MOTHER TERESA WOMEN'S UNIVERSITY

KODAIKANAL – 624 102

M.SC. COMPUTER SCIENCE (INTEGRATED)

(Specialisation in Data Science)

(EFFECTIVE FROM JUNE 2020-2021 ONWARDS)

Mother Teresa Women's University, Kodaikanal
DEPARTMENT OF COMPUTER SCIENCE
Integrated Master of Computer Science with Data Science

ABOUT M.Sc. CS (Data Science):

M.Sc. Computer Science (Data Science) is a five-year Integrated PG programme with the objective of creating Women Computer Professionals with the knowledge and skills on Data Science & Analytics. Data Science is one of the emerging areas in Industry, Research and in Academia. The curriculum supports the students to obtain adequate knowledge in Concepts of data science with hands on experience in relevant domains and tools. The department has a core team of experienced and dedicated faculty with the blend of both teaching and industry experience to facilitate the students to acquire skills in this latest technology which is supplemented by eminent professionals from industry too.

Huge demand in Business sectors, Research and Development for highly qualified students with adequate knowledge in Data Science. Employment opportunities for professionals qualified with M.Sc. Computer Science (with specialization in Data Science) is aplenty in Industries. Through this course, the students are provided with advanced knowledge in the field of Data Science with significant subjects including Data Visualization, Big Data Analytics, Machine Learning Techniques, Artificial Neural Networks, Artificial Intelligence, and Data Modelling. Well-equipped laboratory, ICT enabled classrooms, Library Facility and Wi-Fi connectivity ensures the excellence in curriculum competence. Workshops, Technical Seminars, Hackathon & Ideathon Competitions and Industrial Visits are conducted regularly to enrich and enable the Students' Knowledge and to make them techno savvy.

Programme Outcomes:

1. Identify the need and scope of the Interdisciplinary research
2. Acquire the skills in handling scientific tools for managing and interpreting data
3. Understand the advanced theories and methods to design solutions for complex data science problems
4. Strengthen the analytical and problem solving skill for developing real time applications
5. Understand the importance and use of technology for the sustainability of the environment

6. Gain practical experience in programming tools for data sciences, machine learning and big data tools

Programme Specific Objectives:

PSO1: Ability to identify, analyze and design solutions for data science problems

PSO2: Utilize the data science theories for societal and environmental concerns.

PSO3: Apply the statistical approaches to solve the real life problems in the fields of data science.

PSO4: Ability the knowledge on research-based solutions in identifying, analysing and solving the advanced problems in data science.

REGULATIONS

SCHEME OF EXAMINATION

Internal (Theory)	**-**	**25**
Test	**-**	**15**
Attendance	**-**	**5**
Assignment	**-**	**5**
Total	**-**	**25**

Average of Best Two Internal Scores out of Three Scores

External (Theory) - 75

Passing Minimum: 50%, both in Internal (13 marks) and External Marks (37 marks).

1. Qualification for Admission:

i. Candidate should have passed a Higher Secondary Examination conducted by the Board of Higher Secondary Education, Government of Tamil Nadu/CBCS/ICS within the following subject group Mathematics, Computer Science/Computer Applications.

ii. Candidates sponsored by industries/hospitals/Clinical laboratories may be considered for admission.

2. **Duration of the course:**

The students will undergo the prescribed course of study for a period of not less than five academic years (Ten semesters).

3. **Medium of Instruction**: English

QUESTION PATTERN

1.	**PART A**	**10*1 Marks=10** (Objective Type/Multiple Choice) 2 Question from each Unit	**10**
2.	**PART B**	**5*4 Marks =20** (From each Unit Either or Choice)	**20**
3.	**PART C**	**3*15 Marks =45** (Open Choice) (Any three Question out of 5,onequestion from each unit)	**45**
		Total	**75**

The Internal assessment for Practical : 25

The External assessment for Practical : 75

M.Sc. Computer Science (Integrated – Specialisation in Data Science)

S.No.	SUBJECT CODE	SUBJECT NAME	Hours	Credits	Continuous Internal Assessment	End Sem. Exam	Total
	Semester I						
1.	ITAM11	Part I –Tamil-I	4	3	25	75	100
2.	IENG11	Part II –English-I	4	3	25	75	100
3.	ICST11	Core 1 – Programming in C	5	4	25	75	100
4.	ICSP12	Core 2 - Practical 1 – Programming in C	5	3	25	75	100
5.	ICST13	Professional English	4	4	25	75	100
6.	ICSA11	Allied I – Discrete Mathematics	5	3	25	75	100
7.	IVAE11	Value Education	3	3	25	75	100
			30	**23**			**700**
	Semester II						
8.	ITAM22	Part I –Tamil-II	4	3	25	75	100
9.	IENG22	Part II –English-II	4	3	25	75	100
10.	ICST21	Core 3 – Object Oriented Programming in C++	5	4	25	75	100
11.	ICST22	Core 4 – Data Structures and Algorithms	5	4	25	75	100
12.	ICST23	Professional English	5	4	25	75	100
13.	ICSA22	Allied Practical II – OOPS using C++ Lab	5	3	25	75	100
14.	IEVS21	Environmental Studies	2	2	25	75	100
			30	**23**			**700**
	Semester III						
15.	ITAM33	Part I –Tamil-III	6	3	25	75	100
16.	IENG33	Part II –English-III	6	3	25	75	100
17.	ICST31	Core 5 – Database Management System	4	4	25	75	100
18.	ICST32	Core 6 – Operating System	4	4	25	75	100
19.	ICSP33	Core 7 – Practical 2 - DBMS Lab	3	3	25	75	100
20.	ICSA33	Allied III: Digital Electronics and Computer Organisation	3	3	25	75	100

21.	ICSNE1	Non Major Elective Course I	2	2	25	75	100
22.	ICSS31	Skill Based Studies I – Office Automation	2	2	25	75	100
			30	**24**			**800**
	Semester IV						
23.	ITAM44	Part I –Tamil	5	3	25	75	100
24.	IENG44	Part II –English	5	3	25	75	100
25.	ICST41	Core 8 – Programming in Java	5	4	25	75	100
26.	ICSP42	Core 9 - Practical 3 – Java Programming Lab	5	3	25	75	100
27.	ICSA44	Allied - Numerical Methods	3	3	25	75	100
28.	ICSE41	Elective I	3	2	25	75	100
29.	ICSNE2	Non Major Elective Course II	2	2	25	75	100
30.	ICSS42	Skill Based Studies II – Web Designing with HTML	2	2	25	75	100
			30	**22**			**800**
	Semester – V						
31.	ICST51	Core 10 – Software Engineering	5	4	25	75	100
32.	ICST52	Core 11 – Python Programming	5	4	25	75	100
33.	ICST53	Core 12 – Data Mining and Data Warehousing	5	4	25	75	100
34.	ICSP54	Core 13 –Open Source Lab	5	3	25	75	100
35.	ICSP55	Core 14 – Python Lab	5	3	25	75	100
36.	ICSE52	Elective II – Operations Research	3	3	25	75	100
37.	ICSS53	Skill Based Studies III – PHP Programming	2	2	25	75	100
			30	**23**			**700**
	Semester – VI						
38.	ICST61	Core 15 – Statistical Computing	5	4	25	75	100
39.	ICST62	Core 16 – Mini Project	5	2	25	75	100
40.	ICST63	Core 17 – Web Technology	5	4	25	75	100
41.	ICST64	Core 18 - Principles of Data Science	5	4	25	75	100
42.	ICSP65	Core 19 - Practical IV – Web Technology Lab	5	3	25	75	100

43.	ICSE63	Elective III	3	3	25	75	100
44.	ICSS64	Skill Based Studies IV – Quantitative Aptitude	2	2	25	75	100
45.	ICSEXT	Extension Activity	-	3	25	75	100
			30	**25**			**800**
UG Level – Total Credits				**140**			
	Semester VII						
46.	ICST71	Core 20 – Digital Image Processing	5	5	25	75	100
47.	ICST72	Core 21 – Artificial Intelligence	5	5	25	75	100
48.	ICST73	Core 22 – R Programming	5	5	25	75	100
49.	ICSP74	Core 23 - Practical – Image and Video Analytics Lab	5	3	25	75	100
50.	ICSP75	Core 24 - Practical III – Programming for Data Science using R Lab	5	3	25	75	100
51.	ICSE74	Elective IV	5	4	25	75	100
			30	**25**			**600**
	Semester VIII						
52.	ICST81	Core 25 – Regression Analysis	5	5	25	75	100
53.	ICST82	Core 26 – Cryptography and Network Security	5	5	25	75	100
54.	ICST83	Core 27 – Machine Learning Techniques	5	5	25	75	100
55.	ICSP84	Core 28 - Practical – Regression Analysis Lab	5	3	25	75	100
56.	ICSP85	Core 29 - Practical – Tensorflow Lab	5	3	25	75	100
57.	ICSE85	Elective V	5	4	25	75	100
			30	**25**			**600**
	Semester IX						
58.	ICST91	Core 30 – Computer Networks	5	5	25	75	100
59.	ICST92	Core 31 – Data Analytics and Internet of Things	5	5	25	75	100
60.	ICST93	Core 32 – Natural Language Processing	5	5	25	75	100
61.	ICSP94	Core 33 – Kotlin Programming	5	3	25	75	100
62.	ICSP95	Core 34 - Practical –NLP Lab	5	3	25	75	100
63.	ICSE96	Elective VI	5	4	25	75	100
			30	**25**			**600**

	Semester X						
64.	ICST101	Core 35 - Data Visualization	5	5	25	75	100
65.	ICST102	Core 36 – Deep Learning	5	5	25	25	100
66.	ICSD101	Project Dissertation & Viva-voce	20	5	25	75	100
			30	**15**			**300**
PG Level –Credits				**90**			
TOTAL CREDITS				**230**			

Value Added Programme - **COMPUTER APPLICATIONS IN BUSINESS – Offered by Department of Computer Science to the students of Integrated Programmes of other departments during IV semester.**

List of Electives

1. Computer Graphics
2. Microprocessor and its Applications
3. Complier Design
4. Wireless Networks
5. Cloud Computing
6. Bitcoin and Crypto Currency Technologies
7. Mobile Computing
8. Parallel Processing
9. Big Data Analytics
10. Distributed Operating System
11. Information Retrieval
12. Internet programming
13. Predictive analytics
14. E-commerce
15. Embedded systems
16. Number theory and information security

Non Major Electives

1. Computers in Business Application
2. Cloud Computing
3. Web Designing with HTML

SEMESTER I

ICST11	PROGRAMMING IN C		
	Semester I	**Credits: 4**	**Hours: 5**
Cognitive Level	**K2:** Understand **K3:** Apply **K4:** Analyze		
Objectives	1. To understand and develop well-structured C programs. 2. To provide the foundation and practical implementation of Algorithms 3. To familiarize with linear and non-linear data structures 4. To construct the Problem solving Skills using C Language		

UNIT - I

C fundamentals Character set - Identifier and keywords - data types - constants - Variables - Declarations - Expressions - Statements - Arithmetic, Unary, Relational and logical, Assignment and Conditional Operators - Library functions.

UNIT - II

Data input output functions - Simple C programs - Flow of control - if, if-else, while, do-while, for loop, Nested control structures - Switch, break and continue, go to statements - Comma operator.

UNIT - III

Functions -Definition - proto-types - Passing arguments - Recursions. Storage Classes - Automatic, External, Static, Register Variables - Multi-file programs.

UNIT - IV

Arrays - Defining and Processing - Passing arrays to functions - Multi-dimension arrays - Arrays and String. Structures - User defined data types - Passing structures to functions - Self-referential structures - Unions - Bit wise operations.

UNIT - V

Pointers - Declarations - Passing pointers to Functions - Operation in Pointers - Pointer and Arrays - Arrays of Pointers - Structures and Pointers - Files: Creating Processing, Opening and Closing a data file.

TEXT BOOK

1. E.Balagurusamy, “Programming in ANSI C”, Fifth Edition, Tata McGraw Hill.

REFERENCE BOOKS

1. B.W. Kernighan and D M.Ritchie, “The C Programming Language”, 2nd Edition, PHI, 1988.
2. H. Schildt, “C: The Complete Reference”, 4th Edition. TMH Edition, 2000.
3. Gottfried B.S, “Programming with C”, Second Edition, TMH Pub. Co. Ltd., New Delhi 1996.
4. Kanetkar Y., “Let us C”, BPB Pub., New Delhi, 1999.

Course Outcome

After successful completion of the course, Student shall be able to:

CO1: Understand the flow of data and instructions in programming **K2**

CO2: Manage with data structures based on problem subject domain **K2**

CO3: Practically implement Algorithms using structures **K2**

CO4: Ability to create a program using specific environment **K3**

CO5: Study, analyze and apply the programming concept to any environment **K4**

Mapping of Cos with Pos and PSOs :

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1		M	M	S		M	M		M	
CO2	M	S	M				S			M
CO3	M	S	M				S			M
CO4	M	M			M	S	S	S	M	M
CO5	M	M			M	S	S	S	M	M

S – Strongly Correlating **M- Moderately Correlating**

ICSP12	PROGRAMMING IN C LAB		
	Semester I	**Credits: 3**	**Hours: 5**
Cognitive Level	**K2:** Understand **K3:** Apply **K4:** Analyze		
Objectives	1. To understand and develop well-structured C programs. 2. To provide the foundation and practical implementation of Algorithms 3. To construct the Problem solving Skills using C Language 4. To improve the programming skills through C language		

Course Outcome:

Students are able to understand and develop own source code in the following concepts.,

Using C

CO1. Programs using I/O Statements.
CO 2. Programs using Control Structure.
CO 3. Programs using Arrays and Strings.
CO 4. Program using Functions:
a) Call by value b) Call by Reference c) User Defined d) Built-in
CO 5. Pointers
a) Operators & Expressions b) Pointers and Arrays c) Pointers & Strings d) Pointers & Structures e) Pointers & Functions.
CO 6. Structure & Unions
CO 7. File Handling.

Exercise:

1. Simple Programs
2. Arrays
3. Strings
4. Functions
5. Recursion
6. Structures
7. Pointers
8. Arrays with Structures
9. Arrays with Pointers
10. Files

ICSA11	ALLIED – 1 - DISCRETE MATHEMATICS		
	Semester I	**Credits: 3**	**Hours: 5**
Cognitive Level	**K2:** Understand **K3:** Apply **K4:** Analyze		
Objectives	**1.1 To use mathematically correct terminology and notation.** **1.2 To construct correct direct and indirect proofs.** **1.3 To use division into cases in a proof.** **1.4 To use counterexamples.** **1.5 To apply logical reasoning to solve a variety of problems.**		

UNIT I: Logic: IF Statements – Connectives – Atomic and Compound Statements – WFF – Truth Table of a Formula – Tautology – Tautological Implications and Equivalence of Formulae.

UNIT II: Normal Forms – Principal Normal Forms – Theory of Inference – Open Statements – Quantifiers – Valid Formulae and Equivalence – Theory of Inference for Predicate Calculus.

UNIT III: Graph Theory: Basic Concepts – Matrix representation of Graphs: Trees: Definition – Spanning Trees – Rooted Trees – Binary Trees

UNIT IV : Formal languages: Four class of grammars(phase structure, context sensitive, context free, regular) context free language – generation trees. Finite Automata: Representation of FA – Acceptability of a string by FA – Non deterministic FA (NDFA).

UNIT V : Lattices and Boolean algebra: Lattices – properties – new lattices –modular and distribution lattices. Boolean algebra: Boolean polynomials.

TEXT BOOK

1. Discrete Mathematics – M.K.Venkatraman, N.Sridharan, N.Chandrasekaran, The National Publishing Company,2001. Chapters 9.1-9.56, 11.1-11.81, 12.1-12.20, 12.43-12.61, 7.1-7.39,7.48-7.53,10.1-10.42,10.71 460

REFERENCE BOOK

1. Modern Algebra by S.Arumugam & A.Thangapandi Issac, New Gamma Publishing House, Palayamkottai(for Units I,III)
2. Invitation to Graph Theory by S.Arumugam and S.Ramachandran, Scitech Publications, Chennai.(for Units IV, V)

SEMESTER II

ICST21	**OBJECT ORIENTED PROGRAMMING USING C++**		
	Semester II	**Credits: 4**	**Hours: 5**
Cognitive Level	**K2**-Understand **K3**-Apply **K6**-Analyze		
Objectives	1. To understand the approaches of Object Oriented Programming 2. To impart basic knowledge of Programming Skills in C++ language. 3. To implement real-world entities like inheritance, hiding, polymorphism, etc in programming. 4. The main aim of OOP is to bind together the data and the functions that operate on them so that no other part of the code can access this data except that function.		

