HINDUSTAN
INSTITUTE OF TECHNOLOGY & SCIENCE
(DEEMED TO BE UNIVERSITY)

DEPARTMENT OF COMPUTER APPLICATIONS

REGULATONS,
CURRICULUM AND SYLLABUS

Under CBCS

(Applicable for Students admitted from Academic Year 2019-20)

MCA (MASTER OF COMPUTER APPLICATIONS)
(2 Years)
Regulation 2018

SCHOOL OF COMPUTING SCIENCES

DEPARTMENT OF COMPUTER APPLICATIONS

DEPARTMENT OF COMPUTER APPLICATIONS
VISION AND MISSION

VISION

The department of Computer Applications aims to transform aspiring students into software professionals with a high degree of technical skills and to inculcate a research mind set.

MISSION

M1. To provide strong theoretical foundations complemented with extensive practical training.

M2. To design and deliver curricula to meet the changing needs of industry.

M3. To establish strong collaborations with industry, R&D and academic institutes for training and research.

M4. To promote all-round development of the students through interaction with alumni and industry

MCA (MASTER OF COMPUTER APPLICATIONS)
PROGRAMME EDUCATIONAL OBJECTIVES (PEO)

The program is expected to enable the students to

PEO 1: To prepare graduates to be successful professionals in industry, government, academia, research, entrepreneurial pursuit and consulting firms.

PEO 2: To prepare graduates to achieve peer-recognition, as an individual and as a team player, through demonstration of good analytical, design, implementation and interpersonal skills.

PEO 3: To prepare graduates to contribute to society as broadly educated, expressive, ethical and responsible citizens with proven expertise.

PEO 4: To prepare graduates to pursue life-long learning to fulfill their goals.

PROGRAM OUTCOMES (ALIGNED WITH GRADUATE ATTRIBUTES) (PO)

At the end of this program, graduates will be able to

PO 1 *Computational Knowledge:* Apply knowledge of computing fundamentals, computing specialisation, mathematics, and domain knowledge appropriate for the computing specialisation to the abstraction and conceptualization of computing models from defined problems and requirements.

PO 2 *Problem Analysis*: Identify, formulate, research literature, and solve *complex* computing problems reaching substantiated conclusions using fundamental principles of mathematics, computing sciences, and relevant domain disciplines.

PO 3 *Design /Development of Solutions:* Design and evaluate solutions for *complex* computing problems, and design and evaluate systems, components, or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.

PO 4 *Conduct Investigations of Complex Computing Problems:* Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO 5 *Modern Tool Usage:* Create, select, adapt and apply appropriate techniques, resources, and modern computing tools to *complex* computing activities, with an understanding of the limitations.

PO 6 *Professional Ethics:* Understand and commit to professional ethics and cyber regulations, responsibilities, and norms of professional computing practice.

PO 7 *Life-long Learning:* Recognize the need, and have the ability, to engage in independent learning for continual development as a computing professional.

PO 8 *Project management and finance:* Demonstrate knowledge and understanding of the computing and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO 9 *Communication Efficacy:* Communicate effectively with the computing community, and with society, about *complex* computing activities by being able to comprehend and write effective reports, design documentation, make effective presentations, and give and understand clear instructions.

PO 10 *Societal and Environmental Concern:* Understand and assess societal, environmental, health, safety, legal, and cultural issues within local and global contexts, and the consequential responsibilities relevant to professional computing practice.

PO 11 *Individual and Team Work:* Function effectively as an individual and as a member or leader in diverse teams and in multidisciplinary environments.

PO 12 *Innovation and Entrepreneurship:* Identify a timely opportunity and using innovation to pursue that opportunity to create value and wealth for the betterment of the individual and society at large.

PROGRAM SPECIFIC OUTCOMES (PSO)

PSO 1: Enable the students to design suitable data models, appropriate architectures and analytics techniques for efficient implementation of complex systems

PSO 2: Enable the students to design and integrate systems for providing interactive solutions for healthcare applications

M.C.A - COMPUTER APPLICATIONS									
SEMESTER- I									
SL. NO	**COURSE**	**COURSE CODE**	**NAME OF THE COURSE**	**L**	**T**	**P**	**C**	**S**	**TCH**
1	PC	CAA3701	Advanced Data Structures and Algorithms using Python	3	0	2	4	2	5
2	PC	MAA3706	Statistics for Computer Science	4	0	0	4	1	4
3	PC	CAA3702	Database Technology	3	1	0	4	1	4
4	PC	CAA3703	Object Oriented Programming using Java	2	0	2	4	1	4
5	PC	CAA3704	Computer Networks	3	0	0	3	1	3
PRACTICAL									
6	PC	CAA3781	Software Design Project	0	0	6	2	0	6
			Total	15	1	10	21	6	26
SEMESTER -II									
SL. NO	**COURSE**	**COURSE CODE**	**NAME OF THE COURSE**	**L**	**T**	**P**	**C**	**S**	**TCH**
1	PC	CAA3705	Web Design and Development	3	1	0	4	1	4
2	PC	CAA3706	Data Warehousing and Data Mining	2	0	2	4	1	4
3	PC	CAA3707	Machine Learning	3	1	0	4	1	4
4	PC	CAA3708	Software Engineering	3	1	0	4	1	4
5	PE	CA*****	Elective-1(Specialization)	3	0	0	3	1	3
6	PE	CA*****	Elective-2 (Specialization)	3	0	0	3	1	3
PRACTICAL									
7	PC	CAA3782	Software Development Lab	0	0	2	1	0	3
8	PC	CAA3783	Web Programming Lab	0	0	2	1	0	3
			Total	14	3	6	24	5	23
L – Lecture ; T – Tutorial ; P – Practical ; S- Self Study; C – Credit									

M.C.A - COMPUTER APPLICATIONS									
SEMESTER - III									
SL. NO	**COURSE**	**COURSE CODE**	**NAME OF THE COURSE**	**L**	**T**	**P**	**C**	**S**	**TCH**
1	PC	CAA3709	Software Testing and Quality Assurance	2	0	2	4	1	4
2	PC	CAA3710	DevOps	2	0	2	4	1	4
3	PC	CAA3711	MOOC (Specialization)	0	0	0	2	3	3
4	PE	CA*****	Elective -3 (Specialization)	3	0	0	3	0	3
5	PE	CA*****	Elective -4 (Specialization)	3	0	0	3	0	3
6	OE	*******	Open Elective	3	0	0	3	0	3
PRACTICAL									
7	PC	ELA4383	Presentation Skills and Academic writing	0	0	2	1	0	2
8	PC	CAA3784	Project Phase-I	0	0	6	3	0	6
			Total	13	0	12	23	5	28
SEMESTER - IV									
SL. NO	**COURSE**	**COURSE CODE**	**NAME OF THE COURSE**	**L**	**T**	**P**	**C**	**S**	**TCH**
PRACTICAL									
1	PC	CAA3785	Project Work - Phase – II	0	0	24	12	0	24
			Total	0	0	24	12	0	24

LIST OF DEPARTMENTAL ELECTIVES WITH GROUPING - SEMESTER WISE
M.C.A. with Specialization

SEM	COURSE	COURSE CODE	NAME OF THE COURSE	L	T	P	C	S	TCH
Elective I									
4	PE	CAD3721	Software Process and metrics	3	0	0	3	0	3
4	PE	CAD3722	.Net / ASP Programming	3	0	0	3	0	3
4	PE	CAB3721	Web analytics	3	0	0	3	0	3
4	PE	CAB3722	Big Data Analytics	3	0	0	3	0	3
4	PE	CAC3721	Cloud Architecture	3	0	0	3	0	3
4	PE	CAC3722	Virtualization Techniques	3	0	0	3	0	3
Elective II									
4	PE	CAD3723	Agile Methods	3	0	0	3	0	3
4	PE	CAD3724	Internet of things	3	0	0	3	0	3
4	PE	CAB3723	R Programming	3	0	0	3	0	3
4	PE	CAB3724	Big Data Framework	3	0	0	3	0	3
4	PE	CAC3723	Cloud Application Development	3	0	0	3	0	3
4	PE	CAC3724	Cloud Analytics	3	0	0	3	0	3
Elective III									
5	PE	CAD3725	Image processing	3	0	0	3	0	3
5	PE	CAD3726	Block Chain Technology	3	0	0	3	0	3
5	PE	CAB3725	Semantic Web	3	0	0	3	0	3
5	PE	CAB3726	Data Visualization Techniques and Tools	3	0	0	3	0	3
5	PE	CAC3725	Cloud Security	3	0	0	3	0	3
5	PE	CAC3726	Cloud Storage and Security	3	0	0	3	0	3
Elective IV									
5	PE	CAD3727	Natural Language Processing	3	0	0	3	0	3
5	PE	CAD3728	Distributed Computing	3	0	0	3	0	3
5	PE	CAD3729	Augmented and Virtual Reality	3	0	0	3	0	3
5	PE	CAB3727	Data Classification Methods and Evaluation	3	0	0	3	0	3
5	PE	CAB3728	Principles of Deep Learning	3	0	0	3	0	3
5	PE	CAC3727	Private Cloud Deployment and Management	2	0	1	3	0	3
5	PE	CAC3728	Back up and Disaster Recovery	3	0	0	3	0	3

SEMESTER – I

COURSE TITLE	ADVANCED DATA STRUCTURES AND ALGORITHMS USING PYTHON			CREDITS	4
COURSE CODE	CAA3701	Course Category	PC	L-T-P-C-S	3-0-2-4-2
CIA	60%			ESE	40%
LEARNING LEVEL	BTL-4				

CO	COURSE OUTCOMES	PO
Upon completion of this course, the students will be able to		
1.	Explain the basic of data structure.	1, 2, 3, 5
2.	Solve problems using trees.	1, 2, 5, 7
3.	Implement the sorting.	1, 2, 3, 7
4.	Implement and develop graphs.	2, 3, 5
5.	Implement and develop algorithms.	1, 2, 3, 5, 7

MODULE 1 – INTRODUCTION TO DATA STRUCTURE (12L)

Problem solving concepts, ADT, Stack, Queue, List.

Practical Component:

- Installation of python and its libraries.
- Do the operation in stack, queue and list.

MODULE 2 – TREES (12L)

Preliminaries, Binary Trees Binary Search Trees, AVL Trees, Tree Traversals, Hashing, Hash Function, Hash families Separate Chaining, Open addressing.

Practical Component: (using Python)

- Design a BST and explore the operation.
- Design a balanced AVL tree.

MODULE – 3 : SORTING (12L)

Preliminaries, Insertion Sort, Shells sort, Heap sort– Merge sort–Quick sort– External Sorting-Topological Sort.

Practical Component: (using Python)

- Explore the types of sorting.

MODULE – 4 GRAPHS (12L)

Graph connectivity, Random walks on graph, on line paging algorithm, adversary models.

Practical Component: (using Python)

- Design a graph and its connectivity.
- Design a model using on line paging algorithm.

MODULE 5 – ALOGRITHM (12L)

Randomized algorithm, a min-cut algorithm, Random treaps, Mulmuley games, Markovs chains.

Practical Component: (using Python)

- Explore the randomized algorithm.
- Implementation of Markovs and its chain rule.

TEXT BOOKS

1	Goodrich Michael T, “Data Structures and Algorithms in Python ”, Wiley publication, 2016

2	Rance D.Neclase, “Data Structures and Algorithms in Python”, Wiley Publication (2016)
REFERENCE BOOKS	
1.	E. Horowitz, S.Sahni and Dinesh Mehta, Fundamentals of Data structures in C++, University Press, 2009.
2.	Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", Third Edition, Pearson Education, Asia.2007.
E-BOOKS	
1.	https://doc.lagout.org/Others/Data%20Structures/Advanced%20Data%20Structures%20%5BBrass%202008-09-08%5D.pdf
MOOC	
1.	https://www.mooc-list.com/tags/advanced-data-structures

COURSE TITLE	**STATISTICS FOR COMPUTER SCIENCE**			**CREDITS**	**4**
COURSE CODE	**MAA3706**	**COURSE CATEGORY**	**BS**	**L-T-P-C-S**	**4-0-0-4-1**
CIA	**50%**			**ESE**	**50%**
LEARNING LEVEL	**BTL-3 – APPLY**				

CO	**COURSE OUTCOMES**	**PO**
Upon completion of this course, the students will be able to		
1	Develop statistical models for business analytics	1, 2
2	Use forecasting methods to support managerial, financial, and operational statistics.	1, 3, 7
3	Perform marketing analytics using statistical models.	1, 2, 4, 5
4	Analyze customer data for customer acquisition, retention, and profitability	2, 3.7
5	Analysis of variance	3, 5, 4

MODULE 1: PROBABILITY **(12L)**

Introduction to probability –Bayes theorem-Random variables-discrete random variable (Binomial, Poisson, Geometric), Continues random variable (Uniform, Exponential and Normal distribution). Moment generating function.

Suggested Activities: Basic knowledge on probability

Suggested sources: Introduction to probability

MODULE 2: TWO DIMENSIONAL RANDOM VARIABLES **(12L)**

Joint distribution –Marginal and conditional distribution covariance –correlation and regression (linear and Multiple). Central limit theorem, Chebyshev’s inequality.

Suggested Activities: Basic knowledge on probability

Suggested sources: Probability, Statistics and Random Processes-T.Veerarajan

MODULE 3: THEORY OF SAMPLING AND TEST OF HYPOTHESIS **(12L)**

Introduction to hypothesis, Large and small samples test -mean and variance (single and double), test, Independent of attributes and contingency table. **Suggested Activities**: Basic knowledge of sampling **Suggested sources: Probability, Statistics and Random Processes-T.Veerarajan**	
MODULE 4: TIME SERIES ANALYSIS (12L)	
Introduction to Stochastic process, Time series as a discrete stochastic process. Stationarity, Main characteristics of stochastic process (mean, auto covariation and auto correlation function). Autoregressive models AR (p), Yull-Worker equation Auto regressive moving average models ARMA. Seasonality in Box –Jenkins model. **Suggested Activities**: Basic knowledge of Time series analysis **Suggested sources: Time series-Maurice George kendall,j.k.Ord**	
MODULE 5: DESIGN OF EXPERIMENTS (12L)	
Analysis of variance (one way & two ways) classification – completely randomized design – randomized block design – Lattin square design. **Suggested Activities**: Basic knowledge of design of experiments **Suggested sources: Probability, Statistics and Random Processes-T.Veerarajan**	
TEXT BOOKS	
1	T.Veerarajan , "Probability, Statistics and Random Processes" Tata McGraw-Hill,Education 2008
2	Maurice George Kendall, J. K. Ord,"Time series" Oxford University Press, 1990
REFERENCE BOOKS	
1	K.S.Trivedi.John , "Probability and statistics with reliability, Queuing and computer Science Application", Second edition, Wiley&Son, 2016
2	Levin Richard and Rubin Davids, "Statistics for Management ", Pearson Publications,2016
3	Robert Stine, Dean Foster ,"Statistical for Business: Decision Making and Analysis". Pearson Education, 2nd edition ,2013
E BOOKS	
1	http://www.math.harvard.edu/~knill/teaching/math144_1994/probability.pdf
2	http://www.dartmouth.edu/~chance/teaching_aids/books_articles/probability_book/book.pdf
MOOC	
1	https://nptel.ac.in/courses/IIT-MADRAS/Principles_of_Communication1/Pdfs/1_5.pdf
2	https://nptel.ac.in/courses/110104024/

COURSE TITLE	DATABASE TECHNOLOGY			CREDITS	4
COURSE CODE	CAA3702	COURSE CATEGORY	PC	L-T-P-C-S	3-1-0-4-1
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-4				

CO	COURSE OUTCOMES	PO
Upon completion of this course, the students will be able to		
1.	Implement database design techniques.	1, 2, 3,
2.	Implement normalization.	1, 2, 3, 7
3.	Implement object relational database	1, 2, 3, 5
4.	Implement distributed and parallel dbms	2, 3, 5
5.	Create a design structured and unstructured DB and multimedia database	1, 2, 3,5,7,9

MODULE 1 – DATABASE INTRODUCTION & DESIGN TECHNIQUES (12L)

Introduction to Database Systems, DBMS Architecture, Introduction to Data Modeling, ER Model, EER Model -Specialization/Generalization, Aggregation, Composition, Relational model algebra operations, ER, EER to Relational Model.

MODULE 2 – ADVANCED DESIGN TECHNIQUE -NORMALIZATION (12L)

Normalization – Informal Guidelines, Functional dependencies, decomposition algorithms , Normal Forms up to 5NF, SQL - Basic & Advanced Operations, Query Processing, Query optimization, Storage and File organization.

