website. The contents may be downloaded from the University website <https://uni-mysore.ac.in/PMEB/>.


REGISTRAR
REGISTRAR
University of Mysore
MYSURU - 570 005

To;

1. The Registrar (Evaluation), University of Mysore, Mysuru.
2. The Dean, Faculty of Science & Technology, DOS in Earth Science, Manasagangothri, Mysuru.
3. Prof. D.S. Guru, Chairperson, BOS in BCA (Cloud Computing and Digital Science) (UG), DOS in Computer Science, Manasagangothri, Mysuru.
4. The Principal, Cresta First Grade College, # 182/145/C, Bannur Road, Alanahalli, Mysuru.
5. The Deputy Registrar/ Asst. Registrar/ Superintendent, Examination Branch, UOM, Mysuru.
6. The Special Officer to Hon'ble Vice-Chancellor, University of Mysore, Mysuru.
7. The PA to Vice-Chancellor/Registrar/Registrar (Evaluation), University of Mysore, Mysuru.
8. Office Copy.

**Proposed CBCS Regulations for 3-Year Semester Course Leading
to
BCA (Cloud Computing and Digital Science)**

Regulations – 2021

1. Eligibility for Admission for BCA (Cloud Computing and Digital Science): Those candidates who have successfully completed +2 or PU or equivalent with Mathematics/Computer Science/Business Mathematics/Accountancy OR 3 years Diploma after SSLC/10th Class with Computer Science Engineering/Information Science Engineering or equivalent.
2. Duration of the Course: This is a 3 years program split into 6 semesters each of duration 4 months. However, the maximum duration permitted is 6 years from the date of admission as per the double the duration norm of the University of Mysore.
3. Attendance requirement, progress and conduct: As per the existing norms of the University of Mysore for other Bachelors' degree programme.
4. Hours of instructions/week: Shown in the Tables.
5. Titles of papers/practicals etc: Shown in the Tables.
6. Scheme of Examination/Assessment: Shown in the Tables.
7. Minima for a pass in each paper and aggregate and condition for promotion to next higher class: A candidate has to get a minimum of 40% in every paper (Including IA). However a candidate has to obtain a minimum of 28 out of 80 in the semester-end examination in every paper. Examination will be conducted for both odd and even semesters at the end of every semester. The complete carryover system is permitted except when the candidate is detained for the attendance requirement. However before the candidate enters the 6th semester, the candidate should have completed all papers up to the end of 4th semester successfully and before submitting the final project report, the candidate should have completed all semesters up to the end of 5th semester.

Pattern of Question paper for Theory Exam (for all the semesters)

Max. Marks: 80

Duration: 03 hours.

Part-A:

Answer 10 questions out of 12 questions. Marks: $10 \times 2 = 20$

[Note: Among 12 Questions, 3 Questions from each Unit]

Part-B:

Answer 04 questions. Each carrying 15 Marks. Marks: $4 \times 15 = 60$

[Note: Among 4 Questions, 1 Question from each Unit, Question may have internal splitting]

Pattern of Question paper for Practical Exam(for all the semesters)

Max. Marks: 80

Duration: 03 hours.

Any One Experiment/Program From Each Part

Scheme of Part A:

Procedure development + Implementation + Result $(15+05+05) = 25$

Scheme of Part B:

Procedure development + Implementation + Result $(20+10+05) = 35$

Viva = 20

Total = 80

Proposed scheme for BCA (Cloud Computing and Digital science)

Semester-I

Serial No.	Subject	Credit	L:T:P
DSC-1	Computer Concepts and C Programming	6	4:0:2
DSC-2	Computer Organization and Computer Architectures	6	4:0:2
DSC-3	Cloud computing fundamentals	6	4:2:0

Semester-II

Serial No.	Subject	Credit	L:T:P
DSC-4	Data Structure with C++	6	4:0:2
DSC-5	Cloud Infrastructure and Services	6	4:0:2
DSC-6	Discrete Transformations	6	4:2:0

Semester-III

Serial No.	Subject	Credit	L:T:P
DSC-7	Principles of OS and Linux Administration	6	3:1:2
DSC-8	Oops with JAVA Programming	6	3:1:2
DSC-9	Web Technology Fundamentals	6	4:0:2

Semester-IV

Serial No.	Subject	Credit	L:T:P Pattern
DSC-10	Data Base Management System	6	3:1:2
DSC-11	Data Science with Python	6	3:1:2
DSC-12	Computer Networks and Administration	6	4:0:2

Semester-V

Serial No.	Subject	Credit	L:T:P Pattern
DSE-1		6	
DSE-2		6	
DSE-3		6	

Serial No.	Subject	Credit	L:T:P Pattern
SEC-1		2	
SEC-2		2	

Semester-VI

Serial No.	Subject	Credit	L:T:P Pattern
DSE-4		6	
DSE-5		6	
DSE-6	Project work	6	0:1:5

Serial No.	Subject	Credit	L:T:P Pattern
SEC-3		2	
SEC-4		2	

Electives for Semester-V and VI

Serial. No	Subject	Credits	L:T:P
DSE	Data Analytics using Python	6	4:0:2
DSE	Storage and datacentre	6	4:2:0
DSE	Cloud Architecture and Deployment	6	4:0:2
DSE	Database Security	6	4:0:2
DSE	Statistical Techniques with 'R'	6	4:0:2
DSE	Cloud Web Services	6	4:0:2
DSE	Cloud Security	6	4:2:0
DSE	Advanced Cloud computing	6	4:2:0
DSE	Network Security and Cryptography	6	4:2:0
DSE	Server side Scripting Language	6	4:2:0
DSE	Programming the Web-I	6	4:2:0
DSE	AI and ML	6	4:2:0
DSE	Linear Algebra	6	4:2:0
DSE	Probability and Statistics	6	4:2:0
DSE	Principles of TCP/IP	6	4:2:0
DSE	Raspberry Pi with Python	6	4:0:2
DSE	IOT system design.	6	4:0:2
DSE	Data warehousing and data mining	6	4:0:2
DSE	Advanced web Technology	6	4:0:2

Skill Oriented Course for V and VI semester

Serial. No	Subject	Credits	L:T:P Pattern
SEC-1	Mongo DB	2	0:0:2
SEC-2	Interactive Graphics	2	0:0:2
SEC-3	Android Programming	2	0:0:2
SEC-4	Agile Concepts	2	0:0:2

DSC-1: Computer Concepts and C Programming (LTP::4:0:2)

6 Credits

Unit-I:

Programming Concepts and Introduction to C language:

System software, Application software. Program Translators – Assembler, Compiler, and Interpreter. Programming languages -Machine Level language, Assembly level language, High level language.

Program development life cycle: Problem definition, analysis, Design, Coding, Testing and debugging, Documentation and maintenance. Algorithm- Features, simple examples. Flowchart – Symbols used in a flowchart, suitable examples,

Overview of C: Importance of C, basic structure of C program, executing a C program, sample C program, Constants, variables and data types. C character set, C tokens, identifiers, constants, variables, declaration of variables, assigning values to variables. Data type conversion.

Operators in C: arithmetic operators, relational operators. Logical operators, assignment operators, increment and decrement operators, conditional operators, bitwise operators, special operators, precedence of arithmetical expression, relational expression, logical expressions.

Unit-II:

Input and output operations:

Input and output statements, reading a character: getchar(), writing a character: putchar(), formatted and unformatted i/o statements.

Control structures:

Branching: if, if-else, nested if, else-if ladder, switch.

Looping: while, do-while and for loop. Jump statements, nested loops.

Unit-III:

Arrays, Strings and Functions:

Arrays: Introduction, single dimensional array, two-dimensional arrays, initializing 2-d arrays, multidimensional arrays. Operations on arrays: traversal, insertion and deletion. Searching: linear search & binary search. Sorting: bubble sort, selection sort and insertion Sort.

Strings: Declaring and initializing string variables, reading string from terminal, writing string to screen, putting strings together. Comparison of two strings, length of a string, copying a string, string operations using library functions & User defined functions.

Functions: Introduction, types of functions, need for user-defined functions, function call, types of arguments, nesting of functions, a multi function program, recursion, storage classes.

Unit-IV:

Structures, Unions, Pointers and Files

Structures: Definition and declaration of a structure, assigning and accessing the members of a structure, structure initialization, structure elements in memory, comparison of structure variables, structure with in the structure, array within structures.

Unions: Definition and declaration, accessing the members of a union. Comparison of structure and union.

Pointers: Advantages of pointers, declaration of pointer variable, pointer expressions, pointers and functions: call by value and call by reference, pointers and arrays, array of pointers, pointer to pointer.

Files: Definition, types of files. Creating text file. Modes of opening a file, formatted and unformatted I/O operations, random files.

Recommended Books:

1. E. Balaguruswamy : Programming in ANSI C” Tata Mc Graw-Hill
2. Problem Solving with C -PHI (EEE). By - M.T.Somashekara.
3. S. ByronGottfried. : “Programming with C”, Tata McGraw-Hill(2000)
4. Yashawant Kanetkar : “Let us C”
5. Brain Vermingham & Dennis M. Ritchie “ANSI C Programming” (PHI)

DSC-2: Computer Organization and Computer Architectures (LTP::4:0:2)**6 Credits****Unit I**

Digital Computers: Introduction, Block diagram of Digital Computer, Definition of Computer Organization, Computer Design and Computer Architecture.