UNIT - I

Principles of Object- Oriented Programming – Beginning with C++ - Tokens, Expressions and Control Structures – Functions in C++

UNIT - II

Classes and Objects – Constructors and Destructors – New Operator – Operator Overloading and Type Conversions

UNIT - III

Inheritance: Extending Classes – Pointers- Virtual Functions and Polymorphism

UNIT - IV

Managing Console I/O Operations – Working with Files – Templates – Exception Handling

UNIT - V

Standard Template Library – Manipulating Strings – Object Oriented Systems Development

TEXT BOOK

1. Balagursamy E, Object Oriented Programming with C++, Tata McGraw Hill Publications, Sixth Edition, 2013

REFERENCE BOOK

1. Ashok Kamthane, Programming in C++, Pearson Education, 2013.

Course Outcome

After successful completion of this course, the students shall be able to

CO1: Ability to write a program using objects and data abstraction, class and methods in function abstraction **K2**

CO2: Create a program with basic data structures using array **K3**

CO3: Analyze, write, debug, and test basic C++ codes using the object oriented approaches **K3, K6**

CO4: Ability to utilize the concept of Files and Templates in application **K2**

CO5: Analyze problems and implement simple C++ applications using an object-oriented software engineering approach **K3**

Mapping of Cos with Pos and PSOs :

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	S	M		M		M	S		S	M
CO2	S	M		M		M	S		S	M
CO3		M		S		S	S	S	M	
CO4	S	M		M		M	S		S	M
CO5	S	M		M		M	S		S	M

S – Strongly Correlating M- Moderately Correlating

ICST22	DATA STRUCTURES AND ALGORITHMS		
	Semester II	**Credits: 4**	**Hours: 5**
Cognitive Level	**K2**-Understand **K3**-Apply **K4**-Analyze		
Objectives	1. To recognize the space and time complexities for specific program/ algorithm 2. To understand the linear and non-linear data structure and its operations 3. To know the importance of hashing techniques in space complexity 4. To learn the binary tree and graph representation concept		

UNIT - I

Introduction of algorithms, analyzing algorithms, Arrays: Representation of Arrays, Implementation of Stacks and queues, Application of Stack: Evaluation of Expression - Infix to postfix Conversion - Multiple stacks and Queues, Sparse Matrices.

UNIT - II

Linked list: Singly Linked list - Linked stacks and queues - polynomial addition - More on linked Lists - Doubly linked List and Dynamic Storage Management - Garbage collection and compaction.

UNIT - III

Trees: Basic Terminology - Binary Trees - Binary Tree representations - Binary trees - Traversal - More on Binary Trees - Threaded Binary trees - counting Binary trees. Graphs: Terminology and Representations - Traversals, connected components and spanning Trees, Single Source Shortest path problem.

UNIT - IV

Symbol Tables : Static Tree Tables - Dynamic Tree Tables - Hash Tables : Hashing Functions - overflow Handling. External sorting : Storage Devices - sorting with Disks : K-way merging - sorting with tapes.

UNIT - V

Internal Sorting: Insertion sort - Quick sort - 2 way Merge sort - Heap sort - shell sort - sorting on keys. Files: Files, Queries and sequential organizations - Index Techniques - File organization.

TEXT BOOK

1. Ellis Horowitz, Sartaj Shani, Data Structures, Galgotia publication.

REFERENCE BOOKS

1. Data structures Using C Aaron M. Tenenbaum, Yedidyah Langsam, Moshe J.Augenstein, Kindersley (India) Pvt. Ltd.,
2. Data structure and Algorithms, Alfred V. Aho, John E. Hopcroft, Jeffrey D. Ullman, Pearson Education Pvt. Ltd.,

Course Outcome

After successful completion of this course, the students shall be able to

CO1: Analyse the space and time complexities for an algorithm **K2**
CO2: Identify and use appropriate data structure to solve problems **K3**
CO3: Use Hashing Techniques to solve real time Problems **K3**
CO4: Implement and Handle various searching and sorting algorithms **K3, K4**
CO5: Ability to analyse, design data structures with these approaches **K4**

Mapping of Cos with Pos and PSOs :

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	S	M		M		M	S	S		M
CO2	M	S	M	M			S		S	
CO3	M	S	M	M			S		S	
CO4	M	S	M	M			S		S	
CO5	S				M	M	S			S

S – Strongly Correlating **M- Moderately Correlating**

ICSA22	OBJECT ORIENTED PROGRAMMING USING C++ LAB		
	Semester II	**Credits:3**	**Hours: 5**
Objectives	1. To prepare students to create programs to solve real world problems and also to design appropriate data structure to improve its efficiency. 2. To understand problem solving through Class concept 3. To demonstrate basic data structures using C++ 4. Design and develop modular programs using OOPs Concept		

Program List

1. Classes and Objects

2. Inheritance & its types

3. Constructor and its types

4. Dynamic memory allocation using Files

5. Virtual Inheritance

SEMESTER - III

ICST31	DATABASE MANAGEMENT SYSTEM		
	Semester III	**Credits: 4**	**Hours: 4**
Cognitive Level	**K3**-Apply **K4**-Analyze **K6**-Create		
Objectives	1. To understand the overview of Data Base systems & Data Models. 2. To modify and maintain the database structure. 3. To understand the needs of database processing and learn techniques for controlling the Consequences of concurrent data access. 4. The Students can able to handle the Database.		

UNIT - I

Introduction: Database System Applications-DBMS Vs. File System - View of Data-Data Model Database Languages - Database users and Administrators - Transaction Management - Database System Structure - Application Architecture. Data Models: Basic Concepts - Constraint- Keys- ER Diagram - Weak Entity - Extended ER Features - UML; Relational Model: Structure of Relational Databases - Relational Algebra - Views.

UNIT – II

SQL: Background-Basic Structure-Set Operation-Aggregate Function-Null Values-Nested Sub Queries - Views - Modification of the Database - Data Definition Language - Embedded SQL - Dynamic SQL.

UNIT-III

Advance SQL : Integrity and Security: Domain - Constraint - Referential Integrity - assertions - Triggers - Security and Authorization - Authorization in SQL - Encryption and Authentication.

UNIT - IV

Relational Database Design: First Normal Form - Pitfalls in Relational Database Design-Functional Dependencies (Second Normal Form) - Boyce-Codd Normal Form - Third Normal Form - Fourth Normal Form - Overall Database Design Process.

UNIT-V

Transaction Management: Transaction concepts - States - Serializability. Lock based concurrency control: Locks - Granting - Two-Phase Locking protocol. Time stamp based protocol: Timestamps - Timestamp ordering protocol - Dead lock handling.

TEXT BOOK

1. A Silberschatz, H Korth, S Sudarshan, "Database System and Concepts", 5th Edition McGraw-Hill, 2005.

REFERENCE BOOKS

1. Alexix Leon & Mathews Leon, "Essential of DBMS", 2nd reprint, Vijay Nicole Publications, 2009.
2. Alexix Leon & Mathews Leon, "Fundamentals of DBMS", 2nd Edition, Vijay Nicole Publications, 2014.

Course Outcome

After successful completion of the course, Student shall be able to:

CO1: Create E/R models from application descriptions **K6**

CO2: Improve the database design by normalization. **K4**

CO3: Students can create database structure using SQL **K3**

CO4: Ability to create database and enforce data integrity constraints and queries using SQL **K3, K4**

CO5: Analyse and use the concept of trigger in Database **K4**

Mapping of Cos with Pos and PSOs :

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	M	M		S	S		S	M	M	
CO2	S		S	S	M	M	S	M		M
CO3	M	M		S	S		S	M	M	
CO4	S		S	S	M	M	S	M		M
CO5	S		S	S	M	M	S	M		M

S – Strongly Correlating **M- Moderately Correlating**

ICST32	OPERATING SYSTEM		
	Semester III	**Credits: 4**	**Hours: 4**
Cognitive Level	K1-Recall K2-Understand K3-Apply K4-Analyze		
Objectives	1. To learn the concepts of operating systems. 2. To learn about the various issues in operating systems. 3. To appreciate the emerging trends in operating systems 4. To familiarize with the important mechanisms in operating systems.		

UNIT – I: Introduction - History of operating system- Different kinds of operating system – Operating system concepts - System calls-Operating system structure.

UNIT - II: Processes and Threads: Processes - threads - thread model and usage - inter process communication.

UNIT – III: Scheduling - Memory Management: Memory Abstraction - Virtual Memory - Page replacement algorithms.

UNIT - IV: Deadlocks: Resources- introduction to deadlocks - deadlock detection and recovery - deadlocks avoidance - deadlock prevention. Multiple processor system: multiprocessors - multi computers.

UNIT – V: Input / Output: principles of I/O hardware - principles of I/O software. Files systems: Files - directories - files systems implementation - File System Management and Optimization.

TEXT BOOK

1. Andrew S. Tanenbaum, "Modern Operating Systems", 2nd Edition, PHI private Limited, New Delhi, 2008.

REFERENCE BOOKS

1. William Stallings, "Operating Systems - Internals & Design Principles",5thEdition, Prentice - Hall of India private Ltd, New Delhi, 2004.
2. Sridhar Vaidyanathan, "Operating System", 1st Edition,Vijay Nicole Publications, 2014.

Course Outcome

After successful completion of the course, Student shall be able to:

CO1: Exhibit familiarity with the fundamental concepts of operating systems and process management. **K2**

CO2: Apply different optimization techniques for the improvement of system performance **K4**

CO3: Discuss various protection and security aspects **K2**

CO4: Use the computer system resources in an efficient way **K1**

CO5: Apply different deadlock prevention techniques **K3**

Mapping of Cos with Pos and PSOs :

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	S	M		M	M	S	M	M	S	
CO2	S		S	S	M	M	S	M		M
CO3	S	M		M	M	S	M	M	S	
CO4	S		S	S	M	M	S	M		M
CO5	S		S	S	M	M	S	M		M

S – Strongly Correlating **M- Moderately Correlating**

ICSP33	**DBMS LAB**		
	Semester III	**Credits:3**	**Hours: 3**
Cognitive Level	**K2:** Understand **K3:** Apply **K4:** Analyse **K6:** Create		
Objectives	1. To understand the concepts and techniques relating to ODBC. 2. To understand and analyze the underlying concepts of database technologies 3. To present SQL and procedural interfaces to SQL 4. Able to Design and implement a database schema for a given problem-domain.		

1. Creation of base tables and views.
2. Data Manipulation INSERT, DELETE and UPDATE in Tables. SELECT, Sub Queries and JOIN
3. Data Control Commands
4. High level language extensions – PL/SQL. Or Transact SQL – Packages
5. Use of Cursors, Procedures and Functions
6. Embedded SQL or Database Connectivity.
7. Oracle or SQL Server Triggers – Block Level – Form Level Triggers
8. Working with Forms, Menus and Report Writers for a application project in any domain
9. Front-end tools – Visual Basic.

ICSA33	DIGITAL ELECTRONICS AND COMPUTER ORGANIZATION		
	Semester III	**Credits:3**	**Hours: 3**
Cognitive Level	**K2:** Understand **K3:** Apply **K4:** Analyse **K6:** Create		
Objectives	1. To teach the basics involved in data representation and digital logic circuits used in the computer system. 2. To teach the general concepts in digital logic design, including logic elements, and their use in combinational and sequential logic circuit design. 3. To expose students to the basic architecture of processing, memory and i/o organization in a computer system..		

Unit-I

Introduction to computer – Number Systems – Data types – Data Representations – Fixed Point, Floating Point, Gray, Excess – 3, Alphanumeric codes – Binary codes – Error Detection Codes.

Unit-II

Arithmetic Logic Unit: Binary Half Adder, Full adder and their Designs – Positive and Negative Numbers , Binary Addition & Subtraction Using 1s, 2s, 9s Complements ,Binary Multiplication.

Unit –III

Memory Unit: Classification of Memory: Primary – Secondary – Cache Memory – Associate Memory – virtual Memory –RAM,ROM

Control Unit: General Register Organization, Stack Organization, Instruction Formats, Addressing Modes – Data Transfer and Manipulation Instructions.

Unit-IV

I/O Devices: Punched Tape, Tape Recorders, Punched cards – Card Readers- Printers – CRT Devices – digital to analog Converters, Analog to Digital Converters.

Unit-V

Introduction to Parallel Processing – Parallelism in Uniprocessor Systems – Parallel Computer Structure.

Reference Books:

1. Albert Paul Malvino, Donald P. Leach – Digital Principles and Appli9cations McGraw Hill
2. M .Morris Mano – Computer System, architecture, Prentice Hall of India
3. Thomas C. Bartee – Digital Computer Fundamentals, McGraw Hill

SEMESTER IV

ICST41	PROGRAMMING IN JAVA		
	Semester IV	**Credits: 4**	**Hours: 5**
Cognitive Level	K2-Understand K3-Apply K6-Create		
Objectives	1. To remind the object oriented paradigm in Java programming 2. To understand the importance of Interfaces and exception handling concept 3. Compare and contrast the Net and Applet Java packages 4. To develop Java application using Servlet		

PROGRAMMING IN JAVA

Unit-I: Introduction: Benefits of OOPS- Java History-Java Features- Java Environment- Java Tokens-Constants- Variables- Data Types – Operators and Expressions-Decision Making and Branching-Decision Making and Looping.

Unit-II: Classes, Objects and Methods: Classes and Objects - Constructors- 'Method Overloading- Static Members-Inheritance- Overriding Methods- Final Variables, Final Methods and Final Classes - Finalize Method- Abstract Methods and Abstract Classes –Visibility Control - Arrays - Strings.

Unit-III: Interfaces, Packages and Thread: Defining Interface- Extending Interfaces-Implementing Interfaces – Packages-Multithreaded Programming: Thread Life Cycle - Thread Exceptions – Thread Priority-Synchronization.

Unit-IV: File Handling: Types of Errors – Exceptions- Syntax of Exception Handling Code-Multiple Catch Statements- Using Finally Statements- Managing Input/ Output Files in Java: Concept of Streams-Stream Classes- Character Stream Classes-Reading / Writing Characters- Reading / Writing Bytes-Handling Primitive Data Types- Random Access files.

Unit-V: AWT and Applet: Event Handling Methods- Labels- Button Control- CheckBox Control- Radio Button Control- Choice Control- List Control-Flow Layout- Border Layout-Grid Layout – Menus- Mouse Events-Applets: Lifecycle of an Applet-Development and Execution of a Simple Applet.

Reference Books:

- Java, The Complete Reference – Patrick Naughton and Schildt
- Programming in Java – Joseph L Weber
- Java Programming – Balagurusamy

Course Outcome

After successful completion of this course, the students shall be able to

CO1: Design and Create Java Applications using OOPs concept **K6**

CO2: Utilise the features of exception handling, threads & util package in Java. **K3**

CO3: Simplify the communication between client & server using database connectivity. **K2**

CO4: Build Java applications that include GUIs and event driven programming **K3**

CO5: Ability to create Java applications using JDBC, JSP and Servlet **K6**

Mapping of Cos with Pos and PSOs :

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	M	M		S	S		S	M	M	
CO2	S		S	S	M	M	S	M		M
CO3	M	M		S	S		S	M	M	
CO4	S		S	S	M	M	S	M		M
CO5	S		S	S	M	M	S	M		M

S – Strongly Correlating **M- Moderately Correlating**

ICSP42	PRACTICAL - JAVA PROGRAMMING LAB		
	Semester IV	**Credits: 3**	**Hours: 5**
Cognitive Level	K2-Understand K3-Apply K6-Create		
Objectives	• To be knowledgeable enough about basic Java language syntax and semantics to be able to successfully read and write Java computer programs; • To implement interfaces, inheritance, and polymorphism as programming techniques and apply exceptions handling.		

