



**AMRITA SAI INSTITUTE OF SCIENCE AND TECHNOLOGY  
(AUTONOMOUS)**

Approved by AICTE, New Delhi; Permanently Affiliated To JNTUK, Kakinada  
Recognized by UGC under 2(f) & 12(B) OF 1956 Act,  
ISO 9001:2015 Certified Institution, Accredited by NAAC "A" Grade  
PARITALA(P), KANCHIKACHERLA(M), KRISHNA (DT)-521 180(A. P)  
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Proceedings of the Board of Studies in Computer Science & Engineering(Artificial Intelligence and Machine Learning), held on 2-01-2023 at 10:00 AM in the Department of Computer Science & Engineering Office, Amrita Sai Institute of Science & Technology, Paritala

S. No	Member	Signature	S. No	Member	Signature
1	<b>Dr M.Sreedevi</b> Professor & HOD Department of CSE, Amrita Sai Institute of Science and Technology, Paritala		2	<b>Dr P Chiranjeevi</b> Professor & DOA Department of CSE, Amrita Sai Institute of Science and Technology, Paritala	
3	<b>Dr D.Haritha</b> Professor of CSE University College of Engineering, JNTUK, Kakinada		4	<b>Dr. M Babu Reddy,</b> Professor & HOD, Dept of CS, Krishna University, Machilipatnam	
5	<b>Dr R.KIRAN</b> Professor of CSE Krishna University, Machilipatnam		6	<b>Sri. G.Venu gopal</b> Head HR,Recuriment and consul tenting Wipro technologies, Hyderabad	
7	<b>Dr G Vijay Kumar,</b> Professor,Department of CSE, ASIST, Paritala		8	<b>Sri P Ramesh Babu,</b> Associate Professor, Department of CSE, ASIST, Paritala	
9	<b>Mr. E Sateesh,</b> Assistant Professor, Department of CSE, ASIST, Paritala		10	<b>Sri. K subhash chandra,</b> Assistant Professor, Department of CSE, ASIST, Paritala	
11	<b>Dr P.Srinivasa Kumar</b> Assistant Professor, Department of CSE, ASIST, Paritala		12	<b>Dr P.Parmanand Prabath</b> Assistant Professor, Department of CSE, ASIST, Paritala	
13	<b>Mrs M.Prameela</b> Assistant Professor, Department of CSE, ASIST, Paritala		14	<b>Mr.P.Arun Kumar,</b> Assistant Professor, Department of CSE, ASIST, Paritala	
15	<b>Mrs Ch.Sowjanya</b> Assistant Professor, Department of CSE, ASIST, Paritala		16	<b>Mr. V.Prasad,</b> Assistant Professor, Department of CSE, ASIST, Paritala	
17	<b>Mr.P.Jaya Krishna,</b> Assistant Professor, Department of CSE, ASIST, Paritala		18	<b>Mr.MD.Rafi,</b> Assistant Professor, Department of CSE, ASIST, Paritala	
<b>Special Invitees</b>					
17	<b>Dr. P Durga Bhavani,</b> Professor in Mathematics, Department of S&H, ASIST, Paritala		18	<b>Sri. D Pavan,</b> Associate Professor in Physics, Department of S&H, ASIST, Paritala	
19	<b>Sri. G. Lovakrishna,</b> Assistant Professor in English Department of S&H, ASIST, Paritala		20	<b>Dr.G.Vijay vardhini,</b> Assistant Professor in Chemistry, Department of S&H, ASIST, Paritala	

At the outset, the Chairperson, BOS in Computer Science & Engineering(Artificial Intelligence and Machine Learning), welcomed all members of Board of Studies and Special invitees present in 2<sup>nd</sup> meeting of Board of Studies for AR22, Department of Computer Science & Engineering and briefed about the agenda to be discussed. The following agenda was placed by the Chairperson and decisions were taken after detailed deliberations:

### **The Agenda for the meeting**

1. Preparation of II, III & IV Year syllabus for AR22 REGULATION keeping in view of objectives of college.
2. To prepare the panel of examiners for the Computer Science & Engineering.
3. Suggesting methodologies for teaching and evaluation.
4. Suggestions of research activities carried out in the department.
5. Suggestions or coordination of extension activities in the department.

#### **Agenda 1: Preparation of syllabus for various courses keeping in view of objectives of college.**

The Chairperson appraised the members about the Autonomous for four year course of Computer Science & Engineering. Accordingly, a draft for the II,III&IV Years syllabus was presented and discussed with panel members of committee for their suggestions and approval.

**Resolution:** The BoS gone through the syllabus and discussed in length about various aspects of the syllabus. After incorporation of the changes suggested by the members of BoS, the II,III & IV year s syllabus was approved.

**Attachment:** Annexure-I

#### **Agenda-2: To prepare the panel of examiners for the Computer Science & Engineering.**

The Chairperson presented the proposed panel of examiners pertaining to I to VIII semester Computer Science & Engineering examination 2022-2026.

**Resolution:** After incorporating of certain changes suggested by the members, the panel of examiners was approved.

**Attachment:** Annexure-II

#### **Agenda 3: Suggesting methodologies for teaching and evaluation process.**

The Chairperson presented the proposed methodologies for teaching and evaluation of Computer Science & Engineering were placed before the board members.

**Resolution:** After incorporating of certain changes suggested by the members, methodologies for teaching and evaluation was approved.

**Attachment:** Annexure-III

#### **Agenda 4: Suggestions of research activities carried out in the department.**

The Chairperson asked the board members for research activities carried out in the department. The board suggested following points to be implemented:

1. Conduct regular research orientation sessions to all faculty members and meritorious students to create awareness among them.
2. Encourage students and faculty to publish papers in reputed journals / conferences. It is also suggested that, to provide incentives for the faculty who published in reputed journals.

**Agenda 5: Suggestions or coordination of extension activities in the department.**

Dr D.Haritha, Professor, University College of Engineering, JNTUK, Expert Member of JNTUK briefed the members about the need of extension work and workshops which are to be conducted in the department.

Dr D.Haritha also suggested,

- Conduct at least two workshops per semester on advanced technologies or latest trends.
- Conduct quizzes, seminars, guest lectures to improve or impart extra knowledge among the students and faculty.
- Community service project to be done by the students in II year II Semester.

The meeting was concluded by noting down the panel members suggestions, changes are incorporated in syllabus. The chairperson gave vote of thanks to all the panel members for their valuable suggestions for the improvement of student growth in academics.

Sd/-

**Dr M.SREEDEVI**  
Professor & HOD,  
Chairperson- BoS,  
Department of CSE  
ASIST

**Under Graduate Course Structure**  
**For**  
**Computer Science and Engineering**  
*(Applicable for batches admitted from 2022-2023)*



**Autonomous Regulations-AR22**

**Amrita Sai Institute of Science & Technology**  
*Approved by AICTE, New Delhi; Permanently Affiliated to JNTUK, Kakinada ISO 9001:2015 Certified Institution; Accredited by NAAC with "A" grade Recognized by UGC under 2(f) and 12(B) of UGC 1956 Act*  
**Amrita Sai Nagar, Paritala, Krishna District Andhrapradesh-521 180**  
[www.amritasai.edu.in](http://www.amritasai.edu.in), 0866-2428399

## Outcome-Based Education, Dept of Computer Science and Engineering

The following curriculum for B.Tech. CSE. M.Tech Computer Science and Engineering programmes with Regulations-R22 is conventional to outcome-based teaching-learning process. In general, **TWELVE PROGRAMME OUTCOMES** (a-l) have been identified and the curriculum and syllabus have been structured in such a way such that each of the courses meets one or more of these outcomes.

Student outcomes describe what students are expected to know and are able to do by the time of graduation. These relate to the skills, knowledge, and behaviour that students acquire as they progress through the program. Further, each course in the program spells out clear instructional objectives which are mapped to the student outcomes.

### The Programme Outcomes:

- a. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization for the solution of complex engineering problems.
- b. Problem analysis: Identity, formulates, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- c. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, and cultural, societal, and environmental considerations.
- d. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of the information to provide valid conclusions.
- e. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling of complex engineering activities, with an understanding of the limitations.
- f. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- g. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- h. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering Practice.
- i. Individual and teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multi disciplinary settings.
- j. Communication: Communicate effectively on complex engineering activities with the engineering community and with the e-society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- k. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multi disciplinary environments.
- l. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

### Program Specific Objectives–CSE

PSO-1	Able to utilize the knowledge of latest technologies and emerging technologies, for the benefit of societal requirements.
PSO-2	To explore the scientific theories, ideas, methodologies and the new cutting edge technologies In software industries to solve the current and future software application problems.
PSO-3	To be able to utilize of technologies like java, spark, python, Tensor flow according To industrial applications.

### Program Educational Objectives–

PEO-1	Prepare graduates to have knowledge and competency for careers and related to computer science
PEO-2	Prepare graduates to become leaders in the fields related to computer science
PEO-3	Prepare graduates to have pursue higher education in engineering and other professional skills

### SYLLABUS STRUCTURE:

SNO	DESCRIPTION		NUMBER	CREDIT P RONE	CREDITS
01	TH EO RY	CORE SUBJECTS	26	3	78
02		CORE ELECTIVES	05		
03		OPEN ELECTIVES	04		
04	PRACTICALS		17	1.5	25.5
05	INTERNSHIPS		02	1.5+3	4.5
06	MANDATORY COURSES		04	0	0
07	SKILL ORIENTED PROGRAMS		05	2	10
08	SOCIAL ELECTIVE		01	3	3
09	MAJOR PROJECT/INTERNSHIP		01	12	12
<b>TOTAL</b>			<b>65</b>		<b>160</b>

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ACCREDITED BY NAAC WITH "A" GRADE

PARITALA (P), KANCHIKACHERLA (M), KRISHNA (D)-521180 (A.P.)



**DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING**

**COURSE STRUCTURE FOR AR22 REGULATION**

**I YEAR I SEMESTER:**

SNO	SUBCODE	COURSE TITLE	CATEGORY	L	T	P	CREDITS
1	22HS1T1	ENGLISH-I	HSC	3	0	0	3
2	22BS1T2	MATHEMATICS-I	BSC	3	0	0	3
3	22BS1T3	PHYSICS	BSC	3	0	0	3
4	22ES1T4	C PROGRAMMING	ESC	3	0	0	3
5	22ES1T5	BASICS OF ENGINEERING & TECHNOLOGY	ESC	1	0	4	3
6	22HS1L1	ENGLISH LAB -I	HSC LAB	0	0	3	1.5
7	22BS1L2	PHYSICS & WORKSHOP LAB	BSCLAB	0	0	3	1.5
8	22ES1L3	C PROGRAMMING LAB	ESCLAB	0	0	3	1.5
9	2CS1MC1	LEARNING AN ART FORM	MC	2	0	0	0
<b>TOTAL CREDITS</b>							<b>19.5</b>

**I YEAR II SEMESTER:**

S.NO	SUBCODE	COURSE TITLE	CATEGORY	L	T	P	CREDITS
1	22HS2T1	ENGLISH-II	HSC	3	0	0	3
2	22BS2T2	MATHEMATICS-II	BSC	3	0	0	3
3	22BS2T3	CHEMISTRY	BSC	3	0	0	3
4	22ES2T4	PYTHON PROGRAMMING	ESC	3	0	0	3
5	22ES2T5	BASICS OF IOT	ESC	3	0	0	3
6	22HS2L1	ENGLISH LAB	HSCLAB	0	0	3	1.5
7	22BS2L2	CHEMISTRY & ITWS LAB	BSCLAB	0	0	3	1.5
8	22ES2L3	PYTHON LAB	ESCLAB	0	0	3	1.5
9	22CS2MC1	ENVIRONMENTAL STUDIES	MC	2	0	0	0
<b>TOTAL CREDITS</b>							<b>19.5</b>

CSM

**II YEAR III SEMESTER:**

SNO	SUBCODE	COURSE TITLE	CATEGORY	L	T	P	CREDITS
1	22BS3T1	MATHEMATICS-III	BSC	3	0	0	3
2	22CS3T2	DATA STRUCTURES	PCC	3	0	0	3
3	22CS3T3	OOP'S THROUGH C++	PCC	3	0	0	3
4	22CS3T4	COMPUTER ORGNIZATION	PCC	3	0	0	3
	22CA3T5	INTRODUCTION TO AI & ML					
6	22CS3L1	DATA STRUCTURES LAB	PCCLAB	0	0	3	1.5
	22CM3L2	AI USING PYTHON LAB- 5					
8	22CS3L3	OOP'S THROUGH C++ LAB	PCCLAB	0	0	3	1.5
9	22CS3S1	ADVANCED ENGLISH COMMUNICATION TESTING	SOC	1	0	2	2
10	22CS3MC1	ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE	MC	2	0	0	0
<b>TOTALCREDITS</b>							<b>21.5</b>

**II YEAR VI SEMESTER:**

SNO	SUBCODE	COURSE TITLE	CATEGORY	L	T	P	CREDITS
1	22HS4T1	MATHEMATICS-IV	BSC	3	0	0	3
2	22CS4T2	JAVA PROGRAMMING	PCC	3	0	0	3
3	22CS4T3	DATA BASE MANAGEMENT SYSTEMS	PCC	3	0	0	3
	22CA4T4	ANN &FUZZY LOGIC					
5	22CS4T5	OPERATING SYSTEM	PCC	3	0	0	3
6	22CS4L1	JAVA PROGRAMMING LAB	PCC LAB	0	0	3	1.5
7	22CS4L2	DATA BASE MANAGEMENT SYSTEMS LAB	PCCLAB	0	0	3	1.5
	22CA4L3	ANN & FUZZY LOGIC LAB					
9	22CS4S1	MINI PROJECT-I	SOC	1	0	2	2
<b>TOTALCREDITS</b>							<b>21.5</b>
<b>Internship4 - 8 weeks(Mandatory)during summer vacation</b>							

III YEAR V SEMESTER:

SNO	SUBCODE	COURSE TITLE	CATEGORY	L	T	P	CREDITS
1	22CS5T1	ADVANCED JAV A PROGRAMMING	PCC	3	0	0	3
2	22CS5T2	SOFTWARE ENGINEERING	PCC	3	0	0	3
	22CA5T3	ML USING TENSORFLOW					
4	22CS5PE1	PROFESSIONAL ELECTIVE-I	OEL/JOL	3	0	0	3
5	22CS5OE1	OPEN ELECTIVE-I	PEL	3	0	0	3
6	22CS5L1	ADVANCED JAV A PROGRAMMING LAB	PCCLAB	0	0	3	1.5
	22CA5L2	ML USING TENSORFLOW LAB					
8	22CS5S1	VERBAL, QUANTITATIVE AND REASONING TRAINING	SOC	1	0	2	2
9	20CS5MC1	CONSTITUTION OF INDIA	MC	2	0	0	0
		Summer internship 4 - 8 weeks (mandatory) after second year (to be evaluated during v semester)		0	0	0	1.5
<b>TOTAL CREDITS</b>							<b>21.5</b>

III YEAR VI SEMESTER:

SNO	SUBCODE	COURSE TITLE	CATEGORY	L	T	P	CREDITS
1	22CS6T1	COMPUTER NETWORKS	PCC	3	0	0	3
2	22CS6T2	WEB TECHNOLOGIES	PCC	3	0	0	3
3	22CI6T3	INTRODUCTION TO CYBER SECURITY	PCC	3	0	0	3
4	22CS6PE1	PROFESSIONAL ELECTIVE-II	PEL	3	0	0	3
5	22CS6OE1	OPEN ELECTIVE-II	OEL/JOL	3	0	0	3
6	22CS6L1	COMPUTER NETWORKS LAB	PCCLAB	0	0	3	1.5
7	22CS6L2	WEB TECHNOLOGIES LAB	PCCLAB	0	0	3	1.5
8	22CI6L3	CYBER SECURITY LAB	PCCLAB	0	0	3	1.5
9	22CS6S1	CODING AND TECHNICAL TRAINING	SOC	1	0	2	2
<b>TOTAL CREDITS</b>							<b>21.5</b>
<b>INDUSTRIAL/RESEARCH INTERNSHIP (MANDATORY) 4-8 WEEKS DURING SUMMER VACATION</b>							

**IV YEAR VII SEMESTER:**

SNO	SUBCODE	COURSE TITLE	CATEGORY	L	T	P	CREDITS
1	22CS7E1	PROFESSIONAL ELECTIVE-III	PEL	3	0	0	3
2	22CS7E2	PROFESSIONAL ELECTIVE-IV	PEL	3	0	0	3
3	22CS7E3	PROFESSIONAL ELECTIVE-V	PEL	3	0	0	3
4	22CS7OE1	OPEN ELECTIVE-III	OEL/JOL	3	0	0	3
5	22CS7OE2	OPEN ELECTIVE-IV	OEL/JOL	3	0	0	3
6	22CS7T1	HUMANITIES AND SOCIAL SCIENCE ELECTIVE	HSC	3	0	0	3
7	22CS7S1	MINI PROJECT-II	SOC	1	0	2	2
8	SUMMER INTERNSHIP4 – 8 Weeks (MANDATORY) AFTER THIRD YEAR (TO BE EVALUATED DURING VII SEMESTER)			0	0	0	3
<b>TOTAL CREDITS</b>							<b>23</b>

**IV YEAR VIII SEMESTER:**

SNO	SUBCODE	COURSE TITLE	CATEGORY	L	T	P	CREDITS
1	22CS8P1	MAJOR PROJECT/INTERNSHIP	PROJECT	0	0	0	12
<b>TOTAL CREDITS</b>							<b>12</b>

## **PROFESSIONALELECTIVES:**

### **III Year I Semester Professional Electives**

1. 22CS5E1- INTRODUCTIONTOWINDOWSAZURE
2. 22CS5E2-AD-HOCSENSORNETWORKS
3. 22CS5E3-INTRODUCTIONTODEEPLARNING
4. 22CS5E4-INTRODUCTIONTOCRYPTOGRAPHY
5. 22CS5E5-DATASCIENCEUSINGCLOUD

### **III Year II Semester Professional Electives**

1. 22CS6E1-FLAT
2. 22CS6E2-EMBEDDEDSYSTEMS
3. 22CS6E3-COGNITIVE COMPUTING
4. 22CS6E4-SOFTCOMPUTING
5. 22CS6E5-EDGE COMPUTING

### **IV Year I Semester Professional Electives**

#### **(PE-III)**

1. 22CS7E1-DATAVISUALIZATION
2. 22CS7E2-BIGDATATECHNOLOGIES
3. 22CS7E3-WEB ANALYTICS
4. 22CS7E4-ETHICALHACKING
5. 22CS7E5-INTRODUCTIONTOCYBERFORENSICS

#### **(PE-IV)**

6. 22CS7E6-NATURALLANGUAGEPROCESSING
7. 22CS7E7-FUZZY LOGIC
8. 22CS7E8-SEMANTICWEB
9. 22CS7E9-CYBER SECURITY
10. 22CS7E10-PENETRATION TESTING

#### **(PE-V)**

11. 22CS7E11-PERL PROGRAMMING
12. 22CS7E12-PARALLELANDDISTRIBUTEDSYSTEMS
13. 22CS7E13-GREENCOMPUTING
14. 22CS7E14-ANGULARJS
15. 22CS7E15-E- COMMERCE

## **HUMANITIESANDSOCIALSCIENCEELECTIVE**

22HS7E1-PROFESSIONALETHICS&HUMANVALUES

22HS7E2-UNDERSTANDINGHARMONY  
22HS7E3- IPR  
& PATENTS

22HS7E4-MANAGERIALECONOMICS&FINANCIAL ANALYSIS

## DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

II Year – III Semester	22CS3T2	L	T	P	C
		3	0	0	3
<b>DATA STRUCTURES</b>					

### Course Objectives:

The objective of the course is to

- Introduce the fundamental concept of data structures and abstract data types
- Emphasize the importance of data structures in developing and implementing efficient algorithms
- Describe how arrays, records, linked structures, stacks, queues, trees, and graphs are represented in memory and used by algorithms

### Course Outcomes:

After completing this course a student will be able to:

- Summarize the properties, interfaces, and behaviors of basic abstract data types
- Discuss the computational efficiency of the principal algorithms for sorting & searching
- Use arrays, records, linked structures, stacks, queues, trees, and Graphs in writing programs
- Demonstrate different methods for traversing trees

### UNIT I: Introduction to DS and Arrays

Data Structures - Definition, Classification of Data Structures, Operations on Data Structures  
The Array as an Abstract Data Type, The Polynomial Abstract Data type- Polynomial Representation- Polynomial Addition. Sparse Matrices, Introduction- Sparse Matrix Representation - Transposing a Matrix- Matrix Multiplication, Representation of Arrays.

