ROYAL GLOBAL UNIVERSITY
— GUWAHATI —

ROYAL SCHOOL OF INFORMATION TECHNOLOGY (RSIT)

Learning Outcomes based Curriculum Framework (LOCF)

2021-2022

SYLLABUS

&

COURSE STRUCTURE

MCA (2 YEARS)

Table of Contents –

1. Introduction

The main objective of this report is to propose a curriculum for the 3 year Master of Computer Applications (MCA) course which is an important source of human resource for the software industry. The first MCA curriculum was proposed in 1982 and was later revised by a working group of the Indian Society of Technical Education in 1990.

The MCA program is a blend of both theoretical and practical knowledge. An MCA degree give students' an opportunity to work with tools meant to develop better and faster applications. A good curriculum is an essential requirement for ensuring quality of an academic program. Currently, Information Technology is growing rapidly and increasing applications of computers in almost all areas of human endeavor has led to a vibrant industry with concurrent rapid change in technology. Thus the challenge in designing a curriculum is to identify the areas of core competence which is stable and provide sufficient number of electives and laboratories. Thus the suggested curriculum has a strong laboratory and project orientation in which the use of new tools will be emphasized. Most courses will have an associated laboratory and it is expected that they will be equipped with the latest software tools. As the subject of information technology is changing very fast it is suggested that the curriculum be revised at least once in 3 years.

2. Learning Outcomes based approach to Curriculum Planning

The primary emphasis in MCA is on designing information systems for various organizations such as banks, insurance companies, hotels, hospitals etc. Development of application software in diverse areas where computers are used will be the main function of MCA graduates. The major thrust is on giving the students a sound background in computing, business functioning and mathematics relevant to Information Technology. In computing, students learn best by doing practicals. A strong laboratory component is a part of the curriculum. The laboratories, besides supplementing the theory course will also expose the student to the use of the latest software tools. Every MCA student is required to spend one semester in doing minor project and the last semester must do major project. It is suggested that the student periodically report to college and present a seminar on the work being done by him.

2.1 Nature and extent of MCA

MCA is a two year (4 semester) course. The students entering MCA must have a B.C.A./B.Sc./ B.Com/B.A. degree with Mathematics as one of the subjects at 10+2 level or at graduation. The MCA program is planned to have 5 theory subject plus two laboratories each semester. The curriculum has a strong core covering information technology, business management and mathematics. The key areas of study advanced level in M.C.A. are as follows:

I. Programming in C
II. Digital Systems
III. Object Oriented Programming & Design
IV. Computer Organization and Architecture
V. Data Structures and Algorithms
VI. Operating Systems
VII. Formal Language and Automata Theory
VIII. Advanced Database Management Systems
IX. Design and Analysis of Algorithms
X. Computer Communication Networks
XI. Software Testing and Quality Assurance
XII. Web Programming

2.2 Aims of M.C.A. Program

The overall aims of MCA program are to:
- Learn about the fundamental definitions and higher concepts of computers applications.
- Have an understanding of different tools and software which is used in problem solving.
- Impart comprehensive knowledge with equal emphasis on theory and practice.
- Have exposure to diverse platforms that will motivate the learners to move ahead in future.
- Progress their career productively in software industry, academia, research, entrepreneurial pursuit, government, consulting firms and other Information Technology enabled services.
- To achieve peer-recognition; as an individual or in a team; by adopting ethics and professionalism and communicate effectively to excel well in cross culture and inter-disciplinary teams.
- To embed strong human value and professional ethics for becoming socially responsible citizen.

3. Attributes for learner of M.C.A.

Some of the attributes are listed below:

3.1 Disciplinary knowledge: Ability of demonstrating comprehensive knowledge of computer applications and its subfields, and its applications to one or more disciplines.

3.2 Communications skills: Capability to express various concepts of computer applications in effective and coherent manner using examples , ability to present the complex problem solving ideas in clear, precise and confident way; capability to communicate thoughts and views in correct statements.

3.3 Critical thinking and analytical reasoning:
 (i) Ability to employ foundations of computer science, critical thinking in understanding the concepts in every area of computer applications and allied areas.
(ii) Capability to formulate mathematically correct arguments.
 (iii)Ability to analyze the results and apply them in relevant various problems appearing in different branches of mathematics.

3.4 Problem solving: Capacity to use the earned knowledge to solve different non-familiar problems and apply the learning to real world situations; capability to solve problems in computer graphics using concepts of linear algebra; Capability to apply the acquired knowledge in differential equations to solve specific problems in other disciplines.

3.5 Research-related skills:
(i) Potentiality to think and inquire about relevant/appropriate questions, ability to define problems, formulate and test hypotheses, formulate mathematical arguments and proofs, draw conclusions; ability to write the obtained results clearly.
(ii) To know about the developments in various branches of mathematics.
(iii)To understand application of mathematics in natural, biological and social sciences.

3.6 Information/digital literacy:
(i) Ability to use ICT tools in solving problems or earning knowledge
(ii) Capacity to use appropriate software and programming skills to solve problems.

3.7 Self-directed learning: Potentiality to work independently and do in-depth study of various concepts of computer applications and ability to search relevant resources and e- resources for self-learning and amplifying knowledge in mathematics.