Register Transfer Language and Micro operations: Register Transfer language, Register Transfer, Bus and memory transfers, Arithmetic Micro operations, logic micro operations, shift micro operations, Arithmetic logic shift unit.

Basic Computer Organization and Design: Instruction codes, Computer Registers Computer instructions, Timing and Control, Instruction cycle, Memory Reference Instructions, Input – Output and Interrupt.

Unit II

Microprogrammed Control: Control memory, Address sequencing, micro program example, design of control unit.

Central Processing Unit: General Register Organization, Instruction Formats, Addressing modes, Data Transfer and Manipulation, Program Control.

Unit - III

Input-Output Organization: Input-Output Interface, Asynchronous data transfer, Modes of Transfer, Priority Interrupt Direct memory Access.

Memory Organization: Memory Hierarchy, Main Memory, Auxiliary memory, Associate Memory, Cache Memory.

Unit - IV

Reduced Instruction Set Computer: CISC Characteristics, RISC Characteristics.

Pipeline and Vector Processing: Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, RISC Pipeline, Vector Processing, Array Processor.

Multi Processors: Characteristics of Multiprocessors, Interconnection Structures, Interprocessor arbitration, Interprocessor communication and synchronization, Cache Coherence.

Recommended books

1. Computer System Architecture – M. Moris Mano, Third Edition, Pearson/PHI.

Reference books:

1. Computer Organization – Car Hamacher, Zvonks Vranesic, Safea Zaky, Vth Edition, McGraw Hill.
2. Computer Organization and Architecture – William Stallings Sixth Edition, Pearson/PHI.
3. Structured Computer Organization – Andrew S. Tanenbaum, 4th Edition, PHI/Pearson.

DSC-3: Cloud computing fundamentals (LTP::4:0:2)**6 Credits****(there are 5 units)****Unit-I****CLOUD COMPUTING FUNDAMENTALS**

Cloud Computing definition, private, public and hybrid cloud. Cloud types; IaaS, PaaS, SaaS. Benefits and challenges of cloud computing, public vs private clouds, role of virtualization in enabling the cloud; Business Agility: Benefits and challenges to Cloud architecture. Application availability, performance, security and disaster recovery; next generation Cloud Applications.

Unit-II**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

Unit-III

MANAGEMENT OF CLOUD SERVICES: Reliability, availability and security of services deployed from the cloud. Performance and scalability of services, tools and technologies used to manage cloud services deployment; **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, Ubuntu and Redhat)

Unit-IV**APPLICATION DEVELOPMENT**

Service creation environments to develop cloud based applications. Development environments for service development; Amazon, Azure, Google App.

CLOUD IT MODEL

Analysis of Case Studies when deciding to adopt cloud computing architecture. How to decide if the cloud is right for your requirements. Cloud based service, applications and development platform deployment so as to improve the total cost of ownership (TCO)

REFERENCES

1. Gautam Shroff, "Enterprise Cloud Computing Technology Architecture Applications", Cambridge University Press; 1 edition, [ISBN: 978-0521137355], 2010.
2. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing, A Practical Approach" McGraw-Hill Osborne Media; 1 edition [ISBN: 0071626948], Dimitris N. Chorafas, "Cloud Computing Strategies" 1439834539],2010.

Unit I

Introduction to C++:History ,Characteristics of C++, Character Set, Tokens, Precedence of operators, Type conversion , Structure of a C++ program, Importance of iostream.h , Data types , Input and Output operators.

Unit II

Basic data structure : Primitive and non primitive, Abstract data structure, Operations, Data representation, Arrays - Memory representation of one and two dimensional arrays, Stack – Operations, Applications – Recursion, infix to postfix conversion, evaluation of postfix expression, Queues – Operations, Applications, circular queue-Operations, Dequeue, priority queue – uses of priority queues, Linked list - Dynamic memory allocation, Singly linked list – Operations, Circular linked list – Operations, Applications of linked list, doubly linked list – memory representation

Unit III

Tree – Terminologies, tree properties, binary tree-properties, memory representation – Array and Linked list representation, Binary search tree – Creation through insertion, searching, deletion algorithms, Tree traversal, balanced trees.

Unit IV

Searching and sorting – sequential and binary search, internal and external sorting - bubble, selection, insertion, quick sort and merge sort, comparison of different sorting techniques, Memory management : Garbage collection algorithm for equal sized blocks, storage allocation of objects with mixed size, buddy system.

Books Recommended

1. M.T. Goodrich, R. Tamassia and D. Mount, *Data Structures and Algorithms in C++*, John Wiley and Sons, Inc., 2004.
2. T.H. Cormen, C.E. Leiserson, R.L. Rivest and C. Stein, *Introduction to Algorithms*, 2nd Ed. Prentice-Hall of India, 2006.
3. E.Horowitz and S.Sahani, *Fundamentals of Data structures*, Galgotia Book source Pvt. Ltd., 2003

DSC-5: Cloud Infrastructure and Services (LTP::4:0:2)

6 Credits

Unit I:

Introduction to Cloud Technologies

Introduction to the Cloud Computing, History of cloud computing, Cloud service options, Cloud Deployment models, Business concerns in the cloud.

Virtualization and Cloud Platforms

Exploring virtualization, Load balancing, Hypervisors, Machine imaging, Cloud marketplace overview, Comparison of Cloud providers.

Unit II:

Introduction to AWS: AWS history, AWS Infrastructure, AWS services, AWS ecosystem.

Programming, management console and storage on AWS: Basic Understanding APIs - AWS programming interfaces, Web services, AWS URL naming, Matching interfaces and services, Elastic block store - Simple storage service, Glacier - Content delivery platforms.

AWS identity services, security and compliance: Users, groups, and roles - Understanding credentials, Security policies, IAM abilities and limitations, AWS physical security - AWS compliance initiatives, Understanding public/private keys, Other AWS security capabilities.

Unit III:

AWS computing and market place: Elastic cloud compute - Introduction to servers, Imaging computers, Auto scaling, Elastic load balancing, Cataloging the marketplace, AMIs, Selling on the marketplace.

AWS networking and databases: Virtual private clouds, Cloud models, Private DNS servers (Route 53), Relational database service – DynamoDB, ElastiCache, Redshift.

Unit IV:

Other AWS services and management services: Analytics services, Application services, Cloud security, CloudWatch, CloudFormation, CloudTrail, OpsWorks.

AWS billing and Dealing with disaster: Managing costs, Utilization and tracking, Bottom line impact, Geographic and other concerns, Failure plans, Examining logs.

Reference Books:

- Cloud Computing Bible. Barrie Sosinsky. John Wiley & Sons. ISBN-13: 978-0470903568.
- Amazon Web Services For Dummies. Bernard Golden. For Dummies. ISBN-13: 978- 1118571835
- Rajkumar Buyya, Cloud Computing: Principles and Paradigms, John Wiley & Sons, First Edition

DSC-6: Discrete Transformations (LTP::4:0:2)**6 Credits**

UNIT – I

Set Theory: Sets and Subsets, Set Operations and the Laws of Set Theory, Counting and Venn Diagrams, Cartesian Products and Relations, Functions–One-to-One, Onto Functions, Function Composition and Inverse Functions; Properties of Relations, Computer Recognition – Zero-One Matrices and Directed Graphs, Partial Orders – Hasse Diagrams, Equivalence Relations and Partitions.

UNIT – II

Fundamentals of Logic: Proposition, Logical Connectives and Truth Tables, Logic Equivalence – The Laws of Logic, Logical Implication – Rules of Inference; the Use of Quantifiers, Quantifiers, Definitions and the Proofs of Theorems

UNIT – III

Mathematical Induction and Recursion: Sequences and summations, Mathematical Induction, the Well Ordering Principle, Recursive Definitions, Structural Induction, Recursive algorithms. Counting: Basics of counting, Pigeonhole Principle, Permutation and Combinations, Binomial coefficients.

UNIT – IV

Graphs: Introduction, Representing Graphs & Graph Isomorphism, Connectivity, Euler and Hamilton Paths, Shortest path problems, Planar Graphs, Graph colouring. Trees: Introduction, Applications of Trees, Tree Traversal, Spanning Trees, Minimum Spanning Trees.

Recommended Books:

- Ralph P. Grimaldi, “Discrete and Combinatorial Mathematics”, 5 th Edition, Pearson Education, 2004.
- Kenneth H. Rosen, “Discrete Mathematics and its Applications”, 6 th Edition, McGraw Hill, 2007.
- Jayant Ganguly, “A Treatise on Discrete Mathematical Structures”, Sanguine Pearson, 2010.
- D.S. Malik and M.K. Sen, “Discrete Mathematical Structures: Theory and Applications”, Thomson, 2004.
- Thomas Koshy, “Discrete Mathematics with Applications”, Elsevier, 2005, Reprint 2008.

Unit – I

Introduction and process management

Definition of Operating System, Need, Early systems, Simple monitors, Batch Systems, Multiprogramming, Time Sharing, Real time, Parallel and Distributed systems. Computing Environments – Traditional, Client Server, Peer-to-Peer and Web based. Process Management: Process concept – meaning of process, sequential and concurrent processes, process state, process control block, threads, Process scheduling – scheduling queues, schedulers, context switch.