### UNIT II: STACKS, QUEUES AND LINKED LIST

The Stack Abstract Data Type, The Queue Abstract Data Type, Circular Queues, Evaluation of Expressions, Expression- Postfix Notation- Infix to Postfix, Infix to prefix and prefix evaluation  
Linked List: Introduction, Single linked list, Representation of Linked list in memory, Operations on Single Linked list-Insertion, Deletion, Search and Traversal , Reversing Single Linked list, Applications  
on Single Linked list- Polynomial Expression Representation ,Addition and Multiplication, Sparse Matrix Representation using Linked List, Advantages and Disadvantages of Single Linked list,

### UNIT III: TREES

Introduction, Terminology, Representation of Trees, Binary Trees, The Abstract Data Type, Properties of Binary Trees, Binary Tree Representations, Binary Tree Traversal, Introduction, In order Traversal Pre order Traversal, Post order Traversal, Tree traversals Binary Tree, Heaps, Priority Queues, Definition of a Max Heap, Insertion into a Max Heap, Deletion from a Max Heap, Binary Search Trees, Definition, Searching a Binary Search Tree, Insertion into a Binary Search Tree, Deletion from a Binary Search Tree

#### **UNIT IV: GRAPHS**

Graphs: Basic Concepts, Representations of Graphs-Adjacency Matrix and using Linked list, Graph Traversals (BFT & DFT), Applications- Minimum Spanning Tree Using Prims & Kruskals Algorithm, Dijkstra's shortest path, Sollin's Algorithm

#### **UNIT V: SORTING AND SEARCHING**

Sorting- Insertion sort, Selection sort, Exchange (Bubble sort, quick sort), distribution (radix sort), merging (Merge sort) algorithms. Searching - Linear search, Binary search, Fibonacci search

##### **Text Books:**

- 1) Data Structures Using C. 2<sup>nd</sup> Edition. Reema Thareja, Oxford.
- 2) Data Structures and algorithm analysis in C, 2<sup>nd</sup> ed, Mark Allen Weiss.

##### **Reference Books:**

- 1) Fundamentals of Data Structures in C, 2nd Edition, Horowitz, Sahni, Universities Press.
- 2) Data Structures: A PseudoCode Approach, 2/e, Richard F. Gilberg, Behrouz A. Forouzon, Cengage.
- 3) Data Structures with C, Seymour Lipschutz TMH

##### **Resources:**

- 1) <http://algs4.cs.princeton.edu/home/>
- 2) [https://faculty.washington.edu/jstraub/dsa/Master\\_2\\_7a.pdf](https://faculty.washington.edu/jstraub/dsa/Master_2_7a.pdf)

II Year – III Semester	22CS3T3	L	T	P	C
		3	0	0	3
<b>OBJECT ORIENTED PROGRAMMING THROUGH C++</b>					

**Course Objectives:**

- Describe the procedural and object oriented paradigm with concepts of streams, classes, functions, data and objects
- Understand dynamic memory management techniques using pointers, constructors, destructors
- Describe the concept of function overloading, operator overloading, virtual functions and polymorphism
- Classify inheritance with the understanding of early and late binding, usage of exception handling, generic programming
- Demonstrate the use of various OOPs concepts with the help of programs

**Course Outcomes:**

By the end of the course, the student

- Classify object oriented programming and procedural programming
- Apply C++ features such as composition of objects, operator overloads, dynamic memory allocation, inheritance and polymorphism, file I/O, exception handling
- Build C++ classes using appropriate encapsulation and design principles
- Apply object oriented or non-object oriented techniques to solve bigger computing problems

**UNIT I**

Introduction to C++, Variables, Constants, Data types, Keywords, Operators and Expressions. Control and Loop statements in C++, Functions in C++

**UNIT II**

The Object Oriented Programming, Features of oop, Classes in C++, Members in class, Defining Member Function, Declaring Objects, Accessing members with objects, Access Specifiers and their Scope, Overloading Member Function, Nested class, Constructors, Types of constructors and Destructors, Constructor overloading

**UNIT III**

Operator Overloading, Overloading Operators, Operator Return Type, Rules for Overloading Operators, Inheritance, Advantages and Disadvantages of Inheritance, Types of Inheritance, Virtual Base Classes- Object as a Class Member, Abstract Classes

**UNIT IV**

Pointers & Binding Polymorphisms and Virtual Functions: Pointer, Features of Pointers, Pointer Declaration, Pointer to Class, Pointer Object, The this Pointer, Pointer to Derived Classes and Base Class, Binding Polymorphisms and Virtual Functions, Introduction, Binding in C++, Virtual Functions, Rules for Virtual Function, Virtual Destructor

## UNIT V

Definition of class Templates, Normal Function Templates, Over Loading of Template Function, Exception Handling, Principles of Exception Handling, The Keywords try throw and catch, Multiple Catch Statements

### **Text Books:**

- 1) A First Book of C++, Gary Bronson, Cengage Learning.  
The Complete Reference C++, Herbert Schildt, TMH.

### **Reference Books:**

- 1) Object Oriented Programming C++, Joyce Farrell, Cengage.
- 2) C++ Programming: from problem analysis to program design, DS Malik, Cengage Learning
- 3) Programming in C++, Ashok N Kamthane, Pearson 2<sup>nd</sup> Edition

II Year – III Semester	22CS3T4	L	T	P	C
		3	0	0	3
<b>COMPUTER ORGANIZATION</b>					

**Course Objectives:**

The course objectives of Computer Organization are to discuss and make student familiar with the

- Principles and the Implementation of Computer Arithmetic
- Operation of CPUs including RTL, ALU, Instruction Cycle and Busses
- Fundamentals of different Instruction Set Architectures and their relationship to the CPU Design
- Memory System and I/O Organization
- Principles of Operation of Multiprocessor Systems and Pipelining
- Develop a detailed understanding of computer systems
- Cite different number systems, binary addition and subtraction, standard, floating-point

operations.

- Develop a detailed understanding of architecture and functionality of central processing unit
- Exemplify in a better way the I/O and memory organization
- Illustrate concepts of parallel processing, pipelining and inter processor communication

**UNIT I**

Basic Structure of Computers: Basic Organization of Computers, Historical Perspective, Bus Structures, Data Representation: Data types, Complements, Fixed Point Representation. Floating, Point Representation. Other Binary Codes, Error Detection Codes.

**UNIT-II**

Computer Arithmetic: Addition and Subtraction, Multiplication Algorithms, Division Algorithms  
 Register Transfer Language and Micro operations: Register Transfer language. Register Transfer Bus and Memory Transfers, Arithmetic Micro operations, Logic Micro Operations, Shift Micro Operations, Arithmetic Logic Shift Unit.

**UNIT III**

Basic Computer Organization and Design: Instruction Codes, Computer Register, Computer Instructions, Instruction Cycle, Memory – Reference Instructions. Input –Output and Interrupt, Complete Computer Description.

**UNIT IV**

Central Processing Unit: General Register Organization, STACK Organization. Instruction Formats, Addressing Modes, Data Transfer and Manipulation, Program Control, Reduced Instruction Set Computer. Micro programmed Control: Control Memory, Address Sequencing, Micro Program example, Design of Control Unit.

**UNIT V**

Memory Organization: Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Virtual Memory, Input-Output Organization: Peripheral Devices, Input-Output Interface, Asynchronous data transfer, Modes of Transfer, Priority Interrupts, Direct Memory Access.

**Text Books:**

1. Computer System Architecture, M. Morris Mano, Third Edition, Pearson, 2008.
2. Computer Organization, Carl Hamacher, Zvonko Vranesic, Safwat Zaky, 5/e, McGraw Hill, 2002.

**Reference Books:**

1. Computer Organization and Architecture, William Stallings, 6/e, Pearson, 2006.
2. Structured Computer Organization, Andrew S. Tanenbaum, 4/e, Pearson, 2005.
3. Fundamentals of Computer Organization and Design, Sivarama P. Dandamudi, Springer, 2006.

II Year – III Semester	22CA3T5	L	T	P	C
		3	0	0	3
INTRODUCTION TO AI & ML					

**Course Objectives:**

To have a basic proficiency in a traditional AI language including an ability to write simple to intermediate programs and an ability to understand code written in that language.

To have an understanding of the basic issues of knowledge representation and blind and heuristic search, as well as an understanding of other topics such as minimax, resolution, etc. that play an important role in AI programs.

**Course Outcomes:**

After completing this course, students should be able to:

Identify problems that are amenable to solution by AI methods, and which AI methods may be suited to solving a given problem.

Formalize a given problem in the language/framework of different AI methods (e.g., as a search problem, as a constraint satisfaction problem, as a planning problem, as a Markov decision process, etc).

**UNIT-I:**

**Introduction to artificial intelligence:** Introduction, history, intelligent systems, foundations of AI, applications, tic-tac-toe game playing, development of AI languages, current trends in AI

**UNIT-II:**

**Problem solving: state-space search and control strategies:** Introduction, general problem solving, characteristics of problem, exhaustive searches, heuristic search techniques, iterative-deepening a\*, constraint satisfaction

**Problem reduction and game playing:** Introduction, problem reduction, game playing, alpha-beta pruning, two-player perfect information games

**UNIT-III:**

Introduction to Statistics, **Data Preprocessing:** Importing dataset, Handling missing data, Categorical data, Splitting the dataset into Training set and Test set, Feature Scaling. **Regression:** Simple Linear Regression, Multiple

Linear Regression, Polynomial Regression, Support Vector Regression (SVR), Decision Tree Regression, Random Forest Regression

**UNIT-IV:**

R-Squared Intuition, Adjusted R-Squared Intuition, Interpreting Linear Regression Coefficients **Classification:** Classification, Logistic Regression, K-Nearest Neighbors (K-NN), Support Vector Machines (SVM), Kernel SVM, Naïve Bayes, Decision Tree Classification, Random Forest Classification.

**UNIT-V:**

**Evaluating Classification Models:** False Positives & False Negatives, Confusion Matrix, Accuracy Paradox, CAP Curve, CAP Curve Analysis. **Clustering:** K-Means Clustering, Hierarchical Clustering. **Associate Rule Learning:** Apriori, ECLAT, **Reinforcement Learning:** Upper Confidence Bound, Thompson Sampling, Natural Language Processing,

**UNIT-VI**

**Deep Learning:** Artificial Neural Networks, Convolutional Neural Networks, **Dimensionality Reduction:** Principal Component Analysis (PCA), Kernel PCA, Linear Discriminant Analysis (LDA), **Model Selection & Boosting:** Model Selection, XG Boost.

**TEXT BOOKS:**

Artificial Intelligence- Saroj Kaushik, CENGAGE Learning,  
Artificial intelligence, A modern Approach, 2nd ed, Stuart Russel, Peter Norvig, PEA  
Artificial Intelligence- Rich, Kevin Knight, Shiv Shankar B Nair, 3rd ed, TMH  
Introduction to Artificial Intelligence, Patterson, PHI

**REFERNCE BOOKS:**

Artificial intelligence, structures and Strategies for Complex problem solving, -George F Lugar, 5<sup>th</sup> ed, PEA.  
Introduction to Artificial Intelligence, Ertel, Wolf Gang, Springer  
Artificial Intelligence, A new Synthesis, Nils J Nilsson, Elsevier

II Year – III Semester	22CS3L1	L	T	P	C
		0	0	3	1.5
<b>DATA STRUCTURES LAB</b>					

1. Implementation of Singly linked list with all operations
2. Implementation of Doubly linked list with all operations
3. Implementation of Multistack in a Single Array.
4. Implementation of Circular Queue.
5. Implementation of Binary Search trees.
6. Implementation of Hash table.
7. Implementation of Heaps.
8. Implementation of Breadth First Search Techniques.
9. Implementation of Depth First Search Techniques.
10. Implementation of Prim's Algorithm.
11. Implementation of Dijkstra's Algorithm.
12. Implementation of Kruskal's Algorithm
13. Implementation of MergeSort
14. Implementation of Quick Sort

II Year – III Semester	22CA3L2	L	T	P	C
		0	0	3	1.5
<b>AI USING PYTHON LAB</b>					

1. (a). Write a python program to print the multiplication table for the given number?  
(b). Write a python program to check whether the given number is prime or not?  
(c). Write a python program to find factorial of the given number?
2. Write a python program to implement simple Chatbot?
3. (a) Write a python program to implement List operations  
(Nested List, Length, Concatenation, Membership, Iteration, Indexing and Slicing)?  
(b) Write a python program to implement List methods (Add, Append, Extend & Delete).
4. (a). Write a python program to Illustrate Different Set Operations?  
(b). Write a python program to generate Calendar for the given month and year?  
(c). Write a python program to implement Simple Calculator program?
5. (a). Write a python program to Add Two Matrices.  
(b). Write a python program to Transpose a Matrix.
6. Write a python program to implement Breadth First Search Traversal?
7. Write a python program to implement Water Jug Problem?
8. (a) Write a python program to remove punctuations from the given string?  
(b) Write a python program to sort the sentence in alphabetical order?
9. Write a program to implement Hangman game using python.
10. Write a program to implement Tic-Tac-Toe game using python.
  11. (a) Write a python program to remove stop words for a given passage from a text file using NLTK?  
(b) Write a python program to implement stemming for a given sentence using NLTK?  
(c) Write a python program to POS (Parts of Speech) tagging for the give sentence using NLTK?
12. (a) Write a python program to implement Lemmatization using NLTK?  
(b) Write a python program to for Text Classification for the give sentence using NLTK?

II Year – III Semester	22CS3L3	L	T	P	C
		0	0	3	1.5
<b>OOP'S THROUGH C++ LAB</b>					

**Program Objectives:**

- To strengthen problem solving ability by using the characteristics of an object-oriented approach.
- To design applications using object oriented features
- To handle Exceptions in programs.
- To teach the student to implement object oriented concepts

**Week1:**

- a) Write a C++ program to find the sum of individual digits of a positive integer.
- b) Write a C++ program to generate the first n terms of the sequence.

**Week 2:**

- a) Write a C++ program to generate all the prime numbers between 1 and n, where n is a value supplied by the user.
- b) Write a C++ program to find both the largest and smallest number in a list of integers.

**Week 3:**

- a) Write a C++ program to sort a list of numbers in ascending order.
- b) Write a Program to illustrate New and Delete Keywords for dynamic memory allocation

**Week 4:**

- a) Write a program Illustrating Class Declarations, Definition, and Accessing Class Members.
- b) Program to illustrate default constructor, parameterized constructor and copy constructors

**Week 5:**

- a) Write a Program to Demonstrate the i)Operator Overloading.ii) Function Overloading.
- b) Write a Program to Demonstrate Friend Function and Friend Class.

**Week 6:**

- a)Write a Program to Access Members of a STUDENT Class Using Pointer to Object Members.
- b)Write a Program to Generate Fibonacci Series use Constructor to Initialize the Data

Members.

**Week 7:**

Write a C++ program to implement the matrix ADT using a class. The operations supported by this ADT are:

- a) Reading a matrix.
- b) Addition of matrices.
- c) Printing a matrix
- d)Subtraction of matrices
- e) Multiplication of matrices

**Week 8:**

Write C++ programs that illustrate how the following forms of inheritance are supported:

- a)Single inheritance
- b)Multiple inheritance
- c)Multi level inheritance
- d)Hierarchical inheritance

**Week 9:**

- a.)Write a C++ program that illustrates the order of execution of constructors and destructors when new class is derived from more than one base class.
- b) Write a Program to Invoking Derived Class Member Through Base Class Pointer.

**Week 10:**

- a) Write a Template Based Program to Sort the Given List of Elements.
- b) Write a C++ program that uses function templates to find the largest and smallest number in a list of integers and to sort a list of numbers in ascending order.

**ADDITIONAL PROGRAMS:**

11. Write a Program Containing a Possible Exception. Use a Try Block to Throw it and a Catch Block to Handle it Properly.
12. Write a Program to Demonstrate the Catching of All Exceptions.

**Text Books:**

- a. Object Oriented Programming with C++ by Balagurusamy
- b. C++, the Complete Reference, 4th Edition, Herbert Schildt, TMH.

**References:**

- a. C++ Primer, 3rd Edition, S.B.Lippman and J.Lajoie, Pearson Education.
- b. The C++ Programming Language, 3rd Edition, B.Stroutstrup, Pearson Education.

II Year – IV Semester	22CS4T2	L	T	P	C
		3	0	0	3
<b>JAVA PROGRAMMING</b>					

**Course Objectives:**

The learning objectives of this course are:

- To identify Java language components and how they work together in applications
- To learn the fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries.
- To learn how to extend Java classes with inheritance and dynamic binding and how to use exception handling in Java applications
- To understand how to design applications with threads in Java
- To understand how to use Java APIs for program development

**Course Outcomes:**

By the end of the course, the student will be

- Able to realize the concept of Object Oriented Programming & Java Programming Constructs
- Able to describe the basic concepts of Java such as operators, classes, objects, inheritance, packages, Enumeration and various keywords
- Apply the concept of exception handling and Input/ Output operations
- Able to design the applications of Java & Java applet
- Able to Analyze & Design the concept of Event Handling and Abstract Window Toolkit

**UNIT I**

Introduction to JAVA, Variables, Constants, Data types, Keywords, Operators and Expressions. Control and Loop statements in JAVA, Functions in JAVA

**UNIT II**

The Object Oriented Programming, Features of oop, Classes in C++, Members in class, Defining Member Function, Declaring Objects, Accessing members with objects, Access Specifiers and their Scope, Overloading Member Function, Nested class, Constructors, Types of constructors and Destructors, Constructor overloading, Final and Static.

**UNIT III**

Inheritance: Introduction, Process of Inheritance, Types of Inheritances, Universal Super Class- Object Class, Inhibiting Inheritance of Class Using Final, Access Control and Inheritance, Multilevel Inheritance, Application of Keyword Super, Constructor Method and Inheritance, Method Overriding, Dynamic Method Dispatch, Abstract Classes

**UNIT IV**

Interfaces: Introduction, Declaration of Interface, Implementation of Interface, Multiple Interfaces, Nested Interfaces, Inheritance of Interfaces, Default Methods in Interfaces, Static Methods in Interface, Functional Interfaces, Annotations. Packages and Java Library: Introduction, Defining Package, Importing Packages and Classes into Programs, Path and Class Path, Access Control, Packages in Java SE, Java.lang Package and its Classes

## **UNIT V**

Exception Handling: Introduction, Hierarchy of Standard Exception Classes, Keywords throws and throw, try, catch, and finally Blocks, Multiple Catch Clauses, Class Throwable, Unchecked Exceptions, Checked Exceptions, try-with-resources, Catching Subclass Exception, Custom Exceptions, Nested try and catch Blocks, Rethrowing Exception, Throws Clause.

### **Text Books:**

- 1) JAVA one step ahead, Anitha Seth, B.L.Juneja, Oxford.
- 2) The complete Reference Java, 8th edition, Herbert Schildt, TMH.

### **References Books:**

- 1) Introduction to java programming, 7th edition by Y Daniel Liang, Pearson
- 2) Murach's Java Programming, Joel Murach

II Year – IV Semester	22CS4T3	L	T	P	C
		3	0	0	3
<b>DATABASE MANAGEMENT SYSTEMS</b>					

### **COURSE OBJECTIVES**

To learn the principles of systematically designing and using large scale Database Management Systems for various applications.