3.8 Moral and ethical awareness/reasoning: Ability to identify unethical behaviour such as fabrication or misrepresentation of data, committing plagiarism, infringement of intellectual property rights and adopting objective, unbiased and truthful actions in all aspects.

3.9 Lifelong learning: Ability to earn knowledge and skills through self-learning that helps in personal development as well as skill development to make them suitable for changing demands of work place.

4. Programme Learning Outcomes in MCA

On completion of MCA degree , it will enable the students to

● have successful careers based on their understanding of formal and practical methods of Application Development using the concepts of computer programming, software and design principles.
● demonstrate analytical and design skills including the ability to generate creative solutions and foster team-oriented, professionalism through effective communication in their careers.
● exhibit effective work ethics and be able to adapt to the challenges of a dynamic job environment.
● Identify opportunities, entrepreneurship vision and use of innovative ideas to create value and wealth for the betterment of the individual and society.
● recognize economical, environmental, social, health, legal, ethical issues involved in the use of computer technology and other consequential responsibilities relevant to professional practice.

5. Qualification descriptors for M.C.A.

The course structure of MCA covers a full range of the computer application domain starting from basics in computer fundamentals, data structures, various high level programming paradigms to web technologies so as to learn the overall core concepts associated with the domain. Thus, the qualification descriptors for MCA are as follows:

a. Demonstrate coherent knowledge and understanding of the logical organization of a digital computer, its components and working.
b. Understanding of the time and space complexities of algorithms along with the knowledge in the various categories of algorithms designed to solve computational problems.
c. Demonstrate programming skills in high level language and an ability to learn a new programming paradigm to implement th same fo different time of problem solving aspects.
d. Apply knowledge of logical skills to identify and analyze problems and issues, and seek solutions to real-life problems. For example, creating mobile applications, database applications, and educative computer games.
e. Communication and leadership abilities and ability to do team work so as to cope up in different working environments.

6. Program Structure of MCA

MCA

Programme Structure

1st semester							
S.N	Subject Code	Names of subjects	L	T	P	C	TCP
Core Courses (CC)							
1	CAP054C101	Object Oriented Programming using JAVA	4	0	0	4	4
2	CAP054C102	Advanced Data Structures	4	0	0	4	4
3	CAP054C103	Theory of Computation	4	0	0	4	4
4	CAP054C104	Computer Organization and Architecture	4	0	0	4	4
6	CAP054C111	Object Oriented Programming using JAVA Lab	0	0	4	2	4
7	CAP054C112	Advanced Data Structures Lab	0	0	4	2	4
Department Specific Elective (DSE)							
8	CAP054D10X	DSE-I	4	0	0	4	4
Ability Enhancement Elective Courses (AEEC)							
Ability Enhancement Compulsory Courses (AECC)							
9	BHS984A103	Fundamentals of Organizational Behaviour	1	0	0	1	1
10	CEN984A101	Communication: Skills, Concepts and Applications	1	0	0	1	1
		TOTAL	**22**	**0**	**8**	**26**	**30**
2nd semester							
SN	Subject Code	Names of subjects	L	T	P	C	TCP
Core Courses (CC)							
1	CAP054C201	Advanced Computer Networks	4	0	0	4	4
2	CAP054C202	Modern Operating System	4	0	0	4	4
3	CAP054C203	Advanced Database Management Systems	4	0	0	4	4
4	CAP054C204	Pattern Recognition	4	0	0	4	4
5	CAP054C211	Advanced Computer Networks Lab	0	0	4	2	4
7	CAP054C213	Advanced Database Management Systems Lab	0	0	4	2	4
Department Specific Elective (DSE)							
8	CAP054D20X	DSE-II	4	0	0	4	4
Ability Enhancement Elective Courses (AEEC)							
9	CAP054S20X	AEEC-I	2	0	0	2	2
Ability Enhancement Compulsory Courses (AECC)							

10	BHS984A203	Individual and Interpersonal Behavior	1	0	0	1	1
11	CEN984A201	Business Environment and Communication	1	0	0	1	1
		TOTAL	**24**	**0**	**6**	**28**	**32**

3rd semester							
SN	**Subject Code**	**Names of subjects**	**L**	**T**	**P**	**C**	**TCP**
Core Courses (CC)							
1	CAP054C301	Design and Analysis of Algorithms	4	0	0	4	4
2	CAP054C302	Web Technologies	4	0	0	4	4
3	CAP054C303	Advanced Software Engineering	4	0	0	4	4
4	CAP054C301	Design and Analysis of Algorithms Lab	0	0	4	2	4
5	CAP054C311	Web Technologies Lab	0	0	4	2	4
Department Specific Elective (DSE)							
5	CAP054D30X	DSE-III	4	0	0	4	4
6	CAP054D30X	DSE -IV	4	0	0	4	4
Ability Enhancement Compulsory Courses (AECC)							
7	CEN984A301	Kinesics and Effective Communication	1	0	0	1	1
Ability Enhancement Elective Courses (AEEC)							
8	CAP054S30X	AEEC-II	2	0	0	2	2
		TOTAL	**23**	**0**	**8**	**27**	**31**

4th semester							
SN	**Subject Code**	**Names of subjects**	**L**	**T**	**P**	**C**	**TCP**
Ability Enhancement Compulsory Courses (AECC)							
1	CEN984A401	Advance Corporate Communication	1	0	0	1	1
Project							
2	CAP054C425	Project Dissertation	0	0	0	20	0
		TOTAL	**1**	**0**	**0**	**21**	**1**