Unit -II

Scheduling and Deadlocks

Processor – CPU I/O burst cycle, CPU Scheduler, Preemptive scheduling, dispatcher. Scheduling criteria, Scheduling algorithms: First-Come-First-Served (FCFS), Shortest Job First (SJF), Priority Scheduling, Round Robin. Real time scheduling with pre-emption and Non-preemption. Deadlocks: Definition with example, System model, Deal lock characterization – Necessary Conditions Resource Allocation Graph, Dead lock prevention, Avoidance and detection, Recovery from dead lock..

Unit - III

Overview of Linux

What is Linux, root in Unix, common Linux features, advantages of Linux, overview of Unix and Linux architectures, spine system, hardware requirements for Linux, Linux standard directories, commands for files and directories cd, ls, cp, rm, mkdir, rmdir, pwd, creating and viewing files using cat, file comparisons

Unit - IV

Process in Linux, search fundamentals, connecting processes with pipes, redirecting input, background processing, managing multiple processes, process, nohup command, kill, ps, who, find, sort, touch, file, processing commands - wc, cut, paste etc, writing and reading files with vi editor

Text Books

1. Operating System Concepts, Abraham Silberschatz and Peter Baer Galvin, Fifth edition, Addison - Wesley 1989.
2. Operating System Concepts & Design, Milan Milonkovic, II Edition, McGraw Hill 1992.
3. Operating Systems, Stallings, Pearson Edition
4. Cristopher Negus – Red Hat Linux Bible, Wiley Dreamtech India 2005 edition.
5. Yeswant Kanethkar – UNIX Shell Programming, First edition, BPB.

Unit I

Introduction to JAVA: JAVA Evolution: Java History, Java Features, How Java Differs from C and C++, Java and Internet, Java and World Wide Web, Web Browsers, Hardware and Software Requirements, Java Support Systems, Java Environment. Overview of JAVA Language: Introduction, Simple Java program, More of Java Statements, Implementing a Java Program, Java Virtual Machine, Command Line Arguments, Programming Style. Constants, Variables, and Data Types: Introduction, Constants, Variables, Data Types, Declaration of Variables, Giving Values to Variables, Scope of Variables, Symbolic Constants, Type Casting, Getting Values of Variables, Standard Default Values, Operators and Expressions: Introduction, Arithmetic Operators, Relational Operators Logical Operators, Assignment Operators, Increment and Decrement Operators, Conditional Operators, Bitwise Operators, Special Operators, Arithmetic Expressions, Evaluation of Expressions, Precedence of Arithmetic Operators, Type Conversion and Associativity, Mathematical Functions. Decision Making and Branching: Introduction, Decision Making with if Statement, Simple if Statement, The if...else Statement, Nesting of if else Statements, The else if Ladder, The Switch Statement, The ? : Operator. Decision Making and Looping: Introduction. The while Statement, The do Statement, The for Statement, Jumps in Loops Labeled Loops.

Unit II

Classes, Arrays, Strings, Vectors and Interfaces: Classes, Objects and Methods: Introduction, Defining a Class, Adding Variables, Adding Methods, Creating Objects, Accessing Class Members, Constructors, Methods Overloading, Static Members, Nesting of Methods, Inheritance: Extending a Class Overriding Methods, Final Variables and Methods, Finalizer methods, Abstract Methods and Classes, Visibility Control. Arrays, Strings and Vectors: Arrays, One- dimensional Arrays, Creating an Array, Two -Dimensional Arrays, Creating an Array, Two – dimensional Arrays, Strings, Vectors, Wrapper Classes. Interfaces: Multiple Inheritance: Introduction, Defining Interfaces, Extending Interfaces, Implementing Interfaces, Accessing Interface Variables.

Unit III

Packages, and Multithreaded Programming:

Packages: Putting Classes together: Introduction, Java API Packages, Using System Packages, Naming Conventions, Creating Packages, Accessing a Package, Using a Package, Adding a Class to a Package, Hiding Classes. Multithreaded Programming: Introduction, Creating Threads, Extending the Thread Class, Stopping and Blocking a thread, Life Cycle of a thread, Using Thread Methods, Thread Exceptions, Thread Priority, Synchronization, Implementing the 'Runnable' Interface. Managing Errors and Exceptions: Introduction, Types of Exception Handling Code, Multiple Catch Statements, Using Finally Statement, Throwing Our Own Exceptions, Using Exceptions for Debugging.

Unit IV

Applet Programming, Graphics Programming, Input/Output:: Introduction, How Applets Differ from Applications, Preparing to Write Applets, Building Applet Code, Applet Life Cycle, Creating an Executable applet, Designing a Web Page, Applet Tag, Adding Applet to HTML File, running the

Applet, More About HTML Tags, Displaying Numerical Values, Getting Input from the User. Graphics Programming: Introduction, The Graphics Class, Lines and rectangles, circles, and Ellipses, Drawing Arcs, Drawing Polygons, Lines Graphs, Using Control Loops in Applets, Drawing Bar Charts. Managing Input/Output Files in JAVA: Introduction, Concept of Streams, Stream Classes, Byte Stream Classes, Character Stream Classes, Using Streams, Other Useful I/O Classes, Using the File Class, Input / Output Exceptions, Creation of Files, Reading / Writing Characters, Reading / Writing Bytes, Handling Primitive Data Types, Concatenating and Buffering Files, Interactive Input and output, Other Stream Classes.

Recommended Books:

1. A.Balaguruswamy, “Programming with JAVA”, A Primer, TMH, 1999.

Reference Books:

1. Thomas Boutel, “CGI programming in C and Perl”, Addison – Wesley, 1996.
2. Jeffrey Dwight et al, Using CGI, Second Edition, Prentice Hall, India, 1997.
3. Patrick Naughton & Herbert Schildt, JAVA 2: The Complete Reference, THM, 1999.
4. Schildt, “JAVA The Complete Reference”, 7th Edition.

DSC-9: Web Technology Fundamentals (LTP::4:0:2)

6 Credits

Unit I

Fundamentals of Web, XHTML – 1: Internet, WWW, Web Browsers and Web Servers, URLs, MIME, HTTP, Security, The Web Programmers Toolbox.

XHTML: Basic syntax, Standard structure, Basic text markup, Images, Hypertext Links.

Unit 2

XHTML – 2,

CSS: XHTML (continued): Lists, Tables, Forms, Frames

CSS: Introduction, Levels of style sheets, Style specification formats, Selector forms, Property value forms, Font properties, List properties, Color, Alignment of text, The box model, Background images, The and <div> tags, Conflict resolution.

Unit III

Hours Javascript: Overview of Javascript, Object orientation and Javascript, Syntactic characteristics, Primitives, operations, and expressions, Screen output and keyboard input, Control statements, Object creation and modification, Arrays, Functions, Constructors, Pattern matching using regular expressions, Errors in scripts, Examples.

Unit IV

Javascript and HTML Documents, Dynamic Documents with Javascript: The Javascript execution environment, The Document Object Model, Element access in Javascript, Events and event handling, Handling events from the Body elements, Button elements, Text box and Password elements, The DOM 2 event model, The navigator object, DOM tree traversal and modification. Introduction to dynamic documents, Positioning elements, Moving elements, Element visibility, Changing colors and fonts, Dynamic content, Stacking elements, Locating the mouse cursor, Reacting to a mouse click, Slow movement of elements, Dragging and dropping elements.

Recommended Books:

1. Robert W. Sebesta: Programming the World Wide Web, 4th Edition, Pearson Education, 2008.

(Listed topics only from Chapters 1 to 9, 11 to 15)

Reference Books:

- M. Deitel, P.J. Deitel, A. B. Goldberg: Internet & World Wide Web How to Program, 4th Edition, Pearson Education, 2004.
- Chris Bates: Web Programming Building Internet Applications, 3rd Edition, Wiley India, 2007.
- Xue Bai et al: The web Warrior Guide to Web Programming, Cengage Learning, 2003.

Unit I

Introduction to Database System Concepts and Architecture

Databases and Database Users, Characteristics of the Database Approach, Actors on the Scene, Advantages of Using a DBMS

Data Models, Schemas and Instances, DBMS Architecture and Data Independence, Database Languages and Interfaces, The Database System Environment

Data Modeling Using the Entity-Relationship Model

Entity Types, Entity Sets, Attributes, and Keys, Relationship Types, Relationship Sets, Roles, and Structural Constraints, Weak Entity Types, ER Diagrams, Naming Conventions and Design Aspects

Unit II

Transaction- Transaction Concepts, States, ACID properties, Concurrent executions, Serializability

Relational Data Model, Relational Constraints, and Relational Algebra

Relational Model Concepts, Relational Model Constraints and Relational Database Schemas, Basic Relational Algebra Operations, Additional Relational Operations, Examples of Queries in Relational Algebra.

Normalization- Functional Dependencies, Transitive and Multivalued dependency, First Normal form, Second Normal Form, Third Normal Form and Boyce Codd Normal Form

Unit III

Advantages of RDBMS- Codd's Rules.