### **COURSE OUTCOMES**

- Describe a relational database and object-oriented database.
- Create, maintain and manipulate a relational database using SQL
- Describe ER model and normalization for database design.
- Examine issues in data storage and query processing and can formulate appropriate solutions.
- Understand the role and issues in management of data such as efficiency, privacy, security, ethical responsibility and Strategic advantage.
- Design and build database system for a given real world problem

#### **UNIT-I: An Overview of Database Management**

Introduction, what is Database System- What is Database The Three Levels of Architecture-The External Level- the Conceptual Level- the Internal Level- Mapping- the Database Administrator-The Database Management Systems- Client/Server Architecture.

#### **UNIT-II: SQL**

SQL overview, SQL syntax, SQL data types, SQL operators, SQL expressions, DDL, DML and DCL commands, SQL queries, SQL select, SQL clauses, SQL constraints, SQL joins, The Form of Basic SQL Query, Union, Intersect, and Except, Nested Queries, Aggregate Operators, Null Values, Complex Integrity Constraints in SQL, Triggers and Active Database.

#### **UNIT-III: ER Models**

The E/R Models, The Relational Model, Introduction to Database Design, Database Design and Er-Diagrams, Entities, Attributes, and Entity Sets-Relationship and Relationship Sets-Conceptual Design With the Er Models, The Relational Model Integrity Constraints Over Relations- Key Constraints –Foreign Key Constraints-General Constraints, Set Operation, Renaming – Joins- Division- More Examples of Queries

#### **UNIT-IV: Normalization**

Purpose of Normalization or schema refinement, concept of functional dependency, normal forms based on functional dependency(1NF, 2NF and3 NF), concept of surrogate key, Boyce-codd normal form(BCNF), Lossless join and dependency preserving decomposition, Fourth normal form(4NF).

#### **UNIT-V: Transaction Management and Concurrency Control**

Transaction, properties of transactions, transaction log, and transaction management with SQL using commit rollback and save point. ACID properties, Concurrency control with locking methods, lock types, deadlocks, Concurrency control with time stamp ordering: Wait/Die and Wound/Wait Schemes

**TEXT BOOKS:**

1. Introduction to Database Systems, CJ Date, Pearson
2. Data base Management Systems, Raghurama Krishnan, Johannes Gehrke, TATA McGrawHill 3rd Edition
3. Database Systems - The Complete Book, H G Molina, J D Ullman, J Widom Pearson

**REFERENCES BOOKS:**

1. Data base Systems design, Implementation, and Management, Peter Rob & Carlos Coronel 7th Edition.
2. Fundamentals of Database Systems, Elmasri Navate Pearson Education
3. Introduction to Database Systems, C.J. Date Pearson Education

II Year – IV Semester	22CA4T4	L	T	P	C
		3	0	0	3
ANN &FUZZY LOGIC					

### COURSE OBJECTIVES:

The main objective of this course is for the students to achieve basic knowledge of artificial intelligence, a deepened technical understanding of machine learning research and theories, as well as practical experience of the use and design of machine learning and data mining algorithms for applications and experiments.

The course has a strong focus towards applied IT. The student not only learns how to critically review and compare different algorithms and methods, but how to plan, design, and implement learning components and applications and how to conduct machine learning experiments.

### COURSE OUTCOMES:

The student will be able to evaluate and compare the performance or, other qualities, of algorithms for typical learning problems.

The student will be able to design a supervised or unsupervised learning system.

#### UNIT – I:

**Introduction to Neural Networks:** Introduction, Humans and Computers, Organization of the Brain, Biological Neuron, Biological and Artificial Neuron Models, Hodgkin-Huxley Neuron Model, Integrate-and-Fire Neuron Model, Spiking Neuron Model, Characteristics of ANN, McCulloch-Pitts Model, Historical Developments, Potential Applications of ANN.

#### UNIT- II:

**Essentials of Artificial Neural Networks** Artificial Neuron Model, Operations of Artificial Neuron, Types of Neuron Activation Function, ANN Architectures, Classification Taxonomy of ANN – Connectivity, Neural Dynamics (Activation and Synaptic), Learning Strategy (Supervised, Unsupervised, Reinforcement), Learning Rules, Types of Application

#### UNIT-III:

**Single Layer Feed Forward Neural Networks** Introduction, Perceptron Models: Discrete, Continuous and Multi-Category, Training Algorithms: Discrete and Continuous Perceptron Networks, Perceptron Convergence theorem, Limitations of the Perceptron Model, Applications.

#### UNIT- IV:

**Multilayer Feed forward Neural Networks** Credit Assignment Problem, Generalized Delta Rule, Derivation of Back propagation (BP) Training, Summary of Back propagation Algorithm, Kolmogorov Theorem, Learning Difficulties and Improvements.

**UNIT V:**

**Associative Memories** Paradigms of Associative Memory, Pattern Mathematics, Hebbian Learning, General Concepts of Associative Memory (Associative Matrix, Association Rules, Hamming Distance, The Linear Associator, Matrix Memories, Content Addressable Memory), Bidirectional Associative Memory (BAM) Architecture, BAM Training Algorithms: Storage and Recall Algorithm, BAM Energy Function, Proof of BAM Stability Theorem Architecture of Hopfield Network: Discrete and Continuous versions, Storage and Recall Algorithm, Stability Analysis, Capacity of the Hopfield Network Summary and Discussion of Instance/Memory Based Learning Algorithms, Applications.

**UNIT – VI:**

Classical & Fuzzy Sets Introduction to classical sets - properties, Operations and relations; Fuzzy sets, Membership, Uncertainty, Operations, properties, fuzzy relations, cardinalities, membership functions.

**TEXT BOOK:**

1. Neural Networks, Fuzzy logic, Genetic algorithms: synthesis and applications by Rajasekharan and Rai – PHI Publication.
2. Introduction to Neural Networks using MATLAB 6.0 - S.N. Sivanandam, S. Sumathi, S.N. Deepa, TMH, 2006

II Year – IV Semester	22CS4T5	L	T	P	C
		3	0	0	3
<b>OPERATING SYSTEMS</b>					

### Course Objectives:

The objectives of this course is to

1. Introduce to the internal operation of modern operating systems
2. Define, explain, processes and threads, mutual exclusion, CPU scheduling, deadlock, memory management, and file systems
3. Understand File Systems in Operating System like UNIX/Linux and Windows
4. Understand Input Output Management and use of Device Driver and Secondary Storage (Disk) Mechanism
5. Analyze Security and Protection Mechanism in Operating System.

### Course Outcomes:

1. After learning, the course the students should be able to:
2. Describe various generations of Operating System and functions of Operating System
3. Describe the concept of program, process and thread and analyze various CPU Scheduling Algorithms and compare their performance
4. Solve Inter Process Communication problems using Mathematical Equations by various methods
5. Compare various Memory Management Schemes especially paging and Segmentation in Operating System and apply various Page Replacement x Techniques
6. Outline File Systems in Operating System like UNIX/Linux and Windows

### UNIT I

**Operating Systems Overview:** Operating system functions, Operating system structure, Operating systems operations, Open-Source Operating Systems. System Structures: Operating System Services, User and Operating-System Interface, systems calls, Types of System Calls, system programs, operating system structure

### UNIT-II:

**Process Management** – Process concept, The process, Process State Diagram, Process control block, Process Scheduling- Scheduling Queues, Schedulers, Operations on Processes, Interprocess Communication, Threading Issues, Scheduling-Basic Concepts, Scheduling Criteria, Scheduling Algorithms.

### UNIT-III:

**Memory Management:** Swapping, Contiguous Memory Allocation, Paging, structure of the Page Table, Segmentation. Virtual Memory Management: Virtual Memory, Demand Paging, Page-Replacement Algorithms, Thrashing

#### **UNIT-IV:**

**Concurrency:** Process Synchronization, The Critical- Section Problem, Synchronization Hardware, Semaphores, Classic Problems of Synchronization, Monitors, Synchronization examples

#### **UNIT-V:**

Principles of deadlock – System Model, Deadlock Characterization, Deadlock Prevention, Detection and Avoidance, Recovery form Deadlock

#### **Text Books:**

- 1.Silberschatz A, Galvin P B, and Gagne G, Operating System Concepts, 9th edition, Wiley, 2013.
- 2.Tanenbaum A S, Modern Operating Systems, 3rd edition, Pearson Education, 2008. (for Interprocess Communication and File systems.)

#### **Reference Books:**

- 1.Dhamdhere D M, Operating Systems A Concept Based Approach, 3rd edition, Tata McGraw-Hill, 2012.
- 2.Stallings W, Operating Systems -Internals and Design Principles, 6th edition, Pearson Education, 2009
- 3.Nutt G, Operating Systems, 3rd edition, Pearson Education, 2004.

II Year – IV Semester	22CS4L1	L	T	P	C
		0	0	3	1.5
<b>JAVA PROGRAMMING LAB</b>					

**Course Objectives:**

The aim of this lab is to

- Practice programming in the Java
- Gain knowledge of object-oriented paradigm in the Java programming language
- Learn use of Java in a variety of technologies and on different platforms

**Course Outcomes:**

By the end of the course student will be able to write java program for

- Evaluate default value of all primitive data type, Operations, Expressions, Control-flow, Strings
- Determine Class, Objects, Methods, Inheritance, Exception, Runtime Polymorphism, User defined Exception handling mechanism
- Illustrating simple inheritance, multi-level inheritance, Exception handling mechanism
- Construct Threads, Event Handling, implement packages, developing applets

**Exercise - 1 (Basics)**

- a) Write a JAVA program to display default value of all primitive data type of JAVA
- b) Write a java program that display the roots of a quadratic equation  $ax^2+bx=0$ . Calculate the discriminate D and basing on value of D, describe the nature of root.
- c) Five Bikers Compete in a race such that they drive at a constant speed which may or may not be the same as the other. To qualify the race, the speed of a racer must be more than the average speed of all 5 racers. Take as input the speed of each racer and print back the speed of qualifying racers.

**Exercise - 2 (Operations, Expressions, Control-flow, Strings)**

- a) Write a JAVA program to search for an element in a given list of elements using binary search mechanism.
- b) Write a JAVA program to sort for an element in a given list of elements using bubble sort
- c) Write a JAVA program to sort for an element in a given list of elements using merge sort.
- d) Write a JAVA program using StringBuffer to delete, remove character.

**Exercise - 3 (Class, Objects)**

- a) Write a JAVA program to implement class mechanism. Create a class, methods and invoke them inside main method.
- b) Write a JAVA program to implement constructor.

**Exercise - 4 (Methods)**

- a) Write a JAVA program to implement constructor overloading.
- b) Write a JAVA program implement method overloading.

**Exercise - 5 (Inheritance)**

- a) Write a JAVA program to implement Single Inheritance
- b) Write a JAVA program to implement multi level Inheritance
- c) Write a java program for abstract class to find areas of different shapes

**Exercise - 6 (Inheritance - Continued)**

- a) Write a JAVA program give example for "super" keyword.
- b) Write a JAVA program to implement Interface. What kind of Inheritance can be achieved?

**Exercise - 7 (Exception)**

- a) Write a JAVA program that describes exception handling mechanism
- b) Write a JAVA program Illustrating Multiple catch clauses

**Exercise – 8 (Runtime Polymorphism)**

- a) Write a JAVA program that implements Runtime polymorphism
- b) Write a Case study on run time polymorphism, inheritance that implements in above problem

**Exercise – 9 (User defined Exception)**

- a) Write a JAVA program for creation of Illustrating throw
- b) Write a JAVA program for creation of Illustrating finally
- c) Write a JAVA program for creation of Java Built-in Exceptions
- d) Write a JAVA program for creation of User Defined Exception

**Exercise – 10 (Threads)**

- a) Write a JAVA program that creates threads by extending Thread class .First thread display “Good Morning “every 1 sec, the second thread displays “Hello “every 2 seconds and the third display “Welcome” every 3 seconds ,(Repeat the same by implementing Runnable)
- b) Write a program illustrating `isAlive` and `join ()`
- c) Write a Program illustrating Daemon Threads.

**ADDITIONAL PROGRAMS:**

**11 (Threads continuity)**

- a) Write a JAVA program Producer Consumer Problem
- b) Write a case study on thread Synchronization after solving the above producer consumer problem

**12 (Packages)**

- a) Write a JAVA program illustrate class path
- b) Write a case study on including in class path in your os environment of your package.
- c) Write a JAVA program that import and use the defined your package in the previous Problem

**13 (Applet)**

- a) Write a JAVA program to paint like paint brush in applet.
- b) Write a JAVA program to display analog clock using Applet.
- c) Write a JAVA program to create different shapes and fill colors using Applet.

**14 (Event Handling)**

- a) Write a JAVA program that display the x and y position of the cursor movement using Mouse.
- b) Write a JAVA program that identifies key-up key-down event user entering text in a Applet.

<b>Course Code</b>	<b>B. Tech</b>	<b>Database Management</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>22CS4L2</b>	<b>II Year IVSem</b>	<b>Systems Lab</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>1.5</b>

### OBJECTIVES:

1. To provide a sound introduction to the discipline of database management as a subject in its own right, rather than as a compendium of techniques and product specific tools.
2. To familiarize the participant with the nuances of database environments towards an information oriented data-processing oriented framework
3. To give a good formal foundation on the relational model of data
4. To present SQL and procedural interfaces to SQL comprehensively
5. To give an introduction to systematic database design approaches covering conceptual design, logical design and an overview of physical design

### OUTCOMES:

1. Understand, appreciate and effectively explain the underlying concepts of database technologies
2. Design and implement a database schema for a given problem-domain Normalize a database
3. Populate and query a database using SQL DML/DDDL commands.
4. Declare and enforce integrity constraints on a database using a state-of-the-art RDBMS
5. Programming PL/SQL including stored procedures, stored functions, cursors, packages.
6. Design and build a GUI application using a 4GL.

### List of Experiments:

#### SQL

1. Queries to facilitate acquaintance of Built-In Functions, String Functions, Numeric Functions, Date Functions and Conversion Functions.
2. Queries using operators in SQL
3. Queries to Retrieve and Change Data: Select, Insert, Delete, and Update
4. Queries using Group By, Order By, and Having Clauses
5. Queries on Controlling Data: Commit, Rollback, and Save point
6. Queries for Creating, Dropping, and Altering Tables, Views, and Constraints
7. Queries on Joins and Correlated Sub-Queries
8. Queries on Working with Index, Sequence, Synonym, Controlling Access, and Locking Rows for Update, Creating Password and Security features

## PL/SQL

9. Write a PL/SQL Code using Basic Variable, Anchored Declarations, and Usage of Assignment Operation
10. Write a PL/SQL Code Bind and Substitution Variables. Printing in PL/SQL
11. Write a PL/SQL block using SQL and Control Structures in PL/SQL
12. Write a PL/SQL Code using Cursors, Exceptions and Composite Data Types

### **ADDITIONAL PROGRAMS**

13. Write a PL/SQL Code using Procedures, Functions, and Packages FORMS
14. Write a PL/SQL Code Creation of forms for any Information System such as Student Information System, Employee Information System etc.
15. Demonstration of database connectivity

### **Text Books/Suggested Reading:**

- Oracle: The Complete Reference by Oracle Press
- Nilesh Shah, "Database Systems Using Oracle", PHI, 2007.
- Rick F Vander Lans, "Introduction to SQL", Fourth Edition, Pearson

II Year – IV Semester	22CS4L3	L	T	P	C
		0	0	3	1.5
<b>ANN AND FUZZY LOGIC LAB</b>					

<b>Week-1</b>	<b>PERCEPTRON</b>
Create a perceptron with appropriate number of inputs and outputs. Train it using fixed increment learning algorithm until no change in weights is required. Output the final weights	
<b>Week-2</b>	<b>ARTIFICIAL NEURAL NETWORKS</b>
Write a program to implement artificial neural network without back propagation. Write a program to implement artificial neural network with back propagation.	
<b>Week-3</b>	<b>FUZZY SETS</b>
Implement Union, Intersection, Complement and Difference operations on fuzzy sets. Also create fuzzy relation by Cartesian product of any two fuzzy sets and perform max-min composition on any two fuzzy relations.	
<b>Week-4</b>	<b>GENETIC ALGORITHMS</b>
Implement travelling sales person problem (TSP) using genetic algorithms.	
<b>Week-5</b>	<b>COVARIANCE</b>
Plot the correlation plot on dataset and visualize giving an overview of relationships among data on soya bins data. Analysis of covariance: variance (ANOVA), if data have categorical variables on iris data.	
<b>Week-6</b>	<b>DATA FITTING BY REGRESSION</b>
Implement linear regression and multi-regression for a set of data points.	
<b>Week-7</b>	<b>CRISP MODEL</b>
Implement crisp partitions for real-life iris dataset.	
<b>Week-8</b>	<b>PERCEPTRON RULE</b>
Write a program to implement Hebb's rule Write a program to implement Delta rule.	
<b>Week-9</b>	<b>LOGIC GATES</b>
Write a program to implement logic gates.	
<b>Week-10</b>	<b>CLASSIFICATION</b>
Implement SVM classification by Fuzzy concepts.	

III Year – V Semester	22CS5T1	L	T	P	C
		3	0	0	3
<b>ADVANCED JAVA PROGRAMMING</b>					

### Course Objectives:

The learning objectives of this course are:

- To identify Java language components and how they work together in applications
- To learn the fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries.
- To learn how to extend Java classes with inheritance and dynamic binding and how to use exception handling in Java applications
- To understand how to design applications with threads in Java
- To understand how to use Java APIs for program development

### Course Outcomes:

By the end of the course, the student will be

- To be familiarize with RMI and JSP
- To understand the Java Servlets and Database connectivity
- To Know more about the Enterprise Java Bean (EJB) Programming

### UNIT- I

**APPLET, AWT AND EVENT HANDLING** : Applet Basics – Applet architecture – HTML APPLET tag – -Passing parameter to Applet.getDocumentBase() and getCodeBase() – AWT classes and Graphics – AWT Controls -Event Handling – Event Classes – Event Listener Interfaces – Layout Managers – Menus

### UNIT -II

**INTRODUCING SWING & JAVA BEANS**: Exploring Swing – JLabel and ImageIcon, JTextField – The Swing Buttons – JTabbedPane -JScrollPane, JList&JComboBox – Trees &JTables – What Is a Java Bean? – Advantages of Java Beans – Introspection, Bound and Constrained Properties – Persistence & Customizers

### UNIT -III

**RMI & NETWORKING** : Remote Method Invocation – Settingup Remote Method Invocation – RMI with Applets

Networking Basics – The Networking Classes and Interfaces – InetAddress – Inet4Address and Inet6Address -TCP/IP Client sockets – URL – URL Connection – HttpURLConnection .

### UNIT- IV

**JDBC** : Presentation to JDBC CONNECTION settings – The Concept of JDBC – JDBC Driver Types – JDBC Packages – A Brief Overview of the JDBC Process – Database Connection – Associating the JDBC/ODBC Bridge with the Database – Statement Objects – Result Set.

## **UNIT- V**

**SERVLETS:** Background, The Life Cycle of a Servlet & The JSDK-A Simple Servlet – The Servlet API -RolePlay-Servlet Concept – The javax.servlet Package – Reading Servlet Parameters, The javax.servlet.http Package – Handling HTTP Request and Responses – Using Cookies – Session Tracking.

### **Text Books:**

1. Naughton and H.Schildt, (2007), “Java 2-The complete reference”, Fifth Edition McGraw Hill. (UNIT I – V)

### **References Books:**

1. Jim Keogh, (2002), “The Complete Reference J2EE”, Tata McGraw Hill Edition, New Delhi.
2. Marty Hall, Larry Brown, (2004), “Core Servlets and Java Server Pages”, 2nd Edition. Pearson Education.

III Year – V Semester	22CS5T2	L	T	P	C
		3	0	0	3
<b>SOFTWARE ENGINEERING</b>					

### OBJECTIVES

- To understand the software life cycle models.
- To understand the software requirements and SRS document.
- To understand the importance of modeling and modeling languages.
- To design and develop correct and robust software products.
- To understand the quality control and how to ensure good quality software.
- To understand the planning and estimation of software projects.
- To understand the implementation issues, validation and verification procedures.
- To understand the maintenance of software

### UNIT-I:

**Software and Software Engineering:** The Nature of Software, The Unique Nature of Web Apps, Software Engineering, Software Process, Software Engineering Practice, Software Myths.