SEMESTER	CREDITS
I	26
II	28
III	27
IV	21

TOTAL CREDITS = 102

LIST OF DEPARTMENT SPECIFIC ELECTIVES

Elective No	Sl. No	Subject Code	Name of the Elective
I	1	CAP054D101	Data Science using R
	2	CAP054D102	Distributed Systems

	3	CAP054D103	Natural Language Processing
	4	CAP054D104	Machine Learning and Fuzzy Logic
II	1	CAP054D201	Bioinformatics
	2	CAP054D202	Wireless Computing
	3	CAP054D203	Soft Computing
III	1	CAP054D301	Artificial Intelligence
	2	CAP054D302	Big Data Analytics
IV	1	CAP054D303	Cloud Computing
	2	CAP054D304	Cyber Forensics
	3	CAP054D305	Internet of Things
	4	CAP054D306	Cryptography and Network Security

SUBJECTS UNDER AEEC			
AEEC No	**Sl. No**	**Subject Code**	**Name of the Elective**
I	1	INT054S201	General Aptitude and Quantitative Reasoning-I
II	3	INT054S302	General Aptitude and Quantitative Reasoning-II

Scheme of Evaluation

Theory Papers (T):

- **Continuous Evaluation: 15%** (Assignment, Class Test, Viva, Seminar, Quiz: Any Three)
- **Mid-term examination:** 10%
- **Attendance: 5%**
- **End Term Examination: 70%**

Practical Papers (P):

- **Continuous Evaluation: 25%** (Skill Test, lab copy, viva, lab involvement: Any Three)
- **Attendance: 5%**
- **End term examination:** 70 %

Combined Theory & Practical Papers (TP):

- **Continuous Evaluation: 15%** (Assignment. Class Test, Lab Experiment, Lab Copy, Viva: Any Three)
- **Mid-term examination:** 10%
- **Attendance: 5%**
- **End term examination:** 70 %

7. Detailed Syllabus of 1st Semester

Paper I/ Subject Name: **Object Oriented Programming using JAVA**		Subject Code: **CAP054C101**
L-T-P-C – 4-0-0-4	Credit Units: **04**	Scheme of Evaluation: **T**

Objective:

The objectives of the course are:

- To teach the basic concept and techniques which form the object oriented programming paradigm which is a new way of thinking about problem using models organizes around real world concept.
- To explain the concepts of object oriented programming using JAVA.

Prerequisites: Basics of Programming

Detailed Syllabus:

Modules	Topics	Course content	Periods
I	**Introduction**	A look at procedure-oriented programming, Object-oriented paradigm, Basic concepts of object-oriented programming (OOP) (encapsulation, inheritance, polymorphism), How Java differs from C and C++, Applications of OOP. Overview of JAVA, Use of math functions, comments, Constructing a java program, Introduction of JVM, Command line argument, Data types, Variables: declaration, scope, Type Conversion and Type Casting, Constants, Operators, Evaluation of Expression, Precedence of Operators, Control statements: selection, iteration and jump.	**12**
II	**Classes and**	Class: definition and example, Declaring objects, Method overloading and overriding, Binding : concept of binding, static vs. dynamic binding, Using this and super keywords, Access Control, Inheritance: Extending a class,	**12**

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	Objects	Final, Abstract classes, Constructors Arrays: one-dimensional and multi-dimensional, Strings : string processing functions	
III	**Packages, Interfaces, Exception Handling**	Defining a package, accessing a package and using a package, Interfaces: multiple inheritances, Defining interfaces, implementing interfaces and extending interfaces. Exception handling fundamentals, Exception type: using try…catch, Multiple catch clauses, Throw and Throws Creating threads, Extending the thread class, Stopping and blocking a thread, Life cycle of thread, Threads methods, Thread exceptions	**12**
IV	**Applets and Files**	Introduction: local and remote applets, How to write applets, Building applet code, Applet life cycle, Creating an executable applet I/O basics, concept of streams, Stream classes: byte stream classes, character stream classes, I/O exceptions, Creation of files, Random access files	**12**
Total			**48**

Text Books:

1. *Programming with Java: A Primer*, E. Balagurusamy, 3rd Edition, 2005,Tata McGraw-Hill, New Delhi
2. *Thinking in Java*, Bruce Eckel, 4th Edition, 2006, PHI.

Reference Books:

1. Maurice Naftalin et al, *Java Generics and Collections*, 1st Edition, 2006, O'REILLY Publication.
2. Grady Booch, James Rumbaugh, Ivar Jacobson, *The Unified Modeling Language User Guide*, 2nd Edition, 2005, Pearson Education.
3. Herbert Schildt, *The Complete Reference Java*, 7th Edition, 2007, Tata McGraw-Hill, New Delhi

Facilitating the Achievement of Course Learning Outcomes

Course Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
On completion of this course the students will be expected to: • Show competence in the use of JAVA language in the development different programs. • Understand the basic principles of the object-oriented programming • Demonstrate an introductory understanding of graphical user interfaces, multithreaded programming, and event-driven programming.	• Each topic to be explained with examples. • Students to be motivated to discover the relevant concepts to take part in discussions and ask questions. • Students to be given homework/assignments to make their concept clear. • Discuss and solve the problems in the class.	• Participation in class discussions • Continuous Evaluation(30Marks) (i)15 marks on Assignments, class tests, viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance:5 marks • End-term examinations:70 marks.