1. Define a class called Student with the attributes name, reg_number and marks obtained in four subjects(m1,m2,m3,m4).Write a suitable constructor and methods to find the total mark obtained by the student and display the details of the student.
2. Write a Java program to find the area of a square, rectangle and triangle by
    a. (i) Overloading Constructor (ii) Overloading Method.
3. Write a java program to add two complex numbers. [Use passing object as argument and return object].
4. Define a class called Student_super with data members name, roll number and age. Write a suitable constructor and a method output () to display the details.
5. Derive another class Student from Student_super with data members height and weight. Write a constructor and a method output () to display the details which overrides the super class method output().[Apply method Overriding concept.
6. Write a java program to create an interface called Demo, which contains a double type constant, and a method called area () with one double type argument. Implement the interface to find the area of a circle.
7. Write a java program to create a thread using Thread class.
8. Demonstrate Java inheritance using extends keyword.
9. Create an applet with four Checkboxes with labels MARUTI-800, ZEN, ALTO and ESTEEM and a Text area object. The program must display the details of the car while clicking a particular Checkbox.
10. Write a Java program to throw the following exception,
    1) Negative Array Size 2) Array Index out of Bounds
11. Write a java program to create a file menu with option New, Save and Close, Edit menu with option cut, copy, and paste.
12. Write a java programming to illustrate Mouse Event Handling

ICSA44	ALLIED II - NUMERICAL METHODS		
	Semester IV	**Credits: 3**	**Hours: 3**
Cognitive Level	K2-Understand K3-Apply K6-Create		
Objectives	1. To provide the numerical methods of solving the non-linear equations, interpolation, differentiation, and integration. **2.** To improve the student's skills in numerical methods by using the numerical analysis software and computer facilities.		

Unit1: Iterative methods – Bisection Method – False position method – Newton Raphson method - Solution of Simultaneous Linear Algebraic Equations- Gauss Elimination, Gauss- Jordan , Gauss- Jacobi and Gauss- Seidel iterative methods.

Unit 2 : Definition – Forward and backward differences – Newton's formula for interpolation – Operators – Properties and relationship among them – Missing terms and summation of series – Montmort's theorem.

Unit 3: Divided differences – Newton's divided difference formula – Lagrange's interpolation formula – Inverse interpolation.

Unit 4 : Numerical Differentiation and Integration - Trapezoidal and Simpson's 1/3 rule – Difference equations and Methods of solving.

Unit 5 : Taylor's series – Euler's method – Modified Euler's method – Runge Kutta methods – Picard's method of successive approximation – Predictor and Corrector methods – Milne's and Adam's Bashforth Methods.

Text Book : P.Kandasamy, K.Thilagavathy, K.Gunavathi, "Numerical Methods",S.Chand Company Ltd, Revised edition,2005.

REFERENCES

1. S.Narayanan, S.Viswanathan, " Numerical Analysis",1994.

2. S.S.Sastry, "Introductory Methods of Numerical Analysis" PHI,1995.

SEMESTER V

ICST51	**SOFTWARE ENGINEERING**		
	Semester V	**Credits: 4**	**Hours: 5**
Cognitive Level	K1-Recall K2-Understand K4-Analyze K5-Evaluvate K6-Create		
Objectives	1. To be aware of generic models to structure the software development process. 2. To understand fundamental concepts of requirements engineering and requirements 3. To understand different notion of complexity at both the module and system level. 4. To work as an individual and as part of a multidisciplinary team to develop and deliver quality software.		

UNIT – I: Introduction - Software Engineering Discipline - Evolution and Impact - Programs Vs Software Products. Software Life Cycle Models: Use of a Life Cycle Models - Classical Waterfall Model -Iterative Waterfall Model - Prototyping Model - Evolutionary Model - Spiral Model. Software Project Management: Responsibilities of a Software Project Manager - Project Planning - Metrics for Project Size Estimation - Project Estimation Techniques -Risk Management.

UNIT - II : Requirements Analysis and Specification: Requirements Gathering and Analysis -Software Requirements Specification (SRS) - Formal System Development Techniques. Software Design: Characteristics of a Good Software Design - Cohesion and Coupling -Neat Arrangement - Software Design Approaches.

UNIT - III : Function-Oriented Software Design: Overview of SA/SD Methodology - Structured Analysis - Data Flow Diagrams (DFDs).Object Modeling Using UML: Overview of Object-Oriented Concepts - UML Diagrams - Use Case Model - Class Diagrams - Interaction Diagrams - Activity Diagrams - State Chart Diagram.

UNIT - IV : User Interface Design: Characteristics of a Good User Interface - Basic Concepts - Types of User Interfaces - Component-Based GUI Development; Coding and Testing: Coding - Testing - UNIT Testing - Black-Box Testing - White-Box Testing - Debugging -Integration Testing - System Testing.

UNIT - V : Software Reliability and Quality Management: Software Reliability - Statistical Testing - Software Quality - Software Quality Management System - ISO 9000.Computer Aided Software Engineering: CASE Environment - CASE support in Software Life Cycle - Characteristics of CASE Tools - Architecture of a CASE Environment. Software Maintenance: Characteristics of Software

Maintenance - Software Reverse Engineering - Software Maintenance Process Models - Estimation of Maintenance Cost. Software Reuse: Issues in any Reuse Program - Reuse Approach.

TEXT BOOK

1. Rajib Mall, "Fundamentals of Software Engineering",3rd Edition, Prentice Hall of India Private Limited, 2008.

REFERENCE BOOKS

1. Rajib Mall, "Fundamentals of Software Engineering", 4thEdition, Prentice Hall of India Private Limited, 2014.
2. Richard Fairley, "Software Engineering Concepts", TMGH Publications, 2004.

Course Outcome

After successful completion of the course, Student shall be able to:

CO1: Understand the process to be followed in the software development life cycle **K2**

CO1: Familiarise the concept of CASE tools **K2**

CO1: Understand fundamental concepts of requirements engineering. **K1**

CO1: Analyse and identify the practical solutions to the problems. **K4**

CO1: Ability to develop and deliver quality software **K5,K6**

Mapping of Cos with Pos and PSOs :

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	M	M		M	S		S	M	S	
CO2	M	M	S	M	S	M	S	M	S	M
CO3	M	M		M	S		S	M	S	
CO4	M	M	S	M	S	M	S	M	S	M
CO5	M	S		S		M	S	S		S

S – Strongly Correlating **M- Moderately Correlating**

ICST52	PYTHON PROGRAMMING		
	Semester V	**Credits: 4**	**Hours: 5**
Cognitive Level	K2-Understand K4-Analyze		
Objectives	1. To understand the basic components of computer programming using the Python language 2. To demonstrate significant experience with the Python program development environment. 3. This course covers programming paradigms brought in by Python with a focus on Regular Expressions, List and Dictionaries. 4. It explores the various modules and libraries to cover the landscape of Python programming.		

UNIT-I

Introduction to Python - Why Python - Installing in various Operating Systems - Executing Python Programs - Basic Programming concepts - Variables, expressions and statements - Input/ Output – Operators.

UNIT-II

Conditions - Functions - Arguments - Return values - Iteration - Loops - Strings -Data Structures - Lists - Dictionaries - Tuples - Sequences - Exception Handling.

UNIT-III

File Handling - Modules - Regular Expressions - Text handling - Object Oriented Programming - Classes - Objects - Inheritance - Overloading - Polymorphism Interacting with Databases - Introduction to MySQL - interacting with MySQL - Building a address book with add/edit/delete/search features.

UNIT-IV

Introduction to Graphics programming - Introduction to GTK - PyGTK - Developing GUI applications using pyGTK - Scientific Programming using NumPy / SciPy - Image Processing - Processing multimedia files -Network Programming, Web services using SOAP, Introduction to Graphics programming - PyGame

UNIT-V

Introduction to Version Control Systems - Subversion/Git, Writing Unit Tests, Creating Documentation, Contributing to Open Source Projects

TEXT BOOK

1. Allen B. Downey, ”Think Python: How to Think Like a Computer Scientist“,1st Edition 2012, O’Reilly.

REFERENCE BOOKS

1. Jeff McNeil ,"Python 2.6 Text Processing: Beginners Guide", 2010 ,Packet Publications
2. Mark Pilgrim ,"Dive Into Python " , 2nd edition 2009, Apress

Course Outcome:

After successful completion of the course, Student shall be able to:

CO1: Demonstrate the use of the built -in objects of Python **K2**

CO2: Demonstrate significant experience with the Python program development environment. **K2**

CO3: Understand and implement the basic methods of python modules like NumPy, Matplotlib **K2**

CO4: Know about the working procedure of OOPs Concept in Python **K2**

CO5: Ability to design python programming with MySQL **K4**

Mapping of Cos with Pos and PSOs :

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	S	S		S	M	M	S	M	S	
CO2	S	S		S	M	M	S	M	S	
CO3	M		M	S	M		M	S		M
CO4	M		M	S	M		M	S		M
CO5	M			S	M	S	M	M	M	S

S – Strongly Correlating **M- Moderately Correlating**

ICST53	DATA MINING AND DATA WAREHOUSING		
	Semester V	**Credits: 4**	**Hours: 5**
Cognitive Level	K2-Understand K4-Analyze		
Objectives	1. To identify the scope and essentiality of Data Warehousing and Mining. 2. To analyze data, choose relevant models and algorithms for respective applications. 3. To study spatial and web data mining. 4. To develop research interest towards advances in data mining.		

Unit I: Data Mining Introduction – Kinds of data can be mind, kinds of patterns can be mined, technologies used, kinds of application targeted, major issues in data mining.
Getting to know your data: Data objects & attribute types, basic statistical description of data, data visualization.

Unit II: Data Preprocessing: Overview, Data Cleaning, Data Integration, Data Reduction, Data Transformation and Data Discretization.

Unit III: Data Warehouse and OLAP: Basic Concepts, data warehouse modeling data cube and OLAP, data warehouse design and usage.
Data Cube Technology: Data Cube computation preliminary concepts, data Cube computation methods.

Unit IV: Association: Basic Concepts, Frequent itemset mining methods, Classification: Basic Concepts decision tree induction.

Unit V: Cluster Analysis: Basic concepts, Partitioning methods, web mining: web content mining, web structure mining, semantic web mining, text mining, image mining.

Reference Book
1. Data mining Concepts and Techniques by Jiawelhen, Michelin Kamber, Jlanpie III Edition, Elsevier publication.
2. Data Mining Methods by RajanChattamvelli, Narosa publishing house.

Course Outcomes

1. Upon Completion of the course, the students will be able to
2. Store voluminous data for online processing
3. Preprocess the data for mining applications
4. Apply the association rules for mining the data
5. Design and deploy appropriate classification techniques
6. Cluster the high dimensional data for better organization of the data
7. Discover the knowledge imbibed in the high dimensional system
8. Evolve Multidimensional Intelligent model from typical system
9. Evaluate various mining techniques on complex data objects

ICSP54	**OPEN SOURCE LAB**		
	Semester V	**Credits: 3**	**Hours: 5**
Cognitive Level	K2-Understand K4-Analyze		
Objectives	• To accelerate and enable research by reducing the duplication of effort by multiple labs, and offering alternatives to expensive **lab** equipment. • To develop technical solutions for problems using the open source software"s readily available at free of cost. • To install WampServer. • Learn programming in PHP.		

LAB EXERCISE

1. Create a simple HTML form and accept the user name and display the name through PHP echo statement.
2. Write a PHP script to redirect a user to a different page.
3. Write a PHP function to test whether a number is greater than 30, 20 or 10 using ternary operator.
4. Create a PHP script which display the capital and country name from the given array. Sort the list by the name of the country
5. Write a PHP script to calculate and display average temperature, five lowest and highest temperatures.
6. Create a script using a for loop to add all the integers between 0 and 30 and display the total**.**
7. Write a PHP script using nested for loop that creates a chess board.
8. Write a PHP function that checks if a string is all lower case.
9. Write a PHP script to calculate the difference between two dates**.**
10. Write a PHP script to display time in a specified time zone.

ICSP55	PRACTICAL – PYTHON LAB		
	Semester V	**Credits: 3**	**Hours: 5**
Objectives	1. To provide comprehensive knowledge of python programming paradigms required for Data Science 2. To use of built-in objects of Python 3. To provide significant experience with python program development environment 4. To implement numerical programming, data handling and visualization through NumPy, Pandas and MatplotLib modules		

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Lab Exercises

1. Demonstrate usage of branching and looping statements using Python
2. Demonstrate Recursive functions using Python
3. Demonstrate Lists using Python
4. Demonstrate Tuples and Sets using Object Oriented Programming
5. Demonstrate Dictionaries using Object Oriented Programming
6. Demonstrate inheritance and exceptional handling using Object Oriented Programming
7. Demonstrate use of "re" using Object Oriented Programming
8. Demonstrate Aggregation using NumPy
9. 2. Demonstrate Indexing and Sorting using NumPy
10. Demonstrate handling of missing data using Pandas
11. Demonstrate hierarchical indexing using Pandas
12. Demonstrate usage of Pivot table using Pandas
13. Demonstrate use of eval() and query() using Pandas
14. Demonstrate Scatter Plot using MATPLOTLIB
15. Demonstrate 3D plotting using MATPLOTLIB

ICSE52	ELECTIVE II - OPERATIONS RESEARCH		
	Semester V	**Credits: 3**	**Hours: 3**
Objectives	1.To impart knowledge in concepts and tools of Operations Research 2. To understand mathematical models used in Operations Research 3. To apply these techniques constructively to make effective business decisions		

UNIT-I: Development of OR- Definition OR- General methods for solving OR models – main characteristics and Phases of OR study – tools, techniques and methods – scientific methods in OR – Scope of OR.

UNIT-II: Linear Programming Problem – Mathematical formation of L.P.P – Stack and surplus variables – graphical solution of L.P.P

UNIT-III: Simplex method – computational procedure – Artificial Variables technique – Two phase method – Duality in linear programming.

UNIT-IV: Mathematical Formulation of transportation problem – optimal solution of T.P – Methods for obtaining an initial feasible solution – Optimal solution – Degeneracy in T. Unbalance T.P

UNIT-V: Mathematical Formulation of Assignment problem – assignment algorithm – optimal solution of assignment problem – Unbalanced Assignment solution – balanced assignment solution

TEXT BOOK:

1. Operation Research – S.D.Sharma(Kedarnath Ramanath & COBOL) Chapter 1 to 6 (all section).

Course Outcomes :

- Solve Linear Programming Problems
- Solve Transportation and Assignment Problems
- Understand the usage of game theory and Simulation for Solving Business Problems

ICST61	STATISTICAL COMPUTING		
	Semester VI	**Credits: 4**	**Hours: 5**
Cognitive Level	K2-Understand K3-Apply		
Objectives	1. To understand the applications of various correlation methods 2. To study and model the sampling concepts 3. To acquire knowledge on Hypotheses test 4. Obtain knowledge on sampling, tests of hypothesis, and statistical tests like t-test, F-test, Goodness of Fit, and Confidence interval.		

UNIT-I

Correlation - Definition of Correlation- Scatter Diagram- Kari Pearson's Coefficient of Linear Correlation- Coefficient of Correlation and Probable Error of r- Coefficient of Determination - Merits and Limitations of Coefficient of Correlation- Spearman's Rank Correlation(7.1-7.9.4).

UNIT-II

Regression Analysis - Regression and Correlation(Intro)- Difference between Correlation and Regression Analysis- Linear Regression Equations -Least Square Method- Regression Lines- Properties of Regression Coefficients- Standard Error of Estimate.(8.1-8.8)

UNIT-III

Probability Distribution and mathematical Expectation- Random Variable- Defined - Probability Distribution a Random Variable- Expectation of Random Variable- Properties of Expected Value and Variance(12.2-12.4).

UNIT-IV

Sampling and Sampling Distributions - Data Collection- Sampling and Non-Sampling Errors – Principles of Sampling-- Merits and Limitations of Sampling- Methods of Sampling- Parameter and Statistic- Sampling Distribution of a Statistic- Examples of Sampling Distributions- Standard Normal, Student's *t*, Chi-Square (x^2) and Snedecor's F- Distributions(14.1-14.16).