SQL-The Relational Database Standard

Data Definition, SQL Data Types and Schemas, Constraints, Basic Queries in SQL, Insert, Delete, and Update Statements in SQL, Set Operations, Aggregate functions, Views (Virtual Tables) in SQL, Joins – Inner, Outer and Self, Additional Features of SQL, DCL-commit, Rollback, Save-point, Grant privileges.

Unit IV

Storage Strategies – Indices, B-Trees, Hashing.

Transaction Processing, Transaction and System Concepts, Properties of Transactions

Locking Techniques for Concurrency Control, Time-stamp based schedules, Database Recovery Techniques

Introduction – Object-Oriented and Object Relational Databases, Logical Database, Web Databases, Distributed Databases, Data Warehouse and Data Mining.

Text books:

1. Fundamentals of Database Systems by Navathe and Elmasri –Pearson Education, Fifth Edition.
2. Database Systems Concepts, 3rd edition by Abraham Silberschatz, Henry Korth and S. Sudarshan McGraw Hill International Editions.

Reference books:

1. Introduction to Database systems by CJ Date, Published by Addison-Wesley.
2. Principles of database systems by Ullman, Computer Science press, 1984.
3. Introduction to database systems by Bipin C.Desai, Galgotia.

Unit 1

Introduction: Welcome and overview of the course. Introduction to the data science process and the value of learning data science.

Background: In this optional week, we provide a brief background in python or unix to get you up and running. If you are already familiar with python and/or unix, feel free to skip this content.

Jupyter and Numpy: Jupyter notebooks are one of the most commonly used tools in data science as they allow you to combine your research notes with the code for the analysis. After getting started in Jupyter, we'll learn how to use numpy for data analysis. numpy offers many useful functions for processing data as well as data structures which are time and space efficient.

Unit 2:

Pandas: Pandas, built on top of numpy, adds data frames which offer critical data analysis functionality and features.

Visualization: When working with large datasets, you often need to visualize your data to gain a better understanding of it. Also, when you reach conclusions about the data, you'll often wish to use visualizations to present your results.

Unit 3:

Machine Learning: To take your data analysis skills one step further, we'll introduce you to the basics of machine learning and how to use sci-kit learn - a powerful library for machine learning.

Unit 4:

Working with Text and Databases: You'll find yourself often working with text data or data from databases. This week will give you the skills to access that data. For text data, we'll also give you a preview of how to analyze text data using ideas from the field of Natural Language Processing and how to apply those ideas using the Natural Language Processing Toolkit (NLTK) library

Text book:

Python Data Science Handbook: Essential Tools for Working with Data Paperback – 1 by Jake VanderPlas

Unit I

Introduction to JAVA: JAVA Evolution: Java History, Java Features, How Java Differs from C and C++, Java and Internet, Java and World Wide Web, Web Browsers, Hardware and Software Requirements, Java Support Systems, Java Environment. Overview of JAVA Language: Introduction, Simple Java program, More of Java Statements, Implementing a Java Program, Java Virtual Machine, Command Line Arguments, Programming Style. Constants, Variables, and Data Types: Introduction, Constants, Variables, Data Types, Declaration of Variables, Giving Values to Variables, Scope of Variables, Symbolic Constants, Type Casting, Getting Values of Variables, Standard Default Values, Operators and Expressions: Introduction, Arithmetic Operators, Relational Operators Logical Operators, Assignment Operators, Increment and Decrement Operators, Conditional Operators, Bitwise Operators, Special Operators, Arithmetic Expressions, Evaluation of Expressions, Precedence of Arithmetic Operators, Type Conversion and Associativity, Mathematical Functions. Decision Making and Branching: Introduction, Decision Making with if Statement, Simple if Statement, The if...else Statement, Nesting of if else Statements, The else if Ladder, The Switch Statement, The ? : Operator. Decision Making and Looping: Introduction. The while Statement, The do Statement, The for Statement, Jumps in Loops Labeled Loops.

Unit II

Classes, Arrays, Strings, Vectors and Interfaces: Classes, Objects and Methods: Introduction, Defining a Class, Adding Variables, Adding Methods, Creating Objects, Accessing Class Members, Constructors, Methods Overloading, Static Members, Nesting of Methods, Inheritance: Extending a Class Overriding Methods, Final Variables and Methods, Finalizer methods, Abstract Methods and Classes, Visibility Control. Arrays, Strings and Vectors: Arrays, One- dimensional Arrays, Creating an Array, Two -Dimensional Arrays, Creating an Array, Two – dimensional Arrays, Strings, Vectors, Wrapper Classes. Interfaces: Multiple Inheritance: Introduction, Defining Interfaces, Extending Interfaces, Implementing Interfaces, Accessing Interface Variables.

Unit III

Packages, and Multithreaded Programming:

Packages: Putting Classes together: Introduction, Java API Packages, Using System Packages, Naming Conventions, Creating Packages, Accessing a Package, Using a Package, Adding a Class to a Package, Hiding Classes. Multithreaded Programming: Introduction, Creating Threads, Extending the Thread Class, Stopping and Blocking a thread, Life Cycle of a thread, Using Thread Methods, Thread Exceptions, Thread Priority, Synchronization, Implementing the 'Runnable' Interface. Managing Errors and Exceptions: Introduction, Types of Exception Handling Code, Multiple Catch Statements, Using Finally Statement, Throwing Our Own Exceptions, Using Exceptions for Debugging.

Unit IV

Applet Programming, Graphics Programming, Input/Output:: Introduction, How Applets Differ from Applications, Preparing to Write Applets, Building Applet Code, Applet Life Cycle, Creating an Executable applet, Designing a Web Page, Applet Tag, Adding Applet to HTML File, running the

Applet, More About HTML Tags, Displaying Numerical Values, Getting Input from the User. Graphics Programming: Introduction, The Graphics Class, Lines and rectangles, circles, and Ellipses, Drawing Arcs, Drawing Polygons, Lines Graphs, Using Control Loops in Applets, Drawing Bar Charts. Managing Input/Output Files in JAVA: Introduction, Concept of Streams, Stream Classes, Byte Stream Classes, Character Stream Classes, Using Streams, Other Useful I/O Classes, Using the File Class, Input / Output Exceptions, Creation of Files, Reading / Writing Characters, Reading / Writing Bytes, Handling Primitive Data Types, Concatenating and Buffering Files, Interactive Input and output, Other Stream Classes.

Recommended Books:

1. A.Balaguruswamy, "Programming with JAVA", A Primer, TMH, 1999.

Reference Books:

1. Thomas Boutel, "CGI programming in C and Perl", Addison – Wesley, 1996.
2. Jeffrey Dwight et al, Using CGI, Second Edition, Prentice Hall, India, 1997.
3. Patrick Naughton & Herbert Schildt, JAVA 2: The Complete Reference, THM, 1999.
4. Schildt, "JAVA The Complete Reference", 7th Edition.

Unit I

Introduction to Data Analytics, Python for data analysis, Installing Python , Python Data Types & Data Structures ,Control Flow , Functions, Modules, Packages , File Handling 1, Date/Time Operations , Classes ,Python Packages of Interest for Data Analytics

Unit II

Numpy Introduction, Environment, Narray Object, Data Types, Array Attributes, Array Creation Routines, Array from Existing Data, Array From Numerical Ranges, Indexing & Slicing, Advanced Indexing, Broadcasting, Iterating Over Array, Array Manipulation, Binary Operators, String functions, Statistical functions, sort, search and counting functions

Unit III

Introduction to Panda, data structures, Series, DataFrame, Panel, Basic Functionality, Descriptive Statistics, Function Application, Reindexing, Iteration, Sorting, Working with Text Data, Options & Customization, Indexing & Selecting Data, Statistical Functions, Window Functions, Aggregations, Missing Data, GroupBy, Merging/Joining, Concatenation, Date Functionality, Timedelta, Categorical Data, Visualization, IO Tools, Sparse Data, Caveats & Gotchas

Unit IV

Pyplot API, Simple Plot, PyLab module Object-oriented Interface, Figure Class, Axes Class, Multiplots, Subplots() Function, Subplot2grid() Function, Grids, Formatting Axes, Setting Limits Setting Ticks and Tick Labels, Twin Axes, Bar Plot, Histogram, Pie Chart, Scatter Plot, Contour Plot, Quiver Plot, Box Plot, Violin Plot, Three-dimensional Plotting, 3D Contour Plot, 3D Wireframe plot, 3D Surface plot, Working With Text, Mathematical Expressions, Working with Images, Transforms

Text Book

1. Python for Data Analysis by O'Reilly

Reference Book:

1. Fundamentals of Python, K.A.Lambert and B.L.Juneja, Cengage Learning, 2012

DSE: Storage and datacentre (LTP::4:2:0)

6 Credits

Unit I

Data center Architecture, Data center Requirements, Data center prerequisites, Required Physical Area for Equipment and Unoccupied Space, Required power to run all the devices, Required cooling and HVAC Required weight, Required Network bandwidth

Unit II

Data Center design, Characteristics of an Outstanding Design, Guidelines for Planning a Data Center, Data Center structures, Raised Floor Design and Deployment, Design and Plan against Vandalism, Data center design case study