MODULE – 3 : OBJECT RELATIONAL DBMS (12L)

Introduction to Object Oriented Data Bases - Approaches - Modeling and Design - Persistence - Transaction - Concurrency - Recovery - Database Administration. Overview, Complex Data Types, ODBMS & ORDBMS, Structured Types and Inheritance in SQL, Table Inheritance, Object-Identity and Reference Types in SQL

MODULE – 4 DISTRIBUTED DATABASE AND PARALLEL DBMS (12L)

Concepts, advantages, types, functions, architecture, data allocation, fragmentation, replication, transparencies, Date's rules, transaction management, concurrency control, dead lock, recovery2PC, 3PC.Partition techniques, Architecture, Parallel algorithms for sorting, Parallel join, Parallel Queries.

MODULE 5 – SEMI STRUCTURED, UNSTRUCTURED DATA BASE (12L)

OEM, Overview of XML, DTD, XML schema, XML query languages, XML related technologies, XML and databases, Unstructured database – NOSQL – Overview – Definition – Types of NoSQL DB

TEXT BOOKS

1. Thomas M. Connolly and Carolyn Begg, Database Systems: A Practical Approach to Design, Implementation, and Management, 2015, 6th Edition, Pearson India.
2. Saeed K. Rahimi, Frank S. Haug :Distributed Database Management system", 2015.

REFERENCE BOOKS

1. Ramez Elmasri & B.Navathe: Fundamentals of database systems, 2014, 7th Edition, Addison Wesley.

2.	S.K.Singh, Database Systems: Concepts, Design & Applications, 2011, 2nd Edition, Pearson education
3.	Raghu Ramakrishnan and Johannes Gehrke: Database Management Systems, 2003, 3rd Edition, McGraw Hill.
4.	Joe Fawcett, Danny Ayers, Liam R. E. Quin: Beginning XML, 2012, 5th Edition, Wiley India Private Limited.
5.	Abraham Silberschatz, S. Sudarshan, Henry F. Korth: Database System Concepts, 2011, 6th Edition, Tata McGraw - Hill Education.
E-BOOKS	
1.	https://www.kopykitab.com/eBooks-for-MCA-master-of-computer-applications
MOOC	
1.	https://swayam.gov.in/courses/4598-database-and-content-organisation

COURSE TITLE	**OBJECT ORIENTED PROGRAMMING USING JAVA**			**CREDITS**	**4**
COURSE CODE	**CAA3703**	**COURSE CATEGORY**	**PC**	**L-T-P-C-S**	**2-0-2-4-1**
CIA	**60%**			**ESE**	**40%**
LEARNING LEVEL	**BTL-4**				

CO	**COURSE OUTCOMES**	**PO**
Upon completion of this course, the students will be able to		
1.	Solve real world problems using OOP techniques.	1, 2, 3
2.	Solve problems using java collection framework and I/O classes.	1, 2, 7
3.	Implement Interfaces and Packages	1, 2, 3, 5
4.	Develop multithreaded applications with synchronization.	1, 3, 5
5.	Develop applets for web applications and able to design GUI based applications	1, 2, 3, 5

MODULE 1 – INTRODUCTION TO JAVA (12L)

Classes and Instances, Class Hierarchies- Inheritance, Method binding, Overriding and Exceptions, Summary of Object-Oriented concepts. Java buzzwords, An Overview of Java, Data types, Variables and Arrays, operators, expressions, control statements, Introducing classes, Methods and Classes, String handling, Inheritance concept, Inheritance basics, Member access, Constructors, Creating Multilevel hierarchy, super uses, using final with inheritance, Polymorphism-adhoc polymorphism, pure polymorphism, method overriding, abstract classes, Object class, forms of inheritance- specialization, specification, construction, extension, limitation, combination, benefits of inheritance, costs of inheritance.

MODULE 2 – PACKAGES, INTERFACES AND I/O STREAMS (12L)

Defining a Package, CLASSPATH, Access protection, importing packages. **Interfaces-** defining an interface, implementing interfaces, Nested interfaces, applying interfaces, variables in interfaces and extending interfaces. Introduction to Stream - Introduction to NIO, working with Stream Classes, working with Files, working with Buffers, working with Character Arrays, working with the Print Writer Class, working with the Stream Tokenizer Class, implementing the Serializable Interface, working with the Console Class, Printing with the Formatter Class, scanning Input with the Scanner class.

MODULE – 3 : EXCEPTION HANDLING AND MULTITHREADING (12L)

Fundamentals of exception handling, Exception types, Termination models, Uncaught exceptions, using try and catch, multiple catch clauses, nested try statements, throw, throws and finally, built- in exceptions, creating own exception sub classes. Threading : Differences between thread-based multitasking and process-based multitasking, Java thread model, creating threads, thread priorities, synchronizing threads, inter thread communication.

MODULE – 4 NETWORKING WITH JAVA.NET (12L)

Introduction to Networking - Networking Enhancements in Java SE 8, Client-Server Networking, Proxy Servers, Domain Name Service, Understanding Networking Interfaces and Classes in the java.net Package, Internet Addressing, Understanding Sockets in Java, Understanding the URL Class, Understanding the URI Class, Working with Datagrams.

MODULE 5 – COLLECTION FRAMEWORK AND FUNCIONAL PROGRAMMING (12L)

Collections overview, Collection Interfaces, The Collection classes- Array List, Linked List, Hash Set, Tree Set, Priority Queue, Array Deque. Accessing a Collection via an Iterator, Using an Iterator, The For-Each alternative, Map Interfaces and Classes, Comparators, Collection algorithms, Arrays, The Legacy Classes and Interfaces- Dictionary, Hash table ,Properties, Stack, Vector More Utility classes, String Tokenizer, Bit Set, Date, Calendar, Random, Formatter, Scanner

Functional Programming– Introduction, Key concepts, Pure functional programming- No State, Immutable variables, favor recursion over looping.

TEXT BOOKS

1.	Java The complete reference, 9th edition, Herbert Schildt, McGraw Hill Education (India) Pvt. Ltd, 2014.
2	Understanding Object-Oriented Programming with Java, updated edition, T. Budd, Pearson Education. 1999

REFERENCE BOOKS

1.	An Introduction to programming and OO design using Java, J. Nino and F.A. Hosch, John Wiley & sons, 2008
2.	Programming in Java, S. Malhotra, S. Chudhary, 2nd edition, Oxford Univ. Press, 2013

E-BOOKS

1.	https://bookboon.com/en/java-programming-language-ebooks

MOOC

1.	https://www.coursera.org/courses?query=java

COURSE TITLE	COMPUTER NETWORKS			CREDITS	3
COURSE CODE	CAA3704	COURSE CATEGORY	PC	L-T-P-C-S	3-0-0-3-1
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-4				

CO	COURSE OUTCOMES	PO
Upon completion of this course, the students will be able to		
1.	Illustrate the flow of information from one node to another node in the networks.	1, 2, 7
2.	Identify the components required to build different types of networks	1, 2, 3, 4
3.	Understand the functionalities needed for data communication into layers	1, 2, 3, 4,
4.	Understand the working principles of various application protocols	3, 4, 5
5.	Acquire knowledge about security issues and services available	3, 4, 5, 7

MODULE 1 - NETWORK FUNDAMENTALS (9L)

Uses of Networks – Categories of Networks -Communication model –Data transmission concepts and terminology – Protocol architecture – Protocols – OSI – TCP/IP – LAN Topology – Transmission media.

MODULE 2 – DATA LINK LAYER (9L)

Data link control - Flow Control – Error Detection and Error Correction - MAC – Ethernet, Token ring, Wireless LAN MAC – Blue Tooth - Bridges.

MODULE – 3 : NETWORK LAYER (9L)

Network layer – Switching concepts – Circuit switching – Packet switching –IP —- Datagrams – IP addresses- IPV6– ICMP – Routing Protocols – Distance Vector – Link State- BGP.

MODULE – 4 TRANSPORT LAYER (9L)

Transport layer –service –Connection establishment – Flow control – Transmission control protocol – Congestion control and avoidance – User datagram protocol. -Transport for Real Time Applications (RTP).

MODULE 5 – APPLICATION LAYER (9L)

Applications - DNS- SMTP – WWW –SNMP- Security –threats and services – Dynamic domain name system – Encapsulation - web security –SSL.

Text Books

1.	1. Larry L. Peterson & Bruce S. Davie, “Computer Networks – A systems Approach”, Fourth Edition, Harcourt Asia / Morgan Kaufmann, 2011.
2	2. William Stallings, “Data and Computer Communications”, Nineth Edition, Prentice Hall, 2011.

Reference Books

1.	Forouzan, “Data Communication and Networking”, Fifth Edition, TMH 2012
2.	Andrew S.Tannenbaum David J. Wetherall, “Computer Networks” Fifth Edition, Pearson Education 2011
3	John Cowley, “Communications and Networking: An Introduction”, Springer Indian Reprint, 2010.

4	Achyut S Godbole,Atul Hahate, " Data Communications and Networks "second edition 2011.
E-Books	
1.	https://www.amazon.in/Computer-Networks-Andrew-S...ebook/dp/B0756WH82M
MOOC	
1.	https://www.class-central.com › Subjects › Computer Science

COURSE TITLE	**SOFTWARE DESIGN PROJECT**			**CREDITS**	**2**
COURSE CODE	**CAA3781**	**COURSE CATEGORY**	**PC**	**L-T-P-C-S**	**0-0-6-1-0**
CIA	**80%**			**ESE**	**20%**
LEARNING LEVEL	**BTL-4**				

CO	**OUTCOMES**	**PO**
Upon completion of this course, the students will be able to		
1	Identify a real time work helpful for the society	1,2,3,5,6,9,10,11,12
2	Develop a solution for the problem	1,2,3,5,6,9,10,11,12
3	Develop an application by using relevant computer application concepts	1,2,3,5,6,9,10,11,12

MINI PROJECT

Design and develop practical solutions to real life problems related to needs of the society . The theoretical knowledge gained from the subject should be applied to develop effective solutions to various computing problems. Submit a complete report of the project work carried out.

Semester II

COURSE TITLE	WEB DESIGN AND DEVELOPMENT			CREDITS	3
COURSE CODE	CAA3705	COURSE CATEGORY	PC	L-T-P-C-S	3-0-0-3-1
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-4				

CO	COURSE OUTCOMES	PO
Upon completion of this course, the students will be able to		
1.	Explore markup languages features and create interactive web pages using them.	1, 2, 3
2.	Design Client side validation using scripting languages	1, 2, 3, 5
3.	Acquire knowledge about Open source JavaScript libraries	1, 2, 3
4.	Design front end web page and connect to the back end databases.	3, 5, 7
5.	Explore the features of various platforms and frameworks used in web applications development.	3, 4, 5, 7

MODULE 1 – UI DESIGN (9L)

Markup Language (HTML): Introduction to HTML and HTML5 - Formatting and Fonts - CommentingCode – Anchors –
Backgrounds – Images – Hyperlinks – Lists – Tables – Frames - HTML Forms.

MODULE 2 – CASCADING STYLE SHEET (CSS) (9L)

Introduction to Cascading Style Sheet (CSS): The need for CSS, Introduction to CSS – Basic syntax and structure - Inline Styles – Embedding Style Sheets - Linking External Style Sheets – Backgrounds - Manipulating text - Margins and Padding - Positioning using CSS.

MODULE – 3 : INTRODUCTION TO JAVASCRIPT (9L)

Introduction - Core features - Data types and Variables - Operators, Expressions, and Statements - Functions - Objects - Array, Date and Math related Objects - Document Object Model - Event Handling - Controlling Windows & Frames and Documents - Form handling and validations.

MODULE – 4 ADVANCED JAVASCRIPT (9L)

Browser Management and Media Management – Classes – Constructors – Object-Oriented Techniques in JavaScript – Object constructor and Prototyping - Sub classes and Super classes – JSON - jQuery : Selectors, DOM Manipulation with jQuery, AJAX with jQuery, and AJAX - Other Javascript Frameworks.

MODULE 5 – PHP (9L)

Introduction - How web works - Setting up the environment (LAMP server) - Programming basics - Print/echo - Variables and constants – Strings and Arrays – Operators, Control structures and looping structures – JS: Angular JS – Node JS - Functions – Reading Data in Web Pages - ZEND Framework - Embedding PHP within HTML - Establishing connectivity with MySQL database.

TEXT BOOKS

1.	Deitel, Deitel and Neito, “Internet and World Wide Web – How to program”, Pearson Education Asia, 5th Edition, 2011.
2	Achyut S Godbole and Atul Kahate, “Web Technologies”, Second Edition, Tata McGraw Hill,

	2012.
REFERENCE BOOKS	
1.	Thomas A Powell, Fritz Schneider, “JavaScript: The Complete Reference”, Third Edition, Tata McGraw Hill, 2013.
2.	Thomas A Powell, Fritz Schneider, “JavaScript: The Complete Reference”, Third Edition, Tata McGraw Hill, 2013.
3.	Steven Holzner, “The Complete Reference - PHP”, Tata McGraw Hill, 2008 5. James Lee, Brent Ware , “Open Source Development with LAMP: Using Linux, Apache, MySQL, Perl, and PHP” Addison Wesley, Pearson 2009.
E-BOOKS	
1.	https://www.tutorialspoint.com/web_developers_guide/web_pdf_version.htm
2.	http://home.hit.no/~hansha/documents/software/software_development/topics/resources/programming/exercises/Introduction%20to%20Web%20Programming.pdf
3.	http://www.intuc.net/office_meeting_report/Ajax_SampleChapter.pdf
MOOC	
1.	https://www.coursera.org/courses?query=web%20design%20for%20everybody%20(basics%2 0of%20web%20development%20and%20coding)

COURSE TITLE	**DATA WAREHOUSING AND DATA MINING**			**CREDITS**	**4**
COURSE CODE	**CAA3706**	**COURSE CATEGORY**	**PC**	**L-T-P-C-S**	**2-0-2--4-1**
CIA	**50%**			**ESE**	**50%**
LEARNING LEVEL	**BTL-2**				

CO	**COURSE OUTCOMES**	**PO**
Upon completion of this course, the students will be able to		
1.	Understand about Data Mining fundamentals	1, 2
2.	Understand the Data warehouse implementation	1, 2, 3, 4, 7
3.	Understand the mining rules	3, 5, 7
4.	Implement Classification algorithms	1, 2, 3, 5, 7
5.	Implement Clustering algorithms.	1, 2, 3, 5, 7

MODULE 1 – Introduction	**(12L)**
Fundamentals of data mining, Data Mining Functionalities, Classification of Data Mining systems, Data Mining Task Primitives, Integration of a Data Mining System with a Database or a Data Warehouse System, Major issues in Data Mining. Data Preprocessing: Need for Preprocessing the Data, Data Cleaning, Data Integration and Transformation, Data Reduction, Discretization and Concept Hierarchy Generation.	