UNIT-V

Statistical Inference- Estimation and Testing of Hypothesis - Statistical Inference- Estimation- Point and interval- Confidence interval using normal, *t* and x^2Distributions- Testing of Hypothesis- Significance of a mean - Using *t* Distribution(15.1-15.10.2).

TEXT BOOK:

1. K.L. Sehgal, "Quantitative Techniques and Statistics", First Edition, Himalaya Publishing House, 2011.

REFERENCES BOOK:

1. N. P. Bali, P. N. Gupta, C. P. Gandhi, "A Textbook of Quantitative Techniques", First Edition, Laxmi Publications, 2008.
2. U. K. Srivastava, G. V. Shenoy, S. C. Sharma, "Quantitative Techniques for Managerial Decisions", Second Edition, New Age International Publishers, 2005.
3. David Makinson, "Sets, Logic and Maths for Computing", Springer, 2011.
4. Christopher Chatfield,"Statistics for Technology- A Course in Applied Statistics, Third Edition", CRC Press, 2015.

Course Outcome

After completion of the course, Student shall be able to

CO1: Understand Data analytics metrics used in real world problem **K2**
CO2: Predict the exact reason for the real time issues **K2**
CO3: Knowledge on assimilate the data and fit-in appropriate time series model. **K2**
CO4: Develop the software for the models at implementation level. **K3**
CO5: Capability of developing statistical packages, which computes descriptive statistics. **K3**

Mapping of Cos with Pos and PSOs :

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	S	S	M		M	M	S	M	S	M
CO2	M		S	S	S	S		S	M	S
CO3	S	S	M		M	M	S	M	S	
CO4	M		S	S	S	S		S	M	S
CO5	M	M	S	S	S	S		S	M	S

S – Strongly Correlating **M- Moderately Correlating**

ICST63	WEB TECHNOLOGY		
	Semester VI	**Credits: 4**	**Hours: 5**
Cognitive Level	K2-Understand K3-Apply K4-Analyze		
Objectives	1. To learn to design web pages using HTML5 2. To gain knowledge on creating interactive web pages using JavaScript, jQuery 3. To know to use Cascading Style Sheets (CSS) and DOM. *4.* To learn to develop server side scripting using PHP		

UNIT - I

OVERVIEW OF ASP.NET - The .NET framework – Learning the .NET languages : Data types – Declaring variables- Scope and Accessibility- Variable operations- Object Based manipulation- Conditional Structures- Loop Structures- Functions and Subroutines. Types, Objects and Namespaces : The Basics about Classes- Value types and Reference types- Advanced class programming- Understanding name spaces and assemblies. Setting Up ASP.NET and IIS.

UNIT – II

Developing ASP.NET Applications - ASP.NET Applications: ASP.NET applications– Code behind- The Global.asax application file- Understanding ASP.NET Classes- ASP.NET Configuration. Web Form fundamentals: A simple page applet- Improving the currency converter- HTML control classes- The page class- Accessing HTML server controls. Web controls: Web Control Classes – Auto PostBack and Web Control events- Accessing web controls. Using Visual Studio.NET: Starting a Visual Studio.NET Project- Web form Designer- Writing code- Visual studio.NET debugging. Validation and Rich Controls: Validation- A simple Validation example- Understanding regular expressions- A validated customer form. State management - Tracing, Logging, and Error Handling.

UNIT – III

Working with Data - Overview of ADO.NET - ADO.NET and data management- Characteristics of ADO.NET-ADO.NET object model. ADO.NET data access : SQL basics– Select , Update, Insert, Delete statements- Accessing data- Creating a connection- Using a command with a DataReader - Accessing Disconnected data - Selecting multiple tables – Updating Disconnected data. Data binding: Single value Data Binding- Repeated value data binding- Data binding with data bases. Data list – Data grid – Repeater – Files, Streams and Email – Using XML

UNIT - IV

Web Services - Web services Architecture : Internet programming then and now- WSDL–SOAP- Communicating with a web service-Web service discovery and UDDI. Creating Web services : Web

service basics- The StockQuote web service – Documenting the web service- Testing the web service- Web service Data types- ASP.NET intrinsic objects. Using web services: Consuming a web service- Using the proxy class- An example with TerraService.

UNIT – V

Advanced ASP.NET - Component Based Programming: Creating a simple component – Properties and state- Database components- Using COM components. Custom controls: User Controls- Deriving Custom controls. Caching and Performance Tuning: Designing and scalability– Profiling- Catching- Output catching- Data catching. Implementing security: Determining security requirements- The ASP.NET security model- Forms authentication- Windows authentication.

TEXT BOOK:

1 Mathew Mac Donald, "ASP.NET Complete Reference", TMH 2005.

REFERENCES BOOK:

1. Crouch Matt J, "ASP.NET and VB.NET Web Programming", Addison Wesley 2002.
2. J.Liberty, D.Hurwitz, "Programming ASP.NET", Third Edition, O'REILLY, 2006.

Course Outcome

After successful completion of the course, Student shall be able to:

CO1: Ability to analyse & design web pages using HTML. **K3,K4**

CO2: Able to gain knowledge on creating interactive web pages using JavaScript, Query. **K2, K4**

CO3: Familiarise the concept of ADO.Net **K2**

CO4: Able to write a program and to use Cascading Style Sheets (CSS) and DOM. **K3**

CO5: Able to develop server side scripting using PHP **K3**

Mapping of Cos with Pos and PSOs :

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	S	M	M	S		M	M	S	S	M
CO2	M	S		S	M	M	S	M		M
CO3	M	S		S	M	M	S	M		M
CO4	S	M	M	S	M	M	M	S	S	M
CO5	S	M	M	S	S	M	M	S	S	M

S – Strongly Correlating M- Moderately Correlating

ICST64	PRINCIPLES OF DATA SCIENCE		
	Semester VI	**Credits: 4**	**Hours: 5**
Cognitive Level	K2-Understand K4-Analyze		
Objectives	1. To give a basic understanding of Data Science concept and its applications 2. To understand the underlying core concepts and emerging technologies in data science 3. To impart knowledge about large data handling in bigdata 4. To provide strong foundation for data science and application area related to it.		

UNIT-1

INTRODUCTION TO DATA SCIENCE-Definition – Big Data and Data Science Hype – Why data science – Getting Past the Hype – The Current Landscape – Data Scientist - Data Science Process Overview – Defining goals – Retrieving data – Data preparation – Data exploration – Data modelling – Presentation

UNIT-2

BIG DATA- Problems when handling large data – General techniques for handling large data – Case study – Steps in big data – Distributing data storage and processing with Frameworks – Case study.

UNIT-3

MACHINE LEARNING- Machine learning – Modelling Process – Training model – Validating model – Predicting new observations –Supervised learning algorithms – Unsupervised learning algorithms.

UNIT-4

DEEP LEARNING- Introduction – Deep Feed forward Networks – Regularization – Optimization of Deep Learning – Convolutional Networks – Recurrent and Recursive Nets – Applications of Deep Learning.

UNIT-5

DATA VISUALIZATION- Introduction to data visualization – Data visualization options – Filters – MapReduce – Dashboard development tools – Creating an interactive dashboard with dc.js-summary.

TEXT BOOKS:

[1]. Introducing Data Science, Davy Cielen, Arno D. B. Meysman, Mohamed Ali, Manning Publications Co., 1st edition, 2016

[2]. An Introduction to Statistical Learning: with Applications in R, Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, Springer, 1st edition, 2013

[3]. Deep Learning, Ian Goodfellow, Yoshua Bengio, Aaron Courville, MIT Press, 1st edition, 2016

[4]. Ethics and Data Science, D J Patil, Hilary Mason, Mike Loukides, O' Reilly, 1st edition, 2018

[5]. Data Science from Scratch: First Principles with Python, Joel Grus, O'Reilly, 1st edition, 2015

Course Outcome

After successful completion of this course, the students shall be able to

CO1: Understand the fundamental concepts of data science **K2**

CO2: Evaluate the data analysis techniques for applications handling large data **K4**

CO3: Demonstrate the various machine learning algorithms used in data science process **K2**

CO4: Understand the ethical practices of data science **K2**

CO5: Ability to utilise the concept of privacy, data sharing and algorithmic decision-making **K4**

Mapping of Cos with Pos and PSOs :

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	S	M		M	M	S	M	M	S	
CO2										
CO3	S	M		M	M	S	M	M	S	
CO4	S	M		M	M	S	M	M	S	
CO5	M	M		S		M	M	S	S	M

S – Strongly Correlating **M- Moderately Correlating**

ICSP65	WEB TECHNOLOGY LAB		
	Semester VI	**Credits: 3**	**Hours: 5**
Cognitive Level	K2-Understand K4-Analyze		
Objectives	1. Design web pages using various HTML tags 2. Write simple programs in Java Script		

1. Create a form having number of elements (Textboxes, Radio buttons, Checkboxes, and so on). Write JavaScript code to count the number of elements in a form.

2. Create a HTML form that has number of Textboxes. When the form runs in the Browser fill the textboxes with data. Write JavaScript code that verifies that all textboxes has been filled. If a textboxes has been left empty, popup an alert indicating which textbox has been left empty.

3. Develop a HTML Form, which accepts any Mathematical expression. Write JavaScript code to Evaluates the expression and Displays the result.

4. Create a page with dynamic effects. Write the code to include layers and basic animation.

5. Write a JavaScript code to find the sum of N natural Numbers. (Use user-defined function)

6. Write a JavaScript code block using arrays and generate the current date in words, this should include the day, month and year.

7. Create a form for Student information. Write JavaScript code to find Total, Average, Result and Grade.

8. Create a form for Employee information. Write JavaScript code to find DA, HRA, PF, TAX, Gross pay, Deduction and Net pay.

9. Create a form consists of a two Multiple choice lists and one single choice list

(a)The first multiple choice list, displays the Major dishes available
(b)The second multiple choice list, displays the Starters available.
(c)The single choice list, displays the Soft drinks available.

10. Create a web page using two image files, which switch between one another as the mouse pointer moves over the image. Use the on Mouse Over and on Mouse Out event handlers.

ICST71	DIGITAL IMAGE PROCESSING		
	Semester VII	**Credits: 4**	**Hours: 5**
Cognitive Level	K2-Understand K3-Apply K4-Analyze		
Objectives	1. To learn about the basic concepts of digital image processing and various image transforms. 2. To understand the image enhancement techniques 3. To expose the student to a broad range of image processing techniques and their applications. **4.** The Student can gain the Knowledge about the use of current technologies those are specific to image processing systems.		

Unit I

Introduction: The Origins of Digital Image Processing – Application of Digital Image processing – Fundamental Steps in Digital Image Processing – Component of Image Processing System. **Image Acquisition -** Image Acquisition using a single sensor – Image Acquisition using sensor arrays.

Unit II

Image Sampling and Quantization: Basic Concepts- Representing Digital Images – Spatial and gray level resolution – Aliasing & More Patterns– zooming and shrinking Digital Images

Basic Relationships between pixels: Neighbors of a pixel – Adjacency, connectively, regions and boundaries – Distance Measures, Image operations on a pixel Basis.

Unit III

Color Image Processing: Fundamentals – Color Models: RGB Color model – CMY & CMYK color model – HIS model – Color Image Smoothing & Color Image Sharping

Image Enhancement in Spatial Domain: Gray level transformation: Image negatives-Log transformations – Piecewise-Linear transformation function – Enhancement using arithmetic / logic operations: Image subtraction – Image Averaging.

Unit IV

Image Compression: Fundamentals: Coding redundancy – Interpixel redundancy – Psychovisual redundancy – Image compression models: The source Encoder and Decoder – The channel Encoder and Decoder.

Unit V

Image Segmentation: Detection of Discontinuities: Point Detection – Line Detection - Edge Detection. **Representation of Images:** Chain codes – Polygonal approximation – Signatures – Boundary Segments – Skeletons.

TEXT BOOKS

Digital Image Processing – Second Edition – Rafael C. Gonzalez and Richard E.Woods

REFERENCE BOOKS:

1. Rafael Gonzalez, Richard E. Woods, "Digital Image Processing", Fourth Edition, PHI/Pearson Education, 2013.
2. A. K. Jain, Fundamentals of Image Processing, Second Ed., PHI, New Delhi, 2015.

REFERENCES BOOK:

1. B. Chan la, D. Dutta Majumder, "Digital Image Processing and Analysis", PHI, 2003.
2. Nick Elford, "Digital Image Processing a practical introducing using Java", Pearson Education, 2004.
3. Todd R.Reed, "Digital Image Sequence Processing, Compression, and Analysis", CRC Press, 2015.
4. L.Prasad, S.S.Iyengar, "Wavelet Analysis with Applications to Image Processing", CRC Press, 2015.

Course Outcome

After completion of the course, Student shall be able to

CO1: Understand how digital images are represented and manipulated in computer **K2**

CO2: Develop a broad range of image processing techniques and their applications. **K3**

CO3: Understand the different types of image transformations and image features. **K4**

CO4: Understand the advancements in Computer Vision of Images. **K4**

CO5: Identify, Analyse and Design the image compression techniques **K3,K4**

Mapping of Cos with Pos and PSOs :

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	S	M		M	M	M	M	S	M	S
CO2		S	M	S	M		S	M	S	
CO3	S	M		M	M	M	M	S	M	S
CO4	S	M	S	M	M	M	M	S	M	S
CO5	M	S	M	S	M		S	M	S	M

S – Strongly Correlating **M- Moderately Correlating**

ICST72	**ARTIFICIAL INTELLIGENCE**		
	Semester VII	**Credits: 4**	**Hours: 5**
Cognitive Level	K2-Understand K3-Apply K4-Analyze		
Objectives	1) Explain the basic knowledge representation, problem solving, and learning methods of Artificial Intelligence **2)** Assess the applicability, strengths, and weaknesses of the basic knowledge representation, problem solving, and learning methods in solving particular particular engineering problems **3)** Develop intelligent systems by assembling solutions to concrete computational problems **4)** Understand the role of knowledge representation, problem solving, and learning in intelligent-system engineering And many 6.034 students will, as measured by exit survey: **5)** Develop an interest in the field sufficient to take more advanced subjects		

UNIT I: Problems and Search: AI Problem – AI techniques – Level of the model – Problems, Problem Spaces and Search: Heuristic Search Techniques

UNIT II: Knowledge Representation: Issues – Using Predicate Logic – Representing Knowledge using rules – Symbolic reasoning under uncertainty - Statistical Reasoning – Weal Slot and Strong Slot filler structures.

UNIT III: Game Playing-Planning-Natural Language Processing- Learning – Connectionist Models – Common Sense

UNIT IV: Expert Systems – Representing and using Domain Knowledge – Expert system Shells – Knowledge Acquisition – Perception And Action: Real time search – Perception – Action – Robot Architecture.

UNIT V: Fuzzy Logic System: Introduction – Crisp sets – Fuzzy sets – Fuzzy Terminology – Fuzzy Logic control – Inference processing – Fuzzy Hedges – Neuro Fuzzy Systems.