Unit III

Modular Cabling Design, Points of Distribution, ISP Network Infrastructure, ISP WAN Links, Data Center Maintenance, Network Operations Center, Network Monitoring, Datacenter physical security, Data center Logical security

Unit IV

Data center Consolidation, Reasons for data center Consolidation, Consolidation opportunity, Server consolidation, Storage Consolidation, Network Consolidation, Service Consolidation, Process Consolidation, Staff Consolidation, Data Consolidation phases, Data center servers, Server Capacity Planning, System Management Best Practices, Server Cluster Best Practices, Data Storage Best Practices, Network Management Best Practices, Documentation Best Practices, Security Guidelines Internet security, Source Security Issues, Best Practices for System Administration, System Administration Work Automation, Device Naming, Naming Practices, NIS, DNS, LDAP

Text Book

Administering Data Centers: Servers, Storage and Voice over IP, Kailash Jayaswal Data center fundamentals, Mauricio Arregoces, Maurizio Portolani

Unit I

Definition of Cloud Computing: Defining a Cloud, Cloud Types – NIST model, Cloud Cube model, Deployment models (Public, Private, Hybrid and Community Clouds), Service models – Infrastructure as a Service, Platform as a Service, Software as a Service with examples of services/service providers, Cloud Reference model Characteristics of Cloud Computing – a shift in paradigm Benefits and advantages of Cloud Computing 2. Cloud Architecture: A brief introduction on Composability, Infrastructure, Platforms, Virtual Appliances, Communication Protocols, Applications, Connecting to the Cloud by Clients 3. Services and Applications by Type IaaS – Basic concept, Workload, partitioning of virtual private server instances, Pods, aggregations, silos PaaS – Basic concept, tools and development environment with examples SaaS - Basic concept and characteristics, Open SaaS and SOA, examples of SaaS platform Identity as a Service (IDaaS) Compliance as a Service (CaaS)

Unit II

Concepts of Abstraction and Virtualization Virtualization technologies: Types of virtualization (access, application, CPU, storage), Mobility patterns (P2V, V2V, V2P, P2P, D2C, C2C, C2D, D2D) Load Balancing and Virtualization: Basic Concepts, Network resources for load balancing, advanced load balancing (including Application Delivery Controller and Application Delivery Network), Mention of The Google Cloud as an example of use of load balancing Hypervisors: Virtual machine technology and types, VMware vSphere Machine Imaging (including mention of Open Virtualization Format – OVF) Porting of applications in the Cloud: The simple Cloud API and AppZero Virtual Application appliance 2. Concepts of Platform as a Service Definition of services, Distinction between SaaS and PaaS (knowledge of Salesforce.com and Force.com), Application development Use of PaaS Application frameworks 3. Use of Google Web Services Discussion of Google Applications Portfolio – Indexed search, Dark Web, Aggregation and disintermediation, Productivity applications and service, Ad words, Google Analytics, Google Translate, a brief discussion on Google Toolkit (including introduction of Google APIs in brief), major features of Google App Engine service. 4. Use of Amazon Web Services Amazon Web Service components and services: Amazon Elastic Cloud, Amazon Simple Storage system, Amazon Elastic Block Store, Amazon Simple DB and Relational Database Service

Unit III

Types of services required in implementation – Consulting, Configuration, Customization and Support 1. Cloud Management An overview of the features of network management systems and a brief introduction of related products from large cloud vendors, Monitoring of an entire cloud computing deployment stack – an overview with mention of some products, Lifecycle management of cloud services (six stages of lifecycle) 2. Concepts of Cloud Security Cloud security concerns, Security boundary, Security service boundary Overview of security mapping Security of data: Brokered cloud storage access, Storage location and tenancy, encryption, and auditing and compliance Identity management (awareness of Identity protocol standards)

Unit IV

Service Oriented Architecture: Basic concepts of message-based transactions, Protocol stack for an SOA architecture, Event-driven SOA, Enterprise Service Bus, Service catalogs 2. Applications in the Cloud: Concepts of cloud transactions, functionality mapping, Application attributes, Cloud service attributes, System abstraction and Cloud Bursting, Applications and Cloud APIs 3. Cloud-based Storage: Cloud storage definition – Manned and Unmanned 4. Webmail Services: Cloud mail services including Google Gmail, Mail2Web, Windows Live Hotmail, Yahoo mail, concepts of Syndication services

Text Book:

1. Cloud Computing Bible by Barrie Sosinsky, Wiley India Pvt. Ltd, 2013.
2. Mastering Cloud Computing by Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, McGraw Hill Education (India) Private Limited, 2013
3. Cloud computing: A practical approach, Anthony T. Velte, Tata Mcgraw-Hill
4. Cloud Computing, Miller, Pearson 5. Building applications in cloud: Concept, Patterns and Projects, Moyer, Pearson

Reference Book:

1. Cloud Computing – Second Edition by Dr. Kumar Saurabh, Wiley India

DSE: Database Security (LTP::4:0:2)

6 Credits

Unit I

Introduction: Introduction to Databases Security Problems in Databases Security Controls Conclusions

Security Models -1: Introduction Access Matrix Model Take-Grant Model Acten Model PN Model Hartson and Hsiao's Model Fernandez's Model Bussolati and Martella's Model for Distributed databases

Unit II

Security Models -2: Bell and LaPadula's Model Biba's Model Dion's Model Sea View Model Jajodia and Sandhu's Model The Lattice Model for the Flow Control conclusion

Security Mechanisms : Introduction User Identification/Authentication Memory Protection Resource Protection Control Flow Mechanisms Isolation Security Functionalities in Some Operating Systems Trusted Computer System Evaluation Criteria

Unit III

Security Software Design : Introduction A Methodological Approach to Security Software Design Secure Operating System Design Secure DBMS Design Security Packages Database Security Design

Unit IV

Statistical Database Protection & Intrusion Detection Systems: Introduction Statistics Concepts and Definitions Types of Attacks Inference Controls evaluation Criteria for Control Comparison. Introduction IDES System RETISS System ASES System Discovery

TEXT BOOKS

- Database Security by Castano Pearson Edition (lie) Database Security and Auditing: Protecting Data Integrity and Accessibility, 1st Edition, Hassan Afyouni, THOMSON Edition.

REFERENCE BOOK

- Database security by alfred basta, melissa zgota, CENGAGE learning.

Unit I

General introduction to computing

Using R as a calculator, Numbers, words and logicals; missing values (NA), Vectors and their attributes (names, length, type), System- and user-defined objects, Accessing data (data()). Data in the system and data outside the system (read.table, scan)

First steps in graphics

The basics of R syntax, The R workspace, Matrices and lists, Subsetting, System-defined functions; the help system, Errors and warnings; coherence of the workspace

Unit II

Data input and output; interface with other software packages

Writing your own code; R script, Good programming practice, R syntax -- further steps, The parentheses and brackets; =, == and <- , Exploratory data analysis, Range, summary, mean, variance, median, sd, histogram, box plot, scatterplot

Unit III

Probability distributions. Simulations Random number generation Distributions, the practice of simulation, Apply-type functions Compiling and applying functions Documentation, Conditional statements Loops and iterations, Statistical functions in R: Statistical inference, contingency tables, chi-square goodness of fit, regression, generalized linear models, advanced modeling methods

Unit IV

Graphics; beyond the basics: Graphics and tables, Working with larger datasets Principles of exploratory data analysis (big data analysis) Dataframes in R: Defining your own classes and operations Models and methods in R Customising the user's environment

Text books :

Dalgaard, P. (2002), Introductory Statistics with R, Springer

Dennis, B. (2013). The R Student Companion, Taylor & Francis Group

Matloff, N. (2011). The Art of R Programming: A Tour of Statistical Software Design, William

Philip H. Pollock (2014). An R Companion to Political Analysis, CQ Press

Chihara, L. and Hesterberg, T. (2011), Mathematical statistics with resampling and R, Wiley

Unit I

Evolution and Emergence of Web Services Evolution of distributed computing. Core distributed computing technologies – client/server, CORBA, JAVA RMI, Micro Soft DCOM, MOM, Challenges in Distributed Computing, role of J2EE and XML in distributed computing, emergence of Web Services and Service Oriented Architecture (SOA). Principles of SOA and its components. Brief Over View of XML – XML Document structure, XML namespaces, Defining structure in XML documents, Reuse of XML schemes, Document navigation and transformation.

Unit II

Introduction to SOAP and WSDL SOAP : Simple Object Access Protocol, Inter-application communication and wire protocols, SOAP as a messaging protocol, Structure of a SOAP message, SOAP envelope, Encoding, Service Oriented Architectures, SOA revisited, Service roles in a SOA, Reliable messaging, The enterprise Service Bus, SOA Development Lifecycle, SOAP HTTP binding, SOAP communication model, Error handling in SOAP. Describing Web Services – WSDL introduction, non functional service description, WSDL1.1 Vs WSDL 2.0, WSDL document, WSDL elements, WSDL binding, WSDL tools, WSDL port type, limitations of WSDL.

Registration and discovery of Web services The role of service registries, Service discovery, Universal Description, Discovery, and Integration, UDDI Architecture, UDDI Data Model, Interfaces, UDDI Implementation, UDDI with WSDL, UDDI specification, Service Addressing and Notification, Referencing and addressing Web Services, Web Services notification.