MODULE 2 – Data warehousing	(12L)
Data Warehouse and OLAP Technology for Data Mining: Data Warehouse, Multidimensional Data Model, Data Warehouse Architecture, Data Warehouse Implementation, Further Development of Data Cube Technology, From Data Warehousing to Data Mining Data Cube Computation and Data Generalization: Efficient Methods for Data Cube Computation, Further Development of Data Cube and OLAP Technology, Attribute-Oriented Induction.	
MODULE – 3 : Association Mining	**(12L)**
Mining Frequent Patterns, Associations and Correlations: Basic Concepts, Efficient and Scalable Frequent Item set Mining Methods, Mining various kinds of Association Rules, From Association Mining to Correlation Analysis, Constraint-Based Association Mining	
MODULE – 4 : Classification	**(12L)**
Classification and Prediction: Issues Regarding Classification and Prediction, Classification by Decision Tree Induction, Bayesian Classification, Rule-Based Classification, Classification by Back propagation, Support Vector Machines, Prediction, Accuracy and Error measures, Evaluating the accuracy of a Classifier or a Predictor, Ensemble Methods.	
MODULE -5 Clustering Methods	**(12L)**
Cluster Analysis Introduction :Types of Data in Cluster Analysis, A Categorization of Major Clustering Methods, Partitioning Methods, Hierarchical Methods, Density-Based Methods, Grid-Based Methods, Model-Based Clustering Methods, Clustering High-Dimensional Data, Constraint-Based Cluster Analysis, Outlier Analysis.	
LAB / MINI PROJECT/FIELD WORK	
TEXT BOOKS	
1.	Data Mining – Concepts and Techniques - Jiawei Han & Micheline Kamber, Morgan Kaufmann Publishers, Elsevier,3rd Edition, 2012.
2.	Introduction to Data Mining – Pang-Ning Tan, Michael Steinbach and Vipin Kumar, Pearson education.2006.
REFERENCE BOOKS	
1.	Data Mining Techniques – Arun K Pujari,2nd edition, Universities Press
2.	Chen, Hsinchun, Roger HL Chiang, and Veda C. Storey. "Business intelligence and analytics: from big data to big impact." *MIS quarterly* (2012)
E BOOKS	
1.	http://charuaggarwal.net/Data-Mining.pdf
MOOC	
1.	https://nptel.ac.in/courses/106105174/

COURSE TITLE	MACHINE LEARNING			CREDITS	4
COURSE CODE	CAA3707	COURSE CATEGORY	PC	L-T-P-C-S	3-1-0-4-1
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-4 – ANALYZE				

CO	COURSE OUTCOMES	PO
Upon completion of this course, the students will be able to		
1	Apply multilayer perceptron using simple machine learning techniques.	1,2,3,5
2	Implement decision trees and statistics models	1,2,3,4,5
3	Compute data analysis for machine learning	1,2,3,4,5,7
4	Implement Genetic algorithm and reinforced learning for appropriate applications	1,2,3,4,7
5	Implement the Python programming for machine learning.	1,2,3,5

MODULE 1: Introduction (12L)

Learning - Types of machine learning - Supervised learning - The brain and the neurons, Linear Discriminants -Perceptron - Linear Separability -Linear Regression - Multilayer perceptron - Examples of using MLP - Back propagation of error.

Suggested Activities: Design a Multilayer Perceptron for Rain Forecasting system

Suggested sources: Enrico C, Simon W, Jay R, Machine Learning Techniques for Space Weather, Elsevier, 2018

MODULE 2: Classification Algorithms (12L)

Decision trees - Constructing decision trees - Classification of regression trees - Regression example - Probability and Learning: Turning data into probabilities - Some basic statistics - Gaussian mixture models - Nearest Neighbor methods.

Suggested Activities: Explore the Regression Examples in Machine Learning

Suggested sources: Norman Matlof, “Statistical Regression and Classification: From Linear Models to Machine Learning”, CRC Press, 2017.

MODULE 3: Analysis (12L)

The k-Means algorithm - Vector Quantization’s - Linear Discriminant Analysis - Principal component analysis - Factor Analysis - Independent component analysis - Locally Linear embedding – Isomap - Least squares optimization - Simulated annealing.

Suggested Activities: Simulated annealing / Modelling on any data science application.

Suggested sources: L.M. Rasdi, Simulated Annealing Algorithm for Deep Learning, Procedia Computer Science, Volume: 72, 2015.

MODULE 4: Optimization Techniques (12L)

The Genetic algorithm - Genetic operators - Genetic programming - Combining sampling with genetic programming - Markov Decision Process - Markov Chain Monte Carlo methods: sampling - Monte carlo - Proposal distribution.

Suggested Activities: Design an Encryption algorithm using Genetic algorithm

Suggested sources: Harsh Bhasin, Application of Genetic Algorithms in Machine learning,, International Journal of Computer Science and Information Technologies, Vol. 2 (5), 2011.

MODULE 5: Python for Machine Learning (12L)

Baysean Networks - Markov Random moFields - Hidden Markov Models -Tracking methods. Python: Installation - Python for MATLAB AND R users - Code Basics - Using NumPy and MatPolitB.

Suggested Activities: Design a simple application using NumPy and MatPolitB.

Suggested sources: Rakshith Vasudev, Introduction to Numpy -1 : An absolute beginners guide to Machine Learning and Data science., 2017.

TEXT BOOKS	
1	Kevin P. Murphy, “Machine Learning – A probabilistic Perspective”, MIT Pres, 2016.
2	Randal S, “Python Machine Learning, PACKT Publishing, 2016.
REFERENCE BOOKS	
1	Ethem Alpaydin, "Machine Learning: The New AI”, MIT Press, 2016.
2	Shai Shalev-Shwartz, Shai Ben-David, "Understanding Machine Learning: From Theory to Algorithms”, Cambridge University Press, 2014.
3	Sebastian Raschka, “Python Machine Learning”, Packt Publishing Ltd, 2015.
E BOOKS	
1	http://www.cs.huji.ac.il/~shais/UnderstandingMachineLearning/index.html
2	http://www.mlyearning.org/
MOOC	
1	https://www.coursera.org/learn/practical-machine-learning
2	https://www.coursera.org/learn/python-machine-learning

COURSE TITLE	SOFTWARE ENGINEERING			CREDITS	3
COURSE CODE	CAA3708	COURSE CATEGORY	PC	L-T-P-C-S	3-0-2-3-1
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-4				

CO	COURSE OUTCOMES	PO
Upon completion of this course, the students will be able to		
1.	Understand the Software Engineering Process and Evaluation techniques.	1, 2, 4
2.	Plan and manage requirements at each stage of the software develop the models.	1, 2, 3, 4
3.	Learn about the design activity planning and behaviour management principles.	1, 2, 3, 4, 6, 8
4.	Develop skills to manage the various strategic phases involving testing techniques and various test methods.	3, 4, 5, 8
5.	Deliver successful software projects that support organization‘s strategic and agile process improvement.	3, 4, 5, 8, 9, 11

MODULE 1 – SOFTWARE PROCESS (9L)

Process models – Defining a Framework Activity, Process Patterns, Process Assessment and improvement - Prescriptive Process Models – Specialized process models- The Unified Process – Personal and Team Process models – Process Technology – Product and Process.

MODULE 2 – UNDERSTANDING REQUIREMENTS (9L)

Requirements Engineering – Eliciting requirements – Developing use cases – Building the requirement model – Negotiating and validating requirements –Scenario Based Modelling – UML Models – Data modelling concepts – Class based modelling – Patterns for Requirement modelling.

MODULE – 3 – DESIGN CONCEPTS (9L)

Design Process – Design concepts – Software Architecture – Architectural Styles and Design – Assessing alternative architectural designs – architectural Mapping Using Data Flow – Component Level Design – Designing Class Based Components – Component level design for Web Apps – Designing Traditional Components – User Interface Design.

MODULE – 4 SOFTWARE TESTING STRATEGIES (9L)

Strategic approach for software testing – Test Strategies for Conventional Software – OO Software and testing – Validation testing – System Testing – The art of debugging – Internal and External views of testing – Basis path testing – White Box testing – Control structure testing – Block Box Testing – Model based Testing – Patterns for Software Testing.

MODULE 5 – AGILE METHODOLOGY AND SOFTWARE PROCESS IMPROVEMENT (9L)

What is agility – Agility and cost of change – What is an agile process – Extreme programming – Agile Process models – Tool set for the agile process – Software Process Improvement – SPI Process – CMMI – People of CMM – SPI Framework – SPI Return on Investment – SPI Trends.

TEXT BOOKS:

1. Roger S Pressman, “Software Engineering ”, Tata McGraw- Hill Publications, 7th Edition 2014.

REFERENCE BOOKS

1.	I. Sommerville, “Software Engineering” , 5th Edition : Addision Wesley, 2011.
2.	F. Fleeger, “Software Engineering”, Pearson, 2011.
3	K.K. Agarwal and Yogesh Singh, “Software Engineering”, New Age International Publisher, 3rd Edition, Reprint 2012.
4	Pankaj Jalote, “An Integrated Approach to Software Engineering”, 3rd Edition, Narosa Publishing House, 2005.
EBOOKS	
1	http://www.ddegjust.ac.in/studymaterial/mca-3/ms-12.pdf
MOOC	
1	https://www.coursera.org/courses?query=software%20engineering

COURSE TITLE	**SOFTWARE DEVELOPMENT LAB**			**CREDITS**	**1**
COURSE CODE	**CAA3782**	**COURSE CATEGORY**	**PC**	**L-T-P-C-S**	**0-0-2-1-0**
CIA	**80%**			**ESE**	**20%**
LEARNING LEVEL	**BTL-4**				

CO	**OUTCOMES**	**PO**
Upon completion of this course, the students will be able to		
1	Create use case diagrams	1, 2, 3
2	Develop skills to manage SDLC	1, 2, 8
3	Create software estimation	1, 2,4, 8
4	Analyse different software testing methods	3, 4, 5

LAB EXERCISES

1. Practicing the different types of case tools such as Rational Rose / other Open Source for all the phases of Software development life cycle.
2. Data modeling
3. Source code generators
4. Apply the following to typical application problems:
   a. Project Planning
   b. Software Requirement Analysis
   c. Software Design
   d. Data Modeling & Implementation
5. Software Estimation
6. Software Testing

A possible set of applications may be the following:

a. Library System
b. Student Marks Analyzing System
c. Text Editor.
d. Create a dictionary.
e. Telephone directory.
f. Inventory System.

COURSE TITLE	WEB PROGRAMMING LABORATORY			CREDITS	1
COURSE CODE	CAA3783	COURSE CATEGORY	PC	L-T-P-C-S	0-0-2-1-0
CIA	80%			ESE	20%
LEARNING LEVEL	BTL-4				

CO	OUTCOMES	PO
	Upon completion of this course, the students will be able to	
1.	Create simple three tier applications	1, 2, 4
2.	Create Simple web pages using HTML & DHTML	1, 2, 4,5
3.	Create client side validation scripts.	1, 2, 4
4.	Create Web pages using HTML5 tags	3, 5
5.	Create Web applications using Java Servlets	3, 5, 7

LAB EXERCISES

1. Create a web page with the following.
   a. Cascading style sheets.
   b. Embedded style sheets.
   c. Inline style sheets. Use our college information for the web pages.
2. Create a HTML form for reading Name, Age, Gender, Address, Payment Options, Phone number, Email address, preferred user name, various Area of Interest etc from the user.
3. Create a simple webpage using HTML frames to Include Images and Videos.
4. Write a Java Script program to validate the data including the email id entered by the user in the above form are in correct format. Display error message if input is not in correct format. Call the script when the page is submitted.
5. Create web page to display the rule and regulations for University Examination. Include the content from a separate file. Also display the information like last modified time size of file. Use SSI concept for the above task.
6. Simple application to demonstrate Servlets.
7. Design a simple online test web page in PHP
8. Write a PHP program to implement a session based counter.
9. Write a PHP program to input previous reading and present reading and prepare an electricity bill.

Semester III

COURSE TITLE	SOFTWARE TESTING AND QUALITY ASSURANCE			CREDITS	4
Course Code	CAA3709	Course Category	PC	L-T-P-C-S	2-0-2-4-1
CIA	60%			ESE	40%
LEARNING LEVEL	BTL-4				

CO	COURSE OUTCOMES	PO
	Upon completion of this course, the students will be able to	
1.	Understand the basic knowledge of errors and faults in software testing project	1, 2, 3,4, 5
2.	Identify the software testing fundamentals and Engineering methods.	3, 4, 5, 7
3.	Identify the various software testing types and methods.	5, 7, 8
4.	Write various test cases and skills to communicate with their teammates to conduct their practice-oriented software testing projects	3, 4, 5, 7
5.	Use automation testing and quality assurance tools for their testing projects.	1, 2, 3, 5, 7

MODULE 1 – INTRODUCTION	**12L**
Software Errors-Bugs- Cause of Bugs- Cost of Bugs- Software Tester- Software Development Process-Testing Axioms-Software testing Terms and Definitions	
MODULE 2 – TESTING FUNDAMENTALS	**12L**
Examining the Specifications-Black Box and White Box Testing-Static and Dynamic Testing-Low Level Specification Test Technique-Static and Dynamic Black Box testing-Equivalence Partitioning-Data Testing- State Testing-Other Black Box Testing Techniques-Static White Box Testing-Dynamic White Box Testing-Testing the Pieces-Data Coverage- Code Coverage.	
MODULE – 3 : TESTING TYPES AND APPROACHES	**12L**
Configuration Testing-Compatibility Testing-Foreign Language Testing-Usability Testing-Testing the Documentation-Website Testing	
MODULE -4 : TEST MANAGEMENT AND DOCUMENTATION	**12L**
The Goal of Test Planning-Test Planning topics-Writing and Tracking Test Cases-Goal of Test Case Planning –Test Case Planning Overview- Test Case Tracking- Reporting what you find- A bug life cycle-Bug Tracking Systems-Metrics in Testing-Common Project Level Metrics.	
MODULE – 5 AUTOMATION TESTING AND QUALITY ASSURANCE	**12L**
Benefits of Automation and Tools-Test Tools-Software Test Automation-Random Testing-Software Quality Assurance-Testing and Quality Assurance in workspace-Test management and organizational structures- Capability Maturity Model-ISO 9000	
LAB / MINI PROJECT/FIELD WORK	
TEXT BOOKS	
1.	Ron Patton, Software Testing, Sams, 2006
2	Jeff Tian, Software Quality Engineering: Testing, Quality Assurance, and Quantifiable Improvement, John Wiley & Sons, 2005

REFERENCE BOOKS	
1.	Kshirasagar Naik, Priyadarshi Tripathy, Software Testing and Quality Assurance: Theory and Practice, John Wiley & Sons, 2011
2.	Ilene Burnstein, —Practical Software Testing, Springer International Edition, 2003.
3.	Edward Kit Software Testing in the Real World – Improving the Process, Pearson Education, 1995.
4.	Boris Beizer, Software Testing Techniques – 2nd Edition, Van Nostrand Reinhold, New York, 1990.
5.	Aditya P. Mathur, —Foundations of Software Testing _ Fundamental Algorithms and Techniques, Dorling Kindersley (India) Pvt. Ltd., Pearson Education, 2008
E BOOKS	
1.	"Practical Software Testing – Manual Testing Help eBook Version 2.0"
MOOC	
1.	Introduction to software testing, Kevin Wendt, Coursera

COURSE TITLE	DevOps			CREDITS	4
COURSE CODE	CAA3710	COURSE CATEGORY	PC	L-T-P-C-S	2-0-2-4-1
CIA	60%			ESE	40%
LEARNING LEVEL	BTL-2				

CO	COURSE OUTCOMES	PO
Upon completion of this course, the students will be able to		
1.	Identify the difference between Agile and Devops.	1, 2, 3,4, 5
2.	Practice of GitHub	3, 4, 5, 7
3.	Illustrate various Building tools	3, 4, 5, 7
4.	Analyse various Testing tools	3, 4, 5, 7
5	Illustrate various Configuration management tools	3, 4, 5, 7

MODULE 1 – INTRODUCTION (12L)

Learning Objectives – DevOps Overview – Relationship between Agile and DevOps – DevOps Tool chain - Challenges with the traditional approach – Addressing challenges through DevOps – DevOps approach to the challenges – Overview of the DevOp tools – workflow of DevOps – JIRA

Suggested sources : https://www.atlassian.com/software/jira/guides/use-cases/what-is-jira-used-for

MODULE 2 – VERSION CONTROL SYSTEMS (12L)

Overview of version control systems – role of version control systems – Types of control systems and their supporting tools – Overview of Git – Overview of Source code and Version Control hosts – Deploy the files to GitHub.

Suggested Source : https://github.com/features

MODULE – 3 CONTINUOUS INTEGRATION AND BUILDING TOOL (12L)

Importance of continuous Integration – Overview and Features of Jenkins – Set up Jenkins – Overview and Features of Maven - Setup Maven- Overview and Features of TeamCity – Setup TeamCity –

Suggested Source :
1. https://www.jenkins.io/doc/
2. http://maven.apache.org/

3.https://www.tutorialspoint.com/continuous_integration/continuous_integration_creating_project_teamcity.htm

MODULE – 4 : SOFTWARE AND AUTOMATION TESTING FRAMEWORKS (12L)

Software Testing overview – Testing levels Approach and Automation Tools – Test driven development approaches and JUnit5 – Behavior driven development approach with cucumber.

Suggested Source : https://howtodoinjava.com/junit-5-tutorial/
https://junit.org/junit5/docs/current/user-guide/

MODULE – 5 CONFIGURATION MANAGEMENT TOOLS (12L)

Overview of configuration management tools – overview of puppet – puppet configuration – overview of Chef – Chef configuration - overview of Ansible – Ansible configuration- containerization and docker.