Text Book:

1. Elaine Rich, Kevin Knight, Shivashankar B.Nair , " Artificial Intelligence", Tata McGraw-HillPublishing Company Ltd , IIIrd Edition. ISBN 0-07-460081-8

ICST73	R - PROGRAMMING		
	Semester VII	**Credits: 4**	**Hours: 5**
Cognitive Level	K2-Understand K3-Apply K4-Analyze		
Objectives	1. Understanding of R System and installation and configuration of R-Environment and R-Studio 2. Understanding R Packages, their installation and management 3. Understanding of nuts and bolts of R: a. R program Structure b. R Data Type, Command Syntax and Control Structures c. File Operations in R 4. Application of R Programming in Daily life problems 5. Preparing Data in R a. Data Cleaning b. Data imputation c. Data conversion 6. Visualizing data using R with different type of graphs and charts 7. Applying R Advance features to solve complex problems and finetuning R Processes		

Learning Outcomes:

After successful completion of the course students should be able to

- Understand the basics in R programming in terms of constructs, control statements, string functions
- Understand the use of R for Big Data analytics
- Learn to apply R programming for Text processing
- Able to appreciate and apply the R programming from a statistical perspective

ICSP74	IMAGE AND VIDEO ANALYTICS LAB		
	Semester VIII	**Credits:3**	**Hours: 5**
Objectives	1. Provide a basic foundation towards digital image processing and video analysis. 2. Understand about various Object Detection, Recognition, Segmentation and Compression methods 3. Understand the fundamental principles of image and video analysis 4. Realize image and video analysis to solve real world problems		

Lab Exercises:

1. Implement basic gray-scale and binary processing - image histogram, image labeling, image thresholding
2. Extraction of frames from videos and analyzing frames
3. Implement spatial domain - linear and non-linear filtering
4. Frequency domain – homomorphic filtering on gray scale and color images
5. Implement image restoration methods on images
6. Implement flicker correction on video datasets
7. Implement multi-resolution image decomposition and reconstruction using wavelet
8. Implement image compression using wavelets
9. Implement image segmentation using thresholding
10. Implement Local Binary Pattern texture descriptor

ICSP75	PROGRAMMING FOR DATA SCIENCE USING R LAB		
	Semester VII	**Credits: 3**	**Hours: 5**
Objectives	1. To understand and be able to use the basic programming principles such as data types, variable, conditionals, loops, array, recursion and function calls. 2. To learn how to use basic mathematical problems are evaluated and be able to manipulate text files and file operations. 3. To understand the process and will acquire skills necessary to effectively attempt a programming problem and implement it with a specific programming language - R. 4. Understand and summarize different File handling operations in R		

List of Exercises

Cycle – I

1. R Program to check if a Number is Positive, Negative or Zero. 26
2. R program to check prime numbers.
3. R Program to check Armstrong Number.
4. R Program to Find Hash of File.
5. R Program to Root search.

Cycle – II

6. Factorial of number
7. Fibonacci series
8. Reversing the string
9. Swapping of two numbers
10. Odd or even number
11. Duplication of records
12. Convert Decimal into Binary using Recursion.

ICST81	REGRESSION ANALYSIS		
	Semester VIII	**Credits: 4**	**Hours: 5**
Cognitive Level	K2-Understand K3-Apply K4-Analyze		
Objectives	1. To provide the grounding knowledge about the regression model building of simple and multiple regression. 2. The aim of regression analysis is to examine the relationships between one set of variables (the dependent variable(s) aka outcome, target, etc) and another set (independent variables, predictors, etc.) 3. There can be one or more variables in each set. 4. The goal can be focused on explanation, prediction or both.		

UNIT-I

SIMPLE LINEAR REGRESSION- Introduction to regression analysis: Modelling a response, overview and applications of regression analysis, major steps in regression analysis. Simple linear regression (Two variables): assumptions, estimation and properties of regression coefficients, significance and confidence intervals of regression coefficients, measuring the quality of the fit.

UNIT-II

MULTIPLE LINEAR REGRESSION- Multiple linear regression model: assumptions, ordinary least square estimation of regression coefficients, interpretation and properties of regression coefficient, significance and confidence intervals of regression coefficients.

UNIT-III

CRITERIA FOR MODEL SELECTION- Mean Square error criteria, R2 and criteria for model selection; Need of the transformation of variables; Box-Cox transformation; Forward, Backward and Stepwise procedures.

UNIT-IV

RESIDUAL ANALYSIS- Residual analysis, Departures from underlying assumptions, Effect of outliers, Collinearity, Non-constant variance and serial correlation, Departures from normality, Diagnostics and remedies.

UNIT-V

NON LINEAR REGRESSION- Introduction to nonlinear regression, Least squares in the nonlinear case and estimation of parameters, Models for binary response variables, estimation and diagnosis methods for logistic and Poisson regressions. Prediction and residual analysis.

TEXT BOOK:

1. D.C Montgomery, E.A Peck and G.G Vining, *Introduction to Linear Regression Analysis*, John Wiley and Sons,Inc.NY, 2003.
2. S. Chatterjee and AHadi, *Regression Analysis by Example*, 4th Ed., John Wiley and Sons, Inc, 2006
3. Seber, A.F. and Lee, A.J. (2003) Linear Regression Analysis, John Wiley, Relevant sections from chapters 3, 4, 5, 6, 7, 9, 10.

REFERENCE BOOK

1. Iain Pardoe, Applied Regression Modeling, John Wiley and Sons, Inc, 2012.

2. P. McCullagh, J.A. Nelder, Generalized Linear Models, Chapman & Hall, 1989.

Course Outcome

After successful completion of the course, Student shall be able to:

CO1: Demonstrate deeper understanding of the linear regression model. **K2**
CO2: Evaluate R-square criteria for model selection **K4**
CO3: Understand the forward, backward and stepwise methods for selecting the variables **K2**
CO4: Understand the importance of multi-collinearity in regression modelling **K2**
CO5: Ability to use and understand generalizations of the linear model to binary and count data **K3**

Mapping of Cos with Pos and PSOs :

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	M	S		S		M	M	S	M	
CO2	S	S	M	S	S	S	S	M	S	S
CO3	M	S		S	M	M	M	S	M	
CO4	M	S	M	S		M	M	S	M	S
CO5	S	S	M	S	S	S	S	M	S	S

S – Strongly Correlating **M- Moderately Correlating**

ICST82	CRYPTOGRAPHY AND NETWORK SECURITY		
	Semester VIII	**Credits: 4**	**Hours: 5**
Cognitive Level	K2-Understand K3-Apply K4-Analyze		
Objectives	1. To understand security design principles 2. To learn secure programming techniques 3. To Understand the security requirements in operating systems and databases 4. The Student can familiar with security applications in wireless environment.		

UNIT I: Introduction - Security trends – Legal, Ethical and Professional Aspects of Security, Need for Security at Multiple levels, Security Policies – Model of network security – Security attacks, services and mechanisms – OSI security architecture – Classical encryption techniques: substitution techniques, transposition techniques, steganography- Foundations of modern cryptography: perfect security – information theory – product cryptosystem – cryptanalysis.

UNIT II: Symmetric Encryption and Message Confidentiality - Symmetric Encryption Principles, Symmetric Block Encryption Algorithms, Stream Ciphers and RC4 , Chipher Block Modes of Operation, Location of Encryption Devices, Key Distribution. Public-key Cryptography and Message Authentication: Approaches to Message Authentication, Secure Hash Functions and HMAC, Public-Key Cryptography Principles, Public-Key Cryptography Algorithms, Digital Signatures, Key Management.

UNIT III: Authentication Applications - Kerberos, x.509 Authentication Service, Public-Key Infrastructure. Electronic Mail Security: Pretty Good Privacy (PGP), S/MIME.

UNIT IV: IP Security - IP Security Over view, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations. Web Security: Web Security Considerations, Secure Socket Layer(SSL) and Transport Layer Security(TLS), Secure Electronic Transaction(SET).Network Management Security: Basic Concepts of SNMP, SNMPv1 Community Facility, SNMPv3.

UNIT V : Intruders - Intruders, Intrusion Detection, Password Management. **Malicious Software:** Virus and Related Threats, Virus Countermeasures, Distributed Denial of Service Attacks. **Firewalls:** Firewall Design Principles, Trusted Systems, Common Criteria for Information Technology Security Evaluation.

TEXT BOOK:

1. Behrouz A. Ferouzan, "Cryptography & Network Security", Tata Mc Graw Hill, 2007, Reprint 2015.
2. Stallings William, "Cryptography and Network Security - Principles and Practice 2017.
3. William Stallings, "Network Security Essentials Applications and Standards "Third Edition, Pearson Education, 2008.

REFERENCES BOOK:

1. Man Young Rhee, "Internet Security: Cryptographic Principles", "Algorithms And Protocols", Wiley Publications, 2003.
2. Charles Pfleeger, "Security In Computing", 4th Edition, Prentice Hall Of India, 2006.
3. Ulysess Black, "Internet Security Protocols", Pearson Education Asia, 2000.
4. Charlie Kaufman And Radia Perlman, Mike Speciner, "Network Security, Second Edition, Private Communication In Public World", PHI 2002.
5. Bruce Schneier And Neils Ferguson, "Practical Cryptography", First Edition, Wiley Dreamtech India Pvt Ltd, 2003.
6. Douglas R Simson "Cryptography – Theory And Practice", First Edition, CRC Press, 1995.

Course Outcome

After completion of the Course, students shall be able to

CO1: Learn and operate secure programming techniques **K2**

CO2: Understand the design issues in Network Security **K2**

CO3: Identify security threats, security services and mechanisms to counter them. **K4**

CO4: Be familiar with security applications in wireless environment **K3**

CO5: Ability to analyse and use secure programming techniques **K4**

Mapping of Cos with Pos and PSOs :

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	S	M		S		M	S	M	S	M
CO2	S	M		S	M	M	S	M	S	
CO3		M	M		S	M	M	M	M	S
CO4	S	M		S	M	M	S	M	S	M
CO5	S	M	M		S	M	M	M	M	S

S – Strongly Correlating **M- Moderately Correlating**

ICST83	**MACHINE LEARNING TECHNIQUES**		
	Semester VIII	**Credits: 4**	**Hours: 5**
Cognitive Level	K2-Understand K4-Analyze K6-Create		
Objectives	**1.** To Learn about Machine Intelligence and Machine Learning applications 2. To implement and apply machine learning algorithms to real-world applications. 3. To identify and apply the appropriate machine learning technique to classification, pattern recognition, optimization and decision problems. 4. To understand how to perform evaluation of learning algorithms and model selection.		

UNIT I:

INTRODUCTION**:** Learning Problems – Perspectives and Issues – Concept Learning – Version Spaces and Candidate Eliminations – Inductive bias – Decision Tree learning – Representation – Algorithm – Heuristic Space Search.

UNIT II:

NEURAL NETWORKS AND GENETIC ALGORITHMS :Neural Network Representation – Problems – Perceptrons – Multilayer Networks and Back Propagation Algorithms – Advanced Topics – Genetic Algorithms – Hypothesis Space Search – Genetic Programming – Models of Evaluation and Learning.

UNIT III:

BAYESIAN AND COMPUTATIONAL LEARNING : Bayes Theorem – Concept Learning – Maximum Likelihood – Minimum Description Length Principle – Bayes Optimal Classifier – Gibbs Algorithm – Naïve Bayes Classifier – Bayesian Belief Network – EM Algorithm – Probability Learning – Sample Complexity – Finite and Infinite Hypothesis Spaces – Mistake Bound Model.

UNIT IV :

INSTANT BASED LEARNING : K- Nearest Neighbour Learning – Locally weighted Regression – Radial Basis Functions – Case Based Learning.

UNIT V:

ADVANCED LEARNING : Learning Sets of Rules – Sequential Covering Algorithm – Learning Rule Set – First Order Rules – Sets of First Order Rules – Induction on Inverted Deduction – Inverting Resolution – Analytical Learning – Perfect Domain Theories – Explanation Base Learning – FOCL Algorithm – Reinforcement Learning – Task – Q-Learning – Temporal Difference Learning

TEXT BOOK:

1. Tom M. Mitchell, ―Machine Learning, McGraw-Hill Education (India) Private Limited, 2013.

REFERENCES:

1. EthemAlpaydin, ―Introduction to Machine Learning (Adaptive Computation and Machine Learning), The MIT Press 2004.
2. Stephen Marsland, ―Machine Learning: An Algorithmic Perspective, CRC Press, 2009.
3. Michael Affenzeller, Stephan Winkler, Stefan Wagner, Andreas Beham, "Genetic Algorithms and Genetic Programming", CRC Press Taylor and Francis Group.

Course Outcome

After successful completion of the course, Student shall be able to:

CO1: Have a good understanding of the fundamental issues and challenges of machine learning concept **K2**

CO2: Understand, Analyse and identify the strengths and weaknesses of many popular machine learning approaches. **K2, K4**

CO3: Aware about the underlying mathematical relationships across Machine Learning algorithms and the paradigms of supervised and un-supervised learning. **K2**

CO4: Ability to design and implement various machine learning algorithms in a range of real-world applications. **K4, K6**

CO5: Perform evaluation of machine learning algorithms and model selection. **K4**

Mapping of Cos with Pos and PSOs :

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	S	S		S		M	M	M	S	M
CO2	S	S		S	M	M	M	M	S	
CO3	S	M	M	S		M	M	M	S	M
CO4	M	S	S		M	S	M	S		S
CO5	M	S	S		M	S	M	S		S

S – Strongly Correlating M- Moderately Correlating

ICSP84	**REGRESSION ANALYSIS LAB**		
	Semester VIII	**Credits: 3**	**Hours: 5**
Objectives	1. To introduce the vital area of regression models applications in a wide variety of situations. 2. To expose the students to the wide areas of its applications. 3. Students should be able to analyse specific data problems by their own. 4. familiar with the concepts of exploratory data analysis		

List of Exercise

1. Exercise on Correlation
2. Spearman's rank correlation coefficient.
3. Simple linear regression
4. Multiple linear regression - 1
5. Multiple linear regression - 2
6. Testing the significance of correlation coefficient and equality of correlation coefficients.
7. Testing the significance of regression coefficients. Coefficient of determination, Standard Error of Regression, ANOVA.
8. Fitting of quadratic curve and exponential curve by the method of least squares
9. Statistical Computing using R software – Regression analysis

ICSP85	TENSORFLOW LAB		
	Semester VIII	**Credits: 3**	**Hours: 5**
Objectives	1. To introduce the vital area of regression models applications in a wide variety of situations. 2. To expose the students to the wide areas of its applications. 3. Students should be able to analyse specific data problems by their own. 4. familiar with the concepts of exploratory data analysis		

Exercise 1: Minimize error using cross entropy as the cost function

Exercise 2: Apply exponential learning rate decay

Exercise 3: Apply early stopping when a condition is met

Exercise 4: Apply L1 regularization to weights

Exercise 5: What else can you do to achieve higher accuracy (minimum 0.94)?

EXPLORATION EXERCISES

Exercise 1: For this first exercise, run the code below. It creates a set of classifications for each of the test images, and then prints the first entry in the classifications. The output, after you run it is a list of numbers. Why do you think this is, and what do those numbers represent?

```
classifications = model.predict(test_images)
print(classifications[0])
```

Hint: try running print(test_labels[0]) -- and you'll get a 9. Does that help you understand why this list looks the way it does?

The output of the model is a list of 10 numbers. These numbers are a probability that the value being classified is the corresponding label, i.e. the first value in the list is the probability that the clothing is of class '0', the next is a '1' etc. Notice that they are all VERY LOW probabilities except one. Also, because of Softmax, all the probabilities in this list sum to 1.0.

Both the list and the labels are 0 based, so the ankle boot having label 9 means that it is the 10th of the 10 classes. The list having the 10th element being the highest value means that the neural network has predicted that the item it is classifying is most likely an ankle boot

Exercise 2: Let's now look at the layers in your model. Experiment with different values for the dense layer with 512 neurons. What different results do you get for loss, training time etc? Why do you think that's the case?

So, for example, if you increase to 1024 neurons you have to do more calculations, slowing down the process. But, in this case, they have a good impact because the model is more accurate. That doesn't mean it's always a case of 'more is better', you can hit the law of diminishing returns very quickly.

Exercise 3: What would happen if you remove the Flatten() layer. Why do you think that's the case?

You get an **error** about the shape of the data. The details of the error may seem vague right now, but it reinforces the rule of thumb that the first layer in your network should be the same shape as your data. Right now our data is 28x28 images, and 28 layers of 28 neurons would be infeasible, so it makes more sense to 'flatten' that 28,28 into a 784x1. Instead of writing all the code to handle that ourselves, we add the Flatten() layer at the beginning. And when the arrays are loaded into the model later, they'll automatically be flattened for us.

Exercise 4: Consider the final (output) layers. Why are there 10 of them? What would happen if you had a different amount than 10? For example, try training the network with 5.

You get an **error** as soon as it finds an unexpected value. Another rule of thumb -- the number of neurons in the last layer should match the number of classes you are classifying for. In this case it's the digits 0-9, so there are 10 of them, and hence you should have 10 neurons in your final layer.

Exercise 5: Consider the effects of additional layers in the network. What will happen if you add another layer between the one with 512 and the final layer with 10?

Answer: There isn't a significant impact -- because this is relatively simple data. For far more complex data, extra layers are often necessary.