Unit III

SOA planning, analysis, design and implementation Stages of the SOA lifecycle, SOA Delivery Strategies, service-oriented analysis, Capture and assess business and IT issues and drivers, determining non-functional requirements, business centric SOA and its benefits, Service modeling, Basic modeling building blocks, service models for legacy application integration and enterprise integration, Enterprise solution assets(ESA). Service-oriented design process, design activities, determine services and tasks based on business process model, designing service integration environment (e.g., ESB, registry), Tools available for appropriate designing, implementing SOA, security implementation, implementation of integration patterns, services enablement, quality assurance

Unit IV

Web service security considerations Network-level security mechanisms, Application-level security topologies, XML security standards, Semantics and Web Services, The semantic interoperability problem, The role of metadata, Service metadata, Overview of .NET and J2EE, SOA and Web Service Management, Managing Distributed System, Enterprise management Framework, Standard distributed management frameworks, Web service management, Richer schema languages, WS-Metadata Exchange.

Managing SOA environment and Web technologies Distributing service management and monitoring concepts, operational management challenges, Service level agreement considerations, SOA governance ,QoS compliance in SOA governance, role of ESB in SOA governance, impact of changes to services in the SOA lifecycle, Introduction to Ajax, Ajax Design Basics, JavaScript, Blogs, Wikis, RSS feeds. Distributing service management and monitoring concepts, operational management challenges, Servicelevel agreement considerations, SOA governance (SLA, roles and responsibilities, policies, critical success factors, and metrics), QoS compliance in SOA governance, role of ESB in SOA governance, impact of changes to services in the SOA lifecycle

TEXT BOOKS:

1. Web Services & SOA Principles and Technology, Second Edition, Michael P. Papazoglou
- .2. Developing Java Web Services, R. Nagappan, R. Skoczylas, R.P. Sriganesh, Wiley India.
- 3.Developing Enterprise Web Services, S. Chatterjee, J. Webber, Pearson Education.

REFERENCE BOOKS:

1. Service-Oriented Architecture: Concepts, Technology, and Design. by Thomas Erl. Prentice Hall/Pearson.
2. Building web Services with Java, 2nd Edition, S. Graham and others, Pearson Education.
3. Java Web Services, D.A. Chappell & T. Jewell, O'Reilly, SPD.
4. McGovern, et al., "Java web Services Architecture", Morgan Kaufmann Publishers, 2005.
5. J2EE Web Services, Richard Monson-Haefel, Pearson Education.
6. XML, Web Services, and the Data Revolution, F.P.Coyle, Pearson Education

Unit I

SECURITY CONCEPTS

Confidentiality, privacy, integrity, authentication, non-repudiation, availability, access control, defence 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.

Unit II

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).

Unit III

VIRTUALIZATION SYSTEM-SPECIFIC ATTACKS

Guest hopping, attacks on the VM (delete the VM, attack on the control of the VM, code or file injection into the virtualized file structure), VM migration attack, hyperjacking.

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.

Unit IV

LEGAL AND COMPLIANCE ISSUES

Responsibility, ownership of data, right to penetration test, local law where data is held, examination of modern Security Standards (eg PCIDSS), how standards deal with cloud services and virtualization, compliance for the cloud provider vs. compliance for the customer.

REFERENCES

1. Tim Mather, Subra Kumaraswamy, ShahedLatif, “Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance” O'Reilly Media; 1 edition [ISBN: 0596802765], 2009
2. Cloud Security Alliance, “Security Guidance for Critical Areas of Focus in Cloud Computing” 2009.

3. VMware “VMware Security Hardening Guide” White Paper, June 2011
4. Cloud Security Alliance 2010, “Top Threats to Cloud Computing” Microsoft 2013.
5. Timothy Grance; NIST “Guidelines on Security and Privacy in Public Cloud Computing” .

Unit 1

Introduction of Cloud Computing: What is Cloud Computing?, How it works?, Types of Cloud, Goals & Challenges, Leveraging Cloud Computing, Cloud Economics and Total Cost of Ownership

Cloud Service Models: Software as a Service (SaaS): Introduction, Challenges in SaaS, Model, SaaS Integration Services, Advantages and Disadvantages. Infrastructure As a Services (IaaS): Introduction, Virtual

Unit-II

Machines, VM Migration Services, Advantages and Disadvantages.

Platform As a service (PaaS): Introduction, Integration of Private and Public Cloud, Advantages and Disadvantages.

Virtualization and Abstraction: What is Virtualization and how abstraction is provided in cloud? Advantages and Disadvantages, Types of Hypervisor, and Load balancing.

Unit III

Amazon Web Services 10 Getting started with AWS, AWS Compute, Storage, and Networking, AWS Security, Identity, and Access Management,

AWS Database Options, AWS Elasticity and Management Tools

Architecting on AWS 12 Introduction to System Design: AWS Essentials Review and System Design for High Availability, Automation and Serverless Architectures: Event-Driven Scaling, Well-Architected Best Practices: Security, Reliability, Performance Efficiency, Cost Optimization and Deployment and Implementation: Design Patterns and Sample Architectures

Unit IV

Cloud Security 06 Tools and technologies to secure the data in Private and Public, Cloud Architecture. Security Concerns, Legal issues and Aspects, Multi-tenancy issues. Cloud Simulation CloudSim: Modeling and simulation of Cloud computing data centers with virtualized server hosts.

References:

- Judith Hurwitz, R Bloor, M.Kanfman, F.Halper “Cloud Computing for Dummies”, Wiley India Edition, First Edition
- Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, ”Cloud Computing: Principles and Paradigms”, Wiley Publication,2011
- Tim Mather, SubraKumara swamy, Shahed Latif, “Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance”, O’ReillyMedia Inc, 2009
- Mickey Iqbal 2010, “ IT Virtualization Best Practices: A Lean, Green Virtualized Data Center Approach”, MC Press
- Frank H. P. Fitzek, Marcos D. Katz, “Mobile Clouds: Exploiting Distributed Resources in Wireless, Mobile and Social Networks”, Wiley Publications, ISBN: 978-0-470- 97389-9, Jan 2014.

Unit I

(Introduction to Cryptography and Block Ciphers) Introduction to security attacks - services and mechanism - introduction to cryptography - Conventional Encryption: Conventional encryption model - classical encryption techniques - substitution ciphers and transposition ciphers – cryptanalysis – steganography - stream and block ciphers - Modern Block Ciphers: Block ciphers principals - Shannon’s theory of confusion and diffusion - data encryption standard(DES) - strength of DES - differential and linear crypt analysis of DES - block cipher modes of operations - triple DES – AES.

Unit II

(Confidentiality and Modular Arithmetic) Confidentiality using conventional encryption - traffic confidentiality - key distribution - random number generation - Introduction to graph - ring and field - prime and relative prime numbers - modular arithmetic - Fermat’s and Euler’s theorem - primality testing - Euclid’s Algorithm - Chinese Remainder theorem - discrete algorithms.

Unit III

(Public key cryptography and Authentication requirements) Principles of public key crypto systems - RSA algorithm - security of RSA - key management – Diffie-Hellman key exchange algorithm - introductory idea of Elliptic curve cryptography – Elgamel encryption - Message Authentication and Hash Function: Authentication requirements - authentication functions - message authentication code - hash functions - birthday attacks – security of hash functions and MACS.

Unit IV

(Integrity checks and Authentication algorithms) MD5 message digest algorithm - Secure hash algorithm (SHA) Digital Signatures: Digital Signatures - authentication protocols - digital signature standards (DSS) - proof of digital signature algorithm - Authentication Applications: Kerberos and X.509 - directory authentication service - electronic mail security-pretty good privacy (PGP) - S/MIME

Recommended Books

1. William Stallings, “Cryptography and Network security Principles and Practices”, Pearson/PHI.
2. Wade Trappe, Lawrence C Washington, “ Introduction to Cryptography with coding theory”, Pearson.

Reference Books

1. W. Mao, “Modern Cryptography – Theory and Practice”, Pearson Education.
2. Charles P. Pfleeger, Shari Lawrence Pfleeger – Security in computing – Prentice Hall of India

Unit I

PHP variables, HTML Forms and PHP ,Using Numbers , Using Strings , Control Structures , Using Arrays , Creating functions , Files and Directories, Information models.

Unit II

Cookies and Sessions ,Creating Web Applications , Control Structures, Objects, Properties Methods and Events ,Hypertext and Hypermedia ,Web application architectures for high scalability , Fault Tolerance in Web Applications , Distributed Data and Applications ,Non Database information storage and retrieval systems

Unit III

JavaScript and jQuery: Basics of JavaScript and Client-side scripting language, JavaScript syntaxes for variables, functions, branches and repetitions. JavaScript alert, prompt and confirm. Objects in JavaScript, Access/Manipulate web browser elements using DOM Structure, forms and validations, JavaScript events, Basics of jQuery, jQuery syntaxes, jQuery selectors, events, effects, Access/Manipulate web browser elements using jQuery

Unit IV

PHP and MySQL: Introduction to PHP and its syntax, combining PHP and HTML, understanding PHP code blocks like Arrays, Strings, Functions, looping and branching, file handling, processing forms on server side, cookies and sessions. Introduction to PHP MyAdmin, connection to MySQL server from PHP, execution of MySQL queries from PHP, receiving data from database server and processing it on webserver using PHP.