**Process Models:** A Generic Process Model, Process Assessment and Improvement, Prescriptive Process Models, Specialized Process Models, the Unified Process, Personal and Team Process Models, Process Terminology, Product and Process.

### UNIT-II:

**Requirements Analysis and Specification:** Requirements Gathering and Analysis, Software Requirement Specification (SRS), Formal System Specification.

**Software Design:** Overview of the Design Process, How to Characterize a Design? Cohesion and Coupling, Layered Arrangement of Modules, Approaches to Software Design

### UNIT – III:

**Function-Oriented Software Design:** Overview of SA/SD Methodology, Structured Analysis, Developing the DFD Model of a System, Structured Design, Detailed Design, Design Review, over view of Object Oriented design.

**Coding And Testing:** Coding, Code Review, Software Documentation, Testing, Unit Testing, Black-Box Testing, White-Box Testing, Debugging, Program Analysis Tool, Integration Testing, Testing Object-Oriented Programs, System Testing, Some General Issues Associated with Testing.

### UNIT – IV:

**Software Reliability And Quality Management:** Software Reliability, Statistical Testing, Software Quality, Software Quality Management System, ISO 9000, SEI Capability Maturity Model. Computer Aided Software Engineering: Case and its Scope, Case Environment, Case Support in Software Life Cycle, Other Characteristics of Case Tools, Towards Second Generation CASE Tool, Architecture of a Case Environment.

## **UNIT – V:**

**Software Maintenance:** Software maintenance, Maintenance Process Models, Maintenance Cost, Software Configuration Management.

**Software Reuse:** what can be reused? Why almost No Reuse So Far? Basic Issues in Reuse Approach, Reuse at Organization Level.

## **OUTCOMES**

- Define and develop a software project from requirement gathering to implementation.
- Obtain knowledge about principles and practices of software engineering.
- Focus on the fundamentals of modeling a software project.
- Obtain knowledge about estimation and maintenance of software systems

## **TEXT BOOKS:**

1. Software Engineering - Concepts and Practices: Ugrasen Suman, Cengage Learning.
2. Software Engineering - A Practitioner's Approach, Roger S. Pressman, Seventh Edition McGrawHill International Edition.
3. Fundamentals of Software Engineering, Rajib Mall, Third Edition, PHI.
4. Software Engineering, Ian Sommerville, Ninth edition, Pearson education

## **REFERENCE BOOKS:**

1. Software Engineering : A Primer, Waman S Jawadekar, Tata McGraw-Hill, 2008
2. Software Engineering, A Precise Approach, Pankaj Jalote, Wiley India, 2010.
3. Software Engineering, Principles and Practices, Deepak Jain, Oxford University Press.
4. Software Engineering I: Abstraction and modeling, Diner Bjorner, Springer International edition, 2006.

III Year – V Semester	22CS5T3	L	T	P	C
		3	0	0	3
<b>ML USING TENSOR FLOW</b>					

**UNIT 1: Getting Started with Tensor Flow**

How Tensor Flow Works, Declaring Tensors, Using Placeholders and Variables, Working with Matrices, Declaring Operations, Implementing Activation Functions

**UNIT-II: The Tensor Flow Way**

Operations in a Computational Graph, Layering Nested Operations, Working with Multiple Layers ,Implementing Loss Functions, Implementing Back Propagation, Working with Batch and Stochastic Training, Combining Everything Together, Evaluating Models

**UNIT-III: Linear Regression**

Using the Matrix Inverse Method, Learning The Tensor Flow Way of Linear Regression, Understanding Loss Functions in Linear Regression, Implementing Lasso and Ridge Regression, Implementing Elastic Net ,Regression, Implementing Logistic Regression

**UNIT-IV: Saving & Re storing variables**

Saving variables, Restoring variables, choosing variables selectively to save, API to build & load a saved Model, Using saved model with estimator

**UNIT-V: Importing Data**

Basic Mechanics, Reading input data, reprocessing data with Dataset.map (), Batching Data set elements, Training workflows

<b>Course Code</b>	<b>B. Tech</b>	<b>INTRODUCTION TO WINDOWS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
22CS5E1	III Year V Sem	<b>AZURE</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**UNIT-I: Cloud Computing Overview Azure Portal Azure Storage Service: Storage Service-Azure Storage Account-Azure Blob Storage- Creating a Container-Blob Configuration-Azure Storage Security.**

**UNIT-II: Network Services: Azure Network Service-Azure Virtual Network-Azure Network Security- Azure Network Interface-Availability Zones & Sets-Azure Load Balancer.**

**UNIT-III: Compute Services: Azure Compute Service-Azure Virtual Machines-Azure VM Storage-Virtual Machine Scale Set-Azure Backup-Azure VM Security.**

**UNIT-IV: App Services: Azure App Services-Azure Web App-Azure Mobile App-Azure Notification Hub- Azure API Apps-App Service Backup-App Service Security-App Service Monitoring-Azure CDN.**

**UNIT-V: Database Service: Azure Database Service-Azure SQL Database-SQL Database Configuration- SQL Managed Instance-Azure COSMOS DB-Azure Data Factory-SQL Data Warehouse.**

**Text Books:**

1. Microsoft Azure Fundamentals-Second Edition-Jim Cheshire-Microsoft press-2020.
2. Fundamentals of Azure-Second Edition-Michael Collier and Robin Shahan - Microsoft press

<b>Course Code</b>	<b>B.Tech</b>	<b>Ad hoc and sensor networks</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>22CS5E2</b>	<b>III Year V Sem</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

### OBJECTIVES:

The student should be made to:

1. Understand the design issues in ad hoc and sensor networks.
2. Learn the different types of MAC protocols.
3. Be familiar with different types of adhoc routing protocols.
4. Be exposing to the TCP issues in adhoc networks.
5. Learn the architecture and protocols of wireless sensor networks.

### OUTCOMES:

1. Explain the concepts, network architectures and applications of ad hoc and wireless sensor networks
2. Analyze the protocol design issues of ad hoc and sensor networks
3. Design routing protocols for ad hoc and wireless sensor networks with respect to some protocol design issues
4. Evaluate the QoS related performance measurements of ad hoc and sensor networks.

### UNIT-I: INTRODUCTION

Fundamentals of Wireless Communication Technology – The Electromagnetic Spectrum – Radio propagation Mechanisms – Characteristics of the Wireless Channel -mobile ad hoc networks (MANETs) and wireless sensor networks (WSNs) :concepts and architectures. Applications of Ad Hoc and Sensor networks. Design Challenges in Ad hoc and Sensor Networks.

### UNIT-II MAC PROTOCOLS FOR AD HOC WIRELESS NETWORKS

Issues in designing a MAC Protocol- Classification of MAC Protocols- Contention based protocols- Contention based protocols with Reservation Mechanisms- Contention based protocols with Scheduling Mechanisms – Multi channel MAC-IEEE 802.11

### UNIT III ROUTING PROTOCOLS AND TRANSPORT LAYER IN AD HOC WIRELESS NETWORKS

Issues in designing a routing and Transport Layer protocol for Ad hoc networks- proactive routing, reactive routing (on-demand), hybrid routing- Classification of Transport Layer solutions-TCP over Ad hoc wireless Networks.

### UNIT IV

#### WIRELESS SENSOR NETWORKS (WSNS)AND MAC PROTOCOLS

single node architecture: hardware and software components of a sensor node - WSN Network architecture: typical network architectures-data relaying and aggregation strategies -MAC layer protocols: self-organizing, Hybrid TDMA/FDMA and CSMA based MAC- IEEE 802.15.4.

## **UNIT V**

### **WSN ROUTING, LOCALIZATION & QOS**

Issues in WSN routing – OLSR- Localization – Indoor and Sensor Network Localization-absolute and relative localization, triangulation-QOS in WSN-Energy Efficient Design-Synchronization-Transport Layer issues.

#### **TEXT BOOK:**

1. C. Siva Ram Murthy, and B. S. Manoj, "Ad Hoc Wireless Networks: Architectures and Protocols", Prentice Hall Professional Technical Reference, 2008.
2. Ad hoc and Sensor Networks - Theory and Applications, by Carlos Cordeiro and Dharma P. Agrawal, World Scientific Publications, March 2006, ISBN 981-256-681-3.
3. Wireless Sensor Networks: An Information Processing Approach, Feng Zhao, Leonidas Guibas, Elsevier Science ISBN: 978-1-55860-914-3, (Morgan Kaufman)

#### **REFERENCES:**

1. Carlos De Morais Cordeiro, Dharma Prakash Agrawal "Ad Hoc & Sensor Networks: Theory and Applications", World Scientific Publishing Company, 2006.
2. Feng Zhao and Leonides Guibas, "Wireless Sensor Networks", Elsevier Publication – 2002.
3. Holger Karl and Andreas Willig "Protocols and Architectures for Wireless Sensor Networks", Wiley, 2005
4. Kazem Sohraby, Daniel Minoli, & Taieb Znati, "Wireless Sensor Networks-Technology, Protocols, and Applications", John Wiley, 2007.
5. Anna Hac, "Wireless Sensor Network Designs", John Wiley, 2003.

<b>Course Code</b>	<b>B.Tech</b>	<b>INTRODUCTION TO DEEP LEARNING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>22CS5E3</b>	<b>III Year V Sem</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Course Objectives:**

- To introduce the foundations of Artificial Neural Networks
- To acquire the knowledge on Deep Learning Concepts
- To learn various types of Artificial Neural Networks
- To gain knowledge to apply optimization strategies

**Course Outcomes:**

- Ability to understand the concepts of Neural Networks
- Ability to select the Learning Networks in modeling real world systems Ability to use an efficient algorithm for Deep Models

**UNIT - I**

**Artificial Neural Networks:** Introduction, Basic models of ANN, important terminologies, Supervised Learning Networks, Perceptron Networks, Adaptive Linear Neuron, Back propagation Network. Associative Memory Networks. Training Algorithms for pattern association, BAM and Hopfield Networks.

**UNIT - II**

Unsupervised Learning Network- Introduction, Fixed Weight Competitive Nets, Maxnet, Hamming Network, Kohonen Self-Organizing Feature Maps, Learning Vector Quantization, Counter Propagation Networks, Adaptive Resonance Theory Networks. Special Networks- Introduction to various networks.

**UNIT - III**

Introduction to Deep Learning, Historical Trends in Deep learning, Deep Feed – forward networks, Gradient-] Based learning, Hidden Units, Architecture Design, Back Propagation and Other Differentiation Algorithms.

**UNIT - IV**

**Regularization for Deep Learning**

Parameter norm Penalties, Norm Penalties as Constrained Optimization, Regularization and Under- Constrained Problems, Dataset Augmentation, Noise Robustness,

**UNIT - V**

Semi-Supervised learning, Multi-task learning, Early Stopping, Parameter Typing and Parameter Sharing, Sparse Representations, Bagging and other Ensemble Methods, Dropout, Adversarial Training, Tangent Distance, tangent Prop and Manifold, Tangent Classifier

**TEXT BOOKS:**

1. Deep Learning: An MIT Press Book By Ian Good fellow and Yoshua Bengio and Aaron Courville Neural Networks and Learning Machines, Simon Haykin, 3rd Edition, Pearson Prentice Hall.

<b>Course Code</b>	<b>B.Tech</b>	<b>INTRODUCTION TO CRYPTOGRAPHY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>22CS5E4</b>	<b>III Year V Sem</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Course Objectives:**

1. To understand basics of Cryptography and Network Security.
2. To be able to secure a message over insecure channel by various means.
3. To learn about how to maintain the Confidentiality, Integrity and Availability of a data.
4. To understand various protocols for network security to protect against the threats in the networks.

**OUTCOMES:**

1. Provide security of the data over the network.
2. Do research in the emerging areas of cryptography and network security.
3. Implement various networking protocols.
4. Protect any network from the threats in the world.

**UNIT - I**

**Cryptography Concepts and Techniques:** Introduction, plain text and cipher text, substitution techniques, transposition techniques, encryption and decryption, symmetric and asymmetric key cryptography, steganography, key range and key size, possible types of attacks.

**UNIT - II**

**Symmetric key Ciphers:** Block Cipher principles, DES, AES, Blowfish, RC5, IDEA, Block cipher operation, Stream ciphers, RC4.

**Asymmetric key Ciphers:** Principles of public key cryptosystems, RSA algorithm, Elgamal Cryptography, Diffie-Hellman Key Exchange

**UNIT - III**

MD5 message digest algorithm - Secure hash algorithm (SHA) Digital Signatures: Digital Signatures - authentication protocols - digital signature standards (DSS) - proof of digital signature algorithm

**Unit IV (Integrity checks and Authentication algorithms)**

Authentication Applications: Kerberos and X.509 - directory authentication service -electronic mail security-pretty good privacy (PGP) - S/MIME.

**Unit V (IP Security and Key Management)**

IP Security: Architecture - Authentication header - Encapsulating security payloads -combining security associations - key management. Web Security: Secure socket layer and transport layer security - secure electronic transaction (SET) - System Security: Intruders - Viruses and related threads - firewall design principals –trusted systems.

**RESOURCES:**

**Video Lectures**

[http://nptel.ac.in/courses/106105031/lecture by Dr.](http://nptel.ac.in/courses/106105031/lecture%20by%20Dr.%20Debdeep%20Mukhopadhyay%20IIT%20Kharagpur)

Debdeep Mukhopadhyay IIT Kharagpur

<https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-033-computer-system-engineering-spring-2009/video-lectures/> **lecture by** Prof. Robert Morris and Prof. Samuel Madden MIT.

**Text Books**

William Stallings, "Cryptography and Network security principles and Practices", Pearson/PHI.

Wade Trappe, Lawrence C Washington, " Introduction to Cryptography with coding theory", Pearson.

**Reference Books**

W. Mao, "Modern Cryptography – Theory and Practice", Pearson Education.

Charles P. Pfleeger, Shari Lawrence Pfleeger – Security in computing – Prentice Hall of India.

<b>Course Code</b>	<b>B.Tech</b>	<b>DATA SCIENCE USING CLOUD</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>22CS5E5</b>	<b>III Year V Sem</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- The student will learn about the cloud environment, building software systems and components that scale to millions of users in modern internet cloud concepts capabilities across the various cloud service models including Iaas, Paas, Saas, and developing cloud based software applications on top of cloud platforms.

**OUTCOMES:**

- Understanding the key dimensions of the challenge of Cloud Computing
- Assessment of the economics , financial, and technological implications for selecting cloud computing for own organization
- Assessing the financial, technological, and organizational capacity of employer's for actively initiating and installing cloud-based applications.
- Assessment of own organizations' needs for capacity building and training in cloud computing-related IT areas

**UNIT-I: Systems modeling, Clustering and virtualization**

Scalable Computing over the Internet, Technologies for Network based systems, System models for Distributed and Cloud Computing, Software environments for distributed systems and clouds, Performance, Security And Energy Efficiency

**UNIT-II: Virtual Machines and Virtualization of Clusters and Data Centers**

Implementation Levels of Virtualization, Virtualization Structures/ Tools and mechanisms, Virtualization of CPU, Memory and I/O Devices, Virtual Clusters and Resource Management, Virtualization for Data Center Automation.

**UNIT-III: Cloud Platform Architecture**

Cloud Computing and service Models, Architectural Design of Compute and Storage Clouds, Public Cloud Platforms, Inter Cloud Resource Management, Cloud Security and Trust Management. Service Oriented Architecture, Message Oriented Middleware.

**UNIT-IV: Cloud Programming and Software Environments**

Features of Cloud and Grid Platforms, Parallel & Distributed Programming Paradigms, Programming Support of Google App Engine, Programming on Amazon AWS and Microsoft Azure, Emerging Cloud Software Environments.

**UNIT-V: Cloud Resource Management and Scheduling**

Policies and Mechanisms for Resource Management Applications of Control Theory to Task Scheduling on a Cloud, Stability of a Two Level Resource Allocation Architecture, Feedback Control Based on Dynamic Thresholds. Coordination of Specialized Autonomic Performance Managers, Resource Bundling, Scheduling Algorithms for Computing Clouds, Fair Queuing, Start Time Fair Queuing Borrowed Virtual Time, Cloud Scheduling Subject to Deadlines, Scheduling Map Reduce Applications Subject to Deadlines

III Year – V Semester	22CS5L1	L	T	P	C
		0	0	3	1.5
<b>ADVANCED JAVA PROGRAMMING LAB</b>					

### BEANS PROGRAMMING

1. Write a quiz applet and use gauge bean to update the score
2. Create a time zone list and retrieve any time which is given with zone using java beans
3. Develop a bean program that display a sequece of images in the form of slide show
4. Create a bean that displays a 3D plot of the following function  $Z = f(x,y)$   
 $= 0.01 *(x^2 - y^2)$
5. Create a frame that instantiates the beans registers paints to receive color event notifications fromselectors adds the beans to the frame and makes the frame visible
6. Create a bean that displays a pie chart and use pie customizer to update the pie chart
7. Develop a bean that takes date and year and represent it in the local language in the form of acaleder For (Eg.) French , Italian etc

### SERVLETS PROGRAMMING

1. Write a servlet to display
  - a. IP address and Port no. of server
  - b. The host name and address of the computer on which your browser visits
2. Use a servlet as RMI client to enable a method given
3. Using servlet create a form which contain a text area, checkbox, radio button, label and text field withbuttons
4. Create a chat program that uses servlets to communicate with 2 machines.  
Create a servlet that gets the date and time of the system

III Year – V Semester	22CS5L1	L	T	P	C
		0	0	3	1.5
<b>ML USING TENSOR FLOW LAB</b>					

**COURSE OUTLINE :** This will be an applied Machine Learning Course jointly offered by Google and IIT Madras. We will cover the basics of Tensorflow and Machine Learning in the initial sessions and advanced topics in the latter part. After this course, the students will be able to build ML models using Tensorflow.

Week 1: Getting started with Tensorflow

Week 2: Overview of Machine Learning (Process and Techniques, Demonstration of ML concepts with Deep Playground)

Week 3: Data Input and Preprocessing with Tensorflow

Week 4: Machine Learning Model Building

Week 5: Prediction with Tensorflow

Week 6: Monitoring and evaluating models using Tensorboard

Week 7: Advance Tensorflow (Building custom models - CNNs, Scaling up for large datasets)

Week 8: Distributed training with hardware accelerators

<b>Course Code</b>	<b>B. Tech</b>	<b>COMPUTER NETWORKS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>22CS6T1</b>	<b>III Year VI Sem</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

Understand state-of-the-art in network protocols, architectures, and applications. Process of networking research Constraints and thought processes for networking research Problem Formulation—Approach—Analysis.