ICST91	COMPUTER NETWORKS		
	Semester VIII	**Credits: 4**	**Hours: 5**
Objectives	• Describe the general principles of data communication. • Describe how computer networks are organized with the concept of layered approach. • Describe how signals are used to transfer data between nodes. • Implement a simple LAN with hubs, bridges and switches. • Describe how packets in the Internet are delivered. • Analyze the contents in a given data link layer packet, based on the layer concept. • Design logical sub-address blocks with a given address block. • Decide routing entries given a simple example of network topology • Describe what classless addressing scheme is. • Describe how routing protocols work.		

UNIT-I

Introduction to Data Communications and Networking, Evolution of Computer Networks, General Principles of Network Design: Topologies, Network Models (ISO-OSI, TCP/IP), Network Architecture & Standardization (IEEE802.x).

UNIT-II

Physical Layer: Theoretical Basis for Data Communication-Data, Throughput, Bandwidth, Bit rate, Baud Rate, Data Rate measurement – Multiplexing, Transmission Media (Guided Media, Unguided Media: Wireless), Switching (Circuit, Message, Packet).

UNIT-III

Data Link Layer: Data Link Layer Design Issues, Error detection and Correction, Data Link Control, Elementary Data Link Protocols, Network devices: Repeater, Hubs, Bridges, Switches, Routers, Gateways, Backbone networks and Virtual LANs, Wireless WANs.

UNIT-IV

Network layer: Network Layer Design Issues, Logical Addressing, Internet Protocol, Address Mapping, Error Reporting and Multicasting, Delivery, Forwarding, Routing Algorithms.

UNIT-V

Transport Layer: Transport Service, Elements of Transport Protocols, UDP, TCP.

Application Layer: DNS, Remote Logging, File Transfer, SNMP, Multimedia.

TEXT BOOKS

1. Behrouz A.Forouzan, "Introduction to Data Communications and Networking", Fourth Edition, 2007, McGraw-Hill Education (India), New Delhi.
2. Natalia Olifer & Victor Olifer, "Computer Networks: Principles, Technologies and Protocols", First Edition, 2006, Wiley India Pvt. Ltd., New Delhi.

REFERENCE BOOKS

1. Andrew S. Tanenbaum, "Computer Networks", Fourth Edition, 2003, PHI Learning Pvt. Ltd., / Pearson Education Inc., New Delhi.
2. James F. Kurose, Keith W. Rose, Computer Networking: A Top-Down Approach Featuring the Internet", 4th Edition (2008), Pearson Education Inc., New Delhi.
3. Wayne Tomasi, "Introduction to Data Communications and Networking", First Edition, 2005, Pearson Education Inc., New Delhi.
4. Prakash Gupta, "Data Communications and Networking", First Edition, 2008, PHI Learning Pvt., Ltd., New Delhi.
5. Curt White, "Data Communications and Networking", First Edition, 2008, CENGAGE Learning India Pvt. Ltd., New Delhi.
6. L.L. Peterson & B.S.Davile, "Computer Networks", Fourth Edition, Elsevier Inc,

ICST92	DATA ANALYTICS AND INTERNET OF THINGS		
	Semester VIII	**Credits: 4**	**Hours: 5**
Objectives	• Describe the general principles of data communication. • Describe how computer networks are organized with the concept of layered approach. • Describe how signals are used to transfer data between nodes. • Implement a simple LAN with hubs, bridges and switches. • Describe how packets in the Internet are delivered. • Analyze the contents in a given data link layer packet, based on the layer concept. • Design logical sub-address blocks with a given address block. • Decide routing entries given a simple example of network topology • Describe what classless addressing scheme is. • Describe how routing protocols work.		

Unit 1: Data Definitions and Analysis Techniques: Elements, Variables, and Data categorization - Levels of Measurement - Data management and indexing - Introduction to statistical learning and R-Programming. **Descriptive Statistics:** Measures of central tendency - Measures of location of dispersions - Practice and analysis with R

Unit 2: Basic Analysis Techniques: Basic analysis techniques - Statistical hypothesis generation and testing - Chi-Square test - t-Test - Analysis of variance - Correlation analysis - Maximum likelihood test - Practice and analysis with R. **Data analysis techniques:** Regression analysis - Classification techniques – Clustering - Association rules analysis -Practice and analysis with R

Unit 3: Introduction To IoT: Internet of Things - Physical Design- Logical Design- IoT Enabling Technologies - IoT Levels & Deployment Templates - Domain Specific IoTs - IoT and M2M - IoT System Management with NETCONF-YANG- IoT Platforms Design Methodology

Unit 4: IoT Architecture: M2M high-level ETSI architecture - IETF architecture for IoT - OGC architecture - IoT reference model - Domain model - information model - functional model - communication model - IoT reference architecture

Unit 5: IoT PROTOCOLS: Protocol Standardization for IoT – Efforts – M2M and WSN Protocols – SCADA and RFID Protocols – Unified Data Standards – Protocols – IEEE 802.15.4 – BACNet Protocol – Modbus– Zigbee Architecture – Network layer – 6LowPAN - CoAP – Security.

Reference Books

1. Anil Maheswari, - Data Analytics - Publisher: McGraw Hill India .
2. Arshdeep Bahga, Vijay Madisetti, ―Internet of Things – A hands-on approach‖, Universities Press, 2015
3. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), ―Architecting the Internet of Things‖, Springer, 2011.
4. Honbo Zhou, ―The Internet of Things in the Cloud: A Middleware Perspective‖, CRC Press, 2012.

OUTCOMES:

Upon completion of this course, the students should be able to:

- Organize and Analyze Bigdata
- Discover Useful Information for Decision Making
- Analyze various protocols for IoT
- Develop web services to access/control IoT devices.
- Design a portable IoT using Rasperry Pi
- Deploy an IoT application and connect to the cloud.
- Analyze applications of IoT in real time scenario

ICST93	**NATURAL LANGUAGE PROCESSING**		
	Semester IX	**Credits: 4**	**Hours: 5**
Cognitive Level	K2-Understand K3-Apply		
Objectives	1. To teach principles of NLP and deep learning for generating speech and text 2. To familiarize the recent practical successes of Deep Learning and leading to improvements in fundamental NLP technologies 3. To impart the fundamental techniques in deep learning and neural networks which enable the development of effective NLP applications. 4. To implement machine translation mechanisms for creating enormous interest in academia and industry.		

UNIT – I

INTRODUCTION TO NLP AND DEEP LEARNING: Define Natural language processing, NLP levels, what is Deep learning, how deep is "Deep"?, what are neural networks, basic structure of neural networks, types of neural networks, multilayer perceptrons.

UNIT – II

WORD VECTOR REPRESENTATIONS: Introduction to word embedding: Natural language model, Wordtovec: Skip-Gram model, Model components: Architecture, Hidden layer, output layer, subsampling frequent words.

UNIT - III

SIMPLE RECURRENT NEURAL NETWORKS: Recurrent Neural Networks basics, natural language processing and recurrent neural networks, RNNs mechanism, Training RNNs.

UNIT – IV

SPEECH RECOGNITION: Neural Networks for acoustic modelling and end-to-end speech models, Sequence to Sequence Models: Generating from an embedding, attention mechanisms, advanced sequence to sequence models.

UNIT – V

MACHINE TRANSLATION: Basics of machine translation, language models, types and structure of machine translation, introduction on statistical and neural machine translation, encoder-decoder architecture of NMT.

TEXT BOOK:

1. Jason Brownlee, "Deep Learning for Natural Language Processing", Develop Deep Learning Models for Natural Language in Python, machine learning mastery, 2017, Edition: v1.1
2. Palash Goyal, Sumit Pandey, Karan Jain, "Deep Learning for Natural Language Processing Creating Neural Networks with Python", APress,2018, ISBN-13 (pbk): 978-1-4842-3684-0.

REFERENCES BOOK:

1. Li Deng, Yang Liu, "Deep Learning in Natural Language Processing", Springer Singapore, 2018.
2. Karthiek Reddy Bokka, Shubhangi Hora, Tanuj Jain, "Deep Learning for Natural Language Processing", Packt Publishing, 2019.
3. Uday Kamath, John Liu, James Whitaker, "Deep Learning for NLP and Speech Recognition", springer, 2019.

Course Outcome

After completing this course, students will be able to:

CO1: Understand the definition of a range of neural network models. **K2**

CO2: Be able to derive and implement optimization algorithms for these models. **K3**

CO3: Understand neural implementations of attention mechanisms and sequence embedding models **K2**

CO4: Have an awareness of the hardware issues inherent in implementing scalable neural network models for language data. **K2**

CO5: Be able to implement and evaluate common neural network models for language. **K3**

Mapping of Cos with Pos and PSOs :

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	S	M	S		M	S	M	S		M
CO2	M		S	S	S			S	S	
CO3	S	M	S		M		M	S		M
CO4	S	M	S	M	M	M	M	S		M
CO5	M		S	S	S	S		S	S	S

S – Strongly Correlating **M- Moderately Correlating**

ICSP94	**KOTLIN PROGRAMMING**		
	Semester IX	**Credits: 3**	**Hours: 5**
Cognitive Level	K2-Understand K3-Apply		

1. Program to Compute Quotient and Remainder
2. Program to Swap Two Numbers
3. Program to Check Whether a Number is Even or Odd
4. Program to Check Whether an Alphabet is Vowel or Consonant
5. Program to Find GCD and LCM of two Numbers
6. Program to Count Number of Digits in an Integer
7. Program to Reverse a Number
8. Program to Check Whether a Number is Palindrome or Not
9. Program to Check Whether a Number is Prime or Not
10. Program to Display Prime Numbers Between Two Intervals
11. Program to Check Armstrong Number
12. Program to Display Prime Numbers Between Intervals Using Function
13. Program to Display Armstrong Numbers Between Intervals Using Function
14. Program to Display Factors of a Number
15. Program to Find Factorial of a Number Using Recursion
16. Program to Find G.C.D Using Recursion
17. Program to Convert Binary Number to Decimal and vice-versa
18. Program to Convert Octal Number to Decimal and vice-versa
19. Program to Convert Binary Number to Octal and vice-versa
20. Program to Reverse a Sentence Using Recursion
21. Program to calculate the power using recursion
22. Program to Multiply to Matrix Using Multi-dimensional Arrays
23. Program to Multiply two Matrices by Passing Matrix to a Function
24. Program to Find Transpose of a Matrix
25. Program to Find the Frequency of Character in a String
26. Program to Calculate Difference Between Two Time Periods
27. Kotlin Code To Create Pyramid and Pattern
28. Program to Convert String to Date
29. Program to Concatenate Two Arrays
30. Program to Get Current Date/TIme
31. Program to Add Two Dates
32. Program to Get Current Working Directory
33. Program to Convert Map (HashMap) to List
34. Program to Convert Array to Set (HashSet) and Vice-Versa
35. Program to Convert Byte Array to Hexadecimal
36. Program to Create String from Contents of a File
37. Program to Append Text to an Existing File
38. Program to Convert a Stack Trace to a String
39. Program to Convert File to byte array and Vice-Versa
40. Program to Sort ArrayList of Custom Objects By Property

ICSP95	ICSP97 NLP LAB		
	Semester IX	**Credits: 3**	**Hours: 5**
Objectives	1. Introduce major deep learning algorithms and problem settings 2. To solve real world problems and their applications 3. Identify the deep learning algorithms which are more appropriate for various types of learning tasks in various domains. 4. Implement deep learning algorithms and solve real-world problems.		

List of Programs in deep learning using Matlab

1. Calculate the output of a simple neuron
2. Create and view custom neural networks
3. Classification of linearly separable data with a perceptron
4. Classification of a 4-class problem with a 2-neuronperceptron
5. ADALINE time series prediction with adaptive linear filter
6. Classification of an XOR problem with a multilayer perceptron
7. Classification of a 4-class problem with a multilayer perceptron
8. Prediction of chaotic time series with NAR neural network
9. Radial basis function networks for function approximation
10. 1D and 2D Self Organized Map

ICST101	DATA VISUALIZATION		
	Semester X	**Credits: 4**	**Hours: 5**
Cognitive Level	K2-Understand K3-Apply K4-Analyze		
Objectives	1. Enable students to know the basics of data visualization 2. To understand the importance of data visualization and the design and use of visual components and basic algorithms. 3. Provides the knowledge of various visualization structures such as tables, spatial data, time-varying data, tree and network. 4. Familiarize the concept of Bigdata Visualization		

UNIT I

INTRODUCTION: Information visualization – Theoretical foundations – Information visualization types – Design principles - A framework for producing data visualization.

UNIT II

STATIC DATA VISUALIZATION – tools – working with various data formats- visualization of static data - framework

UNIT III

DYNAMIC DATA DISPLAYS : Introduction to web based visual displays – deep visualization – collecting sensor data – visualization D3 framework - Introduction to Many eyes and bubble charts.

UNIT IV

MAPS – Introduction to building choropleth maps.TREES – Network visualizations – Displaying behavior through network graphs.

UNIT V

BIG DATA VISUALIZATION – Visualizations to present and explore big data – visualization of text data and Protein Sequences

TEXT BOOKS:

1. Ware C and Kaufman M ”Visual thinking for design”, Morgan Kaufmann Publishers, 2008.
2. Chakrabarti, S “Mining the web: Discovering knowledge from hypertext data “, Morgan Kaufman Publishers, 2003.
3. Fry ,”Visualizing data”, Sebastopo”, O“Reily, 2007.

Course Outcome

After successful completion of the course, Student shall be able to:

CO1: Understand the visual representation of data **K2**

CO2: Apply the visual mapping and reference model **K3**

CO3: Analyze the one, two and multi-dimensional data for the data visualization process **K4**

CO4: Evaluate the visualization of groups, trees, graphs, clusters, networks and software **K4**

CO5: Construct the effective model for data visualization by using various techniques **K3**

Mapping of Cos with Pos and PSOs :

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	S	S		M	M	M	M	S	S	
CO2	M	M	S	S		M	M	S	S	S
CO3	S	S	M	M	M	M	M	S	S	
CO4	S	S		M	M	M	M	S	S	M
CO5	M	M	S	S		M	M	S	S	S

S – Strongly Correlating **M- Moderately Correlating**

ICST102	DEEP LEARNING		
	Semester : X	**Credits: 4**	**Hours: 5**
Cognitive Level	K2-Understand K3-Apply		
Objectives	1. To teach principles of deep learning for reducing optimization function 2. TO provide an understanding of different types of deep learning architecture with recurrent networks 3. To familiarize the recent practical successes of Deep Learning 4. To impart the fundamental techniques in deep learning and neural networks which enable the development of effective real time applications. .		

Unit I: Applied Math and Machine Learning Basics. Modern Practical Deep Networks-Deep Feedforward Networks

Unit II: Regularization for Deep Learning-Optimization for Training Deep Models-Convolutional Networks

Unit III: Sequence Modeling: Recurrent and Recursive Nets-Practical Methodology-Applications-Deep Learning Research-Linear Factor Models-Autoencoders-Representation Learning

Unit IV: Structured Probabilistic Models for Deep Learning-Monte Carlo Methods-Confronting the Partition Function Approximate Inference-Deep Generative Models.

Unit V: Overview to FRAMEWORKS-Caffe, Torch7, Theano, cuda-convnet, Ccv, NuPIC, DeepLearning

Reference Book:

Deep Learning (Adaptive Computation and Machine Learning Series) by Ian Goodfellow, Yoshua Bengio and Aaron Courville, MIT Press, 2016

Course Outcome

After completing this course, students will be able to:

CO1: Understand the definition of a range of neural network models. **K2**

CO2: Be able to derive and implement optimization algorithms for these models. **K3**

CO3: Understand neural implementations of attention mechanisms and sequence embedding models **K2**

CO4: Have an awareness of the hardware issues inherent in implementing scalable neural network models for language data. **K2**

CO5: Be able to implement and evaluate common neural network models for language. **K3**

Mapping of Cos with Pos and PSOs :

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	S	M	S		M	S	M	S		M
CO2	M		S	S	S			S	S	
CO3	S	M	S		M		M	S		M
CO4	S	M	S	M	M	M	M	S		M
CO5	M		S	S	S	S		S	S	S

LIST OF ELECTIVES

COMPUTER GRAPHICS

(ELECTIVE – 1 – 1)

UNIT I: Overview of Graphics System – output primitives: points and lines – line drawing algorithm – circle generating algorithm – Ellipse generating algorithm – filled area primitives – character generation.