Paper II/Subject Name: Advanced Data Structure	Subject Code: CAP054C102
L-T-P-C – 4-0-0-4 Credit Units: 04	Scheme of Evaluation: T

Objective:

The objectives of the course are:

- To explain the basic concepts of Data Structures and Algorithms.
- To give students an in-depth concept of various kinds of Trees.
- To explain detailed concepts on Searching and Sorting.
- To give students exposure to the advanced topics in Data Structures like Graphs, Heaps, Hashing & Collision.

Prerequisites: Concepts of Computer Programming

Detailed Syllabus:

Modules	Topics	Course content	Periods
I	**Introduction to Data Structures and Algorithms**	Introduction, Basic Terminology, Classification of Data Structures, Operations on Data Structures, Abstract Data Type. Algorithms- Different Approaches to Designing an Algorithm, Control Structures Used In Algorithms, Time and Space Complexity, Big O Notation, Omega Notation, Theta Notation, Other Useful Notations. Linked Lists- Introduction, Singly Linked Lists, Circular Linked Lists, Doubly Linked Lists, Circular Doubly Linked Lists, Header Linked Lists, Multi-Linked Lists, Operations, Applications of Linked Lists. Stacks- Introduction, Array Representation of Stacks, Operations on Stacks, Multiple Stacks, Applications of Stacks. Queues- Introduction, Array Representation of Queues, Linked Representation of Queues, Types of Queues, Operations on various types of Queues, Applications of Queues.	12
II	**Trees**	Trees- Introduction, Types of Trees, Creating a Binary Tree from a General Tree, Traversing a Binary Tree, Huffman's Tree, applications of Trees. Efficient Binary Trees- Binary Search Trees, Operations on Binary Search Trees, Threaded Binary Trees, AVL Trees, Red-Black Trees, Splay Trees. Multi-way Search Trees- Introduction to M-Way Search Trees, B Trees, B+ Trees, 2-3 Trees, Trie.	12
III	**Searching and Sorting**	Searching- Introduction, Linear Search, Binary Search, Interpolation Search, Jump Search. Sorting- Introduction, Bubble Sort, Insertion Sort, Selection Sort, Merge Sort, Quick Sort, Radix Sort, Heap Sort, Shell Sort, Tree Sort, Comparison of Sorting Algorithms, External Sorting.	12
IV	**Graphs, Heaps, Hashing & Collision**	Graphs- Introduction, Graph Terminology, Directed Graphs, Bi-Connected Components, Representation of Graphs, Graph Traversal Algorithms, Topological Sorting, Applications of Graphs. Heaps- Binary Heaps, Binomial Heaps, Fibonacci Heaps, Comparison among Heaps, Applications of Heaps.	12

		Hashing & Collision- Introduction, Hash Tables, Hash Functions, Different Hash Functions, Collisions, Applications of Hashing.	
		Total	**48**

Text Book:

1. *Data Structures Using C*, Reema Thareja, 2nd Edition, 2014, Oxford University Press.

Reference Books:

1. S. K. Srivastava and Deepali Srivastava, *Data Structures through C in Depth*, 1st Edition, 2004, BPB Publications.
2. Seymour Lipschutz, *Data Structures*, 1st Edition (reprint) 2017, McGraw Hill Education.
3. Narasimha Karumanchi, *Data Structures and Algorithms Made Easy: Data Structures and Algorithmic Puzzles*, 5th Edition, 2016, Careermonk Publications.
4. Tenenbaum, *Data Structures Using C*, 2008, Pearson Education India.
5. Yashavant P. Kanetkar, *Data Structure through C*, 2nd Edition, 2003, BPB Publications.
6. A. M. Padma Reddy, *Data Structures*, Revised edition, 2017, Sri Nandi Publications.
7. Richard F. Gilberg, *Data Structures: A Pseudocode Approach with C*, Indian Edition, 2007, Cengage Learning.
8. Horowitz, Sahni and Anderson-Freed, *Fundamentals of Data Structures in C*, 2nd Edition, 2008, Universities Press.
9. E. Balagurusamy, *Data Structures Using C*, 1st Edition, 2017, McGraw Hill Education.*.*

Facilitating the Achievement of Course Learning Outcomes

Course Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
On completion of this course the students will be expected to: • Have the understanding the data structures, their advantages and drawbacks and how they can be overcome. • Have the understanding their applications and their uses. • Have an idea of about the data structure methods or algorithms mentioned in the course so as to make use of them in a program to enhance their efficiency.	• Each topic to be explained with examples. • Students to be motivated to discover the relevant concepts to take part in discussions and ask questions. • Students to be given homework/assignments to make their concept clear. • Discuss and solve the problems in the class.	• Participation in class discussions • Continuous Evaluation(30Marks) (i)15 marks on Assignments, class tests, viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance:5 marks • End-term examinations:70 marks.

Paper III/Subject Name: Theory of Computation   **Subject Code: CAP054C103**

L-T-P-C – 4-0-0-4　　　　　　　**Credit Units: 04**　　　　　　　**Scheme of Evaluation: T**

Objective:

The objectives of the course are:

- To provide basic concepts of Theory of Computations and Finite Automata.
- To give an exposure to Context-Free Language and Push Down Automata.
- To explain about Turing Machines and Chomsky Hierarchy.
- To teach about Decidability and Complexity Theory.