Reference Books:

1. Black Book, Web Technologies, Dreamtech Press
2. Ralph Moseley and M. T. Savaliya, Developing Web Applications, Wiley-India
3. Cody Lindley, jQuery Cookbook, O'Reilly Media
4. Ryan Benedetti, Ronan Cranley, Head First jQuery - A Brain-Friendly Guide, O'Reilly Media

Unit I

Fundamentals of Web, XHTML – 1: Internet, WWW, Web Browsers and Web Servers, URLs, MIME, HTTP, Security, The Web Programmers Toolbox.

XHTML: Basic syntax, Standard structure, Basic text markup, Images, Hypertext Links.

Unit II

XHTML – 2,

CSS: XHTML (continued): Lists, Tables, Forms, Frames

CSS: Introduction, Levels of style sheets, Style specification formats, Selector forms, Property value forms, Font properties, List properties, Color, Alignment of text, The box model, Background images, The and <div> tags, Conflict resolution.

Unit III

Hours Javascript: Overview of Javascript, Object orientation and Javascript, Syntactic characteristics, Primitives, operations, and expressions, Screen output and keyboard input, Control statements, Object creation and modification, Arrays, Functions, Constructors, Pattern matching using regular expressions, Errors in scripts, Examples.

Unit IV

Javascript and HTML Documents, Dynamic Documents with Javascript: The Javascript execution environment, The Document Object Model, Element access in Javascript, Events and event handling, Handling events from the Body elements, Button elements, Text box and Password elements, The DOM 2 event model, The navigator object, DOM tree traversal and modification. Introduction to dynamic documents, Positioning elements, Moving elements, Element visibility, Changing colors and fonts, Dynamic content, Stacking elements, Locating the mouse cursor, Reacting to a mouse click, Slow movement of elements, Dragging and dropping elements.

Recommended Books:

1. Robert W. Sebesta: Programming the World Wide Web, 4th Edition, Pearson Education, 2008.

(Listed topics only from Chapters 1 to 9, 11 to 15)

Reference Books:

1. M. Deitel, P.J. Deitel, A. B. Goldberg: Internet & World Wide Web How to Program, 4th Edition, Pearson Education, 2004.

2. Chris Bates: Web Programming Building Internet Applications, 3rd Edition, Wiley India, 2007.

3. Xue Bai et al: The web Warrior Guide to Web Programming, Cengage Learning, 2003.

Unit I

Foundations for AI:

AI: Application areas, AI Basics (Divide and Conquer, Greedy, Branch and Bound, Gradient Descent) , NN basics (Perceptron and MLP, FFN, Backpropagation)

Convolution Neural Networks: Image classification, Text classification, Image classification and hyper-parameter tuning, Emerging NN architectures.

Unit II

Recurrent Neural Networks: Building recurrent NN, Long Short-Term Memory & Time Series Forecasting

Deep Learning :Auto-encoders and unsupervised learning, Stacked auto-encoders and semi-supervised learning, Regularization - Dropout and Batch normalization.

Unit III

Foundations for ML, ML Techniques overview, Validation Techniques (Cross-Validations), Feature Reduction/Dimensionality reduction, Principal components analysis (Eigen values, Eigen vectors, Orthogonality)

Unit IV

Clustering: Distance measures, Different clustering methods (Distance, Density, Hierarchical) Iterative distance-based clustering; Dealing with continuous, categorical values in K-Means, Constructing a hierarchical cluster, K-Medoids, k-Mode and density-based clustering, Measures of quality of clustering

Text book :

1. Artificial Intelligence: A Modern Approach

Textbook by Peter Norvig and Stuart J. Russell

2. Machine Learning by Tom M. Mitchell

Unit I:

Matrices and System of Linear Equations, Determinants

1. Systems of linear equations and solution. Gaussian elimination and Gauss-Jordan reduction; rank of matrix.
2. Matrix algebra: addition, multiplication; identity matrix; inverse and transpose; symmetric and skew-symmetric matrices. Solutions of linear systems, LU factorization.
3. Determinants: definition and computation; inverse, products, and singularity.

Unit II:

Vector Spaces

1. Matrices and vectors; Subspaces; span and spanning sets. Linear independence; basis and dimension; change of basis
2. Matrices; row and column spaces; rank and nullity; implications for linear systems.

Unit 3

Orthogonality

1. Dot product and norm; orthogonality; orthogonal subspaces, projection, and bases; orthogonal matrices; least- squares problems.
2. Gram-Schmidt orthogonalization; QR factorization

Linear transformations,

3. Linear transformations and operators; range and kernel; matrix representations.

Unit 4:

Eigenvalue problems

1. Eigenvalues and eigenvectors: definition; characteristic polynomial; product and sum of eigenvalues; similar matrices. .
2. Independence of eigenvectors; multiplicity/degeneracy of eigenvalues; diagonalization.
3. Complex matrices and eigenvalues; Hermitian, unitary, and normal matrices; orthonormal basis of eigenvectors.
4. Systems of linear differential equations; introduction.

Textbook: R. Larson and D. Falvo, Elementary Linear Algebra, Sixth edition

Suggested Texts, readings, & Materials: S. Leon, Linear Algebra with Applications, prentice hall, 8e

Unit I

Probability

1. Probability: Basic concepts
2. Random Variables
3. Discrete Random variables. Special Discrete Univariate Random Variables.

Unit II

1. Continuous Random Variables. Special Continuous Univariate Random Variables. 2, Bivariate Random Variables
3. Asymptotics

Unit III

Statistics

1. Population & Samples.
2. Distribution of Sample Statistics.
3. Point Estimation
4. Confidence Intervals

Unit IV

1. Hypothesis Testing
2. 1-way Anova
3. Simple Regression Model

Textbook

“Statistics for Business and Economics” Paul Newbold, William L. Carlson and Betty Thorne, Upper Saddle River, N.J. : Prentice Hall, cop. 2007, 7th ed.

DSE : Principles of TCP/IP (LTP::4:0:2) 6 Credits

Unit I

Computer networks, the Internet, core, edge, IETF,

Data networking protocols and performance

Application layer: web, HTTP, FTP, SMTP, DNS

UNIT 2

P2P, TCP connection setup and teardown

Socket programming with TCP and UDP

TCP and Transport layer, reliable data transfer, GBN, SR

Unit 3

TCP flow control and congestion control

Network layer: IP

IP addressing and subnetting

IP routing algorithm -- DV and LS

Unit 4

Wireless and mobile networks

Multimedia networking

Multimedia and streaming

Network management

DSE : Raspberry Pi with Python (L:T:P :: 4:0:2)

6 Credits

Overview of IoT: Understanding IoT fundamentals, IOT Architecture, protocols, Various Platforms for IoT, Real time Examples of IoT, Overview of IoT components and IoT Communication Technologies

Getting started with Raspberry Pi: Introduction to Raspberry Pi, Comparison of various Rpi Models, Understanding SoC architecture and SoCs used in Raspberry Pi, Pin Description of Raspberry Pi, On-board components of Rpi

Unit 2:

Booting Up RPi- Operating System and Linux Commands :

Linux:Introduction, Architecture, File System.

Raspbian O.S: Introduction, Tools like Leafpad Editor, Installing Raspbian on Pi, First boot and Basic Configuration of Pi, Popular Linux Commands

Unit 3:

Working with RPi using Python and Sensing Data using Python:Introduction, Python vs. Other Languages, Applications of Python, Understanding Python, Interpreted Languages, Variables, Keywords, Operators and Operands,Data Types in Python, Importing Libraries,Flow Control, Conditional Statement, Loops,Sensors Interfacing- Temperature and Humidity Sensor (DHT11), Motion Sensor(PIR), Obstacle detection using Ultrasonic sensor, etc.Communicating using RPi-GSM interfacing, Accessing on-board Wi-Fi, .Connecting Database with RPi.

Unit 4:

IoT Design using Raspberry Pi: IoT Applications based on Pi, LAMP Web-server, GPIO Control over WebBrowser, Creating Custom Web Page for LAMP, Communicating data using on-board module, Home automation using Pi, Node-RED, MQTT Protocol, Using Node-RED Visual Editor on Rpi.

Recommend Books

Programming the Raspberry Pi, Second Edition: Getting Started with Python By Simon Monk

DSE : INTERNET OF THINGS system Design(L:TP::4:0:2)

6 Credits

Unit 1

1. Introduction & Motivation
2. IoT Around Us
3. Sensors
4. Multi-sensor Systems and Calibration

Unit 2:

1. IoT System Overview
2. Power management & Batteries
3. Understanding Microprocessors
4. Microprocessors for IoT Sensors: An Overview

Unit 3

1. Microcontrollers for IoT Sensors: Resources and Processes [Clock Budgeting of an IoT Sensor Node
2. Representation of Numbers
3. Networking and IoT
4. Design review of certain aspects of oblu
 - Pedestrian Dead Reckoning
 - Case study: oblu's firmware design (framework only)
 - Designing a non-standard communication i/f for an IoT sensor node
 - oblu-Arduino based autonomous vehicle

Unit 4:

1. Big Data
2. Hadoop and MapReduce
3. Revisiting Arduino
4. An Introduction to Raspberry Pi

References

There is no textbook for the course. The following material will be used for reference.