UNIT II: Two Dimensional transformation: basic transformation – Matrix representation – composite transformation and other transformation – window-to-viewport transformation, viewing – clipping – interactive input methods.

UNIT III: Three dimensional transformation: 3 D concepts – 3 D representation: polygon surfaces, curved line and surfaces, quadric surfaces – spline representation – cubic spline interpolation – Bezier curves – B Spline Curves and surfaces and Beta spline – fractal-geometric methods.

UNIT IV: Three dimensional geometric and modeling transformation – 3 D viewing – Visible surface detection methods – illumination models and surface-rendering methods.

UNIT V: Color Models and color applications: properties of light – standard primaries and the chromaticity diagram – all color models – conversion between HSV and RGB Models - Color selection – Design and animation sequences – general computer animation functions – computer animation languages – Key frame system – Motion specification.

REFERENCE BOOK

1. Donald Hearn and M.Pauline Baker – Computer Graphics, Pearson Education, Second Edition.

MICROPROCESSOR AND ITS APPLICATIONS

(ELECTIVE – 1 – 2)

UNIT I: Computers, Microprocessors an introduction computers the 8086, 8081, 80188, 80286 8086 Internal Architecture - Introduction to Programming the 8086 - 8086 family Assembly language programming introduction program development Steps – Constructing the Machine Codes for 8086 instructions - writing programs for use with an assembler assembly language program development tools.

UNIT II: 8086 assembly language programming techniques - objectives practice with simple sequence programs flags – jumps and while-do implementations – repeat until im0plementation and examples – debugging assembly language programs.

UNIT III: If-then-else structures, procedures and Macros if-then, if-then and multiple if-then-else programs. Writing and using procedures – writing and using assembler macros.

UNIT IV: 8086 introduction descriptions and assembler directives unix operating system-structure, operations of the kernel shell application layer – 80286 microprocessor-architefture real address mode – memory management scheme – descriptors – accessing segments address translation registers and physical address- protection mechanisms – task switching and task gates – interrupt handling in PVAM – instructions for PVAM.

UNIT V: Digital interfacing & Applications – programmable parallel ports and handshake input/output – interfacing a microprocessor to keyboards – interfacing to alphanumeric ports to high-power devices – optical motor shaft encoders.

Text Book

1. Microprocessors and Interfacing - Programming and Hardware, D.V.Hall, Seventh reprint, Tata McGraw Hill Edition, New Delhi 1995.

Reference Books

1. Introduction to Microprocessors, A.P.Mathur, 3rd Edition, Tata McGraw Hill Company Limited, New Delhi, 1994.

2.PCArchitecture & Assembly Language, B.Kauler, Galgotia Publication, New Delhi, 1995.

3. Hardware Bible, W.L.Rosch, Prientice Hall of India, New Delhi, 1994.

ELECTIVE - COMPLIER DESIGN
(Elective – 2 – 1)

Unit I: Introduction to Complier – Programming Language Grammar Definition of Programming Language – Lexical and Syntactic Structure of a Language – Finite Automata and Lexical Analysis – Regular Expression – Finite Automata – Deterministic Automata – Non Deterministic Automata – Reduce Automata Syntactic Specification of Programming Languages

Unit II: Basic Parsing Techniques – Shift Reduce – Operator Precedence- Top-down Predictive Parser-Syntax – Directed Translations Schemes – Implementation translation of assignment statements.

Unit III: Symbol Tables – Contents of Symbol table – data structure symbol table-representing scope information – error deletion and recovery – lexical phase errors – syntactic phase errors – semantic error.

Unit IV: Introduction to code optimization – loop optimization – DAG representation of blocks – code generation – problems in code generation – machine model – simple code generation from DAG's

Unit V: Important features and the comparative studies of some programming languages and their implementation.

REFERENCE BOOKS

1. A.Aho Ullman, " Principles of Complier Design", Addition Wesley, 1978.
2. D.M.DhanDhere, "Complier Construction – Principles and Practice", Macmillan India Ltd., 1983.

CLOUD COMPUTING

(2.2.Elective))

Objectives:

1. To understand the principle of cloud virtualization, cloud storage, data management and data visualization.
2. To learn the key dimensions and challenges of Cloud Computing.
3. To facilitate to choose the appropriate technologies, algorithms, and approaches for the related issues.
4. Able to develop and deploy cloud application using popular cloud platforms.

UNIT I: Introduction: Cloud Computing – History – Working of cloud computing – Cloud computing today – Pros and cons of Cloud Computing – Benefits of cloud computing – Non users of Cloud computing – Developing cloud services – Pros and Cons of Cloud service Development – Types of Cloud Service Development – Discovering Cloud Services development services and tools.

UNIT II: Cloud Computing for Everyone: Centralizing Email Communications – Collaborating of Grocery lists – Collaborating on To-Do lists – Collaborating on Household budgets – Collaborating on Contact lists – Communicating across the community – Collaborating on Schedules – Collaborating on group projects and events – Cloud computing for corporation.

UNIT III : Cloud Services: Exploring online calendar applications – Exploring online scheduling applications – Exploring online planning and task management – Collaboration on event management – Collaboration on Contact Management – Collaboration on Project Management – Collaborating on Word Processing and Databases – Storing and Sharing files and other online content.

UNIT IV : Issues in Cloud: Federation in cloud – Four levels of federation – Privacy in cloud – Security in Cloud –Software as a security service – Case Study: Aneka – service level agreements Cloud Storage: Over view of cloud storage – Cloud storage providers – Amazon S3 – Cloud file system – Map Reduce – Hadoop

UNIT V : Cloud Deployment Tools: Study of open source cloud platforms – Eucalyptus - Nimbus – Open Nebula

TEXT BOOKS

1. Michael Miller, "Cloud computing – Web based applications that change the way you work and collaborate online", Pearson Education Inc., 2008
2. John W.Rittinghous, James F.Ransome, "Cloud Computing: Implementation, Management and Security", CRC Press 2010.

REFERENCEBOOKS

1. Danielle Ruest and Nelson Ruest, "Virtualization: A Beginners's Guide", McGraw Hill,2009.
2. Tom White, "Hadoop: The Definitive Guide", O'RIELLY Media 2009.
3. Rajkumar Buyya, James Broberg, Andrezj Goscinski, "Cloud computing – Principles and Paradigms", John Wiley and Sons, 2011.

BITCOIN AND CRYPTO CURRENCY TECHNOLOGIES

(3.1. Elective)

Unit- I : Introduction to Cryptography & Crypto Currencies: Cryptographic Hash Functions –Hash Pointers and Data structures –Digital Signatures- Public keys as Identifiers – A Simple Crypto Currency.

Unit - II : Decentralization in Bitcoin – Centralization Vs. Decentralization – Distributed Consensus – Consensus Without Identity : Using Block Chain - Incentives and Proof of Work.

Unit – III: Mechanics of Bitcoin : Bitcoin Transactions – Bitcoin Scripts – Application of Bitcoin Scripts – Bitcoin Blocks – Bitcoin Network – Limitations and Improvements .

Unit - IV: Storage and use of Bitcoin : Simple Local Storage – Hot and cold Storage – Splitting and Sharing Keys - Online Wallets and Exchanges – Payment Services – Transaction Fees – Currency Exchange Markets.

Unit – V: Bitcoin Mining : The task of Bitcoin Miners – Mining Hardware- Energy consumption & ecology – Mining pools – Mining Incentives and Strategies .

Text Books :
Bitcoin and Crypto currency Technologies – A Comprehensive introduction – Arvind Narayanan, Joseph Bonneau,Edward Felton, Andrew Miller, Steven Goldfeder
Association of American Publishers

MOBILE COMPUTING

(3.2. Elective)

UNIT I: Wireless Communication Fundamentals: Introduction – Applications-A short History of wireless Communications. Wireless Transmission – Frequencies for Radio transmission – Signals – Antennas – Signal Propagation – Multiplexing- Modulations – Amplitude shift keying- Frequency shift keying-Phase shift keying-Spread Spectrum.

UNIT II : Medium Access Control – SDMA – FDMA – TDMA – Fixed TDM- Classical Aloha- CDMA. Telecommunication Systems: – Global System for Mobile Communications – GPRS – Satellite Systems – Basics –Applications- Broadcast Systems – Digital Audio Broadcasting – Digital Video Broadcasting.

UNIT III : Wireless Networks: Wireless LAN: Infrared Vs Radio Transmission – Infrastructure Networks – Ad hoc Networks – IEEE 802.11 –System Architecture-Protocol Architecture-BluetoothUser scenarios- Bluetooth Architecture-Introduction to Wireless ATM – Services - Location Reference Model.

UNIT IV : Mobile Network Layer: Mobile IP – Goals – assumptions – entities and terminology – IP Packet delivery – agent advertisement and discovery – registration – tunneling and encapsulation – optimizations – Dynamic Host Configuration Protocol (DHCP) – routing – DSDV – DSR – Alternative Metrics.

UNIT V : WAP: Introduction – Protocol Architecture – Extensible Markup Language (XML) – WML Script – Applications – Wireless Telephony Application (WTA) – Wireless Telephony Application Architecture.

TEXT BOOKS:

1. Jochen Schiller, “Mobile Communications”, PHI/Pearson Education, Second Edition, 2016.

REFERENCE BOOKS:

1. Kaveh Pahalavan, Prasanth Krishnamoorthy, “Principles of Wireless Networks”, PHI/Pearson Education, 2003.

2. Adelstein, Frank, Gupta, Sandeep KS, Richard III, Golder, Schwiebert, Loren, "Fundamentals of Mobile and Pervasive Computing", ISBN: 0071412379, Tata McGraw Hill Publications, 2005.

3. Stallings Williams, "Wireless Communications and Networks", Pearson Education, Second Edition, 2014.

4. Asoke K Talukder, Hasan Ahmed, Roopa R Yavagal, "Mobile Computing", Tata McGraw Hill Publications, Second edition, 2010.

BIG DATA ANALYTICS
(4.1. Elective)

UNIT – I : INTRODUCTION TO BIG DATA

Introduction – understanding Big data-capturing bigdata-Volume-velocity-variety-veracity-Benefiting Big Data –Management of bigdata- organazing big data- Technology challenges

UNIT – II : BIGDATA SOURCES AND ARCHITECTURE

Big data sources-people to people communication-m2m- big data applications- Examining big data types-structured data – unstructured data- semi structured data-integrating data type into big data environment-Big data Architecture.

UNIT – III : HADOOP

Big Data – Apache Hadoop & Hadoop EcoSystem – Moving Data in and out of Hadoop – Understanding inputs and outputs of MapReduce - Data Serialization- Hadoop Architecture, Hadoop Storage. Hadoop MapReduce paradigm, Map and Reduce tasks, Job, Task trackers-: HDFS- Hive Architecture and Installation, Comparison with Traditional Database, HiveQL - Querying Data - Sorting and Aggregating, Map Reduce Scripts, Joins &Subqueries, HBase

UNIT – IV : ANALYTICS AND BIG DATA

Basic analytics-Advanced analytics-operationalzed analytics-Monetizing analytics-modifying business intelligence products to handle big data- big data analytics solution-understanding text analytics-tools for big data.

UNIT – V : DATA VISUALIZATION & R

Introduction-excellence in visualization- types of chart-Business Intelligence: Tools-skills- applications – Health care- Education-retail – E- Governance – Working eith R- Import a data set in R- plotting a histogram-Big data mining

Text Book(s)

1. Anil Maheshwari, Data Analytics Made Accessible: 2017 edition Kindle Edition
2. Judith Hurwitz, Alan Nugent, Dr. Fern Halper, Marcia Kaufman " Big Data for Dummies " wiley India Pvt.Ltd.New Delhi, 2014

Reference Book(s)

1. Boris lublinsky, Kevin t. Smith, Alexey Yakubovich, “Professional Hadoop Solutions”, Wiley, ISBN: 9788126551071, 2015.
2. Chris Eaton, Dirk deroos et al., “Understanding Big data ”, McGraw Hill, 2012.
3. Tom White, “HADOOP: The definitive Guide”, O Reilly 2012. 6 IT2015 SRM(E&T)
4. Tom Plunkett, Brian Macdonald et al, “Oracle Big Data Handbook”, Oracle Press, 2014.
5. JyLiebowitz, “Big Data and Business analytics”, CRC press, 2013.
6. VigneshPrajapati, “Big Data Analytics with R and Hadoop”, Packet Publishing 2013.

DISTRIBUTED OPERATING SYSTEM

(4.2. Elective)

UNIT I: Introduction – Operating System Definition – Functions of Operating System – Types of Advanced Operating System – Design Approaches – Synchronization Mechanisms – concepts of a Process – Critical Section Problem – Process Deadlock – Models of Deadlock – Conditions for Deadlock – System with single-unit requests, Consumable Resources , Reusable Resources.

UNIT II: Distributed Operating Systems: Introduction- Issues – Communication Primitives – Inherent Limitations –Lamport's Logical Clock , Vector Clock, Global State , Cuts – Termination Detection – Distributed Mutual Exclusion – Non Token Based Algorithms – Lamport's Algorithm - Token Based Algorithms –Distributed Deadlock Detection – Distributed Deadlock Detection Algorithms – Agreement Protocols

UNIT III: Distributed Resource Management – Distributed File Systems – Architecture – Mechanisms – Design Issues – Distributed shared Memory – Architecture – Algorithm – Protocols – Design Issues – Distributed Scheduling – Issues – Components – Algorithms.

UNIT IV: Failure Recovery and Fault Tolerance – Concepts – Failure Classifications – Approaches to Recovery – Recovery in Concurrent Systems – Synchronous and Asynchronous Check pointing and Recovery –Check pointing in Distributed Database Systems – Fault Tolerance Issues – Two-Phase and Nonblocking Commit Protocols – Voting Protocols – Dynamic Voting Protocols.

UNIT V: Multiprocessor and Database Operating Systems –Structures – Design Issues – Threads – Process Synchronization – Processor Scheduling – Memory management – Reliability/Fault Tolerance – Database Operating Systems – concepts – Features of Android OS, Ubuntu, Google Chrome OS and Linux operating systems.

TEXT BOOKS:

1. MukeshSinghalN.G.Shivaratri, "Advanced Concepts in Operating Systems", McGraw Hill 2000.
2. Distributed Operating System – Andrew S. Tanenbaum, PHI.

REFERENCE BOOKS:

1. Abraham Silberschatz, Peter B.Galvin, G.Gagne, "Operating Concepts", 6th Edition Addison Wesley publications 2003.
2. Andrew S.Tanenbaum, "Modern Operating Systems", 2nd Edition Addison Wesley 2001

INFORMATION RETRIEVAL
(5.1. Elective)

Unit I : Introduction to Information Retrieval: Information retrieval process, Indexing, Information retrieval model, Boolean retrieval model. Dictionary ad Postings: Tokenization, Stop words, Stemming, Inverted index, Skip pointers, Phrase queries.

Unit II: Tolerant Retrieval: Wild card queries, Permuterm index, Bigram index, Spelling correction, Edit distance, Jaccard coefficient, Soundex. Term Weightinh and Vector Space Model: Wild card queries, Permuterm index, Bigram index, Spelling correction, Edit distance, Jaccard coefficient, Soundex.

Unit – III: Evaluation: Precision, Recall, F-measure, E-measure, Normalized recall, Evaluation problems. Latent Semantic Indexing: Eigen vectors, Singular value decomposition, Low-rank approximation, Problems with Lexical Semantics.

Unit – IV: Query Expansion: Relevance feedback, Rocchio algorithm, Probabilistic relevance feedback, Query Expansion and its types, Query drift. Probabilistic Information Retrieval: Probabilistic relavance feedback, Probability ranking principle, Binary Independence Model, Bayesian network for text retrieval.

Unit – V: XML Indexing and Search: Data vs. Text-centric XML, Text-Centric XML retrieval, Structural terms. Content based Image Retrieval: Introduction to content Based Image retrieval, Challenges in Image retrieval, Image representation, Indexing and retrieving images, Relevance feedback.