Prerequisites: None

Detailed Syllabus:

Modules	Topics	Course content	Hours
I	**Basic Concepts of Theory of Computations and Finite Automata**	Introduction- Symbol & Alphabet, Sets, Relations & Functions, Graphs, Strings & Languages. Finite State Machines- Finite State Automata, Transition System, DFA, NFA, Acceptability of a String, Equivalence of NFA & DFA, NFA with transitions. Regular expressions, regular Grammars, Equivalence between Regular Expression and Finite Automata. Regular Sets and Properties- Pumping Lemma.	**12**
II	**Context-Free Language and Push Down Automata**	Context-Free Languages- Introduction, Context-Free Grammars, Derivation Trees, Left-most Derivation and Right-most Derivation, Ambiguity in CFG, Simplification of CFG, Normal forms. Push Down Automata- Basic definition and PDA model, Deterministic & Non-deterministic PDA, Equivalence of Acceptance, PDA Lemma for CFL's, Pumping Lemma for CFLs	**12**
III	**Turing Machines and Chomsky Hierarchy**	Turing Machines- Turing Machine Model, Representation, Language Acceptance, Design of TM, Recursively enumerable languages, Church's Hypothesis, Types of TMs, Halting Problem.	**12**
IV	**Decidability and Complexity Theory**	Decidable and Undesirable Languages- Decidability, Countable sets, Rice's Theorem, Enumerability, the relationship between decidable and enumerable languages. Complexity Theory- the running time of algorithms, the complexity classes P & NP, Non-deterministic algorithms, NP-complete languages.	**12**
Total			**48**

Text Books:

1. *Theory of Computer Science: Automata, Languages and Computation*, K. L. P. Mishra and N. Chandrasekaran, 3rd Edition, 2006, Prentice Hall India Learning Private Limited.
2. *Theory of Computation: Formal Languages and Automata Theory,* G. P. S. Verma and B. T. Rao, Scitech Publications (India) Pvt. Ltd.
3. *Introduction to the Theory of Computation*, Michael Sipser, 3rd Edition, 2012, Cengage Learning.

Reference Books:

1. Hopcroft, *Introduction to Automata Theory, Languages, and Computation*, 3rd Edition, 2008, Pearson Education India.
2. Vivek Kulkarni, *Theory of Computation*, 2013, Oxford University Press.
3. A.M. Natarajan, A. Tamilarasi and P. Balasubramani, *Theory of Computation*, 2008, New Age Publishers.

Facilitating the Achievement of Course Learning Outcomes

Course Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
On completion of this course the students will be expected to: • Analyse and design finite automata, pushdown automata, Turing machines, formal languages, and grammars. • Demonstrate the understanding of key notions, such as algorithm, computability, decidability, and complexity through problem solving. • Prove the basic results of the Theory of Computation.	• Each topic to be explained with examples. • Students to be motivated to discover the relevant concepts to take part in discussions and ask questions. • Students to be given homework/assignments to make their concept clear. • Discuss and solve the problems in the class.	• Participation in class discussions • Continuous Evaluation(30Marks) (i)15 marks on Assignments, class tests, viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance:5 marks • End-term examinations:70 marks.

Paper IV/ Subject Name: Computer Organization and Architecture	Subject Code: CAP054C104
L-T-P-C – 4-0-0-4 Credit Units: 04	Scheme of Evaluation: T

Objective:

The objectives of the course are:

- To make the students understand the machine instructions and basic computer organization
- To give an idea of representation of information in computers
- To explain about memory hierarchy and various memory mapping techniques
- To teach I/O subsystems and pipelining processing.

Prerequisites:

Detailed Syllabus:

Modules	Topics	Course content	Periods
I	**Overview of Computer Architecture**	Introduction- Organization versus Architecture, Structure and Function. Computer Evolution and Performance- Designing for Performance, Performance Assessment. Computer Function and Interconnection- Computer Components, Computer Function, Interconnection Structures, Bus Interconnection. Computer Arithmetic- Integer Representation, Integer Arithmetic, Floating-Point Representation, Floating-Point Arithmetic.	12
II	**Computer System**	Cache Memory- Computer Memory System Overview, Cache Memory Principles, Elements of Cache Design. Internal Memory Technology- Semiconductor Main Memory, Error Correction, Advanced DRAM Organization. External Memory- Magnetic Disk, RAID, Optical Memory, Magnetic Tape. Input/Output- External Devices, I/O Modules, Programmed I/O, Interrupt-Driven I/O, Direct Memory Access, I/O Channels and Processors. Operating System Support- Operating System Overview, Scheduling, Memory Management.	12
III	**Central Processing Unit**	Characteristics and Functions of Instruction Sets- Machine Instruction Characteristics, Types of Operands, Types of Operations. Addressing Modes and Formats- Addressing, Instruction Formats, Assembly Language. Processor Structure and Function- Processor Organization, Register Organization, the Instruction Cycle, Instruction Pipelining. Reduced Instruction Set Computers (RISCs)- Instruction Execution Characteristics, the use of a Large Register File, Compiler-Based Register Optimization, Reduced Instruction Set Architecture, RISC Pipelining. Control Unit Operation- Micro-operations, Control of the Processor, Hardwired Implementation. Microprogrammed Control- Basic Concepts, Microinstruction Sequencing, Microinstruction Execution.	12
IV	**Parallel Organization**	Instruction-Level Parallelism and Superscalar Processors- Overview, Design Issues. Parallel Processing- the use of Multiple Processors, Symmetric Multiprocessors, Cache Coherence and the MESI Protocol, Multithreading and Chip Multiprocessors, Clusters, Non Uniform Memory Access Computers, Vector Computation. Multicore Computers- Hardware Performance Issues, Software Performance Issues, Multicore Organization.	12
Total			**48**