Suggested Source :
1. https://www.tutorialspoint.com/puppet/index.htm
2. https://puppet.com/blog/how-get-started-puppet-beginners-guide/
3. https://www.tutorialspoint.com/chef/index.htm
4. https://docs.chef.io/chef_overview/
5. https://www.tutorialspoint.com/ansible/index.htm
6. https://docs.ansible.com/ansible/latest/user_guide/intro_getting_started.html
7. https://docker-curriculum.com/

LAB / MINI PROJECT/FIELD WORK

TEXT BOOKS

1.	Jez Humble and David Farley, Continuous Delivery: Reliable Software Releases through Build, Test, and Deployment Automation, Pearson Education, Inc.2011
2	Jennifer Davis, Katherine Daniels, Effective DevOps: Building a Culture of Collaboration, Affinity, and Tooling at Scale, O'Reilly, 2016

REFERENCE BOOKS

1.	Gene Kim, Jez Humble, Patrick Debois, and John Willis, THE DEVOPS HANDBOOK How to Create World-Class Agility, Reliability, & Security in Technology Organizations, IT Revolution Press, 2016.

EBOOK

1	https://devops.com/downloads/7-best-devops-ebooks-2018-collection/
2	http://images.itrevolution.com/documents/DevOps_Handbook_Intro_Part1_Part2.pdf
3	https://www.microfocus.com/media/ebook/Software-DevOps-eBook.pdf

MOOC

1	https://www.coursera.org/learn/uva-darden-continous-delivery-devops

COURSE TITLE	Presentation Skills and Academic Writing			CREDITS	1
Course Code	ELA4383	Course Category	BS	L-T-P-S	TCH
CIA	80%			ESE	20%
LEARNING LEVEL	BTL5,6				

	COURSE OUTCOMES	PO
1.	To develop effective communication skills with emphasis on Listening, Speaking, Reading and Writing.	5, 6, 10
2.	To excel in presentation skills and enhance competence in scholarly communications	9,10
3.	To develop the syntax and improve the writing skills	2,4, 10
4.	to enhance the core features of the scientific writing style in projects, technical reports	6,7,10, 12
5.	To understand the techniques to participate and excel in group discussions	10, 12

Prerequisites : Plus Two English-Intermediate Level

Suggested Activities: Lab Practical Sessions (Presentation Skills, GD's, Online modules activities)

Examination: Practical examination (oral technical presentations and online examination)

Practical Record submission: Self Analysis report, Technical Presentation, Report Writing and GD

MODULE 1 Listening & Reading Skills

Importance of Listening skills-Listening to native speakers,-Listening and sequencing of sentences – Listening and answering the questions - Cloze Exercises – Vocabulary building –Reading Skills & Comprehension

MODULE 2 Presentation Skills

Presentation techniques-tips of how to be an effective presenter-Preparation — how to deal with fear and anxiety 2) Voice, pace and gesture — how to speak, stand and move. 3) Getting live feedback — how to interact with the audience – Practical session on technical presentations

MODULE 3 Group Discussion

Group Discussion - Strategies in GD – Team work – Body Language – Mock GD – Video Samples

MODULE 4 Professional Communication & Etiquette

Professional Speaking – Conversation Practice- Role Plays - Use of appropriate and ethical language in professional contexts- Netiquette-–Email etiquette- Mobile phone etiquette

MODULE 5 Academic writing

Techniques of effective writing – Elements of Writing- Writing Clear and Effective Sentences and Paragraphs, Developing Unity, Coherence - Writing Technical Reports - Project Writing,

TEXT BOOKS

1.	Soft Skills & Employability Skills by Sabina Pillai and Agna Fernandez published by Cambridge University Press 2018.

REFERENCE BOOKS

1.	Professional Speaking Skills by Aruna Koneru, Oxford Publications, 2015
2.	Soft Skills for everyone by Jeff Butterfield Cengage Learning 2011

E BOOKS

1.	https://www.britishcouncil.in/english/courses-business
2.	http://www.bbc.co.uk/learningenglish/english/features/pronunciation

3.	http://www.bbc.co.uk/learningenglish/english/
4.	http://www.antimoon.com/how/pronunc-soundsipa.htm
5.	http://www.cambridgeenglish.org/learning-english/free-resources/write-and-improve/
6.	Oneshopenglish.com
7.	Breakingnews.com
MOOC	
1.	https://www.mooc-list.com/tags/english
2.	https://www.mooc-list.com/course/adventures-writing-stanford-online
3.	http://www.cambridgeenglish.org/learning-english/free-resources/mooc/

ELECTIVES

COURSE TITLE	Software Process and Metrics			CREDITS	3
Course Code	CAD3721	Course Category	PE	L-T-P-C-S	3-0-0-3-0
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
Upon completion of this course, the students will be able to		
1.	Define and relate the fundamentals of Measurement theory to software process metrics.	**1, 2**
2.	Analyse a real time scenario and apply the appropriate metric tool to assess the quality of software	**2,3,4**
3.	Recognise the different quality management models and the metrics associated with them	**1, 2**
4.	Associate testing and apply in-process metrics appropriately	**2,5**
5.	Apply complexity metrics on simple real time software projects	**2,5,10,11**

MODULE 1 – FUNDAMENTALS OF MEASUREMENT THEORY **9L**

Software Quality, TQM, Measurement, levels of measurement, Reliability and validity, Measurement errors, criteria for causality, Software development process models, Process maturity framework and quality standards.

MODULE 2 – SOFTWARE QUALITY METRICS & QUALITY TOOLS **9L**

Product quality metrics, In-process quality metrics, Metrics for software maintenance, Real time examples, Application of Seven basic tools in software quality development

MODULE – 3 : DEFECT REMOVAL EFFECTIVENESS AND QUALITY MANAGEMENT MODELS **9L**

Defect removal effectiveness, Quality planning, Phase based defect removal model, cost effectiveness, Defect removal, process maturity level, Rayleigh model framework, Code integration pattern, Reliability growth models, In-process metrics and reports, orthogonal defect classification

MODULE – 4 IN-PROCESS METRICS AND AVAILABILITY METRICS **9L**

In-process metrics for software testing, In-process metrics and quality management, Metrics for acceptance, Measurements of system availability, In-process metrics for outage and availability.

MODULE 5 – COMPLEXITY METRICS AND ADVANCED METRICS **9L**

Lines of code, Halstead's science, Cyclomatic complexity, Syntactic constructs, Structure metrics, Design and complexity metrics, Productivity metrics, Quality and quality management metrics

TEXT BOOKS

1. Stephen H. Kan, "Metrics and Models in Software Quality Engineering", Second edition, Pearson education India, 2015, ISBN-13: 978-9332551602

REFERENCE BOOKS

1. Norman Fenton and James Bieman , "Software Metrics: A Rigorous and Practical Approach, CRC Press,Third Edition, 2014, ISBN-13: 978-1439838228
2. Anirban Basu, "Software Quality Assurance, Testing and Metrics", PHI Learning, 2015, ISBN-13: 978-8120350687

3.	David Tuffley, “Software Metrics : A How to Guide for Project Staff”, Createspace Independent Publishing Platform, 2011, ISBN-13: 9781461127659
EBOOK	
1	https://www.springer.com/la/book/9783824465187
2	https://kupdf.net/download/crcpresssoftwaremetricspdf_5a43fbd6e2b6f55c6ad538da_pdf
MOOC	
1	https://www.coursera.org/learn/reviews-and-metrics-for-software-improvements

COURSE TITLE	**. Net/ ASP.Net Programming**			**CREDITS**	3
Course Code	**CAD3722**	**Course Category**	**PE**	**L-T-P-C-S**	3-0-0-3-0
CIA	**50%**			**ESE**	**50%**
LEARNING LEVEL	**BTL-4**				

CO	**COURSE OUTCOMES**	**PO**
Upon completion of this course, the students will be able to		
1.	Understand the basic of .net	**1, 2**
2.	Use of understand object oriented concepts.	**1, 2**
3.	To understand and implement data sources.	**1, 2**
4.	Able to connect with backend	**1,2**
5.	Use of understand reports	**1,2**

MODULE 1 – INTRODUCTION OF .NET	**9L**
Introduction/Overview of .Net - .Net Framework [Advanced] - Visual C#.Net Language - Introduction to Windows Forms - Event Handling – User Defined Controls – Tool-Box **Exercise : Implement a Simple Calculator in windows .net - C# Environment**	
MODULE 2 – Object Oriented Concepts	**9L**
Object Oriented Concepts (Basic) - Object Oriented Concepts (Advanced) - Object Oriented Concepts (Implementation Oriented) - Error Handling - ADO.Net Components – Programming with ADO.Net **Exercise: Using ADO.Net Connectivity execute a simple login and redirect to another Window using windows C#.**	
MODULE 3 – Introduction to ASP.Net	**9L**
Introduction to Web Forms – Controls : Web, Server, Client, Navigation – Master Page – Advance ASP .Net : AJAX – WPF – Web Services – Silverlight – Java Script Validations **Exercise: Create a web based form using Silverlight’s and Ajax Control with a Login page Validation.**	
MODULE 4 – Introduction to MSSQL Server 2016	**9L**

Introduction to Databases - Structured Query Language - Stored Procedures – Functions – Triggers – Rollback **Exercise: Create a database and establish a connectivity with Windows based C# application for signup Form**
MODULE 5 - SAP Crystal Reports XI & Project Work – Windows Application 9L
Introduction : Crystal Reports XI – Database Connectivity – Connectivity between C# Forms and SAP Crystal Reports Exercise : Implementation of windows based C# Application with Database and Crystal Report XI [Project to be Executed]
TEXT BOOKS
1. Imar Spaanjaars , Beginning ASP.NET 4: in C# and VB (Wrox Programmer to Programmer) ISBN: 978-0-470-50221-1
REFERENCE BOOKS
1.

E-BOOKS	
1.	http://www.mentorum.nl/docs/Traindocs/dotNET_Tutorial_for_Beginners.pdf https://www.tutorialspoint.com/asp.net/asp.net_tutorial.pdf http://www.csc.villanova.edu/~mdamian/ASPNET/1-startTutorial.pdf

COURSE TITLE	**Web Analytics**			**CREDITS**	**3**
Course Code	**CAB3721**	**Course Category**	**PE**	**L-T-P-C-S**	**3-0-0-3-0**
CIA	**50%**			**ESE**	**50%**
LEARNING LEVEL	**BTL-4**				

CO	**COURSE OUTCOMES**	**PO**
	At the end of the course the students will be able to	
1.	Understand the concepts of web analytics	1,2
2.	Apply the web analytics basics	1, 4,
3.	Understand and apply the strategies of web analytics	1,2,3
4.	Apply the concepts of web analytics into various websites like Google, social media and mobile	1,2,3
5.	Apply Mobile Analytics basics	1,2,3,4
MODULE 1 – INTRODUCTION		**(9L)**

Introduction: Web analytics, History, current landscape and challenges, Five 'Whs' of web analytics **Data Collection:** Clickstream data, web logs, web beacons, packet sniffing, java Script tags, **Types of data:** outcomes data, Research data, competitive data
MODULE2:FUNDAMENTALS OF WEB ANALYTICS AND DATA ANALYSIS (9L
Capturing data, Type and size of data, Innovation, Integration, selection of web analytic tool, web analytic dashboard, types of metrics to track the data, Key Performance Indicators (KPI), identification of audience, site referrers and most important pages. Qualitative Analysis: Essence of Customer Centricity, Lab usability testing, Heuristic evaluations, Site Visits and surveys
MODULE 3 – WEB ANALYTICS CONCEPTS AND STRATEGIES (9L)
URI, URL parameters, Cookies, Geotargeting, Geotagging, mobile phone tracking, Focus on Customer Centricity, Solve for business questions, follow the 10/90 rule, Hire great web analytics, Identify optimal organizational structure and responsibilities, Centralization, Decentralization, centralized decentralization
MODULE 4 – GOOGLE WEB ANALYTICS (9L)
Installing Google web analytics, setting up: Account, property, view, users profiles and filters, tracking traffic channels, E-commerce tracking, On-site search tracking, On-page interacting tracking, Analyzing data through Google Analytics. Google analytics vs Crazy Egg. **Case study**: Make website and apply web analytics strategies.
MODULE 5 - SOCIAL MEDIA AND MOBILE ANALYTICS (9L)
Social Media Analytics : Measure, Analyze, Interpret, The conundrum of social media, Targeting your customers, Online social intelligence, Friends, Fans and Followers, Influence, score carding, monitoring tools and technologies. **Mobile Analytics:** Mobile Market places, Triangulating mobiles, mobile sites, mobile apps, mining mobiles

TEXT BOOKS	
1.	Avinash Kaushik, Web Analytics 2.0: The Art of Online Accountability and Science of Customer Wiley Publishing, 2010
2.	Justin Cutroni, Google Analytics: Understanding Visitor Behavior 1st Edition, 2010
REFERENCE BOOKS	
1.	Marshall Sponder, Social Media Analytics: Effective Tools for Building, Interpreting, and Using Metrics, Mc Graw Hill, 2012
2	Jesus Mena, Mobile Analytics, Meaghan Mena, 2012
E-BOOK	
1.	file:///C:/Users/Chitradevi/Downloads/Web-Analytics-Course-eMarketing-Institute-Ebook-2018-Edition.pdf
MOOC	
1.	https://www.coursera.org/courses?query=web%20analytics

COURSE TITLE	Big Data Analytics			CREDITS	3
COURSE CODE	CAB3722	COURSE CATEGORY	PE	L-T-P-C-S	3-0-0-3-0
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-4				

CO	COURSE OUTCOMES	PO
Upon completion of this course, the students will be able to		
1.	Describe big data and use cases from selected business domains	**1, 2**
2.	Explain NoSQL big data management	**1, 2**
3.	Install, configure, and run Hadoop and HDFS	**1, 2**
4.	Perform map-reduce analytics using Hadoop.	**3**
5.	Use Hadoop related tools such as HBase, Cassandra, and Hive for big data analytics	**3**

MODULE 1 – INTRODUCTION (9L)

What is big data, why big data, convergence of key trends, unstructured data, industry examples of big data, web analytics, big data and marketing, fraud and big data, risk and big data, credit risk management, big data and algorithmic trading, big data and healthcare, big data in medicine, advertising and big data, big data technologies, introduction to Hadoop, open source technologies, cloud and big data, mobile business intelligence, Crowd sourcing analytics, inter and trans firewall analytics

MODULE 2 – NoSQL (9L)

Introduction to NoSQL, aggregate data models, aggregates, key-value and document data models, relationships, graph databases, schemaless databases, materialized views, distribution models, sharding, master-slave replication, peer-peer replication, sharding and replication, consistency, relaxing consistency, version stamps, map-reduce, partitioning and combining, composing map-reduce calculations.

MODULE – 3 : Hadoop (9L)

Data format, analyzing data with Hadoop, scaling out, Hadoop streaming, Hadoop pipes, design of Hadoop distributed file system (HDFS), HDFS concepts, Java interface, data flow, Hadoop I/O, data integrity, compression, serialization, Avro, file-based data structures

MODULE – 4: MapReduce (9L)

MapReduce workflows, unit tests with MRUnit, test data and local tests, anatomy of MapReduce job run, classic Map-reduce, YARN, failures in classic Map-reduce and YARN, job scheduling, shuffle and sort, task execution, MapReduce types, input formats, output formats.

MODULE 5 – : Big data Analysis (9L)

Hbase, data model and implementations, Hbase clients, Hbase examples, praxis. Cassandra, Cassandra data model, Cassandra examples, Cassandra clients, Hadoop integration, Hive, data types and file formats, HiveQL data definition, HiveQL data manipulation, HiveQL queries.