Books

1. Introduction to Information Retrieval by Christopher D. Manning.
2. Natural Language Processing And Information Retrieval by *Tanveer Siddiqui and U.S. Tiwary*

INTERNET PROGRAMMING
(5.2. Elective)

UNIT I : Web Essentials: Clients, Servers and Communication – The Internet – Basic Internet protocols – World wide web – HTTP Request Message – HTTP Response Message – Web Clients – Web Servers – HTML5 – Tables – Lists – Image – HTML5 control elements – Semantic elements – Drag and Drop – Audio – Video controls – CSS3 – Inline, embedded and external style sheets – Rule cascading – Inheritance – Backgrounds – Border Images – Colors – Shadows – Text – Transformations – Transitions – Animations.

UNIT II : Java Script: An introduction to JavaScript–JavaScript DOM Model-Date and Objects,-Regular Expressions- Exception Handling-Validation-Built-in objects-Event Handling- DHTML with JavaScript- JSON introduction – Syntax – Function Files – Http Request – SQL.

UNIT III : Servlets: Java Servlet Architecture- Servlet Life Cycle- Form GET and POST actions-Session Handling- Understanding Cookies- Installing and Configuring Apache Tomcat Web Server-DATABASE CONNECTIVITY: JDBC perspectives, JDBC program example – JSP: Understanding Java Server Pages-JSP Standard Tag Library (JSTL)-Creating HTML forms by embedding JSP code.

UNIT IV: An introduction to PHP: PHP- Using PHP- Variables- Program control- Built-in functions-Form Validation- Regular Expressions – File handling – Cookies – Connecting to Database. XML: Basic XML- Document Type Definition- XML Schema DOM and Presenting XML, XML Parsers and Validation, XSL and XSLT Transformation, News Feed (RSS and ATOM).

UNIT V: AJAX: Ajax Client Server Architecture-XML Http Request Object-Call Back Methods; Web Services: Introduction- Java web services Basics – Creating, Publishing, Testing and Describing a Web services (WSDL)-Consuming a web service, Database Driven web service from an application –SOAP.

TEXT BOOK

1. Deitel and Deitel and Nieto, Internet and World Wide Web – How to Program‖, Prentice Hall, 5th Edition, 2011.

REFERENCES BOOKS

1. Stephen Wynkoop and John Burke ―Running a Perfect Website‖, QUE, 2nd Edition,1999.
2. Chris Bates, Web Programming – Building Intranet Applications, 3rd Edition, Wiley Publications, 2009.
3. Jeffrey C and Jackson, ―Web Technologies A Computer Science Perspective‖, Pearson Education, 2011.
4. Gopalan N.P. and Akilandeswari J., ―Web Technology‖, Prentice Hall of India, 2011.

ELECTIVE PREDICTIVE ANALYTICS

(6.1. Elective)

Unit-I: Linear Methods for Regression and Classification: Overview of supervised learning, Linear regression models and least squares, Multiple regression, Multiple outputs, Subset selection , Ridge regression, Lasso regression, Linear Discriminated Analysis, Logistic regression, Perceptron learning algorithm.

Unit-II: Model Assessment and Selection : Bias, Variance, and model complexity, Bias-variance trade off, Optimism of the training error rate, Estimate of In-sample prediction error, Effective number of parameters, Bayesian approach and BIC, Cross- validation, Boot strap methods, conditional or expected test error.

Unit-III: Additive Models, Trees and Boosting: Generalized additive models, Regression and classification trees, Boosting methods-exponential loss and Ada Boost, Numerical Optimization via gradient boosting, Examples (Spam data, California housing, New Zealand fish, Demographic data)

Unit-IV: Neural Networks(NN), Support Vector Machines(SVM),and K-nearest Neighbor: Fitting neural networks, Back propagation, Issues in training NN, SVM for classification, Reproducing Kernels, SVM for regression, K-nearest –Neighbour classifiers(Image Scene Classification)

Unit-V: Unsupervised Learning and Random forests: Association rules, Cluster analysis, Principal Components, Random forests and analysis.

Texts

1. Trevor Hastie, Robert Tibshirani, Jerome Friedman , The Elements of Statistical Learning-Data Mining, Inference, and Prediction ,Second Edition , Springer Verlag, 2009.
2. G.James,D.Witten,T.Hastie,R.Tibshirani-An introduction to statistical learning with applications in R,Springer,2013.
3. E.Alpaydin, Introduction to Machine Learning, Prentice Hall Of India,2010,(Chapter-19)

References

1.C.M.Bishop –Pattern Recognition and Machine Learning,Springer,2006
2. L.Wasserman-All of statistics Texts 1 and 2 and reference 2 are available on

E-COMMERCE
(6.2. Elective)

Unit I: Electronic Commerce-Frame work, anatomy of E-commerce applications-Commerce Consumer applications-Commerce organization applications. Consumer Oriented Electronic Commerce-Mercantile Process Models

Unit II: Electronic Payment Systems-Digital Token-Based, Smart Cards, Credit cards, Risks in Electronic payment systems. Inter Organizational Commerce-EDI,EDI Implementation, Value added Networks.

Unit III: Intra Organizational Commerce-Work Flow, Automation Customization and internal Commerce, Supply chain management. Corporate Digital Library-Document Library, Digital Document types, Corporate Data Warehouses. Advertising and Marketing-Information Based marketing, advertising on internet, on-line marketing process, market research.

Unit IV: Consumer Search and Resource Discovery-Information search and Retrieval, Commerce Catalogues, Information Filtering.

Unit V: Multimedia-Key multimedia concepts, Digital video and Electronic Commerce, Desktop video processing, Desktop video conferencing.

TEXT BOOKS

1. Frotiers of electronic commerce-Kalakata, Whinston, Pearson.

REFERENCE BOOKS

1. E-Commerce fundamentals and applications Hendry Chan, Raymond LEE, Tharam Dillon, Ellizabeth chang, John Wiley.
2. E-Commerce, S.Jaiswal-Galgotia.
3. E-Commerece, Efrain Turbon,Jae Lee, David King,H.Michael Chang.
4. Electronic Commerce-Gary P.Schneider-Thomson.
5. E-Commerce-Business, Technology, Society, Kenneth C.Taudon, Carol Guyerico Traver.

EMBEDDED SYSTEMS

(7.1. Elective)

Unit I: Embedded Computing: Introduction, complex systems and microprocessor, the embedded system design process, formalisms for system design, design examples.
(Chapter 1 from text book 1, Wolf)

The 8051 Architecture: Introduction,8051 Micro controller Hardware, Input/Output Ports and circuits ,External Memory, Counter and timers, Serial data Input/Output, Interrupts.

Unit II: Basic Assembly Language Programming Concepts: The Assembly Language Programming Process, Programming Tools and Techniques, Programming the 8051. Data Transfer and Logical Instructions.

Unit III: Arithmetic Operations, Decimal Arithmetic. Jump and call Instructions, Further Details on Interrupts.
Applications: Interfacing with Keyboards, Displays, D/A and A/D Convections, Multiple Interrupts, serial Data Communications.

Unit IV: Introduction to Real-Time Operating Systems: Tasks and Task States, Tasks and Data, Semaphores, and shared Data; Message Queues, Mailboxes and pipes, Timer Functions, Events, Memory Management, Interrupt Routines in an RTOS Environment.
(Chapter 6 and 7 from Text Book 3, Simon)

Unit V: Basic Design Using a Real-Time Operating System: Principles, Semaphores and Queues, Hard Real-Time Scheduling Considerations ,Saving Memory and power, An example RTOS like uC-OS (Open Source);Embedded Software Development Tools: Host and target machines, Linker/Locators for Embedded Software, Getting Embedded Software into the target System; Debugging Techniques: Testing on Host Machine, Using Laboratory Tools, An Example System.

TEXT BOOKS

1. Computers and Components, Wayne Wolf, Elseir.

2. The 8051 Microcontroller, Third Edition, Kenneth J.Alaya, Thomson.

3. An Embedded Software Primer, David E.Simon, Pearson Education.

REFERENCE BOOKS

1. Embedding System building blocks, Labrosse, via CMP Publishers.

2. Embedded Systems, Raj Kamal, TMH.

3. Micro Controllers, jay V Deshmkhi, TMH.

4. Embedded System Design, Frank Vahid, Tony Givargis, Fohn Wiley.

5. Microcontrollers, Raj Kamal, Pearson Education.

NUMBER THEORY AND INFORMATION SECURITY
(7.2. Elective)

Unit I: Preliminaries: The Number System and the Well Ordering Principle – Mathematical Induction. Divisibility and Factorisation: Divisibility, Greatest Common Divisors, Euclidean Algorithm - Least Common Multiple – Representations of Integers: Decimal Representation and Binary Representation of Integers.

Unit II: Solving Linear Diophantine Equations – Primes: Prime Number – Unique Prime Factorization – Test of Primality by Trial Division.

Unit III: The Theory of Congruences: The Concept of Congruences – Congruence Classes – Applications of Conguences: Check Digits – Solving Linear Congruences: Solving (Single) Linear Congruence - Solving System of Linear Congruences, The Chinese Remainder Theorem.

Unit IV: Fermat's Theorem and Euler's Generalisation: Fermat's Little Theorem – Euler's Theorem. Primitive Roots: The Multiplicative Order – Promotive Roots (mod n) – The Modulus n which does not have Primitive Roots – The Existence Theorems- Applications: The Use of Primitive Roots.

Unit V: Quadratic Congruences: Euler's Criterian – The Legendre Symbol and its Properties – Examples of Computing the Legendre Symbol – Jacobi Symbol – Quadratic Residues and Primitive Roots. Cryptography: Introduction – Symmetric-Key Cryptography – Asymmetric Key or Public Key Cryptography.

Text Book

1. G.H. Hardy and E. M. Wright, "*An Introduction to the Theory of Numbers"*

2. **Leo Moser,** "*An Introduction to the Theory of Numbers",* The Trillia Group, 2011

3. Charles P. Pfleeger, "An Independent Consultant Specialized in Computer and Information System Security", 2015

4. David Kim, and Michael G. Solomon *"Fundamentals of Information Systems Security"*

NON MAJOR ELECTIVES

COMPUTERS IN BUSINESS APPLICATION
(Non Major Elective – I)

Unit I: Data processing – the use of computers in data processing – basic structure of a computer based data processing, system – sub systems of data processing system - computer applications – sales analysis, payroll, production, planning & Control.

Unit II: Master Files, Transaction files, file updating in sequential and direct Access storage, batch processing, online and Real time Processing, Distributed Processing.

Unit III: Word Processing: Creation, Edition, Formatting of Documents, Global search and replacement of text, special print features, mail merge, spelling checker.

Unit IV: Data base Management: Using Access – Creating and Editing Database Files, Programming and Report Generation.

Unit V: The basics of spreadsheet: Building a complex spread sheet application using formulas, conditional calculations: Charting – Creating with the Chart Wizard & Editing Charts Writing Macros, Interfacing the spreadsheet with a database system.

REFERENCE BOOKS

1. Ron Mansfield – Working Microsoft Office, Tata McGraw Hill international Editions.
2. Data Processing Methods – Barry.S, Lee.

CLOUD COMPUTING

(Non Major Elective-1I)

Objectives:

1. To understand the principle of cloud virtualization, cloud storage, data management and data visualization.
2. To learn the key dimensions and challenges of Cloud Computing.
3. To facilitate to choose the appropriate technologies, algorithms, and approaches for the related issues.
4. Able to develop and deploy cloud application using popular cloud platforms.

UNIT I

Introduction: Cloud Computing – History – Working of cloud computing – Cloud computing today – Pros and cons of Cloud Computing – Benefits of cloud computing – Non users of Cloud computing – Developing cloud services – Pros and Cons of Cloud service Development – Types of Cloud Service Development – Discovering Cloud Services development services and tools.

UNIT II

Cloud Computing for Everyone: Centralizing Email Communications – Collaborating of Grocery lists – Collaborating on To-Do lists – Collaborating on Household budgets – Collaborating on Contact lists – Communicating across the community – Collaborating on Schedules – Collaborating on group projects and events – Cloud computing for corporation.

UNIT III

Cloud Services: Exploring online calendar applications – Exploring online scheduling applications – Exploring online planning and task management – Collaboration on event management – Collaboration on Contact Management – Collaboration on Project Management – Collaborating on Word Processing and Databases – Storing and Sharing files and other online content.

UNIT IV

Issues in Cloud: Federation in cloud – Four levels of federation – Privacy in cloud – Security in Cloud –Software as a security service – Case Study: Aneka – service level agreements Cloud Storage: Over view of cloud storage – Cloud storage providers – Amazon S3 – Cloud file system – Map Reduce – Hadoop

UNIT V

Cloud Deployment Tools: Study of open source cloud platforms – Eucalyptus - Nimbus – Open Nebula

TEXT BOOKS

3. Michael Miller, "Cloud computing – Web based applications that change the way you work and collaborate online", Pearson Education Inc., 2008
4. John W.Rittinghous, James F.Ransome, "Cloud Computing: Implementation, Management and Security", CRC Press 2010.

REFERENCEBOOKS

4. Danielle Ruest and Nelson Ruest, "Virtualization: A Beginners's Guide", McGraw Hill,2009.
5. Tom White, "Hadoop: The Definitive Guide", O'RIELLY Media 2009.
6. Rajkumar Buyya, James Broberg, Andrezj Goscinski, "Cloud computing – Principles and Paradigms", John Wiley and Sons, 2011.

WEB DESIGNING WITH HTML

(Non Major Elective – III)

Unit I

Computer Basics – Working Principle of Computers - Components of Computer – Hardware – Storage Media – Software: System software and Application Software – Windows Basics: Mouse Operations – Windows Utilities: Recycle Bin, My Computer , Network Neighborhood, Windows Explore, Accessories**.**

Unit II

Introduction to Network – Internet Fundamentals - Introducing HTML – The Document Head – Body Text Content – Adding Style to Content.

Unit III

Lists and Entities – Making Tables – Hyperlinks and Anchors – Embedding Contents.

Unit IV

Using Frames – Creating Forms – Borders and Margins – Positioning Content Boxes.

Unit V

Stylish Text – List and Table Styles – Styling Backgrounds, Case Study: Create a Website of own with all the features of HTML.

TEXT BOOK

1. HTML 4 in Easy Steps - Mike McGrath

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VALUED ADDED PROGRAMME

Integrated – IV Semester

COMPUTER SKILLS IN BUSINESS APPLICATIONS

Hours: 30 Marks: 100

UNIT 1: **Fundamentals of Computer**:Definition- Characteristics of computer –Application – Components: Hardware- input device,Output device,CPU-Memory unit,ALU,Control unit,Software – Application Software –System Software-Introduction to Windows Operating System – Windows Utilities:Recycle Bin,PaintFile Explorer, Network,Notepad,Task Bar.

UNIT 2: **Word Processor**:Introduction –Screen layout – rules Line, Tool Bar,Menu Bar – Editing a Document –Formatting Features –Fonts –Shapes –Insertion of Objects: Clip Art, OrganizationalChart, EquationEditor – Mail Merge –Saving and Printing of Document - Word Art.

UNIT 3: Spreadsheet Package:Introduction – Screen Layout – Cell , Cell Pointer, Cell Addresses -Data Entry: Labels and Numbers – AutomaticRecalculation - Formula – Copying Formula – Relative and Absolute Addressing – Formatting Cell Contents – Data Manipulation –Sorting, Filtering Data – Transformation of Data into Charts – Formatting of Charts – Worksheet Manipulation : Insertion,Deletion,Moving and Copying –Saving and Printing Spreadsheet data.

UNIT 4: **Presentation package**:Slide Creation – Editing of Slides – Slide Sorter: Transition Effects, Applying Design Templates – Animation Effects -Time Setting – Organizing Slides – Slide show – Attaching Music to the Powerpoint.

UNIT 5: Database Package:Introduction – Table creation –Fields – Data Types – Validation Properties –Design Templates – Validation Properties –Design View of Table – Datasheet View of Table – Adding data to Table – Primary Key Setting – Creating Multiple Tables – Relating Tables – One to Many Relationship - Form: Data Entry Screen - Query: Retrieving Data from Multiple Tables – Reports: Creation of Report.

References:

1. MS-Office, S.S. Shrivastava (2015), Laxmi Publications; First edition, ISBN: 978-8131802908
2. Microsoft Office 2016 Word, Excel, One Note Book – Vol. 1: Lalit Mali (2017), Notion Press; 1st edition, ISBN: 978-1947027657

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