- Internet of Things: A Hands-on Approach, By Arshdeep Bahga and Vijay Madisetti
- Introduction to Embedded Systems: A Cyber-Physical Systems Approach, By Edward Ashford Lee and Sanjit Arunkumar Seshia
- Introduction to Computation and Programming using Python, by John Guttag
- Python documentation: <https://www.python.org/doc/>

- Android developer: <https://developer.android.com/training/index.html>
- [oblu - A Shoe Mounted Indoor GPS \(A comprehensive note on oblu\)](#)
- Recent publications for case studies

Unit I

Data Warehousing:

Introduction, Operational Data Stores (ODS), Extraction Transformation Loading (ETL), Data Warehouses. Design Issues, Guidelines for Data Warehouse Implementation, Data Warehouse Metadata:

Online Analytical Processing (OLAP): Introduction, Characteristics of OLAP systems, Multidimensional view and Data cube, Data Cube Implementations, Data Cube operations, Implementation of OLAP and overview on OLAP Software's.

Unit II

Data Mining: Introduction, Challenges, Data Mining Tasks, Types of Data, Data Preprocessing, Measures of Similarity and Dissimilarity, Data Mining Applications

Association Analysis: Basic Concepts and Algorithms: Frequent Itemset Generation, Rule Generation, Compact Representation of Frequent Itemsets, Alternative methods for generating Frequent Itemset, FP Growth Algorithm, Evaluation of Association Patterns

Unit III

Classification -1 : Basics, General approach to solve classification problem, Decision Trees, Rule Based Classifiers, Nearest Neighbor Classifiers.

Classification - 2: Bayesian Classifiers, Estimating Predictive accuracy of classification methods, Improving accuracy of clarification methods, Evaluation criteria for classification methods, Multiclass Problem.

Unit IV

Clustering Techniques: Overview, Features of cluster analysis, Types of Data and Computing Distance, Types of Cluster Analysis Methods, Partitional Methods, Hierarchical Methods, Density Based Methods, Quality and Validity of Cluster Analysis

Hours Web Mining: Introduction, Web content mining, Text Mining, Unstructured Text, Text clustering, Mining Spatial and Temporal Databases.

Text Books:

1. Pang-Ning Tan, Michael Steinbach, Vipin Kumar: Introduction to Data Mining, Pearson Education, 2005.
2. G. K. Gupta: Introduction to Data Mining with Case Studies, 3rd Edition, PHI, New Delhi, 2009.

Reference Books:

1. Arun K Pujari: Data Mining Techniques 2nd Edition, Universities Press, 2009.
2. Jiawei Han and Micheline Kamber: Data Mining - Concepts and Techniques, 2nd Edition, Morgan Kaufmann Publisher, 2006.
3. Alex Berson and Stephen J. Smith: Data Warehousing, Data Mining, and OLAP Computing, Mc GrawHill Publisher, 1997.

UNIT – 1

XML: Introduction, Syntax, Document structure, Document type definitions, Namespaces, XML schemas, Displaying raw XML documents, Displaying XML documents with CSS, XSLT style sheets, XML processors, Web services.

UNIT – 2

Perl, CGI Programming: Origins and uses of Perl, Scalars and their operations, Assignment statements and simple input and output, Control statements, Fundamentals of arrays, Hashes, References, Functions, Pattern matching, File input and output; Examples.

The Common Gateway Interface; CGI linkage; Query string format; CGI.pm module; A survey example; Cookies.

Database access with Perl and MySQL

UNIT – 3

PHP: Origins and uses of PHP, Overview of PHP, General syntactic characteristics, Primitives, operations and expressions, Output, Control

statements, Arrays, Functions, Pattern matching, Form handling, Files, Cookies, Session tracking, Database access with PHP and MySQL.

UNIT – 4

Ruby, Rails: Origins and uses of Ruby, Scalar types and their operations, Simple input and output, Control statements, Arrays, Hashes, Methods, Classes, Code blocks and iterators, Pattern matching.

Overview of Rails, Document requests, Processing forms, Rails applications with Databases, Layouts.

Recommended Books:

1. Robert W. Sebesta: Programming the World Wide Web, 4th Edition, Pearson Education, 2008. (Listed topics only from Chapters 1 to 9, 11 to 15)

Reference Books:

1. M. Deitel, P.J. Deitel, A. B. Goldberg: Internet & World Wide Web How to Program, 4th Edition, Pearson Education, 2004.
2. Chris Bates: Web Programming Building Internet Applications, 3rd Edition, Wiley India, 2007.
3. Xue Bai et al: The web Warrior Guide to Web Programming, Cengage Learning, 2003.

SEC-1: MongoDB (LTP::1:0:1)

2 Credits

Unit I:

Overview , Advantages, Environment 5, Data Modelling , Create Database , Drop Database , Create Collection, Drop Collection, Datatypes

Unit II

Insert Document , Query Document, Update Document ,Delete Document ,Projection , Limit Records, Sort Records, Indexing , Aggregation ,Replicatio , Sharding , Create Backup, Deployment, Java, php

Reference:

1. https://www.tutorialspoint.com/mongodb/mongodb_tutorial.pdf

Unit I

Static Visualization:

Introduction, Creating Plots that Present Global Patterns in Data like Scatter Plots, Hexagonal Binning Plots, Contour Plots, Line Plots, Heat maps. Present summary statistics of data using Histogram, Box Plot, Violin plots, QQ plot using Seaborn.

From Static to Interactive Visualization-1:

Interactive data visualization using Plotly Express: creating different interactive graphs.

Unit II

From Static to Interactive Visualization-2:

Interactive data visualization using Bokeh, Preparing the data set for graphics, Adding slider to static graphs, Adding Hover tool,

Interactive data visualization of Data across Strata: Adding Zoom-in and Zoom-Out, Adding Hover and tooltip functionality, Exploring select and highlight functionality on a plot,

Interactive visualization of geographical data: Choropleth maps.

Case study: India map coloring based on Covid -19 data

Reference:

- 1) <https://plotly.com/python/>
- 2) Interactive Data visualization with Python by Abha Belorkar, Sharath Chandra untuku, Shubhangi Hora, Anshu Kumar, second edition , Released April 2020 , Publisher(s): Packt Publishing

SEC 4: Android Programming (LTP:1:0:1)

2 credits

Unit I

Mobile technology: Overview of Android - An Open Platform for Mobile development, Open Handset Alliance, Use Android for mobile app development, Android Marketplaces, Android Development Environment setup, Android development Framework - Android-SDK, Eclipse Emulators / Android AVD, Creating & setting up custom Android emulator, Android Project Framework and its applications, Linux Kernel, Libraries, Android Runtime, Application Framework, Applications, Android Startup and Zygote, Android Debug bridge, Android Permission model, Android Manifest File,

Unit II

Android application components Intent, Activity, Activity Lifecycle, Broadcast receivers, Services and Manifest, Create Application and new Activities, Expressions and Flow control, Android Manifest, Simple UI -Layouts and Layout properties, XML Introduction to GUI objects, Event driven Programming in Android (Text Edit, Button clicked etc.), Creating a splash screen, Android Activity Lifecycle, Introduction to threads in Android, Menu: Custom Vs. System Menus, Creating and Using Handset menu Button (Hardware), Android Themes, Dialog, create an Alter Dialog, Toast in Android, List & Adapters, Android Manifest.xml File, SQLite: Open Helper and create database, Open and close a database.

Recommended Books:

1. Android - A Programmer's Guide, Jerome (J.F.) DiMarzio, McGraw Hill Education.
2. Professional Android 2 Application Development, Reto Meier, Wiley India Pvt Ltd.

Reference Books:

1. Beginning Android, Mark L Murphy, Wiley India Pvt Ltd
2. Professional Android, Sayed Y Hashimi and Satya Komatineni, Wiley India Pvt Ltd
3. Android Studio Development Essentials by Neil Smyth

SEC-4: Agile Concepts (LTP::1:0:1)

2 Credits

Unit I

Project Management through Agile

Introduction to Project management, Advantages of Agile practices, Agile project management open source tools, Introduction to Gitlab and its components.

Mastering Scrum with Gitlab

Introduction to Scrum framework, Scrum Team, Sprint planning, Sprint backlog, Sprint Demo, Daily stand-ups, Retrospective, Scrum Board,

Unit II

Mastering Kanban with Gitlab

Introduction to Kanban framework, List of stories, Columns/lanes, Work in Progress (WIP), Release, Kanban Board,

Project Estimation, Metrics, Monitoring

Estimation: Agile estimation, Story point vs hours, planning poker, Metrics: Agile metrics, Burndown chart, Velocity chart, Control chart, Monitoring: Gantt chart

References:

1. Coaching Agile Teams: A Companion for ScrumMasters, Agile Coaches, and Project Managers in Transition, **Lyssa Adkins, 2010.**
2. <https://opensource.com/article/18/2/agile-project-management-tools>
3. <https://www.atlassian.com/agile/project-management>
4. <https://about.gitlab.com/install/>