TEXT BOOKS

1	Big Data Analytics, Introduction to Hadoop, Spark, and Machine-Learning, Raj kamal, Preeti Saxena, McGraw Hill, 2018.

2	Big Data, Big Analytics: Emerging Business intelligence and Analytic trends for Today's Business, Michael Minelli, Michelle Chambers, and AmbigaDhiraj, John Wiley & Sons, 2013
REFERENCE BOOKS	
1.	Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013
2.	Hadoop: The Definitive Guide, Tom White ,Third Edition, O'Reilley, 2012.
3	Hadoop Operations, Eric Sammer, O'Reilley, 2012.
4	Programming Hive, E. Capriolo, D. Wampler, and J. Rutherglen, O'Reilley, 2012.
5	HBase: The Definitive Guide, Lars George, O'Reilley, 2011.
6	Cassandra: The Definitive Guide, Eben Hewitt, O'Reilley, 2010.
7	Programming Pig, Alan Gates, O'Reilley, 2011.
E-BOOKS	
1.	http://index-of.co.uk/Big-Data-Technologies/Data%20Science%20and%20Big%20Data%20Analytics.pdf
MOOC	
1.	https://www.coursera.org/specializations/big-data

COURSE TITLE	**CLOUD ARCHITECTURE**			**CREDITS**	**3**
COURSE CODE	**CAC3721**	**COURSE CATEGORY**	**PE**	**L-T-P-C-S**	3-0-0-3-0
CIA	**50%**			**ESE**	**50%**
LEARNING LEVEL	**BTL-4**				

CO	**COURSE OUTCOMES**	**PO**
Upon completion of this course, the students will be able to		
1.	Understand the cloud computing fundamentals.	**1, 2**
2.	Understand cloud applications.	**1, 2,3,4**
3.	Understand the management of cloud services.	**1, 2,3,4**
4.	Understand application development.	**1,2,3,4**
5.	Develop and implement cloud IT model.	**1,2,3,5**

MODULE 1 – CLOUD COMPUTING FUNDAMENTALS (8L)

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 -

Cloud computing Architecture – Cloud containers	
MODULE 2 – CLOUD APPLICATIONS	**(6L)**
Web Service Architecture – Web Service APIs – Web service Authentication - Web service authentication methods - Technologies and the processes required when deploying web services; Deploying a web service from inside and outside a cloud architecture, advantages and disadvantages	
MODULE 3 – MANAGEMENT OF CLOUD SERVICES	**(12L)**
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).	
MODULE 4 – APPLICATION DEVELOPMENT	**(10L)**
Programming Models for Cloud Computing - Software Development in Cloud - Service creation environments to develop cloud based applications. Development environments for service development; Amazon, Azure, Google App.	
MODULE 5 - CLOUD IT MODEL	**(9L)**
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)..	
TEXT BOOKS	
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], 2009.
REFERENCE BOOKS	
1.	Dimitris N. Chorafas, “Cloud Computing Strategies” CRC Press; 1 edition [ISBN: 1439834539] 2010.
E-BOOKS	
1.	https://www.springer.com/us/book/9789811328282
MOOC	
1.	https://www.mooc-list.com/course/cloud-computing-security-edx

COURSE TITLE	VIRTUALIZATION TECHNIQUES			CREDITS	3
COURSE CODE	CAC3722	COURSE CATEGORY	PE	L-T-P-C-S	3-0-0-3-0
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-4				

CO	COURSE OUTCOMES	PO
Upon completion of this course, the students will be able to		
1.	Understand the cloud and its techniques.	1,2
2.	Illustrate the different cloud delivery and deployment models	1,5
3.	Understand cloud file systems and its related technologies	1,2,5
4.	Illustrate Cloud File Systems and cloud workloads	1,5
5.	Understand the usage of various cloud tools	1,3,5

MODULE 1 – CLOUD COMPUTING FUNDAMENTALS (8L)

Introduction to Cloud Computing, Definition, Characteristics, Components, Cloud provider, SLA, Virtualization, Types of virtualization, Server virtualization, storage virtualization, Network Virtualization and application virtualization, Importance of virtualization in cloud, Study of hypervisors.

MODULE 2 – CLOUD IMPLEMENTATIONS (6L)

Cloud deployment models: Public cloud, Private cloud and Hybrid cloud- Organizational scenarios of clouds, , Deploy application over cloud-Workload distribution, Resource pooling, dynamic scalability, elasticity, Service load balancing, Cloud bursting, Service Technology: SOAP and REST Web services, AJAX and mashups Web services, Service Middleware.

MODULE 3 – MANAGEMENT OF CLOUD SERVICES (12L)

Overview, Infrastructure as a Service (IaaS) Cloud Delivery Model, Platform as a Service (PaaS) Cloud Delivery Model, Software as a Service (SaaS) Cloud Delivery Model- Administering & Monitoring cloud services, benefits and limitations- Cloud computing platforms: Infrastructure as a service: Amazon EC2, Platform as a Service: Google App Engine, Microsoft Azure, Utility Computing, Elastic Computing.

MODULE 4 – CLOUD FILE SYSTEMS AND WORKLOADS (10L)

GFS and HDFS, BigTable, HBase and Dynamo, Map-Reduce: The Map-Reduce model- Cloud Workload Overview, Workloads most suitable for Cloud, Workloads not suitable for Cloud

MODULE 5 - CLOUD TOOLS AND FUTURE CLOUD (9L)

Tools and Technologies for Cloud, Cloud Computing Platform: Eucalyptus, Nimbus, OpenNebula, Cloud Mashups, Cloud Tools: VMWare, Eucalyptus, CloudSim, Implementing real time application over cloud platform, QOS Issues in Cloud, data migration, streaming in Cloud, Concepts in Mobile Cloud Computing, Fog Computing, Dockers, Green Cloud, Cloud Computing, IoT Cloud.

TEXT BOOKS

1.	Thomas Erl, Zaigham Mahmood, and Ricardo Puttini,"Cloud Computing Concepts, Technology & Architecture", Prentice Hall, 2013.
2.	A.Srinivasan,J.Suresh,"Cloud Computing, A practical approach for learning and implementation",Pearson,2014.

REFERENCE BOOKS	
1.	Cloud Computing: Principles and Paradigms, Editors: Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Wiley,2011
E-BOOKS	
1.	https://www.manning.com/books/exploring-cloud-computing
MOOC	
1.	https://www.mooc-list.com/course/cloud-computing-concepts-part-2-coursera

COURSE TITLE	**AGILE METHODOLOGY**			**CREDITS**	3
Course Code	**CAD3723**	**Course Category**	**PE**	**L-T-P-C-S**	3-0-0-3-0
CIA	**50%**			**ESE**	**50%**
LEARNING LEVEL	**BTL-4**				

CO	**COURSE OUTCOMES**	**PO**
Upon completion of this course, the students will be able to		
1.	Develop techniques and tools for improving team collaboration and software quality	1,2,3
2.	Perform iterative software development processes: how to plan them, how to execute them	2,3,4
3.	Perform Software process improvement as an ongoing task for development teams	1,2,4,5
4.	Show how agile approaches can be scaled up to the enterprise level.	1,2,4,5
5.	Articulate the agile principles, practices, and roles of Scrum	1,2,3,

MODULE 1 –INTRODUCTION TO AGILE METHODOLOGY

Theories for Agile Management , Classification and methods-Traditional Model vs. Agile Model, Overview of Scrum, ,Agile Project Management – Agile Team Interactions – Ethics in Agile Teams Agility in **Design**, Testing – Agile Documentations – Agile Drivers, Capabilities and Values

MODULE 2 – AGILE TESTING

The Agile lifecycle and its impact on testing, Test-Driven Development (TDD), Unit framework and tools for TDD, Testing user stories - acceptance tests and scenarios, Planning and managing testing cycle, Exploratory testing, Risk based testing, Regression tests, Test Automation, Tools to support the Agile tester

MODULE 3 – AGILITY AND KNOWLEDGE MANAGEMENT

Agile Information Systems – Institutional Knowledge Evolution Cycle – Development, Acquisition, Refinement, Distribution, Deployment , Leveraging – KM in Software Engineering – Managing Software Knowledge – Challenges of Migrating to Agile Methodologies – Agile Knowledge Sharing – Role of Story-Cards – Story-Card Maturity Model (SMM).

MODULE 4 – AGILE DEVELOPMENT AND REQUIREMENTS

Impact of Agile Processes in RE–Current Agile Practices – Variance – Overview of RE Using Agile – Managing Unstable Requirements – Requirements Elicitation – Agile Requirements Abstraction Model – Requirements Management in Agile Environment, Agile Requirements Prioritization – Agile Requirements Modeling and Generation – Concurrency in Agile Requirements Generation.

MODULE 5 – AGILE INDUSTRY TRENDS	
Market scenario and adoption of Agile, Agile ALM, Roles in an Agile project, Agile applicability, Agile in Distributed teams, Business benefits, Challenges in Agile, Risks and Mitigation, Agile projects on Cloud, Balancing Agility with Discipline, Agile rapid development technologies	
TEXT BOOKS	
1.	David J. Anderson and Eli Schragenheim, —Agile Management for Software Engineering: Applying the Theory of Constraints for Business Results, Prentice Hall, 2003.
2.	Hazza and Dubinsky, —Agile Software Engineering, Series: Undergraduate Topics in Computer Science, Springer, 2009.
REFERENCE BOOKS	
1.	Craig Larman, —Agile and Iterative Development: A Managers Guide, Addison-Wesley, 2004.
E-BOOKS	
1.	The Agile Guide to Agile Development-by infopro Learning
MOOC	
1.	Agile Development specialization-Coursera

COURSE TITLE	**INTERNET OF THINGS**			**CREDITS**	3
Course Code	**CAD3724**	**Course Category**	**PE**	**L-T-P-C-S**	3-0-0-3-0
CIA	**50%**			**ESE**	**50%**
LEARNING LEVEL	**BTL-4**				

CO	**COURSE OUTCOMES**	**PO**
Upon completion of this course, the students will be able to		
1.	Recognize characteristics and physical design of IoT.	1,2,12
2.	Identify suitable connectivity protocols.	1,2,12
3.	Discuss IoT sensor networks at various use cases.	2,3,12
4.	Demonstrate the functionalities of Arduino and Machine to Machine communication	2,3,4
5.	Develop IoT enabled hardware setup to execute domain specific IoT application.	1,2,3,4,5,12

MODULE 1 – FUNDAMENTALS OF IOT	**9L**
Introduction: Definition & Characteristics of IoT – Physical Design of IoT –Logical Design of IoT- IoT Enabling Technologies –IoT Applications – IoT Challenges- Sensors- Actuators.	
MODULE 2 – IOT PROTOCOLS	**9L**
6LoWPAN, MQTT, CoAP, XMAP, AMQP, IEEE 802.15.4, RFID, Zigbee, Bluetooth, NFC.	
MODULE 3 – SENSOR NETWORKS	**9L**

Wireless Sensor Networks: Application of WSN in IoT, WSN in Agriculture, wireless multimedia sensor networks, WSN challenges	
MODULE 4 – ARDUINO INTERFACING& MACHINE-TO-MACHINE COMMUNICATION 9L	
Arduino Programming: Features, Types, Board details, IDE. Setup, Function Libraries, Examples programs. M2M : Introduction- Difference between IoT and M2M- Software Defined Networking (SDN)	
MODULE 5 – DOMAIN SPECIFIC IOTS 9L	
Smart Lighting- Intrusion Detection - Weather monitoring- Indoor Air Quality Monitoring- Smart Irrigation.	
TEXT BOOKS	
1.	Arshdeep Bahga, Vijay Madisetti, "Internet of Things – A hands-on approach", Universities Press, 2015
2	Olivier Hersent, David Boswarthick, Omar Elloumi, "The Internet of Things – Key applications and Protocols", Wiley, 2012
REFERENCE BOOKS	
1.	https://drive.google.com/file/d/1VMQdwIjDw-an9KA3Jwiw16hB1mhJ411m/view
E-BOOKS	
1.	https://drive.google.com/file/d/1VMQdwIjDw-an9KA3Jwiw16hB1mhJ411m/view
MOOC	
1.	https://nptel.ac.in/courses/106105166/

COURSE TITLE	**R Programming**			**CREDITS**	**3**
Course Code	**CAB3723**	**Course Category**	**PE**	**L-T-P-C-S**	**3-0-0-3-0**
CIA	**50%**			**ESE**	**50%**
LEARNING LEVEL	**BTL-2**				

	COURSE OUTCOMES	**PO**
	At the end of the course the students will be able to	
1.	Learn about R fundamentals	1,5
2.	Know to implement R operator and R functions	1,5
3.	Learn to work with Lists and Frames	1,5
4.	Be able to work with Tables	1,5
5.	Know about basic Programming Structures in R	1,5

MODULE 1 – Introduction. (9L)

R – OVERVIEW-Evolution of R -Features of R 2. R – ENVIRONMENT SETUP -Local Environment Setup-BASIC SYNTAX -R Command Prompt - Script File - R – DATA TYPES -Vectors -Lists -Matrices -Arrays-Factors -Data Frames - R – VARIABLES -Variable Assignment -Data Type of a Variable Finding Variables -Deleting Variables
MODULE 2 – OPERATORS (9L)
R – OPERATORS -Types of Operators -Arithmetic Operators-Relational Operators-Logical Operators Assignment Operators-Miscellaneous Operators - R – DECISION MAKING -R - If Statement-R – If...Else Statement -The if...else if...else -Switch Statement - R – LOOP-R - Repeat LoopR - While Loop -R – For Loop -Loop Control Statements-R-Break statement -R – Next Statement . R – FUNCTION -Function Definition -Function Components -Built-in Function –User-defined Function -Calling a Function -Lazy Evaluation of Function –User-defined Function -Calling a Function
MODULE – 3 LISTS AND FRAMES (9L)
LISTS- LISTS -Creating a -Naming List Elements - Accessing List Elements -Manipulating List Elements -Merging Lists Converting List to Vector - R – MATRICES -Accessing Elements of a Matrix - Matrix Computation-ARRAYS -Naming Columns and Rows -Accessing Array Elements-Manipulating Array Elements - R – FACTORS -Factors in Data Frame -Changing the Order of Levels -Generating Factor Levels 16. R – DATA FRAMES -Extract Data from Data Frame
MODULE – 4 : FACTORS AND TABLES (9L)
Common Functions Used with Factors- The tapply() Function - The split() Function -The by() Function - Working with Tables- Matrix/Array-Like Operations on Tables- Extended Example: Extracting a Subtable- Extended Example: Finding the Largest Cells in a Table- Table-Related Functions- The aggregate() Function- The cut() Function
MODULE – 5 R PROGRAMMING STRUCTURES (9L)
Control Statements- Loops- Looping Over Nonvector Sets - if-else- Arithmetic and Boolean Operators and Values- Default Values for Argument- Return Values- Deciding Whether to Explicitly Call return() - Returning Complex Object- Functions Are Objects..
LAB / MINI PROJECT/FIELD WORK

TEXT BOOKS	
1.	Matloff, Norman. The art of R programming: A tour of statistical software design. No Starch Press, 2011.
REFERENCE BOOKS	
1.	Crawley, Michael J. The R book. John Wiley & Sons, 2012.
E BOOKS	
1.	https://www.cs.upc.edu/
MOOC	
1.	R Programming Coursera –Johns Hopkins university

COURSE TITLE	Big Data Framework			CREDITS	3
COURSE CODE	CAB3724	COURSE CATEGORY	PE	L-T-P-C-S	3-0-0-3-0
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-4				

CO	COURSE OUTCOMES	PO
Upon completion of this course, the students will be able to		
1.	Understand the basics of Big Data.	1, 2
2.	Implement the basic operations in Scala.	1, 2
3.	Develop custom Scala functions as per the requirement.	1, 2
4.	Understand the basics of RDDs.	3
5.	Illustrate spark runtime environment.	3

MODULE 1 – INTRODUCTION TO BIG DATA (9L)

What is big data?, the four V's of big data, Distributed File System, functional programming vs object oriented programming, advantages of scala, spark streaming

MODULE 2 –BASIC OPERATIONS IN SCALA (9L)

Variables and functions in scala, looping in scala, importance of vals, sets and maps, understanding classes and singleton objects, rich wrappers, objects and variables, for expression, try expression, match expression

MODULE – 3 :FUNCTIONS AND CONTROL STATEMENTS IN SCALA (9L)

Nested functions-first class functions-placeholder syntax-closures-repeated parameters-tail recursion-reducing code duplication-currying-by name parameters-writing new control structures.

MODULE – 4: RDD BASCIS (9L)

RDD basics, creating RDD,RDD transformations, passing functions to spark, aggregation on pair RDD, grouping data on pair RDD, joins on pair RDD, sorting data in pair RDD, data partitioning in RDDs

MODULE 5 – SAVING DATA, COMPRESSIONS, SPARK RUNTIME ARCHITECTURE (9L)

Saving data into various formats like text, json, csv, sequence files, object files etc. compression, spark sql, accumulators, fault tolerance, broadcast variables, Numeric RDD operations, spark runtime architecture, cluster managers

TEXT BOOKS

1.	Martin Odersky, Lex Spoon, Bill Venners, Programming in Scala: A comprehensive Step-by-Step Scala Programming Guide , Third Edition, Artima, 2016
2	Holden Karau, Andy Konwinski, Patrick Wendell, Matei Zaharia, Learning Spark , Orelly, 2016

REFERENCE BOOKS

1.	Sandy Ryza, Uri Laserson, Sean Owen and Josh Wills , Advanced Analytics with Spark , Orelly, 2017
2.	Cay Hortsmann, Scala for the Impatient, Pearson Education, 2012.