Understand protocols and LAN technologies Design applications using internet protocols Understand routing

**OUTCOMES:**

Understand OSI and TCP/IP models

Analyze MAC layer and congestion control algorithms understand how internet works

**UNIT – I:**

**Introduction:** Network Topologies WAN, LAN, MAN. Reference models- The OSI Reference Model- the TCP/IP Reference Model - A Comparison of the OSI and TCP/IP Reference Models

**UNIT – II:**

**Physical Layer – Fourier analysis – Bandwidth Limited Signals – The Maximum Data Rate of a Channel - Guided Transmission Media, Digital Modulation and Multiplexing: Frequency Division Multiplexing, Time Division Multiplexing, and Code Division Multiplexing**

**Data Link Layer Design Issues, Error Detection and Correction, Elementary Data Link Protocols, Sliding Window Protocols**

**UNIT – III:**

**The Data Link Layer - Services Provided to the Network Layer – Framing – Error Control – Flow Control, Error Detection and Correction – Error-Correcting Codes – Error Detecting Codes, Elementary Data Link Protocols- A Utopian Simplex Protocol-A Simplex Stop and Wait Protocol for an Error free channel-A Simplex Stop and Wait Protocol for a Noisy Channel, Sliding Window Protocols**

**UNIT – IV:**

**The Medium Access Control Sublayer-The Channel Allocation Problem-Static Channel Allocation- Assumptions for Dynamic Channel Allocation, Multiple Access Protocols-Aloha-Carrier Sense Multiple Access Protocols-Collision-Free Protocols-Limited Contention Protocols-Wireless LAN Protocols, Ethernet-Classic Ethernet Physical Layer-Classic Ethernet MAC Sublayer Protocol-Ethernet Performance- Fast Ethernet Gigabit Ethernet-10-Gigabit Ethernet- Retrospective on Ethernet, Wireless Lans-The 802.11 Architecture and Protocol Stack-The 802.11 Physical Layer- The802.11 MAC Sublayer Protocol-The 805.11 Frame Structure-Services**

**UNIT – V:**

Design Issues-The Network Layer Design Issues – Store and Forward Packet Switching- Services Provided to the Transport layer- Implementation of Connectionless Service- Implementation of Connection Oriented Service-Comparison of Virtual Circuit and Datagram Networks, Routing Algorithms-The Optimality principle-Shortest path Algorithm, Congestion Control Algorithms, **Transport Layer** – The Internet Transport Protocols: Udp, the Internet Transport Protocols: Tcp **Application Layer** –The Domain Name System: The DNS Name Space, Resource Records, Name Servers, Electronic Mail: Architecture and Services, The User Agent, Message Formats, Message Transfer, Final Delivery

**TEXT BOOKS:**

- 1.Tanenbaum and David J Wetherall, Computer Networks, 5th Edition, Pearson Edu, 2010
- 2.Computer Networks: A Top Down Approach, Behrouz A. Forouzan, Firouz Mosharraf, McGraw HillEducation

**REFERENCE BOOKS:**

Larry L. Peterson and Bruce S. Davie, “Computer Networks - A Systems Approach” (5th ed), MorganKaufmann/ Elsevier, 2011

<b>Course Code</b>	<b>B. Tech</b>	<b>WEB TECHNOLOGIES</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>22CS6T2</b>	<b>III Year VI Sem</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVE:**

This course is designed to introduce students with no programming experience to the programming languages and techniques associated with the World Wide Web. The course will introduce web-based media-rich programming tools for creating interactive web pages.

**UNIT-I: HTML**

HTML overview, Standard HTML Document Structure, Basic HTML tags, HTML elements, Text Markup tags, HTML attributes, HTML formatting, HTML phrase tags, HTML comments, Images, Hypertext text, image and email Links, Lists, Tables, HTML frames, HTML blocks, HTML backgrounds, HTML colors, HTML fonts, HTML Audio, HTML video

**UNIT-II: HTML Forms**

HTML forms, HTML form controls, Text Fields, Text Areas, Check Boxes, Radio Buttons, List Boxes, Password Controls, Hidden Controls, Image Maps, File Uploads, Buttons, Reading data using Form Controls (Text Fields, Text Areas, Check Boxes, Radio Buttons, List Boxes, Password Controls, Hidden Controls, Image Maps, File Uploads, Buttons), Submitting form values, Accessing form inputs with Get/Post functions

**UNIT-III: CSS**

CSS overview, CSS syntax, CSS selectors, Levels of Style Sheets, Style Specification Formats, Types of CSS, Selector Forms, The Box Model, Conflict Resolution, CSS colors, CSS fonts, CSS backgrounds, Setting text properties, Setting image properties, Setting link properties, Setting table properties

**UNIT-IV: Java Script**

The Basic of Java script: Objects, Primitives Operations and Expressions, Screen Output and Keyboard Input, Control Statements, Loop statements, Object Creation and Modification, Arrays, Functions, Constructors, form validation, HTML: Positioning Moving and Changing Elements

**UNIT-V: PHP Programming**

Introducing PHP, Creating PHP script, Running PHP script, working with form, PHP file upload and download, PHP Mail, PHP classes, methods and objects, oop features inheritance, Abstract classes and interfaces

**OUTCOMES:**

- Analyze a web page and identify its elements and attributes.
- Create web pages using HTML and Cascading Styles sheets. Build dynamic web pages.
- Build web applications using PHP.

**TEXT BOOKS:**

Programming the World Wide Web, Robert W Sebesta, 7ed, Pearson. Web Technologies, Uttam K Roy, Oxford The Web Warrior Guide to Web Programming, Bai, Ekedahl, Farrell, Gosselin, Zak, Karparhi, MacIntyre, Morrissey, Cengage

**REFERENCE BOOKS:**

Ruby on Rails Up and Running, Lightning fast Web development, Bruce Tate, Curt Hibbs, O'Reilly (2006)

Programming Perl, 4ed, Tom Christiansen, Jonathan Orwant, O'Reilly (2012)

Web Technologies, HTML JavaScript, PHP, Java, JSP, XML and AJAX, Black book, Dream Tech. An Introduction to Web Design, Programming, Paul S Wang, Sanda S Katila, Cengage Learning

<b>Course Code</b>	<b>B.Tech</b>	<b>INTRODUCTION TO CYBERSECURITY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
22CI6T3	III Year VI Sem		3	0	0	3

### **OBJECTIVES:**

The Cyber security Course will provide the students with foundational Cyber Security principles, Security architecture, risk management, attacks, incidents, and emerging IT and IS technologies. Students will gain insight into the importance of Cyber Security and the integral role of Cyber Security professionals.

### **OUTCOMES:**

Cyber Security architecture principles  
 Identifying System and application security threats and vulnerabilities  
 Identifying different classes of attacks  
 Cyber Security incidents to apply appropriate response  
 Describing risk management processes and practices  
 Evaluation of decision making outcomes of Cyber Security scenarios

### **UNIT- I: Introduction to Cybercrime:**

Introduction, Cybercrime: Definition and Origins of the Word, Cybercrime and Information Security, Who are Cybercriminals?, Classifications of Cybercrimes, Cybercrime: The Legal Perspectives, Cybercrimes: An Indian Perspective, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes, Cybercrime Era: Survival Mantra for the Netizens.

### **UNIT -II: Cyber offenses:**

How Criminals Plan Them –Introduction, How Criminals Plan the Attacks, Social Engineering, Cyber stalking, Cyber cafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector Cloud Computing.

### **UNIT -III: Cybercrime Mobile and Wireless Devices:**

Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication Service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops.

#### **UNIT -IV: Tools and Methods Used in Cybercrime:**

Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Key loggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks, Phishing and Identity Theft: Introduction, Phishing,

#### **UNIT -V: Cybercrimes and Cyber security:**

Why Do We Need Cyber laws: The Indian Context, The Indian IT Act, Challenges to Indian Law and Cybercrime Scenario in India, Consequences of Not Addressing the Weakness in Information Technology Act, Digital Signatures an the Indian IT Act, Information Security Planning and Governance, Information Security Policy Standards, Practices, The information Security Blueprint, Security education, Training and awareness program, Continuing Strategies.

#### **TEXT BOOKS:**

Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Nina Godbole, Sunit Belapure, Wiley.

Principles of Information Security, Micheal E. Whitman and Herbert J. Mattord, Cengage Learning.

#### **REFERENCES:**

1. Information Security, Mark Rhodes, Ousley, M

**PROFESSIONAL ELECTIVES III YEAR VI SEM**

<b>Course Code</b>	<b>B.Tech</b>	<b>FORMAL LANGUAGES AND AUTOMATA THEORY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>22CS6E1</b>	<b>III Year VI Sem</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**COURSE OBJECTIVE:**

- Introduce the student to the concepts of Theory of computation in computer science
- The students should acquire insights into the relationship among formal languages, formal Grammars and automata

**COURSE OUTCOMES:**

- Classify machines by their power to recognize languages,
- Employ finite state machines to solve problems in computing,
- Explain deterministic and non-deterministic machines,
- Comprehend the hierarchy of problems arising in the computer science

**UNIT 1**

Alphabets, Languages, Operations on strings and languages and operations on languages, Why Study Automata Theory? The Central Concepts of Automata Theory, s, Acceptance of a String by a Finite Automaton, Components of FSA, Elements of FSA, Mathematical representation of FSA, DFA, Design of DFAs, NFA, Design of NFA, Equivalence of DFA and NFA, Conversion of NFA into DFA, Finite Automata with E-Transition, Minimization of Finite Automata, 2DFA Mealy and Moore Machines, Applications and Limitation of Finite Automata.

**UNIT 2**

Regular sets, Regular expressions, Operations and applications of regular expressions, Identity rules, Conversion of a given regular expression into a finite automaton, Conversion of finite automata into a regular expression, Pumping lemma for regular sets, Closure properties of regular sets

**UNIT 3**

Formal Languages, Grammars, Classification of Grammars, Chomsky Hierarchy Theorem, Context Free Grammar, Leftmost and Rightmost Derivations, Parse Trees, Ambiguous Grammars, Simplification of Context Free Grammars-Elimination of Useless Symbols, EProductions and Unit Productions, Normal Forms for Context Free Grammars-Chomsky NormalForm and Greibach Normal Form ,Applications of Context Free Grammars.

#### **UNIT 4**

Pushdown Automata, Definition, Model, Graphical Notation, Instantaneous Description Language Acceptance of pushdown Automata, Design of Pushdown Automata, Deterministic and Non – Deterministic Pushdown Automata, Equivalence of Pushdown Automata and Context Free Grammars Conversion, Two Stack Pushdown Automata, Application of Pushdown Automata.

#### **UNIT 5**

Turing Machine, Definition, Model, Representation of Turing Machines-Instantaneous Descriptions, Transition Tables and Transition Diagrams, Language of a Turing Machine, Design of Turing Machines, Techniques for Turing Machine Construction, Types of Turing Machines, Church's Thesis, Universal Turing Machine, Restricted Turing Machine

#### **TEXT BOOKS:**

1. Introduction to Automata Theory, Languages and Computation, J.E.Hopcroft, R.Motwani and J.D.Ullman, 3rd Edition, Pearson, 2008.
2. Theory of Computer Science-Automata, Languages and Computation, K.L.P.Mishra and N.Chandrasckharan, 3rd Edition, PHI, 2007

#### **REFERENCE BOOKS:**

1. A Textbook on Automata Theory Nasir S.F.B, P.K Srimani, Cambridge university press Formal Language and Automata Theory, K.V.N.Sunitha and N.Kalyani, Pearson, 2015.
2. Introduction to Automata Theory, Formal Languages and Computation, Shyamalendu Kandar, Pearson, 2013.

<b>Course Code</b>	<b>B.Tech</b>	<b>EMBEDDED SYSTEMS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>22CS6E2</b>	<b>III Year VI Sem</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

### Course Objectives:

The objective of this course is to equip the students with the basic concepts of embedded system, applications in which they are used, 8051 microcontroller programming concepts and various aspects of embedded system design from Hardware and Software points of view and it describes tools and methodologies needed for embedded system design. It provides RTOS concepts for coding the embedded system software routines. It tells what makes a system a real-time system and describes the characteristics of latency in real-time systems.

### Course Outcomes:

At the end of this course student will:

CO1) Understand the microprocessor architecture and its components used in embedded systems

CO2) Write the 8051 assembly language code for specific purposes

CO3) impliment code for interfacing various devices.

CO4) Develop simple embedded systems for real time operations

CO5) Compose simple embedded system with error free software to obtain target system

### Syllabus:

#### UNIT 1

**Embedded Systems Basics:** Introduction to Embedded systems, Examples of embedded systems, Typical Hardware, Gates, Timing Diagrams, Memory, Microprocessors, Buses, Direct Memory Access, Interrupts, Microprocessor Architecture, and Interrupt Basics.

#### UNIT 2

The 8051 Architecture : Introduction, 8051 Micro controller Hardware, Input/output Pin Ports and Circuits, External Memory, Serial data Input/output, Interrupts.

#### UNIT 3

**Basic Assembly Language Programming Concepts:** The Assembly Language Programming Process, Programming Tools and Techniques, Programming the 8051.

#### UNIT 4

**Moving Data:** Introduction, Addressing Modes, External Data Moves, Code Memory Read-Only Data Moves, Push and Pop Opcodes, Data Exchanges.

**Basic Design Using a Real-Time Operating System:** Message Queues, Mailboxes and Pipes, Timer Functions, Events, Memory Management, Interrupt Routines in an RTOS Environment

## **UNIT 5**

**Applications:** Introduction, keyboards, Human Factor, Key Switch Factors, Keyboard Configurations, Displays, Seven-Segment Numeric Display, D/A and A/D Conversions.

**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.

### **Learning Resource**

#### **Text Books**

1. An Embedded Software Primer, David E. Simon, Pearson Education.
2. The 8051 Microcontroller, Third Edition, Kenneth J. Ayala, Thomson.

#### **References**

1. 8051 Microcontrollers, Satish Shah, Oxford Higher Education.
2. Embedded Microcomputer Systems Real Time Interfacing, Jonathan W. Valvano, Cengage Learning.
3. Micro Controllers, Ajay V Deshmukhi, TMH.
4. Embedded System Design, Frank Vahid, Tony Givargis, John Wiley.
5. Microcontrollers, Raj kamal, Pearson Education.
  - a. <http://nptel.ac.in/courses.php>
  - b. <http://jntuk-coecrd.in/>

<b>Course Code</b>	<b>B.Tech</b>	<b>Cognitive Computing</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>22CS6E3</b>	<b>III Year VI Sem</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Course Objective:** To develop algorithms that use AI and machine learning along with human interaction and feedback to help humans make choices/decisions and to understand how Cognitive computing supports human reasoning by evaluating data in context and presenting relevant findings along with the evidence that justifies the answers.

**Pre-requisite:** A course on AI should be studied by students, to study this course.

**Course Outcome:**

After studying this course, the students will be able to:

- Understand basics of Cognitive Computing and its differences from traditional
- Approaches of Computing. . Plan and use the primary tools associated with cognitive computing.
- Plan and execute a project that leverages Cognitive Computing.

**Pedagogy:** Classroom teaching which focuses upon relating the textbook concepts with real world phenomena, along with periodic tutorial classes in case studies to enhance the problemsolving ability.

**UNIT I:**

Cognitive science and cognitive Computing with AI, Cognitive Computing - Cognitive Psychology - The Architecture of the Mind - The Nature of Cognitive Psychology – Cognitive architecture – Cognitive processes

**UNIT-II**

The Cognitive Modeling Paradigms - Declarative / Logic based Computational cognitive modeling – connectionist models – Bayesian models. Introduction to Knowledge-Based AI – Human Cognition on AI – Cognitive Architectures

**UNIT III :**

Cognitive Computing With Inference and Decision Support Systems: Intelligent Decision making, Fuzzy Cognitive Maps, Learning algorithms: Non linear Hebbian Learning – Data driven NHL - Hybrid learning, Fuzzy Grey cognitive maps, Dynamic Random fuzzy cognitive Maps.

**UNIT IV:**

Cognitive Computing with Machine Learning: Machine learning Techniques for cognitive decision making – Hypothesis Generation and Scoring - Natural Language Processing - Representing Knowledge - Taxonomies and Ontologies - Deep Learning.

**UNIT V :**

Cognitive Systems in health care – Cognitive Assistant for visually impaired – AI for cancer detection, Predictive Analytics - Text Analytics - Image Analytics -Speech Analytics – IBM Watson

**Text Books**

Hurwitz, Kaufman, and Bowles, Cognitive Computing and Big Data Analytics, Wiley, Indianapolis, IN, 2005, ISBN: 978-1-118-89662-4. 2 Masood, Adnan, Hashmi, Adnan ,Cognitive Computing Recipes- Artificial Intelligence Solutions Using Microsoft Cognitive Services and TensorFlow, 2015

**Reference Books**

1. Peter Fingar, Cognitive Computing: A Brief Guide for Game Changers, PHI Publication, 2015
2. Gerardus Blokdyk ,Cognitive Computing Complete Self-Assessment Guide, 2018
3. Rob High, Tanmay Bakshi, Cognitive Computing with IBM Watson: Build smart applications using Artificial Intelligence as a service, IBM Book Series, 2019

<b>Course Code</b>	<b>B.Tech</b>	<b>SOFT COMPUTING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>22CS6E4</b>	<b>III Year VI Sem</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**UNIT I: Introduction to soft computing:**

Concept of computing system," soft " computing versus "Hard " Computing, Characteristics of soft computing of soft computing , some applications of Soft computing Techniques.

**UNIT-II: Fuzzy Logic:**

Introduction to Fuzzy logic, Fuzzy sets and membership functions, Operations on Fuzzy Sets, Fuzzy relations, rules, propositions, implications and inferences, Defuzzification techniques, some applications Of Fuzzy logic.

**UNIT III :**

Concept of "Genetics" and "Evolution" and its application to probabilistic search Techniques , Basic GA frame work and different GA architectures, GA operators

**UNIT IV:**

Encoding , Crossover , selection , Mutation, etc. Solving single – objective Optimization Problems using GA s.

**UNIT V:**

**Artificial Neural Networks :**

Biological neurons and its working , simulation of biological neurons to problem Solving, Different ANNs architectures, Training techniques for ANNs, Applications of ANN s to solve some real life problems.

<b>Course Code</b>	<b>B.Tech</b>	<b>EDGE COMPUTING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>22CS6E5</b>	<b>III Year VI Sem</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

### UNIT I

#### IoT and Edge Computing Definition and Use Cases

Introduction to Edge Computing Scenario's and Use cases - Edge computing purpose and definition, Edge computing use cases, Edge computing hardware architectures, Edge platforms, Edge vs Fog Computing, Communication Models - Edge, Fog and M2M.

### UNIT II

IoT Architecture and Core IoT Modules-A connected ecosystem, IoT versus machine-to-machine versus, SCADA, The value of a network and Metcalfe's and Beckstrom's laws, IoT and edge architecture, Role of an architect, Understanding Implementations with examples-Example use case and deployment, Case study – Telemedicine palliative care, Requirements, Implementation, Use case retrospective.

### UNIT III

RaspberryPi: Introduction to RaspberryPi, About the RaspberryPi Board: Hardware Layout and Pinouts, Operating Systems on RaspberryPi, Configuring RaspberryPi, Programming RaspberryPi, Connecting Raspberry Pi via SSH, Remote access tools, Interfacing DHT Sensor with Pi, Pi as Webserver, Pi Camera, Image & Video Processing using Pi.

### UNIT IV

Implementation of Microcomputer RaspberryPi and device Interfacing, Edge to Cloud Protocols-Protocols, MQTT, MQTT publish-subscribe, MQTT architecture details, MQTT state transitions, MQTT packet structure, MQTT data types, MQTT communication formats, MQTT 3.1.1 working example.

### UNIT V

Edge computing with RaspberryPi, Industrial and Commercial IoT and Edge, Edge computing and solutions.

### TEXT BOOKS

- 1) IoT and Edge Computing for Architects - Second Edition, by Perry Lea, Publisher: Packt Publishing, 2020, ISBN: 9781839214806
- 2) Raspberry Pi Cookbook, 3rd Edition, by Simon Monk, Publisher: O'Reilly Media, Inc., 2019, ISBN: 978149204322.

### REFERENCES

- 1) Fog and Edge Computing: Principles and Paradigms by Rajkumar Buyya, Satish Narayana Srirama, wiley publication, 2019, ISBN: 9781119524984.
- 2) David Jensen, "Beginning Azure IoT **Edge Computing**: Extending the Cloud to the Intelligen

<b>Course Code</b>	<b>B. Tech</b>	<b>COMPUTER NETWORKS LAB</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>22CS6L1</b>	<b>III Year VI Sem</b>		<b>0</b>	<b>0</b>	<b>3</b>	<b>1.5</b>

1. Study of different types of Network cables and Practically implement the cross-wired cable and straight through cable using clamping tool.
2. Study of Network Devices in Detail.
3. Study of network IP.
4. Connect the computers in Local Area Network.
5. Study of basic network command and Network configuration commands.
6. Configure a Network topology using packet tracer software.
7. Configure a Network topology using packet tracer software.
8. Character stuffing
9. Bit stuffing
10. CRC-12
11. CRC-16
12. Shortest path routing
13. Distance vector routing

**TEXT BOOKS:**

Tanenbaum and David J Wetherall, Computer Networks, 5th Edition, Pearson Edu, 2010  
 Computer Networks: A Top Down Approach, Behrouz A. Forouzan, Firouz Mosharraf,  
 McGraw Hill Education

**REFERENCE BOOKS:**

Larry L. Peterson and Bruce S. Davie, "Computer Networks - A Systems Approach" (5th ed), Morgan Kaufmann/ Elsevier, 2011

<b>Course Code</b>	<b>B.Tech</b>	<b>WEB TECHNOLOGIES LAB</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>22CS6L2</b>	<b>III Year VI Sem</b>		<b>0</b>	<b>0</b>	<b>3</b>	<b>1.5</b>

**OBJECTIVES:**

To acquire knowledge of XHTML, Java Script and XML to develop web applications

Ability to develop dynamic web content using Java Servlets and JSP

To understand JDBC connections and Java Mail API

To understand the design and development process of a complete web application Design the following static web pages required for an online book store web site.