Text Book:

1. *Computer System and Architecture*, Moris Mano, 3rd Edition, 2007, PHI.
2. *Structured Computer Organization,* A. S. Tanenbaum, 5th Edition, 2009, Prentice Hall of India

Reference Books:

1. V. C. Hamacher, Z. G. Vranesic and S. G. Zaky, *Computer Organization,* 5th Edition, 2002 McGraw Hill.
2. J. L. Hennessy and D. A. Patterson,*Computer Architecture: A Quantitative Approach,* 4th Edition, 2006, Morgan Kaufmann.
3. D. V. Hall, *Microprocessors and Interfacing,* 2nd Edition, 2006, McGraw Hall.

Facilitating the Achievement of Course Learning Outcomes

Course Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
On completion of this course the students will be expected to: • Have an overview of Computer Organization and Architecture. • Have an in-depth concept of the Computer System. • Have detailed concepts on the Central Processing Unit. • Have exposure to Multicore computing and Parallel Organization of Computers.	• Each topic to be explained with examples. • Students to be motivated to discover the relevant concepts to take part in discussions and ask questions. • Students to be given homework/assignments to make their concept clear. • Discuss and solve the problems in the class.	• Participation in class discussions • Continuous Evaluation(30Marks) (i)15 marks on Assignments, class tests, viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance:5 marks • End-term examinations:70 marks.

Paper V/Subject Name: Object Oriented Programming using JAVA Lab		**Subject Code: CAP054C111**
L-T-P-C – 0-0-4-2	**Credit Units: 02**	**Scheme of Evaluation: P**

Objective:

The objectives of the course are:

- To teach the basic concept and techniques which form the object oriented programming paradigm which is a new way of thinking about problem using models organizes around real world concept.
- To practically explain the concepts of object oriented programming using JAVA.

Prerequisites: Basics of Procedural or Object Oriented Programming

Detailed Syllabus:

Minimum 20 Laboratory experiments based on the following-

- Write a program in java that outputs your name in giant letters.
- Write a program in Java to find the day of the week of a given date.
- Write a program in Java called GradesStatistics, which reads in n grades (of int between 0 and 100, inclusive) and displays the average, minimum, maximum, and standard deviation.
- Write a program in Java to compute execution time by generating random numbers.
- Write a program in Java to implement the following:
  - a. Tokenize the paragraph into single word.
  - b. Find the number of word in a paragraph?
  - c. Find the number of similar words from the input word.
  - d. Find the number of occurrence of each word.
- Write a program in Java to implement some inheritance hierarchy.
- Design and implement an address book object that contains a person's name, home address and phone number, business address and phone number, and numbers for their fax machine, cellular phone, and pager. Write a program in Java to this test plan for the object and implement a driver [finally prepare a package].
- Write a program in Java to demonstrate the use of try, catch, finally throw and throws keywords and demonstrate the following points in the program.
  - a. Multiple catch blocks.
  - b. try-catch-finally combination.

      c. try-finally combination.
      d. Exception propagation among many methods.
      e. Use of getMessage(), printStackTrace() function of Throwable class.
      f. Nested try blocks
- Write a program that does the following.
  a. Prompts the user for an input file name through a dialog box.
  b. Prompts the user for an output file name through a dialog box.
  c. Copies the input file into the output file, subject to the removal of the space characters listed below from each line.
     i. The leading space characters
     ii. The trailing space characters
     iii. The space characters that are preceded by space characters
- Write a program in Java to design forms.
- Write a program in Java to design a student information form to enter data into the database.
- Write a program in Java to connect some form designedwith the back-end database and test them by inserting some records.

Text Books:

1. *Programming with Java: A Primer*, E. Balagurusamy, 3rd Edition, 2005, Tata McGraw-Hill, New Delhi
2. *Thinking in Java*, Bruce Eckel, 4th Edition, 2006, PHI.

Reference Books:

1. Maurice Naftalin et al, *Java Generics and Collections*, 1st Edition, 2006, O'REILLY Publication.
2. Grady Booch, James Rumbaugh, Ivar Jacobson, *The Unified Modeling Language User Guide*, 2nd Edition, 2005, Pearson Education.
3. Herbert Schildt, *The Complete Reference Java*, 7th Edition, 2007, Tata McGraw-Hill, New Delhi

Facilitating the Achievement of Course Learning Outcomes

Course Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
On completion of this course the students will be expected to: • Show competence in the use of JAVA language in the development different programs. • Understand the basic principles of the object-oriented programming • Demonstrate an introductory understanding of graphical user interfaces, multithreaded programming, and event-driven programming.	• Each topic to be explained with examples. • Students to be motivated to discover the relevant concepts to take part in discussions and ask questions. • Students to be given homework/assignments to make their concept clear. • Discuss and solve the problems in the class.	• Participation in class discussions • Continuous Evaluation(30Marks) (i)15 marks on Assignments, class tests, viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance:5 marks • End-term examinations:70 marks.