E-BOOKS

1.	http://www.lirmm.fr/~ducour/Doc-objets/scalabook.pdf
MOOC	
1.	https://www.coursera.org/specializations/big-data

COURSE TITLE	**CLOUD APPLICATION DEVELOPMENT**			**CREDITS**	**3**
COURSE CODE	**CAC3723**	**COURSE CATEGORY**	**PE**	**L-T-P-C-S**	**3-0-0-3-0**
CIA	**50%**			**ESE**	**50%**
LEARNING LEVEL	**BTL-4**				

CO	**COURSE OUTCOMES**	**PO**
Upon completion of this course, the students will be able to		
1.	Understand the applications of cloud computing	1,2
2.	Design a cloud infrastructure	1,2,3
3.	Deploy cloud framework	1,2,3
4.	Build an application using LAMP	1,2,3,5
5.	Develop an application in Cloud	1,2,3,5

MODULE 1 – CLOUD BASED APPLICATIONS	**(9L)**
Introduction, Contrast traditional software development and development for the cloud. Public v private cloud apps. Understanding Cloud ecosystems – what is SaaS/PaaS, popular APIs, mobile.	
MODULE 2 – DESIGNING CODE FOR THE CLOUD	**(9L)**
Class and Method design to make best use of the Cloud infrastructure; Web Browsers and the Presentation Layer: Understanding Web browsers attributes and differences. Building blocks of the presentation layer: HTML, HTML5, CSS, Silverlight, and Flash.	
MODULE – 3 : WEB DEVELOPMENT TECHNIQUES AND FRAMEWORKS	**(9L)**
Building Ajax controls, introduction to Javascript using JQuery, working with JSON, XML, REST. Application developement Frameworks e.g. Ruby on Rails , .Net, Java API's or JSF; Deployment Environments – Platform As A Service (PAAS) ,Amazon, vmForce, Google App Engine, Azure, Heroku, AppForce	
MODULE – 4 : USE CASE 1	**(9L)**
Building an Application using the LAMP stack: Setting up a LAMP development environment. Building a simple Web app demonstrating an understanding of the presentation layer and connectivity with persistance.	
MODULE 5 – USE CASE 2	**(9L)**
Developing and Deploying an Application in the Cloud : Building on the experience of the first project students will study the design, development, testing and deployment of an application in the cloud using a development framework and deployment platform.	
REFERENCE BOOKS	
1.	Guo Ning Liu, Qiang Guo Tong, Harm Sluiman, Alex Amies, "Developing and Hosting

	Applications on the Cloud", IBM Press (2012)
2.	Chris Hay, Brian Prince, Azure in Action [ISBN: 978-1935182481],2018
3.	Henry Li, Introducing Windows Azure [ISBN: 978-1-4302-2469-3]
4.	Eugenio Pace, Dominic Betts, Scott Densmore, Ryan Dunn, Masashi Narumoto, Matias Woloski, Developing Applications for the Cloud on the Microsoft Windows Azure Platform [ISBN: 9780735656062]
5.	Eugene Ciurana, Developing with Google App Engine [ISBN: 978-1430218319]
6.	Charles Severance, Using Google App Engine [ISBN: 978-0596800697]

COURSE TITLE	**CLOUD ANALYTICS**			**CREDITS**	**3**
COURSE CODE	**CAC3724**	**COURSE CATEGORY**	**PE**	**L-T-P-C-S**	**3-0-0-3-0**
CIA	**50%**			**ESE**	**50%**
LEARNING LEVEL	**BTL-4**				

CO	**COURSE OUTCOMES**	**PO**
Upon completion of this course, the students will be able to		
1.	Understand the basics of cloud analytics	1,2
2.	Understand the architecture of cloud computing	1,2,3,5
3.	Understand the Google Cloud Platform	1,2,3,5
4.	Understand the Cloud data processing and visualizing	1,2,3,5
5.	Understand the Google cloud functions	1,2,3,4,5

MODULE 1 – INTRODUCTION (9L)

Cloud computing- Major benefits of cloud computing - Cloud computing deployment models - Types of cloud computing services - PaaS, IaaS, and SaaS - Emerging cloud technologies and services - Different ways to secure the cloud - Risks and challenges with the cloud - major cloud vendors in the world.

MODULE 2 – DESIGN AND BUSINESS CONSIDERATIONS (9L)

Cloud computing and migration - Parameters before adopting cloud strategy - Prerequisites for an application to be moved to the cloud - Infrastructure contemplation for cloud - Available deployment models while moving to cloud - Cloud migration checklist - Architecture of a cloud computing ecosystem - Applications of cloud computing - Preparing a plan for moving to cloud computing - Technologies utilized by cloud computing .

MODULE – 3 : UNDERSTANDING OF GCP (9L)

Different services offered by typical cloud vendors - Understanding cloud categories -Cloud Compute - Cloud Storage and databases - Cloud storage - Cloud Networking -Cloud Big Data - Cloud Data transfer - Cloud AI - Cloud IoT Core beta- cloud Management tools - cloud Developer tools.

MODULE – 4 DATA PROCESSING AND VISUALIZING (9L)

Cloud Dataflow - Cloud Pub/Sub - Cloud storage - Cloud storage classes - Cloud SQL - Cloud BigTable - Cloud Spanner - Cloud Datastore - Persistent disks. Google BigQuery - Cloud Dataproc - Google Cloud Datalab - Data Studio - Google Compute Engine - Advantages of Compute Engine - Types of Compute Engine
MODULE 5 – CASE STUDY (9L)
Google App Engine - Google Container Engine - Google Cloud Functions
TEXT BOOKS
1. Sanket Thodge, "Cloud analytics with Google platform", Packt (2018)
REFERENCE BOOKS
1. John Myers," Analytics in the Cloud", Red Paper, An ENTERPRISE MANAGEMENT ASSOCIATES® (EMATM) End-User Research Report (2015).
2. Brendan Gregg, "Systems Performance: Enterprise and the Cloud", Prentice hall (2014).
EBOOKS
1 https://smartbridge.com/cloud-analytics-ebook-accelerate-future-state/
2 https://azure.microsoft.com/en-in/resources/cloud-analytics-with-microsoft-azure/
MOOC
1 https://cloud.google.com/training

COURSE TITLE	**IMAGE PROCESSING**			**CREDITS**	3
COURSE CODE	**CAD3725**	**Course Category**	**PE**	**L-T-P-C-S**	3-0-0-3-0
CIA	**50%**			**ESE**	**50%**
LEARNING LEVEL	**BTL-4**				

CO	**COURSE OUTCOME**	**PO**
Upon completion of this course, the students will be able to		
1	Explain the digital image fundamentals.	1,2,3
2	Apply image enhancement and filtering techniques	1,2,3
3	Use image restoration and compression techniques	1,2,3
4	Perform Color Image processing and Morphological Image processing	1,4
5	Segment and Represent features of images and perform recognition.	1,3,4

MODULE 1 – DIGITAL IMAGE INTRODUCTION & FUNDAMENTALS (9L)
Introduction to Digital Image Processing (DIP) - Fields that use Digital Image Processing, Fundamental Steps in Digital Image Processing – Components of an Image processing System- Image acquisition – Image formation model- Image sampling and quantization - Relationship between pixels- Basic Intensity Transformation Function, Histogram processing.

MODULE 2 – FILTERING IN SPATIAL AND FREQUENCY DOMAIN (9L)
Spatial Filters for Image enhancement: Fundamentals of Spatial Filtering - Smoothing and Sharpening Spatial Filters - Combining Spatial Enhancement Methods. Filtering in the Frequency Domain: Basics of Filtering in the Frequency Domain - Image Smoothing Using Frequency Domain Filters - Image Sharpening Using Frequency Domain Filters - Selective Filtering - Implementation.
MODULE 3 – IMAGE RESTORATION AND COMPRESSION (9L)
Image Restoration: A model of the Image Degradation/Restoration Process - Noise Models, Restoration in the presence of Noise–Only Spatial Filtering - Periodic Noise Reduction by Frequency Domain Filtering- Linear Position-Invariant Degradations, Estimation of Degradation Function, Inverse Filtering - Weiner Filtering - Constrained Least Squares Filtering. Image Compression: Fundamentals, Compression Methods, Digital Image Watermarking.
MODULE 4 – COLOR IMAGE AND MORPHOLOGICAL IMAGE PROCESSING (9L)
Color Image Processing: Color Fundamentals- Color Models- Pseudo Color Image Processing- Basics of Full–Color Image Processing - Color Transformations - Smoothing and Sharpening- Image Segmentation Based on Color. Morphological Image Processing: Erosion and Dilation, Opening and Closing, The Hit-or-Miss Transformation, Morphological Algorithms, Gray-Scale Morphology.
MODULE 5 – SEGMENTATION, REPRESENTATION AND RECOGNITION (9L)
Image Segmentation: Fundamentals - Point, Line, and Edge Detection- Thresholding - Region-Based Segmentation. Representation and Description: Representation- Boundary and Regional Descriptors - Use of Principal Components for Description. Object Recognition: Patterns and Pattern classes - Recognition based on Decision–Theoretic Methods- Structural methods.
TEXT BOOKS
1.Rafael C. Gonzalez, Richard E.Woods, "Digital Image Processing," Pearson, Fourth Edition, 2017.
REFERENCE BOOKS
1. Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, “Digital Image Processing Using MATLAB”, Third Edition Tata Mc Graw Hill Pvt. Ltd., 2011.
2. Anil Jain K. “Fundamentals of Digital Image Processing”, PHI Learning Pvt. Ltd., 2011.
E-BOOKS
1.Fundamentals of Image Processing : 2. https://www.cis.rit.edu/class/simg361/Notes_11222010.pdf
MOOC
1.Fundamentals of Digital Image and Video Processing: 2.https://www.coursera.org/learn/digital

COURSE TITLE	Blockchain Technology			CREDITS	3
Course Code	CAD3726	Course Category	PE	L-T-P-C-S	3-0-0-3-0
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-4				

CO	COURSE OUTCOMES	PO
Upon completion of this course, the students will be able to		
1.	Recall the concepts of Cryptography and Basics of Blockchain.	1,2,3
2.	Design and implement a Hyperledger	1,3,4
3.	Understand the concept of cryptocurrencies and analyse the different types of Wallets.	1,2,3
4.	Analyse the various cryptocurrencies.	1,3,4
5.	Create smartcontracts in Ethereum.	1,2,3,4

MODULE 1 – Blockchain: Introduction **(9L)**

Introduction to Cryptographic Concepts and cryptocurrencies, Blockchain: Defining the terms, Building blocks of Blockchain Frameworks, Fundamentals of the secure transaction processing protocol, Decentralization of Information, Centralized vs. Distributed Systems, Distributed vs. Decentralized Systems, Benefits of Decentralization, Business and Technology Considerations for choosing blockchain framework, Distributed Consensus, Blockchain Applications.

MODULE 2 – Hyperledger Fabric **(9L)**

Exploring Hyperledger fabric-Building on the foundation of open computing, Hyperledger frameworks, tools and building blocks, Hyperledger Fabric component design, sample transaction, governance in business networks powered by blockchain.

MODULE 3 – Cryptocurrency Fundamentals **(9L)**

History, Commonly Used Concepts, Cryptography, Wallets, Public and Private Keys in Cryptocurrency, Transactions, Hashes, Custodial vs. Non-custodial Wallets, Security Fundamentals, Pros and Cons of Different Types of Wallets, Mining, Block generation, Proof-of-Work, Proof-of-Stake, Other PoW, Brokerages, Exchanges, Custody, Analytics Information

MODULE 4 – Cryptocurrencies **(9L)**

Beginnings of Altcoins, Novel Concepts, Litecoin, Fun and Bad Experiments, Scaling debate, SegWit, Lightning, The Bitcoin Cash Fork, Bitcoin SV, NXT, Counterparty, ZCash, Other Privacy-Focused Cryptocurrencies, Drawbacks of Existing Consensus, Ripple, Stellar, Centralization Concerns.

MODULE 5 – Ethereum
(9L)

Evolution of Bitcoin, Colored Coins, Mastercoin, Omni Layer, Tether, Colored Coins and Tokens, Mastercoin, Understanding Omni Layer. Ethereum-Cryptocurrency, Smart contracts, Use cases, Decentralized autonomous organizations (DAO), Key Organizations in Ethereum Ecosystem. Dapps-Use cases, State of Ethereum Dapps, Challenges developing Dapps, Deploying and Executing Smart Contracts in Ethereum, Ethereum Virtual Machine, Read and Write Contract. Tokens on the Ethereum Platform.

TEXT BOOKS

1. Lorne Lantz, Daniel Cawrey, Mastering Blockchain: Unlocking the power of Cryptocurrencies and Smartcontracts, O'Reilly Media, Inc, 2019.

2.	Nitin Gaur, Luc Desrosiers, Venkatraman Ramakrishna, Petr Novotny, Salman A. Baset, Anthony O'Dowd, Hands-On Blockchain with Hyperledger: Building decentralized applications, Packt Publishing Ltd, 2018.
REFERENCE BOOKS	
1.	Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Princeton University Press,2016.
2.	Mastering Bitcoin: Unlocking Digital Cryptocurrencies, by Andreas Antonopoulos, "O'Reilly Media, Inc.", 2014
3.	Blockchain by Melanie Swa, "."O'Reilly Media,", 2014
4.	"Hyperledger Fabric: A Distributed Operating System for Permissioned Blockchains", research paper in Eurosys 2018: https://arxiv.org/pdf/1801.10228
5.	DR. Gavin Wood, "ETHEREUM: A Secure Decentralized Transaction Ledger,"Yellow paper.2014.
6.	Nicola Atzei, Massimo Bartoletti, and Tiziana Cimoli, A survey of attacks on Ethereum smart contracts, Lecture Notes in Computer Science, March 2017.
E-BOOKS	
1.	https://www.velmie.com/practical-blockchain-study
MOOC	
1.	https://nptel.ac.in/courses/106105184/
2.	https://nptel.ac.in/courses/106104220/
3.	https://www.udemy.com/course/build-your-blockchain-az/

COURSE TITLE	**SEMANTIC WEB**			**CREDITS**	3
COURSE CODE	**CAB3725**	**COURSE CATEGORY**	**PE**	**L-T-P-C-S**	3-0-0-3-0
CIA	**50%**			**ESE**	**50%**
LEARNING LEVEL	**BTL-4**				

CO	**COURSE OUTCOMES**	**PO**
Upon completion of this course, the students will be able to		
1.	Understand Knowledge Representation for the Semantic Web	1,2,3
2.	Design Resource design framework schemas	2,3
3.	Model Ontology using SPARQL and OWL	1,2,3
4.	Illustrate various rules for ontology	1,2,3
5.	Understand the principles of Ontology Engineering	1,2,3,4

MODULE 1 – Semantic Web Vision	**(5L)**
Motivation for the Semantic Web - Design Decisions for the Semantic Web - Basic Technology for the Semantic Web - The Web Architecture of the Semantic Web - Semantic Web Technologies - A Layered Approach	
MODULE 2 – Describing Web Resources: RDF	**(9L)**
Introduction - RDF: Data Model - RDF Syntaxes - RDFS: Adding Semantics - RDF Schema: The Language - RDF and RDF Schema in RDF Schema - An Axiomatic Semantics for RDF and RDF Schema - A Direct Inference System for RDF and RDFS	
MODULE 3 – SPARQL and OWL	**(12L)**
SPARQL Infrastructure - Basics: Matching Patterns - Filters - Constructs for Dealing with an Open World - Organizing Result Sets - Other Forms of SPARQL Queries - Querying Schemas - Adding Information with SPARQL Update - The Follow Your Nose Principle - Requirements for Ontology Languages - Compatibility of OWL2 with RDF/RDFS - The OWL Language - OWL2 Profiles	
MODULE 4 – Logic and Interfaces : Rules	**(10L)**
Introduction - Example of Monotonic Rules: Family Relationships - Monotonic Rules: Syntax - Monotonic Rules: Semantics - OWL2 RL: Description Logic Meets Rules - Rule Interchange Format: RIF - Semantic Web Rules Language (SWRL) - Rules in SPARQL: SPIN - Nonmonotonic Rules: Motivation and Syntax - Example of Nonmonotonic Rules: Brokered Trade - Rule Markup Language (RuleML)	
MODULE 5 - Ontology Engineering	**(9L)**
Constructing Ontologies Manually - Reusing Existing Ontologies - Semiautomatic Ontology Acquisition - Ontology Mapping - Exposing Relational Databases - Semantic Web Application Architecture	
TEXT BOOKS	
1.	Grigoris Antoniou Paul Groth Frank van Harmelen Rinke Hoekstra, "A Semantic Web Primer", Third edition, MIT Press , 2012.
2.	Social Networks and the Semantic Web, Peter Mika, Springer, 2007.
REFERENCE BOOKS	
1.	Semantic Web Technologies, Trends and Research in Ontology Based Systems, J. Davies, R. Studer, P. Warren, John Wiley & Sons.
2	Semantic Web and Semantic Web Services -Liyang Lu Chapman and Hall/CRC Publishers,(Taylor & Francis Group)
3	Information sharing on the semantic Web – Heiner Stuckenschmidt; Frank Van Harmelen, Springer Publications.
4	Programming the Semantic Web, T. Segaran, C. Evans, J. Taylor, O'Reilly, SPD.
E-BOOKS	
1	http://ebooks.iospress.nl/volume/ontology-and-the-semantic-web
MOOC	
1	http://videolectures.net/iswc08_hendler_ittsw/
2	https://www.coursera.org/learn/web-data#syllabus