1. Program to describe various text formatting commands.
2. Program to create an Unordered list.
3. Program to create an Ordered list.
4. Program to create a Table.
5. Program to create a simple form.
6. Program to create a Hyper link.
7. Program to insert an image to Web page.
8. Program to divide a page into Frames.
9. Design the static web page HOME PAGE required for an online book store web site.
10. Design the static web page LOGIN PAGE required for an online book store web site.
11. Design the static web page CATOLOGUE PAGE required for an online book store web site.
12. Design the static web page REGISTRATION PAGE required for an online book store web site.
13. Write JavaScript to validate the following fields of the Registration page.

First Name (Name should contains alphabets and the length should not be less than 6 characters).

- b. Password (Password should not be less than 6 characters length).
- c. E-mail id (should not contain any invalid and must follow the standard pattern name@ domain.com)
- d. Mobile Number (Phone number should contain 10 digits only).
- e. Last Name and Address (should not be Empty)

14. Develop and demonstrate the usage of inline, internal and external style sheet using CSS
15. Create student registration form using text box, text area, check box, radio button, select, submit button. And display user inserted value in new PHP page
16. Write Ruby program reads a number and calculates the factorial value of it and prints the same.
17. Write a Ruby program which counts number of lines in a text files using its regular Expressions facility.
18. Write a Ruby program that uses iterator to find out the length of a string. Write simple Ruby programs that uses arrays in Ruby.
19. Write programs which uses associative arrays concept of Ruby.
20. Write Ruby program which uses Math module to find area of a triangle.
21. Write Ruby program which uses tk module to display a window
22. Define complex class in Ruby and do write methods to carry operations on complex objects.

**OUTCOMES:**

- Students will be able to develop static web sites using XHTML and Java Scripts
- To implement XML and XSLT for web applications
- Develop Dynamic web content using Java Servlets and JSP
- To develop JDBC connections and implement a complete Dynamic web page

<b>Course Code</b>	<b>B.Tech</b>	<b>CYBER SECURITY LAB</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>22CI6T3</b>	<b>III Year VI Sem</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Course Objective:**

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

1. Get the skill to identify cyber threats/attacks.
2. Get the knowledge to solve security issues in day to day life.
3. Able to use Autopsy tools
4. Perform Memory capture and analysis
5. Demonstrate Network analysis using Network miner tools

**List of Experiments**

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

**TEXT BOOKS:**

1. Real Digital Forensics for Handheld Devices, E. P. Dorothy, Auer back Publications, 2013.
2. The Basics of Digital Forensics: The Primer for Getting Started in Digital Forensics, J. Sammons, SyngressPublishing, 2012.

**REFERENCE BOOKS:**

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

**PROFESSIONAL ELECTIVES IV YEAR VII SEM**

Course Code	B.Tech	DATA VISUALIZATION	L	T	P	C
22CS7E1	IV Year VII Sem		3	0	0	3

**UNIT I :**

**Introduction to Data Visualization:** Acquiring and Visualizing Data, Simultaneous acquisition and visualization, Applications of Data Visualization, Keys factors of Data Visualization (Control of Presentation, Faster and Better JavaScript processing, Rise of HTML5, Lowering the implementation Bar) Exploring the Visual Data Spectrum: charting Primitives (Data Points, Line Charts, Bar Charts, Pie Charts, Area Charts), Exploring advanced Visualizations (Candlestick Charts, Bubble Charts, Surface Charts, Map Charts, Infographics). Making use of HTML5 CANVAS, Integrating SVG

**UNIT II :**

**Basics of Data Visualization – Tables:** Reading Data from Standard text files (.txt, .csv, XML), Displaying JSON content Outputting Basic Table Data (Building a table, Using Semantic Table, Configuring the columns), Assuring Maximum readability (Styling your table, Increasing readability, Adding dynamic Highlighting), Including computations, Using data tables library, relating data table to a chart

**UNIT III :**

**Visualizing data Programmatically:** Creating HTML5 CANVAS Charts (HTML5 Canvas basics, Linear interpolations, A Simple Column Chart, Animations), Starting with Google charts (Google Charts API Basics, A Basic bar chart, A basic Pie chart, Working with Chart Animations).

**Introduction to D3.js:** Getting setup with D3, Making selections, changing selection's attribute, Loading and filtering External data : Building a graphic that uses all of the population distribution data, Data formats you can use with D3, Creating a server to upload your data, D3's function for loading data, Dealing with Asynchronous requests, Loading and formatting Large Data Sets

**UNIT IV :**

**Advanced Data Visualization:** Making charts interactive and Animated: Data joins, updates and exits, interactive buttons, Updating charts, Adding transactions, using keys Adding a Play Button: wrapping the update phase in a function, Adding a Play button to the page, Making the Play button go, Allow the user to interrupt the play, sequence.

**UNIT V :**

**Information Dashboard Design:** Introduction, Dashboard design issues and assessment of needs, Considerations for designing dashboard-visual perception, Achieving eloquence, Advantages of Graphics \_Library of Graphs, Designing Bullet Graphs, Designing Sparklines, Dashboard Display Media, Critical Design Practices, Putting it all together - Unveiling the dashboard.

**Text Books:**

1. Fundamentals of mathematical statistics; S.C. Gupta, V.K. Kapoor; Sultan Chand & Sons.
2. Probability and statistics; Murray R. Spiegel, John Schiller and R. Alu Srinivasan; Schaum's outline series, McGraw-hill.
3. The Elements of Statistical leaning; Trevor Hastie, Robert Tibshirani, Jerome Friedman; Springer.

**Reference Books:**

1. Applied Linear Statistical Models, Michael H. Kutner, Christopher J. Nachtsheim, John Neter; McGraw Hill
2. Applied logistic Regression, David W. Hosme, Stanley Icmeshow; Wiley
3. Practical Statistics for Data Scientists, Peter Bruce & Andrew Bruce, O'Reilly

<b>Course Code</b>	<b>B.Tech</b>	Introduction to cyber forensics	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
22CS7E5	IV Year VII Sem		3	0	0	3

**OBJECTIVES:**

- To learn computer forensics
- To become familiar with forensics tools
- To learn to analyze and validate forensics data

**UNIT I INTRODUCTION TO COMPUTER FORENSICS 9**

Introduction to Traditional Computer Crime, Traditional problems associated with Computer Crime. Introduction to Identity Theft & Identity Fraud. Types of CF techniques - Incident and incident response methodology - Forensic duplication and investigation. Preparation for IR: Creating response tool kit and IR team. - Forensics Technology and Systems - Understanding Computer Investigation – Data Acquisition.

**UNIT II EVIDENCE COLLECTION AND FORENSICS TOOLS 9**

Processing Crime and Incident Scenes – Working with Windows and DOS Systems. Current Computer Forensics Tools: Software/ Hardware Tools.

**UNIT III ANALYSIS AND VALIDATION 9**

Validating Forensics Data – Data Hiding Techniques – Performing Remote Acquisition – Network Forensics – Email Investigations – Cell Phone and Mobile Devices Forensics

**UNIT IV ETHICAL HACKING 9**

Introduction to Ethical Hacking - Footprinting and Reconnaissance - Scanning Networks - Enumeration - System Hacking - Malware Threats - Sniffing

**UNIT V ETHICAL HACKING IN WEB 9**

Social Engineering - Denial of Service - Session Hijacking - Hacking Web servers - Hacking Web Applications – SQL Injection - Hacking Wireless Networks - Hacking Mobile Platforms.

**OUTCOMES:** At the end of the course, the student should be able to:

- Understand the basics of computer forensics
- Apply a number of different computer forensic tools to a given scenario
- Analyze and validate forensics data
- Identify the vulnerabilities in a given network infrastructure
- Implement real-world hacking techniques to test system security

**TEXT BOOKS:**

1. Bill Nelson, Amelia Phillips, Frank Enfinger, Christopher Steuart, —Computer Forensics and Investigationsl, Cengage Learning, India Edition, 2016.
2. CEH official Certified Ethical Hacking Review Guide, Wiley India Edition, 2015.

**REFERENCES**

1. John R.Vacca, —Computer Forensicsl, Cengage Learning, 2005
2. MarjieT.Britz, —Computer Forensics and Cyber Crimel: An Introductionl, 3rd Edition, Prentice Hall, 2013.

Course Code	B.Tech		L	T	P	C
22CS7E6	IV Year VII Sem	Natural Language Processing	3	0	0	3

**Course objectives:**

Understand comprehend the key concepts of NLP and identify the NLP challenges and issues

Develop Language Modeling for various text corpora across the different languages

**UNIT-I Introduction to NLP:**

What is NLP? Why NLP is Difficult? History of NLP, Advantages of NLP, Disadvantages of NLP, Components of NLP, Applications of NLP, How to build an NLP pipeline? Phases of NLP, NLP APIs, NLP Libraries

**UNIT-II Language Modeling and Part of Speech Tagging:**

Unigram Language Model, Bigram, Trigram, N-gram, Advanced smoothing for language modeling, Empirical Comparison of Smoothing Techniques, Applications of Language Modeling, Natural Language Generation, Parts of Speech Tagging, Morphology, Named Entity Recognition

**UNIT-III Words and Word Forms:**

Bag of words, skip-gram, Continuous Bag-Of-Words, Embedding representations for words  
Lexical Semantics, Word Sense Disambiguation, Knowledge Based and Supervised Word Sense Disambiguation

**UNIT-IV Text Analysis, Summarization and Extraction:**

Sentiment Mining, Text Classification, Text Summarization, Information Extraction, Named Entity Recognition, Relation Extraction, Question Answering in Multilingual Setting; NLP in Information Retrieval, Cross-Lingual IR

**UNIT-V Machine Translation:**

Need of MT, Problems of Machine Translation, MT Approaches, Direct Machine Translations, Rule-Based Machine Translation, Knowledge Based MT System, Statistical Machine Translation (SMT), Parameter learning in SMT (IBM models) using EM, Encoder-decoder architecture, Neural Machine Translation

**Reference Books:**

1. Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition Jurafsky, David, and James H. Martin, PEARSON
2. Foundations of Statistical Natural Language Processing, Manning, Christopher D., and Hinrich Schütze, Cambridge, MA: MIT Press
3. Natural Language Understanding, James Allen. The Benjamin/Cummings Publishing Company Inc..
4. Natural Language Processing with Python – Analyzing Text with the Natural Language Toolkit Steven Bird, Ewan Klein, and Edward Loper.

<b>Course Code</b>	<b>B.Tech</b>		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>22CS7E7</b>	<b>IV Year VII Sem</b>	<b>Fuzzy Logic</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Unit-1** Introduction, Classical Sets and Fuzzy Sets 7 hours

Background, Uncertainty and Imprecision, Statistics and Random Processes, Uncertainty in Information, Fuzzy Sets and Membership, Chance versus Ambiguity. Classical Sets - Operations on Classical Sets, Properties of Classical (Crisp) Sets, Mapping of Classical Sets to Functions  
Fuzzy Sets - Fuzzy Set operations, Properties of Fuzzy Sets. Sets as Points in Hypercubes

**Unit-2** Classical Relations and Fuzzy Relations 6 hours

Cartesian Product, Crisp Relations- Cardinality of Crisp Relations, Operations on Crisp Relations, Properties of Crisp Relations, Composition. Fuzzy Relations - Cardinality of Fuzzy Relations, Operations on Fuzzy Relations, Properties of Fuzzy Relations, Fuzzy Cartesian Product and Composition, Non-interactive Fuzzy Sets. Tolerance and Equivalence Relations - Crisp Equivalence Relation, Crisp Tolerance Relation, Fuzzy Tolerance and Equivalence Relations. Value Assignments - Cosine Amplitude, Max-min Method, Other Similarity methods

**Unit-3** Membership Functions 6 hours

Features of the Membership Function, Standard Forms and Boundaries, Fuzzification, Membership Value Assignments – Intuition, Inference, Rank Ordering, Angular Fuzzy Sets, Neural Networks, Genetic Algorithms, Inductive Reasoning.

**Unit-4** Fuzzy-to-Crisp Conversions, Fuzzy Arithmetic 7 hours

Lambda-Cuts for Fuzzy Sets, Lambda-Cuts for Fuzzy Relations, Defuzzification Methods  
Extension Principle - Crisp Functions, Mapping and Relations

**Unit -5** Functions of fuzzy Sets – Extension Principle, Fuzzy Transform (Mapping), Practical Considerations, Fuzzy Numbers Interval Analysis in Arithmetic, Approximate Methods of Extension - Vertex method, DSW Algorithm, Restricted DSW Algorithm, Comparisons, Fuzzy Vectors

<b>Course Code</b>	<b>B.Tech</b>		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
22CS7E8	IV Year VII Sem	Semantic web	3	0	0	3

**Learning Objectives:**

- To Introduce Semantic Web Vision
- Understanding about XML,RDF,RDFS,OWL
- Querying Ontology
- Ontology Reasoning
- Migration from Document to Data Web
- LOD Cloud

**UNIT I:Foundation of Semantic Web Technologies :**

Introduction, Current web vs Semantic Web, Semantic Web Technologies,A layered approach,Descriptive Logic: Introduction, Definition of the basic formalism, Reasoning algorithms, Language extensions

**UNIT II Structured Web Documents in XML:**

XML, Structuring, Namespaces, Addressing and querying XML document, Processing Describing Web Resources: RDF RDF: Basic Ideas, RDF: XML-Based Syntax, RDF serialization, RDF Schema: Basic Ideas, RDF Schema: The Language, RDF and RDF Schema in RDF Schema.

**UNIT III : Web Ontology Language: OWL and RDF/RDFS, Three Sublanguages of OWL, Description of the OWL Language, Layering of OWL, Examples, OWL in OWL.**

**UNIT IV : SPARQL simple Graph Patterns, Complex Graph Patterns, Group Patterns, Queries with Data Values, Filters, OWL Formal Semantics.**

**UNIT V :Linked Open data Principles of Linked Data, Web of Data, LOD Cloud, Linked Data Source : Dbpedia, Freebase**

**Learning Outcome:**

- Understand the semantic web Vision and technologies
- Understand about ontology
- Understanding about Data Web(Linked open data Cloud)

**Text Book:** A Semantic Web Primer by Grigoris Antoniou Frank van Harmelen, The MIT Press  
Cambridge Foundation of Semantic Web Technologies, Pascal Hitzler, Markus and Sebastian  
Linked Data : Evolving the Web into a Global Data space by Tom Heath, Christian Bizer  
, Morgan & Claypool publication Basic Description Logic by Franz Baader, Warner Nutt

<b>Course Code</b>	<b>B.Tech</b>		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
22CS7E9	IV Year VII Sem	Cyber security	3	0	0	3

**OBJECTIVES:**

The Cyber security Course will provide the students with foundational Cyber Security principles, Security architecture, risk management, attacks, incidents, and emerging IT and IS technologies. Students will gain insight into the importance of Cyber Security and the integral role of Cyber Security professionals.

**OUTCOMES:**

Cyber Security architecture principles  
Identifying System and application security threats and vulnerabilities  
Identifying different classes of attacks  
Cyber Security incidents to apply appropriate response  
Describing risk management processes and practices  
Evaluation of decision making outcomes of Cyber Security scenarios

**UNIT- I: Introduction to Cybercrime:**

Introduction, Cybercrime: Definition and Origins of the Word, Cybercrime and Information Security, Who are Cybercriminals? , Classifications of Cybercrimes, Cybercrime: The Legal Perspectives, Cybercrimes: An Indian Perspective, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes, Cybercrime Era: Survival Mantra for the Netizens.

**UNIT -II: Cyber offenses:**

How Criminals Plan Them –Introduction, How Criminals Plan the Attacks, Social Engineering, Cyber stalking, Cyber cafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector Cloud Computing.

**UNIT -III: Cybercrime Mobile and Wireless Devices:**

Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication Service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops.

**UNIT -IV: Tools and Methods Used in Cybercrime:**

Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Key loggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks, Phishing and Identity Theft:Introduction, Phishing.

**UNIT -V: Cybercrimes and Cyber security:**

Why Do We Need Cyber laws: The Indian Context, The Indian IT Act, Challenges to Indian Law and Cybercrime Scenario in India, Consequences of Not Addressing the Weakness in Information Technology Act, Digital Signatures and the Indian IT Act, Information Security Planning and Governance, Information Security Policy Standards, Practices, The information Security Blueprint, Security education, Training and awareness program, Continuing Strategies.

**TEXT BOOKS:**

Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Nina Godbole, SunitBelapure, Wiley.

Principles of Information Security, MichealE. Whitman and Herbert J. Mattord, Cengage Learning.

**REFERENCES:**

Information Security, Mark Rhodes, Ousley, M

<b>Course Code</b>	<b>B.Tech</b>		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>22CS7E11</b>	<b>IV Year VII Sem</b>	<b>Perl programming</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

Objectives: Every student will be able to:

- Use the Pico editor to create a Perl program
- Use basic Unix commands and CHMOD for Perl programming
- Telnet to a Unix account for program development
- Describe and use Perl variables, relational operators and control statements
- Explain and use looping and array manipulation in Perl
- Use the sequential and binary search methods in Perl
- Write Perl programs that open files to store data
- Use subroutines in Perl programs
- Describe the use of Perl modules

**UNIT-I Introduction to Perl Programming**

The Pico editor and basic Pico commands, Basic Unix for Perl Programmers, A first Perl Program, Using numbers and strings

**UNIT II. Perl Programming** :Perl variables and numerical operators, Assignment operators, Control statements and relational operators, Logical operators and complex conditions

**UNIT III.**

Looping and regular expressions, Substitution and translation, Arrays and array manipulation, The anatomy of an X/HTML tag, Push and Pop, Sorting

**UNIT-IV** Sequential search, Binary search, Hashes

**UNIT-V** File input and output, Using subroutines, Perl Modules

<b>Course Code</b>	<b>B.Tech</b>		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>22CS7E12</b>	<b>IV Year VII Sem</b>	Distributed systems	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

Provides an introduction to the fundamentals of distributed computer systems, assuming the availability of facilities for data transmission, IPC mechanisms in distributed systems, Remote procedure calls. Expose students to current technology used to build architectures to enhance distributed Computing infrastructures with various computing principles.

**OUTCOMES:**

- Develop a familiarity with distributed file systems.
- Describe important characteristics of distributed systems and the salient architectural features of such systems.
- Describe the features and applications of important standard protocols which are used in distributed systems.
- Gaining practical experience of inter-process communication in a distributed environment

**UNIT-I:**

**Characterization of Distributed Systems:** Introduction, Examples of Distributed Systems, Resource Sharing and the Web, Challenges.

**System Models:** Introduction, Architectural Models- Software Layers, System Architecture, Variations, Interface and Objects, Design Requirements for Distributed Architectures, Fundamental Models- Interaction Model, Failure Model, Security Model.

**UNIT-II:**

**Inter process Communication:** Introduction, The API for the Internet Protocols- the Characteristics of Inter process communication, Sockets, UDP Datagram Communication, TCP Stream Communication; External Data Representation and Marshalling; Client Server Communication; Group Communication- IP Multicast- an implementation of group communication, Reliability and Ordering of Multicast.

**UNIT-III:**

**Distributed Objects and Remote Invocation:** Introduction, Communication between Distributed Objects- Object Model, Distributed Object Model, Design Issues for RMI, Implementation of RMI, Distributed Garbage Collection; Remote Procedure Call, Events and Notifications, Case Study: JAVA RMI

**UNIT-IV:**

**Operating System Support:** Introduction, the Operating System Layer, Protection, Processes and Threads – Address Space, Creation of a New Process, Threads.