Paper VI/ Subject Name: Advanced Data Structuress Lab		Subject Code: CAP054C112
L-T-P-C – 0-0-4-2	**Credit Units: 02**	**Scheme of Evaluation: P**

Objective:

The objectives of the course are:

- To explain practically the concepts of Data Structures and Algorithms.
- To provide an in-depth practical experience of various kinds of Trees.
- To give students detailed practical experience on Searching and Sorting.
- To teach the advanced topics in Data Structures like Graphs, Heaps, Hashing & Collision.

Prerequisites: Concepts of Computer Programming

Detailed Syllabus:

Minimum 20 Laboratory experiments based on the following-

1. Introduction, Basic Terminology, Classification of Data Structures, Operations on Data Structures, Abstract Data Type.
2. Algorithms- Different Approaches to Designing an Algorithm, Control Structures Used In Algorithms, Time and Space Complexity, Big O Notation, Omega Notation, Theta Notation, Other Useful Notations.
3. Linked Lists- Introduction, Singly Linked Lists, Circular Linked Lists, Doubly Linked Lists, Circular Doubly Linked Lists, Header Linked Lists, Multi-Linked Lists, Operations, Applications of Linked Lists.Stacks- Introduction, Array Representation of Stacks, Operations on Stacks, Multiple Stacks, Applications of Stacks.
4. Queues- Introduction, Array Representation of Queues, Linked Representation of Queues, Types of Queues, Operations on various types of Queues, Applications of Queues.
5. Trees- Introduction, Types of Trees, Creating a Binary Tree from a General Tree, Traversing a Binary Tree, Huffman's Tree, applications of Trees.
6. Efficient Binary Trees- Binary Search Trees, Operations on Binary Search Trees, Threaded Binary Trees, AVL Trees, Red-Black Trees, Splay Trees.
7. Multi-way Search Trees- Introduction to M-Way Search Trees, B Trees, B+ Trees, 2-3 Trees, Trie.
8. Searching- Introduction, Linear Search, Binary Search, Interpolation Search, Jump Search.
9. Sorting- Introduction, Bubble Sort, Insertion Sort, Selection Sort, Merge Sort, Quick Sort, Radix Sort, Heap Sort, Shell Sort, Tree Sort, Comparison of Sorting Algorithms, External Sorting.
10. Graphs- Introduction, Graph Terminology, Directed Graphs, Bi-Connected Components, Representation of Graphs, Graph Traversal Algorithms, Topological Sorting, Applications of Graphs.
11. Heaps- Binary Heaps, Binomial Heaps, Fibonacci Heaps, Comparison among Heaps, Applications of Heaps.
12. Hashing & Collision- Introduction, Hash Tables, Hash Functions, Different Hash Functions, Collisions, Applications of Hashing.

Text Book:

1. *Data Structures Using C*,ReemaThareja, 2nd Edition, 2014, Oxford University Press.

Reference Books:

1. S. K. Srivastava and Deepali Srivastava, *Data Structures Through C in Depth*, 1st Edition, 2004, BPB Publications.
2. Seymour Lipschutz, *Data Structures*, 1st Edition (reprint) 2017, McGraw Hill Education.

3. NarasimhaKarumanchi, *Data Structures and Algorithms Made Easy: Data Structures and Algorithmic Puzzles*, 5th Edition, 2016, Careermonk Publications.
4. Tenenbaum, *Data Structures Using C*, 2008, Pearson Education India.
5. Yashavant P. Kanetkar, *Data Structure through C*, 2nd Edition, 2003, BPB Publications.
6. A. M. Padma Reddy, *Data Structures*, Revised dition, 2017, Sri Nandi Publications.
7. Richard F. Gilberg, *Data Structures: A Pseudocode Approach with C*, Indian Edition, 2007, Cengage Learning.
8. Horowitz, Sahni and Anderson-Freed, *Fundamentals of Data Structures in C*, 2nd Edition, 2008, Universities Press.
9. E. Balagurusamy, *Data Structures Using C*, 1st Edition, 2017, McGraw Hill Education.

Facilitating the Achievement of Course Learning Outcomes

Course Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
On completion of this course the students will be expected to: • Learn the implementation of various data structures through C++. • Understandthe applications and uses of data structures in real world. • Learn to analyze the efficiency of algorithms.	• Each topic to be explained with examples. • Students to be motivated to discover the relevant concepts to take part in discussions and ask questions. • Students to be given homework/assignments to make their concept clear. • Discuss and solve the problems in the class.	• Participation in class discussions • Continuous Evaluation(30Marks) (i)15 marks on Assignments, class tests, viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance:5 marks • End-term examinations:70 marks.