COURSE TITLE	DATA VISUALIZATION TECHNIQUES AND TOOLS			CREDITS	3
COURSE CODE	CAB3726	COURSE CATEGORY	PE	L-T-P-C-S	3-0-0-3-0
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-4				

CO	COURSE OUTCOMES	PO
Upon completion of this course, the students will be able to		
1.	Understand Data visualization, process and its relationships	1,2,3
2.	Use visualization applications to explore the data	1, 4,
3.	Understand and implement Layout and Mapping process to create effective visualizations	2,3,5
4.	Use story telling principles and interaction methods	2,3, 5
5.	Generate web-based visualizations using D3 and Java script.	2,3, 5

MODULE 1 – INTRODUCTION (9L)

Data Visualization-Introduction, Data to visualization, Data Visualization process - Data Types and Dataset Types, relationships and visualization formats- Basic Principles for data visualization - Spatial Data, Graphic Design, Graphical Integrity

MODULE 2 – DATA-DRIVEN DOCUMENTS(D3) (9L)

HTML, CSS, DOM, javascript and SVG method chaining, D3: introduction, D3 Key Features- Data – Binding Data. Drawing with Data- Setting Attributes, Setting Styles Sketching, Drawing SVGs, Making Bar Charts, Making Scatter plots, Scales, Statistical Graphs, Axes, HD data, filtering, updates, transition and motion, paths, Brushing & Linking. Animation. Aggregation, Tree and Network

MODULE 3 – LAYOUTS AND MAPPING (9L)

Layouts: Pie Layout, Stack Layout, Force Layout Maps. Dot density maps, Geomapping: JSON, Projection, Choropleth Maps, data by country, Symbol Maps, Panning, Cartograms, Zooming, Visual Channels, Value labels, Acquiring and preparing raw Geodata, Exporting.

MODULE 4 – COLOR PROCESSING (9L)

Color: Introduction, Color Processing. Human color perception, Color blindness, opponent process theory Color Spaces. Uniform color spaces, simultaneous contrast, Reflection and absorption, Colors for Visualization- Cognition. Looking vs. Seeing. Image Gist. Gestalt Principles. Visual Attention. Visual Working & Long-Term Memory

MODULE 5 - INTERACTION,TABLES AND PRESENTATIONS (9L)

Types of interaction- feedback/animation, Visual Story Telling. Selection, details and highlighting, zooming, semantic zooming, van Wijk smooth zooming, Views: Reducing attributes, Multiple views Multiform views small multiples, interaction with Multiform and small multiples, Brushing navigation, navigation constraints. Messaging. Effective Presentations.

TEXT BOOKS

1.	Scott Murray "Interactive Data Visualization for the Web" O'Reilly Media, 2nd edition, 2017.

2.	Claus O Wilke, “Fundamentals of Data Visualization : A Primer on Making Informative and Compelling Figures”, Ist Edition, O'Reilly Media, 2019.
REFERENCE BOOKS	
1	Ben Fry "Visualizing Data: Exploring and Explaining Data with the Processing Environment"O'Reilly Media, 2007.
3	Scott Murray "Interactive Data Visualization for the Web" O'Reilly Media, 2013.
4	Edward Tufte "The Visual Display of Quantitative Information" 2001.
5	Colin Ware, “Visual Thinking for Design”, Morgan Kaufman Series, 2008.
6	Alberto Cairo, “The Functional Art: An introduction to information graphics and visualization” , New Riders ,2012.
E-BOOKS	
1	https://github.com/d3/d3
2	https://www.ebooks.com/en-af/book/209748129/learn-d3-js/helder-da-rocha/
3	https://www.netquest.com/en/download-ebook-data-visualization
MOOC	
1	https://www.coursera.org/learn/datavisualization

COURSE TITLE	**CLOUD SECURITY**			**CREDITS**	3
COURSE CODE	**CAC3725**	**COURSE CATEGORY**	**PE**	**L-T-P-C-S**	3-0-0-3-0
CIA	**50%**			**ESE**	**50%**
LEARNING LEVEL	**BTL-4**				

CO	**COURSE OUTCOMES**	**PO**
Upon completion of this course, the students will be able to		
1.	Describe the security architecture of cloud computing and security service models.	1,2,3, 6,7
2.	Analyse the Strategies for Secure Operation the cloud architecture and list the security requirements.	1,2,3, 6,7
3.	Explain different key strategies for data security and apply the best practice models in real time application.	1,2,3, 6,7
4.	Appy the security model for cloud application with network, data and security considerations.	1,2,3,6,7,10,12
5.	Develop an information security framework model for cloud operation	1,2,3, 6,7,10,12

MODULE 1 – INTRODUCTION **(9L)**

Introduction to Cloud Computing and Security: Understanding Cloud Computing - The IT Foundation for Cloud- overview of Security Architecture, Cloud Computing Architecture: Cloud Reference Architecture-Control over Security in the Cloud Model- Cloud Deployment & Services Models- Key Examples

MODULE 2 – SECURING THE CLOUD: ARCHITECTURE (9L)	
Cloud Computing: Security Concerns- Risk Tolerance- Legal and Regulatory Issues, Security Requirements for the Architecture-Security Patterns and Architectural Elements-Cloud Security Architecture-Key Strategies for Secure Operation	
MODULE 3 – DATA SECURITY AND KEY STRATEGIES (9L)	
Overview of Data Security in Cloud Computing-Common Risks with Cloud Data Security- Data Encryption: Applications and Limits- Errors with Data Encryption- Cloud Data Security: Sensitive Data Categorization, Cloud Data Storage-Roach Motel Syndrome, Overall Strategy: Effectively Managing Risk, Overview of Security Controls, Overview of Security Controls, The Limits of Security Controls, Best Practices, Security Monitoring	
MODULE 4 – SECURITY CRITERIA (9L)	
Private Clouds: Motivation and Overview-Security Implications: Shared versus Dedicated Resources, Security Criteria for Ensuring a Private Cloud - Network Considerations- Data Center Considerations- Operational Security Considerations- Regulation, Selecting a CSP: Overview of Assurance, Overview of Risks, Security Criteria- Revisiting Defense-in-depth- Additional Security-relevant Criteria	
MODULE 5 - INFORMATION SECURITY FRAMEWORK AND CLOUD OPERATION (9L)	
Evaluating Cloud Security, Checklists for Evaluating Cloud Security- Foundational Security- Business Considerations- Defense-in-depth- Operational Security, Operating a Cloud: From Architecture to Efficient and Secure Operations, Bootstrapping Secure Operations, Security Operations Activities- Business Continuity, Backup, and Recovery- Managing Changes in Operational Environments - Information Security Management - Vulnerability and Penetration Testing, Security Monitoring and Response	
TEXT BOOKS	
1.	Vic (J.R.) Winkler, “Securing the Cloud: Cloud Computer Security Techniques and Tactics”, Elsevier,2011.
REFERENCE BOOKS	
1.	Sushil Jajodia, Krishna Kant, “Secure Cloud Computing”, Elsevier,2014.
2.	Curtis Franklin, Jr. ,Brian J. S. Chee, “Securing the Cloud: Security Strategies for the Ubiquitous Data Center”, CRC Press, 2019.
EBOOk	
1.	https://solutionsreview.com/cloud-platforms/free-cloud-computing-ebooks/
MOOC	
1	https://www.coursera.org/learn/cloud-computing-security

COURSE TITLE	CLOUD STORAGE AND SECURITY			CREDITS	3
COURSE CODE	CAC3726	COURSE CATEGORY	PE	L-T-P-C-S	3-0-0-3-0
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-4				

CO	COURSE OUTCOMES	PO
Upon completion of this course, the students will be able to		
1.	Understand the basics of data storage, Virtualization and storage services	1,2,
2.	Analyze the infrastructures for Cloud and Virtual Environments	1,2,3
3.	Evaluate the storage network security	2,3,4
4.	Analyze the role technology plays in the design of a storage solution in a cloud architecture	2,3,4,5
5.	Understand server Virtualization and Connectivity	1,2,3

MODULE 1 – INTRODUCTION (9L)

Importance of data storage - Business issues and IT challenges - Business and IT opportunities - opportunity for Cloud, Virtualization and Data Storage Networking - Server and Storage I/O Fundamentals - I/O connectivity and Networking Fundamentals - IT Clouds - Virtualization - Virtualization and Storage Services - Data and Storage Access

MODULE 2 – INFRASTRUCTURE RESOURCE MANAGEMENT (9L)

Managing Data Infrastructures for Cloud and Virtual Environments - Introduction to Infrastructure resource management - understanding and managing IT Resources - Service offerings - Categories - and Technology Alignment - Gaining Situational Awareness and control - From SRM - E2E SRA - Search and eDiscovery - Performance and Capacity Planning - Data Movement and Migration

MODULE 3 – DATA AND STORAGE NETWORK SECURITY (9L)

Being Secure without Being Scared - Eliminating Blind Spots, Gaps in Coverage, or Dark Territories - Security Threat Risks Challenges - Taking Action to resources - Securing Networks- Securing Storage - Virtual Servers, Physical Servers and Desktops - Security Clouds - Disposing of Digital Assets and Technology - Security Checklist

MODULE 4 – STORAGE SERVICES AND SYSTEMS (9L)

Tiered Storage - Storage Reliability - Availability - Serviceability (RAS) - Storage Services and Functionalities - Storage System Architectures - Storage Virtualization and Virtual Storage

MODULE 5 - SERVER VIRTUALIZATION AND CONNECTIVITY (9L)

Virtual Servers - Inside Virtual Servers and Virtual Machines - Virtual Desktop Infrastructures - Cloud and Virtual Servers - Networking Challenges - I/O and Networking Bits and Bytes, Decoding Encoding, I/O and Networking Fundamentals - Virtual Servers - I/O Networking Devices - Converged and Unified Networking - Local Networking - Enabling Distance - Cloud virtualization and management topics - Configuring for reliability, availability and Serviceability (RAS)

TEXT BOOKS

1. Greg Schulz, “Cloud and Virtual Data Storage Networking”, Auerbach Publications [ISBN: 978-1439851739], 2012.
2. EMC, “Information Storage and Management” Wiley; 2 edition [ISBN: 978-0470294215],2012.

REFERENCE BOOKS

1.	Volker Herminghaus, Albrecht Scriba, “Storage Management in Data Centers” Springer; edition [ISBN: 978-3540850229]. 2009
E-BOOKS	
1.	https://solutionsreview.com/cloud-platforms/free-cloud-computing-ebooks/
MOOC	
1.	https://nptel.ac.in/courses/106/105/106105167/#

COURSE TITLE	**NATURAL LANGUAGE PROCESSING**			**CREDITS**	**3**
COURSE CODE	**CAD3727**	**COURSE CATEGORY**	**PE**	**L-T-P-S**	**3- 0- 0- 0**
CIA	**50%**			**ESE**	**50%**
LEARNING LEVEL	**BTL3 – Apply**				

CO	**OUTCOMES**	**PO**
1	Understand the basic concepts related to language processing	
2	Analyze the language morphologically	
3	Illustrate various parsing techniques	
4	Analyze the semantic content of text	
5	Develop any one Natural Language Processing application	

MODULE 1: INTRODUCTION (9L)

Introduction to NLP, NLP and its neighbors, Three Themes in Natural Language Processing, N gram Language Models, Smoothing and discounting, Recurrent Neural Network Language Models, Evaluating language Models, Out-of- Vocabulary words.

MODULE 2: SEQUENCE LABELLING AND APPLICATIONS (9L)

Sequence Labeling as Classification - Sequence labeling as structure prediction - The Viterbi Algorithm - Hidden Markov Models - Discriminative Sequence labeling with features - Neural sequence labeling - Unsupervised sequence labeling - Part -of - Speech Tagging, Morphosyntactic Attributes - Named Entity Recognition - Tokenization - Code Switching - Dialogue Acts

MODULE 3: PARSING METHODS (12L)

Context Free Parsing : Deterministic Bottom-up parsing - Ambiguity - Weighted Context-Free Grammars- Learning weighted Context- Free Grammars - Grammar Refinement

Dependency parsing: Dependency Grammar - Graph-Based Dependency Parsing - Transition- Based Dependency parsing - Applications

MODULE 4: SEMANTIC ANALYSIS (9L)

Logical Semantics: Meaning and Denotation - Logical Representations of Meaning - Semantic Parsing and the Lambda Calculus - Learning semantic parsers

Predicate- Argument Semantics: Semantic Roles - Semantic Role Labeling - Abstract meaning representations

Distributional and Distributed Semantics: The distributional Hypothesis - Design decisions for word

representations - Latent Semantic Analysis - Brown Clusters - Neural Word Embeddings - Evaluating Word Embeddings
MODULE 5: APPLICATIONS (6L)
Sentiment and Opinion Analysis, Question Answering system, Dialog Systems and Chatbots, Word sense disambiguation

TEXT BOOKS	
1	Jacob Eisenstein. Natural Language Processing, MIT Press, 2018.
2	Dan Jurafsky and James H. Martin. Speech and Language Processing (3rd ed. draft), 2019.
E BOOKS	
1	https://www.cs.vassar.edu/~cs366/docs/Manning_Schuetze_StatisticalNLP.pdf
MOOC	
1	https://www.coursera.org/learn/language-processing

COURSE TITLE	**DISTRIBUTED COMPUTING**			**CREDITS**	**3**
COURSE CODE	**CAD3728**	**COURSE CATEGORY**	**PE**	**L-T-P-S**	**3-0-0-0**
CIA	**50%**			**ESE**	**50%**
LEARNING LEVEL	**BTL-3**				

CO	**COURSE OUTCOMES**	**PO**
Upon completion of this course, the students will be able to		
1	Explorer the Distributed Computation Models.	1,2
2	Use the Message passing paradigms in distributed environment.	1,2
3	Design the Mutual Exclusive algorithms.	1,2,3
4	Use Deadlock detection algorithms.	1,2,3
5	Use the Checkpoint and Recovery algorithms	1,2,3,5

MODULE 1 – DISTRIBUTED COMPUTATIONS (9)
Distributed Systems - Global State, Model of Distributed Executions, Models of communication networks, Models of process communications, Logical Time – Framework, Scalar Time, Vector Time, Jard–Jourdan's adaptive technique, Matrix Time, Virtual Time, Physical clock synchronization.
MODULE 2 – MESSAGE ORDERING AND GROUP COMMUNICATION (9)
Message ordering paradigms, Asynchronous execution with synchronous communication, Synchronous program order on an asynchronous system, Group communication, Multicast algorithms, Fault-tolerant group communication.
MODULE 3 – DISTRIBUTED MUTUAL EXCLUSION ALGORITHMS (9)
Lodha and Kshemkalyani's fair mutual exclusion algorithm, Agarwal–El Abbadi quorum-based algorithm, Token-based algorithms, Suzuki–Kasami's broadcast algorithm, Distributed shared memory - Memory consistency models, Shared memory mutual exclusion, Wait-freedom method.