## **UNIT-V:**

**Distributed File Systems:** Introduction, File Service Architecture; Peer-to-Peer Systems: Introduction, Napster and its Legacy, Peer-to-Peer Middleware, Routing Overlays.

**Coordination and Agreement:** Introduction, Distributed Mutual Exclusion, Elections, Multicast Communication.

**Transactions & Replications:** Introduction, System Model and Group Communication, Concurrency Control in Distributed Transactions, Distributed Dead Locks, Transaction Recovery; Replication- Introduction, Passive (Primary) Replication, Active Replication.

### **TEXT BOOKS:**

Ajay D Kshem kalyani, Mukesh Sigal, "Distributed Computing, Principles, Algorithms and Systems", Cambridge

George Coulouris, Jean Dollimore, Tim Kindberg, "Distributed Systems- Concepts and Design", Fourth Edition, Pearson Publication

### **REFERENCE BOOKS**

1. Distributed-Systems-Principles-Paradigms-Tanenbaum PHI

<b>Course Code</b>	<b>B.Tech</b>		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
22CS7E13	IV Year VII Sem	Green computing	3	0	0	3

**OBJECTIVES:**

- To learn the fundamentals of Green Computing.
- To analyze the Green computing Grid Framework.
- To understand the issues related with Green compliance.
- To study and develop various case studies.

**UNIT I FUNDAMENTALS**

Green IT Fundamentals: Business, IT, and the Environment – Green computing: carbon foot print, scoop on power – Green IT Strategies: Drivers, Dimensions, and Goals – Environmentally Responsible Business: Policies, Practices, and Metrics.

**UNIT II GREEN ASSETS AND MODELING**

Green Assets: Buildings, Data Centers, Networks, and Devices – Green Business Process Management: Modeling, Optimization, and Collaboration – Green Enterprise Architecture – Environmental Intelligence – Green Supply Chains – Green Information Systems: Design and Development Models.

**UNIT III GRID FRAMEWORK**

Virtualization of IT systems – Role of electric utilities, Telecommuting, teleconferencing and teleporting – Materials recycling – Best ways for Green PC – Green Data center – Green Grid framework.

**UNIT IV GREEN COMPLIANCE**

Socio-cultural aspects of Green IT – Green Enterprise Transformation Roadmap – Green Compliance: Protocols, Standards, and Audits – Emergent Carbon Issues: Technologies and Future.

**UNIT V CASE STUDIES**

The Environmentally Responsible Business Strategies (ERBS) – Case Study Scenarios for Trial Runs – Case Studies – Applying Green IT Strategies and Applications to a Home, Hospital, Packaging Industry and Telecom Sector.

**TEXT BOOKS:**

1. Bhuvan Unhelkar, —Green IT Strategies and Applications-Using Environmental Intelligencel, CRC Press, June 2014.
2. Woody Leonhard, Katherine Murray, —Green Home computing for dummiesl, August 2012.

**REFERENCES**

1. Alin Gales, Michael Schaefer, Mike Ebbers, —Green Data Center: steps for the Journeyl, Shroff/IBM rebook, 2011.
2. John Lamb, —The Greening of ITl, Pearson Education, 2009.
3. Jason Harris, —Green Computing and Green IT- Best Practices on regulations & industryl, Lulu.com, 2008
4. Carl speshocky, —Empowering Green Initiatives with ITl, John Wiley & Sons, 2010.
5. Wu Chun Feng (editor), —Green computing: Large Scale energy efficiencyl, CRC Press

<b>Course Code</b>	<b>B.Tech</b>		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
22CS7E14	IV Year VII Sem	Angular JS	3	0	0	3

**OBJECTIVES:**

- To acquire knowledge of basics in java scripting.
- To acquire knowledge of various object models in java script.
- To acquire basics of Angular JS
- To apply Angular JS in developing real-time applications

**OUTCOMES:**

- Use operators, variables, arrays, control structures, functions and objects in Java Script.
- Map HTML using the DOM - Document Object Model.
- Use regular expressions for form validation.
- Using Angular JS along with HTML and CSS

**Unit-I: JAVA SCRIPT-INTRODUCTION AND BASICS**

**Introduction:**

Overview-Applications-Limitations-Where to place the script?-

**Java Script Basics:**

Syntax-Enabling-Comments-Variables: Local and Global Variables-Data types: primitive and non- primitive data types –Operators: Arithmetic, Comparison, Bitwise, Logical, Assignment, Special operators-if statement-switch statement-loops: for, while, do- while- functions: syntax, arguments,function object.

**Unit-II: JAVA SCRIPT OBJECTS AND MODELS**

**Java Script Objects:**

JS Object: ways of creating an object, Defining method in JavaScript Object, JavaScript Object Methods-Array Object-String Object-Date Object-Number Object-Math Object- Boolean Object

**Java Script Object Models:**

Browser Object Models (BOM): Window Object, History Object, Navigation Object, Screen Object. Document Object Model (DOM): introduction- methods-Document-Elements- HTML-CSS-Events-Event Listener-Navigation-Nodes-Node Lists

### **Unit-III: JAVA SCRIPT REGULAR EXPRESSIONS, VALIDATIONS & ERRORHANDLING**

#### **Java Script Regular Expression and Validations:**

Syntax-Modifiers-Patterns: Met characters, Quantifiers-properties-methods HTML Form Validation using Java Script-String, Password, Number, Image, Email

#### **Java Script Error Handling:**

Syntax Errors-Runtime Errors, Logical Errors-try-catch-finally-throw

### **Unit-IV: Angular JS-I**

Overview-Environment setup-Angular JS MVC-First Example-Data Binding-Expressions- Directives-Controllers-Modules: Creating a Module, Add controller to a module, Add directive to a module Angular JS Scope-Dependency Injection: value, factory, service, provider, constant.

### **Unit-V: Angular JS-II**

Angular JS Filters: list, how to add filters to directives and expressions-Tables: Displaying table with Angular JS and CSS-select: ng-options vs ng-repeat-DOM-Forms: input controls and events- Validation-Animation.

### **Unit-VI: Angular JS-Applications**

Angular JS-Notepad Application-Angular JS-Login Application-Angular JS-Upload File Application-Angular JS-Navigating Menu Application-Angular JS-Search Tab-Angular JS- Maps Application-Angular JS-Timer Application.

### **TEXT BOOKS**

Learning Angular JS: A Guide to Angular JS Development-Ken Williamson- O'Reilly

Professional Angular JS-Karpov, Netto- Wiley India Pvt Ltd

<b>Course Code</b>	<b>B.Tech</b>		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>22CS7E15</b>	<b>IV Year VII Sem</b>	E-commerce	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

### UNIT I

#### Introduction

What is E-Commerce, Forces behind E-Commerce Industry Framework, Brief history of ECommerce, Inter Organizational E-Commerce Intra Organizational E-Commerce, and Consumer to Business Electronic Commerce, Architectural framework .

#### Network Infrastructure for E-Commerce

Network Infrastructure for E-Commerce, Market forces behind I Way, Component of I way Access Equipment, Global Information Distribution Network, Broad band Telecommunication.

### UNIT-II

#### Mobile Commerce

Introduction to Mobile Commerce, Mobile Computing Application, Wireless Application Protocols, WAP Technology, Mobile Information Devices, Web Security

Introduction to Web security, Firewalls & Transaction Security, Client Server Network, Emerging Client Server Security Threats, firewalls & Network Security.

### UNIT-III

#### Encryption

World Wide Web & Security, Encryption, Transaction security, Secret Key Encryption, Public Key Encryption, Virtual Private Network (VPM), Implementation Management Issues.

### UNIT - IV

#### Electronic Payments

Overview of Electronics payments, Digital Token based Electronics payment System, Smart Cards, Credit Card I Debit Card based EPS, Emerging financial Instruments, Home Banking, Online Banking.

### UNIT-V

#### Net Commerce

EDA, EDI Application in Business, Legal requirement in E -Commerce, Introduction to supply Chain Management, CRM, issues in Customer Relationship Management.

**References:**

1. Greenstein and Feinman, "E-Commerce", TMH
2. Ravi Kalakota, Andrew Whinston, "Frontiers of Electronic Commerce", Addison Wesley
3. Denial Amor, " The E-Business Revolution", Addison Wesley
4. Diwan, Sharma, "E-Commerce" Excel
5. Bajaj & Nag, "E-Commerce: The Cutting Edge of Business", TMH

<b>Course Code</b>	<b>B.Tech</b>	<b>BIG DATA TECHNOLOGIES</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>22CS7E2</b>	<b>IV Year VII Sem</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Course Objectives: -**

The growth of information systems has given rise to large amount of data which do not qualify as traditional definition of data. This scenario has given us new possibilities but at same time pose serious challenges. Such challenges lie in effective storage, analysis and search of such large set of data. Fortunately, a number of technologies have been developed that answer such challenges. This course introduces this scenario along with technologies and how they answer these challenges. In this context, the specific objective of the course is to introduce student to current scenarios of big data and provide various facets of big data. It also provides them opportunity to be familiar with the technologies playing key role in it and equips them with necessary knowledge to use them for solving various big data problems in different domains.

**UNIT-1 Introduction to Big Data:**

Big Data Overview, Background of Data Analytics, Role of Distributed System in Big Data, Role of Data Scientist, Current Trend in Big Data Analytics

**UNIT-II Google File System:**

Architecture, Availability, Fault tolerance, Optimization for large scale data.

**UNIT-III Map-Reduce Framework:**Basics of functional programming,Fundamentals of functional programming, Real world problems modeling in functional style,Map reduce fundamentals,Data flow (Architecture),Real world problems, Scalability goal, Fault tolerance,Optimization and data locality,Parallel Efficiency of Map- Reduce

**UNIT-IV NoSQL**,Structured and Unstructured Data,Taxonomy of NoSQL Implementation,Discussion of basic architecture of Hbase, Cassandra and MongoDB

**UNIT-V Searching and Indexing Big Data**, Full text Indexing and Searching,Indexing with Lucene,Distributed Searching with elastic search

<b>Course Code</b>	<b>B.Tech</b>	<b>WEB ANALYTICS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>22CS7E3</b>	<b>IV Year VII Sem</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Course Objective:** To Assess that how website visitors view and interact with a site's pages and features, and business intelligence, which would allow using data on customer purchasing patterns, demographics, and demanding trends to make effective strategic decisions.

**UNIT-I Introduction:** Definition, Process, Key terms: Site references, Keywords and Key phrases; building block terms: Visit characterization terms, Content characterization terms, Conversion metrics; Categories: Offsite web, On site web; Web analytics platform, Web analytics evolution, Need for web analytics, Advantages, Limitations.

**UNIT-II Data Collection:** Clickstream Data: Web logs, Web Beacons, JavaScript tags, Packet Sniffing; Outcomes

Data: E-commerce, Lead generation, Brand/Advocacy and Support; Research data: Mindset, Organizational

structure, Timing; Competitive Data: Panel-Based measurement, ISP-based measurement, Search Engine data.

**Qualitative Analysis:** Heuristic evaluations: Conducting a heuristic evaluation, Benefits of heuristic

evaluations; Site Visits: Conducting a site visit, Benefits of site visits; Surveys: Website surveys, Post-visit surveys, Creating and running a survey, Benefits of surveys.

**UNIT-III Web Analytic fundamentals:** Capturing data: Web logs or JavaScripts tags, Separate data serving and data capture, Type and size of data, Innovation, Integration, Selecting optimal web analytic tool, Understanding clickstream data quality, Identifying unique page definition, Using cookies, Link coding issues.

**Web Metrics:** Common metrics: Hits, Page views, Visits, Unique visitors, Unique page views, Bounce, Bounce rate, Page/visit, Average time on site, New visits; Optimization(e-commerce, non e-commerce sites): Improving bounce rates, Optimizing adwords campaigns; Real time report, Audience report, Traffic source report, Custom campaigns, Content report, Google analytics, Introduction to KPI, characteristics, Need for KPI, Perspective of KPI, Uses of KPI.

**UNIT-IV Web analytics 2.0:** Web analytics 1.0, Limitations of web analytics 1.0, Introduction to analytic 2.0,

Competitive intelligence analysis : CI data sources, Toolbar data, Panel data ,ISP data, Search engine data,

Hybrid data, Website traffic analysis: Comparing long term traffic trends, Analyzing competitive site overlap and opportunities.

**Google Analytics:** Brief introduction and working, Adwords, Benchmarking, Categories of traffic: Organic traffic, Paid traffic; Google website optimizer, Implementation technology, Limitations, Performance concerns, Privacy issues.

**UNIT-V Relevant technologies:**Internet & TCP/IP, Client / Server Computing, HTTP (HyperText Transfer Protocol), Server Log Files & Cookies, Web Bugs.

**Laboratory Work:**to analyzing the web for various functionalities given in the subject and using various tools and technologies to do the experimentation. It also involves installation and working on tools and technologies in this domain.

**Recommended Books:**

Clifton B., Advanced Web Metrics with Google Analytics, Wiley Publishing, Inc. (2010), 2nd ed.

Kaushik A., Web Analytics 2.0 The Art of Online Accountability and Science of Customer Centricity, Wiley Publishing, Inc. (2010),1st ed.

Sterne J., Web Metrics:Proven methods for measuring web site success, John Wiley and Sons (2002),1sted

<b>Course Code</b>	<b>B.Tech</b>	<b>ETHICAL HACKING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>22CS7E4</b>	<b>IV Year VII Sem</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

### **Program Objectives**

This Seminar will educate the student into an interactive environment where they will be shown about how to scan, test, hack and secure their systems. Students will understand how our defense measure works and then scan their networks & attack their own. On completion of the session students will be able to identify the different threats posed by hackers and other malicious attackers and how to protect our network & devices from those attacks.

### **Learning Outcome**

At the conclusion of course students are able to:

- Understand the core foundations of ethics in regards to computer security
- Learn about the hacker mindset and the history of hackers
- Understand basic networking and security technologies
- Gain a basic understanding of security policy
- Learn about basic system defense infrastructure

### **UNIT-I**

Information Security Overview – Information Security Threats and Attack Vectors – Hacking Concept Ethical Hacking Concepts – Information Security Controls – Penetration Testing Concepts – Information Security Laws and Standards

### **UNIT-II**

Footprinting Concepts – Footprinting through Search Engines – Footprinting through Web Services – Footprinting through Social Networking Sites – Website Footprinting – Email Footprinting – Competitive Intelligence – Whois Footprinting – DNS Footprinting – Network Footprinting – Footprinting Through Social Engineering – Footprinting Tools – Footprinting Countermeasures – Footprinting Penetration Testing

### **UNIT-III**

Network Scanning Concepts – Scanning Tools – Scanning Techniques – Scanning Beyond IDS and Firewall – Banner Grabbing – Draw Network Diagrams – Scanning Pen Testing

### **UNIT-IV**

Cyptography Concepts – Encryption Algorithms – Cryptography Tools – Public Key Infrastructure – Email Encryption Disk Encryption Cryptanalysis – Countermeasures

### **UNIT-V**

Key issues plaguing the information security world, Various types of footprinting, footprinting tools, competitive intelligence gathering and countermeasures.  
 Network scanning techniques and scanning countermeasures.  
 Enumeration techniques and enumeration countermeasures.  
 System hacking methodology, steganography, steganalysis attacks, and covering tracks

<b>Course Code</b>	<b>B.Tech</b>	<b>INTRODUCTION TO CYBER FORENSICS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>22CS7E5</b>	<b>IV Year VII Sem</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To learn computer forensics
- To become familiar with forensics tools
- To learn to analyze and validate forensics data

**UNIT I: INTRODUCTION TO COMPUTER FORENSICS**

Introduction to Traditional Computer Crime, Traditional problems associated with Computer Crime. Introduction to Identity Theft & Identity Fraud. Types of CF techniques - Incident and incident response methodology - Forensic duplication and investigation. Preparation for IR: Creating response tool kit and IR team. - Forensics Technology and Systems - Understanding Computer Investigation – Data Acquisition.

**UNIT II: EVIDENCE COLLECTION AND FORENSICS TOOLS**

Processing Crime and Incident Scenes – Working with Windows and DOS Systems. Current Computer Forensics Tools: Software/ Hardware Tools.

**UNIT III: ANALYSIS AND VALIDATION**

Validating Forensics Data – Data Hiding Techniques – Performing Remote Acquisition – Network Forensics – Email Investigations – Cell Phone and Mobile Devices Forensics

**UNIT IV: ETHICAL HACKING**

Introduction to Ethical Hacking - Footprinting and Reconnaissance - Scanning Networks - Enumeration - System Hacking - Malware Threats - Sniffing

**UNIT V: ETHICAL HACKING IN WEB**

Social Engineering - Denial of Service - Session Hijacking - Hacking Web servers - Hacking Web Applications – SQL Injection - Hacking Wireless Networks - Hacking Mobile Platforms.

**OUTCOMES:** At the end of the course, the student should be able to:

- Understand the basics of computer forensics
- Apply a number of different computer forensic tools to a given scenario
- Analyze and validate forensics data
- Identify the vulnerabilities in a given network infrastructure
- Implement real-world hacking techniques to test system security

**TEXT BOOKS:**

1. Bill Nelson, Amelia Phillips, Frank Enfinger, Christopher Steuart, —Computer Forensics and Investigations, Cengage Learning, India Edition, 2016.
2. CEH official Certified Ethical Hacking Review Guide, Wiley India Edition, 2015.

**REFERENCES:**

1. John R. Vacca, —Computer Forensics, Cengage Learning, 2005
2. Marjie T. Britz, —Computer Forensics and Cyber Crime: An Introduction, 3rd Edition, Prentice Hall, 2013.

<b>Course Code</b>	<b>B.Tech</b>		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>22CS7E6</b>	<b>IV Year VII Sem</b>	<b>NARURAL LANGUAGE PROCESSING</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Course objectives:**

Understand comprehend the key concepts of NLP and identify the NLP challenges and issues  
 Develop Language Modeling for various text corpora across the different languages

**UNIT-I Introduction to NLP:**

What is NLP? Why NLP is Difficult? History of NLP, Advantages of NLP, Disadvantages of NLP, Components of NLP, Applications of NLP, How to build an NLP pipeline? Phases of NLP, NLP APIs, NLP Libraries

**UNIT-II Language Modeling and Part of Speech Tagging:**

Unigram Language Model, Bigram, Trigram, N-gram, Advanced smoothing for language modeling, Empirical Comparison of Smoothing Techniques, Applications of Language Modeling, Natural Language Generation, Parts of Speech Tagging, Morphology, Named Entity Recognition

**UNIT-III Words and Word Forms:**

Bag of words, skip-gram, Continuous Bag-Of-Words, Embedding representations for words Lexical Semantics, Word Sense Disambiguation, Knowledge Based and Supervised Word Sense Disambiguation

**UNIT-IV Text Analysis, Summarization and Extraction:**

Sentiment Mining, Text Classification, Text Summarization, Information Extraction, Named Entity Recognition, Relation Extraction, Question Answering in Multilingual Setting; NLP in Information Retrieval, Cross-Lingual IR

**UNIT-V Machine Translation:**

Need of MT, Problems of Machine Translation, MT Approaches, Direct Machine Translations, Rule-Based Machine Translation, Knowledge Based MT System, Statistical Machine Translation (SMT), Parameter learning in SMT (IBM models) using EM), Encoder-decoder architecture, Neural Machine Translation

**Reference Books:**

1. Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition Jurafsky, David, and James H. Martin, PEARSON
2. Foundations of Statistical Natural Language Processing, Manning, Christopher D., and Hinrich Schütze, Cambridge, MA: MIT Press
3. Natural Language Understanding, James Allen. The Benjamin/Cummings Publishing Company Inc..
4. Natural Language Processing with Python – Analyzing Text with the Natural Language Toolkit Steven Bird, Ewan Klein, and Edward Loper.

<b>Course Code</b>	<b>B.Tech</b>		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>22CS7E7</b>	<b>IV Year VII Sem</b>	<b>FUZZY LOGIC</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Unit-1** Introduction, Classical Sets and Fuzzy Sets Background, Uncertainty and Imprecision, Statistics and Random Processes, Uncertainty in Information, Fuzzy Sets and Membership, Chance versus Ambiguity. Classical Sets - Operations on Classical Sets, Properties of Classical (Crisp) Sets, Mapping of Classical Sets to Functions Fuzzy Sets - Fuzzy Set operations, Properties of Fuzzy Sets. Sets as Points in Hypercubes

**Unit-2** Classical Relations and Fuzzy Relations, Cartesian Product, Crisp Relations- Cardinality of Crisp Relations, Operations on Crisp Relations, Properties of Crisp Relations, Composition. Fuzzy Relations - Cardinality of Fuzzy Relations, Operations on Fuzzy Relations, Properties of Fuzzy Relations, Fuzzy Cartesian Product and Composition, Non-interactive Fuzzy Sets. Tolerance and Equivalence Relations - Crisp Equivalence Relation, Crisp Tolerance Relation, Fuzzy Tolerance and Equivalence Relations. Value Assignments - Cosine Amplitude, Max-min Method, Other Similarity methods

**Unit-3** Membership Functions Features of the Membership Function, Standard Forms and Boundaries, Fuzzification, Membership Value Assignments – Intuition, Inference, Rank Ordering, Angular Fuzzy Sets, Neural Networks, Genetic Algorithms, Inductive Reasoning.

**Unit-4** Fuzzy-to-Crisp Conversions, Fuzzy Arithmetic 7 hours  
Lambda-Cuts for Fuzzy Sets, Lambda-Cuts for Fuzzy Relations, Defuzzification Methods  
Extension Principle - Crisp Functions, Mapping and Relations

**Unit -5** Functions of fuzzy Sets – Extension Principle, Fuzzy Transform (Mapping), Practical Considerations, Fuzzy Numbers Interval Analysis in Arithmetic, Approximate Methods of Extension - Vertex method, DSW Algorithm, Restricted DSW Algorithm, Comparisons, Fuzzy Vectors

<b>Course Code</b>	<b>B.Tech</b>		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>22CS7E8</b>	<b>IV Year VII Sem</b>	<b>SEMANTIC WEB</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Learning Objectives:**

To Introduce Semantic Web Vision

Understanding about XML,RDF,RDFS,OWL

Querying Ontology

Ontology Reasoning

Migration from Document to Data Web, LOD Cloud

**UNIT I: Foundation of Semantic Web Technologies:**

Introduction, Current web vs Semantic Web, Semantic Web Technologies,A layered approach,Descriptive Logic: Introduction, Definition of the basic formalism, Reasoning algorithms, Language extensions

**UNIT II: Structured Web Documents in XML:**

XML, Structuring, Namespaces, Addressing and querying XML document, Processing Describing Web Resources: RDF/RDF: Basic Ideas, RDF: XML-Based Syntax, RDF serialization, RDF Schema: Basic Ideas, RDF Schema: The Language, RDF and RDF Schema in RDF Schema.

**UNIT III: Web Ontology Language: OWL**

OWL and RDF/RDFS, Three Sublanguages of OWL, Description of the OWL Language, Layering of OWL, Examples, OWL in OWL.

**UNIT IV :SPARQL**

SPARQL simple Graph Patterns, Complex Graph Patterns, Group Patterns, Queries with Data Values, Filters, OWL Formal Semantics.

**UNIT V :Linked Open data**

Principles of Linked Data, Web of Data, LOD Cloud, Linked Data Source : Dbpedia, Freebase

**Learning Outcome:**

Understand the semantic web Vision and technologies

Understand about ontology

Understanding about Data Web(Linked open data Cloud)

**Text Book:** A Semantic Web Primer by Grigoris Antoniou Frank van Harmelen, The MIT

Press Cambridge Foundation of Semantic Web Technologies, Pascal Hitzler, Markus and SebastianLinked Data : Evolving the Web into a Global Data space by Tom Heath,

Christian Bizer , Morgan & Claypool publication Basic Description Logic by Franz Baader, Warner Nutt

<b>Course Code</b>	<b>B.Tech</b>		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>22CS7E9</b>	<b>IV Year VII Sem</b>	<b>CYBER SECURITY</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

The Cyber security Course will provide the students with foundational Cyber Security principles, Security architecture, risk management, attacks, incidents, and emerging IT and IS technologies. Students will gain insight into the importance of Cyber Security and the integral role of Cyber Security professionals.

**OUTCOMES:**

Cyber Security architecture principles  
 Identifying System and application security threats and vulnerabilities  
 Identifying different classes of attacks  
 Cyber Security incidents to apply appropriate response  
 Describing risk management processes and practices  
 Evaluation of decision making outcomes of Cyber Security scenarios

**UNIT- I: Introduction to Cybercrime:**

Introduction, Cybercrime: Definition and Origins of the Word, Cybercrime and Information Security, Who are Cybercriminals? , Classifications of Cybercrimes, Cybercrime: The Legal Perspectives, Cybercrimes: An Indian Perspective, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes, Cybercrime Era: Survival Mantra for the Netizens.

**UNIT -II: Cyber offenses:**

How Criminals Plan Them –Introduction, How Criminals Plan the Attacks, Social Engineering, Cyber stalking, Cyber cafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector Cloud Computing.

**UNIT -III: Cybercrime Mobile and Wireless Devices:**

Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication Service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops.

**UNIT -IV: Tools and Methods Used in Cybercrime:**

Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Key loggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks, Phishing and Identity Theft: Introduction, Phishing,

**UNIT -V: Cybercrimes and Cyber security:**

Why Do We Need Cyber laws: The Indian Context, The Indian IT Act, Challenges to Indian Law and Cybercrime Scenario in India, Consequences of Not Addressing the Weakness in Information Technology Act, Digital Signatures and the Indian IT Act, Information Security Planning and Governance, Information Security Policy Standards, Practices, The information Security Blueprint, Security education, Training and awareness program, Continuing Strategies.

**TEXT BOOKS:**

Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Nina Godbole, Sunit Belapure, Wiley.

Principles of Information Security, Micheal E. Whitman and Herbert J. Mattord, Cengage Learning.

**REFERENCES:**

Information Security, Mark Rhodes, Ousley, M

<b>Course Code</b>	<b>B.Tech</b>		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>22CS7E11</b>	<b>IV Year VII Sem</b>	<b>PERL PROGRAMMING</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Objectives:** Every student will be able to:

- Use the Pico editor to create a Perl program
- Use basic Unix commands and CHMOD for Perl programming
- Telnet to a Unix account for program development
- Describe and use Perl variables, relational operators and control statements
- Explain and use looping and array manipulation in Perl
- Use the sequential and binary search methods in Perl
- Write Perl programs that open files to store data
- Use subroutines in Perl programs
- Describe the use of Perl modules

**UNIT-I** Introduction to Perl Programming

The Pico editor and basic Pico commands, Basic Unix for Perl Programmers, A first Perl Program, Using numbers and strings

**UNIT II.** Perl Programming :Perl variables and numerical operators, Assignment operators, Control statements and relational operators, Logical operators and complex conditions

**UNIT III.**

Looping and regular expressions, Substitution and translation, Arrays and array manipulation, The anatomy of an X/HTML tag, Push and Pop, Sorting

**UNIT-IV** Sequential search, Binary search, Hashes

**UNIT-V** File input and output, Using subroutines, Perl Modules

<b>Course Code</b>	<b>B.Tech</b>		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>22CS7E12</b>	<b>IV Year VII Sem</b>	<b>DISTRIBUTED SYSTEMS</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

Provides an introduction to the fundamentals of distributed computer systems, assuming the availability of facilities for data transmission, IPC mechanisms in distributed systems, Remote procedure calls. Expose students to current technology used to build architectures to enhance distributed Computing infrastructures with various computing principles.

**OUTCOMES:**

- Develop a familiarity with distributed file systems.
- Describe important characteristics of distributed systems and the salient architectural features of such systems.
- Describe the features and applications of important standard protocols which are used in distributed systems.
- Gaining practical experience of inter-process communication in a distributed environment

**UNIT-I:**

**Characterization of Distributed Systems:** Introduction, Examples of Distributed Systems, Resource Sharing and the Web, Challenges.

**System Models:** Introduction, Architectural Models- Software Layers, System Architecture, Variations, Interface and Objects, Design Requirements for Distributed Architectures, Fundamental Models- Interaction Model, Failure Model, Security Model.

**UNIT-II:**

**Inter process Communication:** Introduction, The API for the Internet Protocols- the Characteristics of Inter process communication, Sockets, UDP Datagram Communication, TCP Stream Communication; External Data Representation and Marshalling; Client Server Communication; Group Communication- IP Multicast- an implementation of group communication, Reliability and Ordering of Multicast.

**UNIT-III:**

**Distributed Objects and Remote Invocation:** Introduction, Communication between Distributed Objects- Object Model, Distributed Object Model, Design Issues for RMI, Implementation of RMI, Distributed Garbage Collection; Remote Procedure Call, Events and Notifications, Case Study: JAVA RMI

**UNIT-IV:**

**Operating System Support:** Introduction, the Operating System Layer, Protection, Processes and Threads – Address Space, Creation of a New Process, Threads.

**UNIT-V:**

**Distributed File Systems:** Introduction, File Service Architecture; Peer-to-Peer Systems: Introduction, Napster and its Legacy, Peer-to-Peer Middleware, Routing Overlays.

**Coordination and Agreement:** Introduction, Distributed Mutual Exclusion, Elections, Multicast Communication.

**Transactions & Replications:** Introduction, System Model and Group Communication, Concurrency Control in Distributed Transactions, Distributed Dead Locks, Transaction Recovery; Replication- Introduction, Passive (Primary) Replication, Active Replication.

**TEXT BOOKS:**

Ajay D Kshem kalyani, Mukesh Sigal, "Distributed Computing, Principles, Algorithms and Systems", Cambridge

George Coulouris, Jean Dollimore, Tim Kindberg, "Distributed Systems- Concepts and Design", Fourth Edition, Pearson Publication

**REFERENCE BOOKS**

1. Distributed-Systems-Principles-Paradigms-Tanenbaum PHI

<b>Course Code</b>	<b>B.Tech</b>		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>22CS7E13</b>	<b>IV Year VII Sem</b>	<b>GREEN COMPUTING</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To learn the fundamentals of Green Computing.
- To analyze the Green computing Grid Framework.
- To understand the issues related with Green compliance.
- To study and develop various case studies.

**UNIT I:FUNDAMENTALS**

Green IT Fundamentals: Business, IT, and the Environment – Green computing: carbon foot print, scoop on power – Green IT Strategies: Drivers, Dimensions, and Goals – Environmentally Responsible Business: Policies, Practices, and Metrics.

**UNIT II:GREEN ASSETS AND MODELING**

Green Assets: Buildings, Data Centers, Networks, and Devices – Green Business Process Management: Modeling, Optimization, and Collaboration – Green Enterprise Architecture – Environmental Intelligence – Green Supply Chains – Green Information Systems: Design and Development Models.

**UNIT III:GRID FRAMEWORK**

Virtualization of IT systems – Role of electric utilities, Telecommuting, teleconferencing and teleporting – Materials recycling – Best ways for Green PC – Green Data center – Green Grid framework.

**UNIT IV:GREEN COMPLIANCE**

Socio-cultural aspects of Green IT – Green Enterprise Transformation Roadmap – Green Compliance: Protocols, Standards, and Audits – Emergent Carbon Issues: Technologies and Future.

**UNIT V:CASE STUDIES**

The Environmentally Responsible Business Strategies (ERBS) – Case Study Scenarios for Trial Runs – Case Studies – Applying Green IT Strategies and Applications to a Home, Hospital, Packaging Industry and Telecom Sector.

**TEXT BOOKS:**

1. Bhuvan Unhelkar, —Green IT Strategies and Applications-Using Environmental Intelligencel, CRC Press, June 2014.
2. Woody Leonhard, Katherine Murray, —Green Home computing for dummiesl, August 2012.

**REFERENCES:**

1. Alin Gales, Michael Schaefer, Mike Ebbers, —Green Data Center: steps for the Journeyl, Shroff/IBM rebook, 2011.
2. John Lamb, —The Greening of ITl, Pearson Education, 2009.
3. Jason Harris, —Green Computing and Green IT- Best Practices on regulations & industryl, Lulu.com, 2008
4. Carl speshocky, —Empowering Green Initiatives with ITl, John Wiley & Sons, 2010.
5. Wu Chun Feng (editor), —Green computing: Large Scale energy efficiencyl, CRC Press

<b>Course Code</b>	<b>B.Tech</b>		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>22CS7E14</b>	<b>IV Year VII Sem</b>	<b>ANGULAR JS</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To acquire knowledge of basics in java scripting.
- To acquire knowledge of various object models in java script.
- To acquire basics of Angular JS
- To apply Angular JS in developing real-time applications

**OUTCOMES:**

- Use operators, variables, arrays, control structures, functions and objects in Java Script.
- Map HTML using the DOM - Document Object Model.
- Use regular expressions for form validation.
- Using Angular JS along with HTML and CSS

**Unit-I: JAVA SCRIPT-INTRODUCTION AND BASICS**

**Introduction:**

Overview-Applications-Limitations-Where to place the script?-

**Java Script Basics:**

Syntax-Enabling-Comments-Variables: Local and Global Variables-Data types: primitive and non- primitive data types –Operators: Arithmetic, Comparison, Bitwise, Logical, Assignment, Special operators-if statement-switch statement-loops: for, while, do- while- functions: syntax, arguments,function object.

**Unit-II: JAVA SCRIPT OBJECTS AND MODELS**

**Java Script Objects:**

JS Object: ways of creating an object, Defining method in JavaScript Object, JavaScript Object Methods-Array Object-String Object-Date Object-Number Object-Math Object- Boolean Object

**Java Script Object Models:**

Browser Object Models (BOM): Window Object, History Object, Navigation Object, Screen Object. Document Object Model (DOM): introduction- methods-Document-Elements- HTML-CSS-Events-Event Listener-Navigation-Nodes-Node Lists

**Unit-III: JAVA SCRIPT REGULAR EXPRESSIONS, VALIDATIONS & ERROR HANDLING**

**Java Script Regular Expression and Validations:**

Syntax-Modifiers-Patterns: Met characters, Quantifiers-properties-methods HTML Form Validation using Java Script-String, Password, Number, Image, Email

### **Java Script Error Handling:**

Syntax Errors-Runtime Errors, Logical Errors-try-catch-finally-throw

### **Unit-IV: Angular JS-I**

Overview-Environment setup-Angular JS MVC-First Example-Data Binding-Expressions-Directives-Controllers-Modules: Creating a Module, Add controller to a module, Add directive to a module Angular JS Scope-Dependency Injection: value, factory, service, provider, constant.

### **Unit-V: Angular JS-II**

Angular JS Filters: list, how to add filters to directives and expressions-Tables: Displaying table with Angular JS and CSS-select: ng-options vs ng-repeat-DOM-Forms: input controls and events- Validation-Animation.

### **Unit-VI: Angular JS-Applications**

Angular JS-Notepad Application-Angular JS-Login Application-Angular JS- Upload File Application-Angular JS-Navigating Menu Application-Angular JS-Search Tab-Angular JS-Maps Application-Angular JS-Timer Application.

### **TEXT BOOKS**

Learning Angular JS: A Guide to Angular JS Development-Ken Williamson-O'Reilly  
Professional Angular JS-Karpov, Netto- Wiley India Pvt Ltd

<b>Course Code</b>	<b>B.Tech</b>		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>22CS7E15</b>	<b>IV Year VII Sem</b>	<b>E-COMMERCE</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**UNIT I**

**Introduction**

What is E-Commerce, Forces behind E-Commerce Industry Framework, Brief history of ECommerce, Inter Organizational E-Commerce Intra Organizational E-Commerce, and Consumer To Business Electronic Commerce, Architectural framework, Network Infrastructure for E-Commerce Network Infrastructure for E-Commerce, Market forces behind I Way, Component of a way Access Equipment, Global Information Distribution Network, Broad band Telecommunication.

**UNIT-II**

**Mobile Commerce**

Introduction to Mobile Commerce, Mobile Computing Application, Wireless Application Protocols, WAP Technology, Mobile Information Devices, Web Security Introduction to Web security, Firewalls & Transaction Security, Client Server Network, Emerging Client Server Security Threats, firewalls & Network Security.

**UNIT-III**

**Encryption**

World Wide Web & Security, Encryption, Transaction security, Secret Key Encryption, Public Key Encryption, Virtual Private Network (VPM), Implementation Management Issues.

**UNIT - IV**

**Electronic Payments**

Overview of Electronics payments, Digital Token based Electronics payment System, Smart Cards, Credit Card I Debit Card based EPS, Emerging financial Instruments, Home Banking, Online Banking.

**UNIT-V**

**Net Commerce**

EDA, EDI Application in Business, Legal requirement in E -Commerce, Introduction to supply Chain Management, CRM, issues in Customer Relationship Management.

**References:**

1. Greenstein and Feinman, "E-Commerce", TMH
2. Ravi Kalakota, Andrew Whinston, "Frontiers of Electronic Commerce", Addison Wesley
3. Denieal Amor, " The E-Business Revolution", Addison Wesley
4. Diwan, Sharma, "E-Commerce" Excel
5. Bajaj & Nag, "E-Commerce: The Cutting Edge of Business", TMH

**Under Graduate Course Structure**  
**For**  
**Computer Science and Engineering**  
*(Applicable for batches admitted from 2022-2023)*



**Autonomous Regulations-AR22**

**Amrita Sai Institute of Science & Technology**  
*Approved by AICTE, New Delhi; Permanently Affiliated to JNTUK, Kakinada ISO 9001:2015 Certified Institution; Accredited by NAAC with "A" grade Recognized by UGC under 2(f) and 12(B) of UGC 1956 Act*  
**Amrita Sai Nagar, Paritala, Krishna District Andhrapradesh-521 180**  
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## Outcome-Based Education, Dept of Computer Science and Engineering

The following curriculum for B.Tech. CSE. M.Tech Computer Science and Engineering programmes with Regulations-R22 is conventional to outcome-based teaching-learning process. In general, **TWELVE PROGRAMME OUTCOMES** (a-l) have been identified and the curriculum and syllabus have been structured in such a way such that each of the courses meets one or more of these outcomes.

Student outcomes describe what students are expected to know and are able to do by the time of graduation. These relate to the skills, knowledge, and behaviour that students acquire as they progress through the program. Further, each course in the program spells out clear instructional objectives which are mapped to the student outcomes.

### The Programme Outcomes:

- a. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization for the solution of complex engineering problems.
- b. **Problem analysis:** Identity, formulates, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- c. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, and cultural, societal, and environmental considerations.
- d. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of the information to provide valid conclusions.
- e. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling of complex engineering activities, with an understanding of the limitations.
- f. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- g. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- h. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering Practice.
- i. **Individual and teamwork:** Function effectively as an individual, and as a member or leader in diverse teams, and in multi disciplinary settings.
- j. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with the society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- k. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multi disciplinary environments.
- l. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

### Program Specific Objectives–CSE

PSO-1	Able to utilize the knowledge of latest technologies and emerging technologies, for the benefit of societal requirements.
PSO-2	To explore the scientific theories, ideas, methodologies and the new cutting edge technologies in software industries to solve the current and future software application problems.
PSO-3	To be able to utilize of technologies like java, spark, python, Tensor flow according To industrial applications.

### Program Educational Objectives–

PEO-1	Prepare graduates to have knowledge and competency for careers and related to computer science
PEO-2	Prepare graduates to become leaders in the fields related to computer science
PEO-3	Prepare graduates to have pursue higher education in engineering and other professional skills

### SYLLABUS STRUCTURE:

SNO	DESCRIPTION	NUMBER	CREDIT PERCENTAGE	CREDITS			
01	THEORY	CORE SUBJECTS	26	35	3	78	105
02		CORE ELECTIVES	05		3	15	
03		OPEN ELECTIVES	04		3	12	
04	PRACTICALS	17	1.5	25.5			
05	INTERNSHIPS	02	1.5+3	4.5			
06	MANDATORY COURSES	04	0	0			
07	SKILL ORIENTED PROGRAMS	05	2	10			
08	SOCIAL ELECTIVE	01	3	3			
09	MAJOR PROJECT/INTERNSHIP	01	12	12			
<b>TOTAL</b>		<b>65</b>		<b>160</b>			