MODULE 4 – DEADLOCK DETECTION IN DISTRIBUTED SYSTEMS	(9)
Models of deadlocks - Knapp's classification of distributed deadlock detection algorithms, Mitchell and Merritt's algorithm for the singlere source model, Chandy–Misra–Haas algorithm for the AND model, Chandy–Misra–Haas algorithm for the OR model, Kshemkalyani–Singhal algorithm for the P-out-of-Q model.	
MODULE 5 – CHECKPOINTING AND ROLLBACK RECOVERY	**(9)**
Failure recovery – Issues, Checkpoint-based recovery - Asynchronous checkpointing and recovery, Synchronous checkpointing algorithm, Log-based rollback recovery, Unreliable failure detectors, An adaptive failure detection protocol.	
TEXT BOOKS	
1	Ajay D. Kshemkalyani, Mukesh Singhal, "Distributed Computing Principles, Algorithms, and Systems", CAMBRIDGE UNIVERSITY PRESS, 2017.
REFERENCE BOOKS	
1	Hagit Attiya, Jennifer Welch, "Distributed Computing, Fundamentals, Simulations and Advanced Topics, Wiley Interscience, 2015.
MOOC	
1	https://www.coursera.org/learn/distributed-programming-in-java

COURSE TITLE	**AUGMENTED AND VIRTUAL REALITY**			**CREDITS**	3
Course Code	**CAD3729**	**Course Category**	**PE**	**L-T-P-C-S**	3-0-0-3-0
CIA	**50%**			**ESE**	**50%**
LEARNING LEVEL	**BTL-4**				

CO	**COURSE OUTCOMES**	**PO**
Upon completion of this course, the students will be able to		
1.	Create VR or AR ideas	2,3
2.	Navigate around 3D world	1,2,3,5
3.	Describe and to build VR Rigs	1,2,3,5,7
4.	Perform raycasting by detecting colliding objects	1,2,3,5
5.	Design applications for different XR platforms	1,2,3,5,7,8,9,11

MODULE 1 – VIRTUAL REALITY AND VIRTUAL ENVIRONMENTS	**9L**
Introduction - Virtual Reality – Types – Virtual Reality Vs Augmented Reality – Applications – 3D interfaces. VR Environment: Unity overview: Interface – Navigation – Game Objects – Hierarchy	
MODULE 2 – BUILDING SIMPLE SCENES	**8L**
Parenting objects – Using Asset store – Importing plug-ins – Moving scaling objects – Creating terrains – Creating game objects – Physics	
MODULE 3 – BUILDING VR RIGS	**9L**

Open VR and Building a VR Rig – Coding movement in VR – Grabbing and Throwing objects	
MODULE 4 – RAYCASTING INTERACTIONS	**10L**
C# Scripting of Events and delegates – Object Manipulations with Raycast – Scripting Animation & sound effects – Creating buttons, dials, levers and wheels – Publishing your application in VR devices	
MODULE 5 – AUGMENTED REALITY	**9L**
AR Foundation – Introduction to Vuforia – Plane Tracking – Spatial Mapping – Occlusion – Design a simple UI in AR – Object interactions	
TEXT BOOKS	
1.	Jesse Glover, Jonathan Linowe, Complete Virtual Reality and Augmented Reality Development with Unity: Leverage the power of Unity and become a pro at creating mixed reality applications, Packt, 2019
2.	Jonathan Linowes, Unity Virtual Reality Projects, Packt, Second Edition, 2018
REFERENCE BOOKS	
1.	Erin Pangilinan, Steve Lukas, Vasanth Mohan, Creating Augmented and Virtual Realities: Theory and Practice for Next Generation Spatial Computing, O'Reilly, 2019
E-BOOKS	
1.	https://www.springer.com/gp/book/9783030062453
MOOC	
1.	https://in.udacity.com/course/introduction-to-virtual-reality--ud1012

COURSE TITLE	**DATA CLASSIFICATION METHODS AND EVALUATION**			**CREDITS**	3
COURSE CODE	**CAB3727**	**COURSE CATEGORY**	**PC**	**L-T-P-C-S**	3-0-0-3-0
CIA	**50%**			**ESE**	**50%**
LEARNING LEVEL	**BTL-4**				

CO	**COURSE OUTCOMES**	**PO**
Upon completion of this course, the students will be able to		
1.	Illustrate the concepts of the Data Classification.	1, 2, 3
2.	Apply Probabilistic Models for Classification	1, 2,3, 4, 5
3.	Apply Rule-Based Classification	1, 2, 3,4, 5
4.	Implement Support Vector Machines and Neural Networks.	3, 4, 5
5.	Visualize the output of Big Data Classification using various tools	3,4, 5,7
MODULE 1 – An Introduction to Data Classification		**(9L)**
Introduction: Common Techniques in Data Classification, Handing Different Data Types, Variations on Data Classification, Feature Selection for Classification: A Review: Introduction, Algorithms for Flat Features, Filter Models, Algorithms for Structured Features, Algorithms for Streaming Features,		

MODULE 2 – Probabilistic Models for Classification (9L)
Introduction, Naive Bayes Classification , Logistic Regression Classification , Probabilistic Graphical Models for Classification, Decision Trees: Theory and Algorithms : Introduction, Top-Down Decision Tree Induction, Case Studies with C4.5 and CART, Scalable Decision Tree Construction , Incremental Decision Tree Induction,
MODULE 3 – Rule-Based Classification (9L)
Introduction, Rule Induction, Classification Based on Association Rule Mining, Applications Instance-Based Learning: A Survey**:** Introduction, Instance-Based Learning Framework, Lazy SVM Classification , Locally Weighted Regression, Lazy Naive Bayes, Lazy Decision Trees, Rule-Based Classification, Radial Basis Function Networks: Leveraging Neural Networks for Instance-Based Learning, Lazy Methods for Diagnostic and Visual Classification
MODULE 4 – Support Vector Machines and Neural Networks (9L)
Support Vector Machines, Neural Networks: A Review, Fundamental Concepts, Single-Layer Neural Network, Kernel Neural Network, Multi-Layer Feed forward Network, Deep Neural Networks, Introduction, Generic Stream Classification Algorithms, Rare Class Stream Classification, Discrete Attributes: The Massive Domain Scenario, Other Data Domains,
MODULE 5 - Big Data Classification (9L)
Introduction , Scale-Up on a Single Machine, Scale-Up by Parallelism, Text Classification: Introduction, Feature Selection for Text Classification, Decision Tree Classifiers, Rule-Based Classifiers, Probabilistic and Naive Bayes Classifiers, Linear Classifiers, Proximity-Based Classifiers, Classification of Linked and Web Data, Meta-Algorithms for Text Classification, Leveraging Additional Training Data, Multimedia Classification, Time Series Data Classification, Discrete Sequence Classification, Collective Classification of Network Data, Active Learning: A Survey

TEXT BOOKS	
1.	Charu C. Aggarwal “Data Classification: Algorithms and Applications”, CRC Press 2015.
REFERENCE BOOKS	
1.	Saman K. Halgamuge, Lipo Wang (Eds.) “Classification and Clustering for Knowledge Discovery” Springer 2015
E-BOOKS	
1.	https://www.semanticscholar.org/paper/Data-Classification%3A-Algorithms-and-Applications-Coggeshall-Klinkenberg/82076c288b729fd87050e27a74760ad5f6e164bf
MOOC	
1.	https://www.coursera.org/specializations/data-mining

COURSE TITLE	**PRINCIPLES DEEP LEARNING**			**CREDITS**	**3**
COURSE CODE	**CAB3728**	**COURSE CATEGORY**	**PC**	**L-T-P-C-S**	**3-0-0-3-0**
CIA	**50%**			**ESE**	**50%**
LEARNING LEVEL	**BTL-3**				

CO	**COURSE OUTCOMES**	**PO**
Upon completion of this course, the students will be able to		
1	Design a simple Neural Networks using Linear Perceptron.	1, 2

2	Design a Convolutional Neural Networks using TensorFlow.	1, 2, 3
3	Explore the Differentiable Neural Computers.	1,2,3,4
4	Explore the Deep Reinforcement Learning.	1, 2, 4, 5,7
5	Design the simple deep learning algorithms for the given applications.	1, 2, 3,5,7

MODULE 1 – THE NEURAL NETWORK	**(9)**
Mechanics of Machine Learning , The Neuron, Linear Perceptron, Linear Neurons and Their Limitations, Sigmoid, Feed-Forward Neural Networks, Fast-Food Problem, The Delta Rule.	
MODULE 2 – CONVOLUTIONAL NEURAL NETWORKS & TENSORFLOW	**(9)**
Neurons in Human Vision, Convolutional Layer, Convolution Networks, TensorFlow, Creating and Manipulating TensorFlow Variables, TensorFlow Operations, Implementing an Autoencoder in Tensor.	
MODULE 3 – MEMORY AUGMENTED NEURAL NETWORKS	**(9)**
Neural Turing Machines, Attention-Based Memory Access, Differentiable Neural Computers (DNC) - Memory Reuse - Temporal Linking - Controller Network.	
MODULE 4 – DEEP REINFORCEMENT LEARNING	**(9)**
Deep Reinforcement Learning - Markov Decision Processes, Policy Versus Value Learning, Pole-Cart with Policy Gradients, Q-Learning	
MODULE 5 – APPLICATIONS	**(9)**
Deep learning for Real time applications, Deep Learning Applications at the Enterprise Scale, Deep Learning Models for Healthcare Applications.	
TEXT BOOKS	
1	Nikhil Buduma, Nicholas Locascio, “Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithms”, O'Reilly Media, 2017.
REFERENCE BOOKS	
1	Ian Goodfellow, YoshuaBengio, Aaron Courville, ”Deep Learning (Adaptive Computation and Machine Learning series”, MIT Press, 2017.
EBOOK	
1	http://www.deeplearningbook.org/
MOOC	
1	https://www.coursera.org/learn/neural-networks-deep-learning
2	https://in.udacity.com/course/deep-learning--ud730

COURSE TITLE	**PRIVATE CLOUD DEPLOYMENT AND MANAGEMENT**			**CREDITS**	3
COURSE CODE	**CAC3727**	**COURSE CATEGORY**	**PE**	**L-T-P-C-S**	1-0-2-3-0
CIA	**40%**			**ESE**	**60%**
LEARNING LEVEL	**BTL-4**				
CO	**COURSE OUTCOMES**				**PO**

Upon completion of this course, the students will be able to

1.	Describe various Cloud Deployment models and differentiate the various models.	1,2,3
2.	Illustrate private cloud deployment key features.	1,2,3
3.	Analyse the organization's requirement and suggest a suitable transformation policy into Private cloud.	1,2,3,5
4.	Explain the Features of Amazon Virtual Private Cloud and IBM SmartCloud Entry	1,2,3,4
5.	Summarize the key characteristics of VMware vCloud and deploy Private cloud using OpenStack.	1,2,3,5

MODULE 1 – CLOUD DEPLOYMENT MODELS (3L+6P)

Cloud Deployment Models – Private Cloud, Public Cloud, Hybrid Cloud and Community Cloud – Cloud Services and Deployment Models – Comparison of Various Cloud Deployment models.

Practical Component:

i. Create and run virtual machines using VMWare Workstation/Virtual Box.
ii. Creation of VM image of base operating system.

MODULE 2 – PRIVATE CLOUD (3L+6P)

Introduction of Private Cloud – Characteristics of Private Cloud - Virtualization vs Private Cloud - Types of Private cloud , On Premise and Outsourced Private Cloud, Benefits and Issues. Limitations of Private Cloud.

Practical Component:

i. Implement Infrastructure as a Service by using OpenStack.

MODULE 3 – TRANSITION INTO PRIVATE CLOUD (3L+6P)

Traditional IT environment, Planning and Strategy , Consolidation, Virtualization, Standardization, Automation, Shared Resources, Private Cloud. Features of Private Cloud : Automated Service Management, Self-service portal, Dashboard, Metering, usage and Accounting, Automated Provisioning.

Practical Component:

i. Implement Software as a Service by using OwnCloud

MODULE 4 – PRIVATE CLOUD CASE STUDIES - I (3L+6P)

Amazon Virtual Private Cloud-Introduction To VPC And AWS Networking, AWS Networking Architecture, Building Your Own Custom VPC.
IBM SmartCloud Entry – IaaS,SaaS and PaaS. Key Capabilities, Solution architecture.

Practical Component:

i. Getting Started: MathWorks Managed Clusters , Get ready-to-use clusters with MATLAB Parallel Cloud.
ii. Access Preconfigured Clusters in Amazon Web Services (AWS), Start customizable clusters managed by MathWorks Cloud Center

MODULE 5 - PRIVATE CLOUD CASE STUDIES - II (3L+6P)

VMware vCloud Director- Components , Architecture Suite, VMware Cloud benefits.
OpenStack – Core Software Projects, Features of OpenStack, Architectural Over view, Components.

Practical Component: i. Visualizing the Density of a Data Cloud with MATLAB. ii. Scale Parallel MATLAB Applications to Amazon EC2 Using Cloud Center	
TEXT BOOKS	
1.	Thomas Erl , Cloud Computing (The Pearson Service Technology Series) 1st Edition, 2014.
2	K.Chandra Sekaran, Essentials of Cloud Computing, 1st Edition, 2015, CRC Press, Taylor & Francis Group.
3	A.Srinivasan,J.Suresh,"Cloud Computing, A practical approach for learning and implementation",Pearson,2014.
REFERENCE BOOKS	
1.	Ray Rafaels, Cloud Computing, 1st Edition, 2018
2.	Rajkumar Buyya, Christian Vecchiola, S Thamarai Selvi, Mastering Cloud Computing, 2013, McGrawHill Edn.
E-BOOKS	
1.	https://www.manning.com/books/exploring-cloud-computing (Paid Version)
MOOC	
1.	https://nptel.ac.in/courses/106105167
2	https://www.coursera.org/specializations/cloud-computing

COURSE TITLE	**BACKUP AND DISASTER RECOVERY**			**CREDITS**	3
COURSE CODE	**CAC3728**	**COURSE CATEGORY**	**PE**	**L-T-P-C-S**	3-0-0-3-0
CIA	**50%**			**ESE**	**50%**
LEARNING LEVEL	**BTL-4**				

CO	**COURSE OUTCOMES**	**PO**
Upon completion of this course, the students will be able to		
1.	Understand the basics of Storage	1,2,7
2.	Identify, analyze and address risks in Business continuity	1,2,7
3.	Understand Backup & Archive and fix restore mode.	1,2, 3, 7
4.	Apply the technologies of Local and Remote Replication	1,2,7
5.	Illustrate Securing storage Infrastructure	1,2,5,7

BASICS OF STORAGE	**(9L)**
Data Center Infrastructure-Redundant Array of Inexpensive Disk: Implementation Methods-Techniques-Levels- Components of an Intelligent storage Systems- Components of Intelligent Storage Systems-Storage Provisioning	
INTRODUCTION TO BUSINESS CONTINUITY	**(9L)**

Information Availability- BC Terminology- BC Planning Life Cycle- Failure Analysis- Business Impact Analysis-BC Technology Solutions- Concept in Practice	
BACKUP AND ARCHIVE (9L)	
Backup purpose- Considerations- Granularity-Recovery considerations- Methods-Backup Architecture- Restore Operations-Backup in NAS environments- Backup Targets-Data Deduplication-Backup in virtualized environment-Data Archive	
LOCAL AND REMOTE REPLICATION (9L)	
Replication Terminology-Replica Consistency-Local replication Technologies-Tracking changes to source ad Replica-Restore and Restart Considerations-Creating multiple replicas-Local replication in virtualized environment- Remote replication modes and technologies-Three site replication	
SECURING STORAGE INFRASTRUCTURE (9L)	
Risk Triad-Security implementations in FC SAN- NAS-Securing storage infrastructure in virtualized and cloud environments	
TEXT BOOKS	
1.	Somasundaram Gnanasundaram, Alok Shrivastava, "Information Storage and management, Storing, Managing, and Protecting Digital Information in Classic, Virtualized, and Cloud Environments", 2nd Edition, John Wiley & Sons, Inc. 2012
2.	Andrew Hiles, The Definitive Handbook of Business Continuity Management, 3rd Edition, 2010, Wiley
REFERENCE BOOKS	
1.	Nitin Vengurlekar, Prasad Bagal, "Database Cloud Storage: The essential guide to Oracle Automatic Storage Management", McGrawHill Education, 2013
E-BOOKS	
1.	https://pages.awscloud.com/rs/112-TZM-766/images/AWS004%20B%26R%20eBook%20R4i.pdf
MOOC	
1.	https://www.udemy.com/course/computercavalry-it-administrator-backups/