Paper VIII/ Subject Name: Fundamentals of Organizational Behaviour	Subject Code: BHS984A103
L-T-P-C – 1-0-0-1 Credit Units: 01	Scheme of Evaluation: T

Objective:

The objectives of the course are:

- To provide students with a better understanding of organizational behavior and insight into the vital parts of an organization, namely, communication and culture

Prerequisites: None

Detailed Syllabus:

Modules	Topics	Course content	Periods
I	**Understanding Organizational Behaviour**	Fundamental concepts: The nature of people, The nature of organizations. Limitations of organizational behaviour: Behavioural bias, The law of diminishing returns Unethical manipulation of people	3
II	**Modes of Organizational Behaviour**	Autocratic, Custodial, Supportive, Collegial and System	3
III	**Communication Fundamentals**	The importance of communication, The two-way communication process, Potential problems, Communication barriers, Communication symbols, The impact of barriers on the communication process	3
IV	**Social System and Organizational Culture**	Understanding a social system, Social equilibrium Functional and dysfunctional effects, Psychological and economic contracts, Social culture, Cultural diversity, Social culture values, Organizational culture, Characteristics of culture, Measuring organizational culture, Communicating and changing culture	3
		Total	**12**

Text Books:

1. *Organizational Behaviour: Human behavior at work,* Newstrom, J. W., 2007, Tata McGraw-Hill, New Delhi.

Reference Books:

1. Robbins, S. P., Judge, T. A. & Sanghi, S., *An Essentials of Organizational Behaviour,* 2010, Dorllings Kindersley, India

Facilitating the Achievement of Course Learning Outcomes

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks

Have a better understanding of organizational behavior and insight into the vital parts of an organization, namely, communication and culture.	i) Each topic to be expounded with adequate examples. ii) Class discussions and question- answer rounds are encouraged iii) theoretical problems solving is part of the class to grasp the underlying concepts iv) Students have to go through case studies for real time experience v) Students to be encouraged to give short presentations.	(a) Participation in class discussions (b)Continuous Evaluation(30Marks) (i)15 marks on ☐ Assignments ☐ Class tests. ☐ viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.

Paper IX/ Subject Name: Communication: Skills, Concepts and Applications Subject Code: CEN984A101
L-T-P-C – 1-0-0-1   Credit Units: 01   Scheme of Evaluation: T

Objective:

The objectives of the course are:

● To give students an exposure to the basics of communication improving their business writing skills, group communication and speaking skills in English by engaging them for meaningful discussion and interactive activities.

Prerequisites: Basic understanding of English.

Detailed Syllabus:

Modules	Topics	Course content	Periods

I	Basics of Communication	Nature, Process of Communication, Definition, Classification, Purpose, Channels and Methods , Communication Networks, Organizational Communication (Formal, informal, grapevine), External communication (formal, informal) , Types/forms of Communication (Oral-written, Formal-Informal, Interpersonal-Intrapersonal, Mass- Group, Verbal- Non-Verbal) Non-verbal Communication (types and cross-cultural significance), Barriers to Communication, Communication Breakdown: 7 Cardinal mistake managers make	3
II	Focus on Business Writing Skills	Introduction , Planning & Execution of Messages, Writing different messages Characteristics of Good Writing Business Letters ✓ Format, Language and Types, essentials of good Business letters ✓ Writing routine and good-news letters ✓ Writing a persuasive letter Memorandum (how to write a memo, uses of a memo) Emails (how to write an email, netiquettes, emails and intercultural communication	3
III	Understanding Group communication	Group Discussion - Definition , Advantages, Qualities/skills required/assessed, General Do's & Don'ts, Participating in a GD (Leadership, GD protocol, discussion techniques, Listening)	3
IV	Mastering Speaking Skills	Presentation Skills - Introduction, Importance and Types, Common Problems with Presentations, Presentation Strategies (purpose, Audience, Context, Technique), Preparation and Delivery (Collecting information, Organizing Information), Structure of a Presentation, Delivering the Presentation (Delivery outline, stage fright and speech anxiety, how to deal with stage fright successfully, body language, visual cues, vocal and verbal elements, handling questions, preparing visual aids)	3
		Total	**12**

Text Books:

1. *Business Communication: Concepts, Cases and Applications*, Chaturvedi, P. D. and Chaturvedi Mukesh, 2nd Edition, 2011, Dorling Kindersley(India) Pvt. Ltd.

Reference Books:

1. Raman, Meenakshi and Sharma, Sangeet, *Technical Communication: Principles and Practices.* 2nd Edition, 2011, Oxford University Press.
2. Rizvi, M. Ashraf, *Effective Technical Communication,* 11th reprint. 2008, Tata McGraw Hill Publishing Company Limited.

Facilitating the Achievement of Course Learning Outcomes

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
Be familiar with the basics of writing, speaking and group communication.	i) Each topic to be expounded with adequate examples. ii) Class discussions and question- answer rounds are encouraged iii) theoretical problems solving is part of the class to grasp the underlying concepts iv) Students have to go through case studies for real time experience v) Students to be encouraged to give short presentations.	(a) Participation in class discussions (b)Continuous Evaluation(30Marks) (i)15 marks on ☐ Assignments ☐ Class tests. ☐ viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.

8. Detailed Syllabus of Semester-II

Paper I/ Subject Name: Advanced Computer Networks	Subject Code: CAP054C201
L-T-P-C – 4-0-0-4 Credit Units: 04	Scheme of Evaluation: T

Objective:

The objectives of the course are:

● To give students an overview of Computer Networks and introduction to the Physical Layer.
● To provide detailed concepts on the Data-Link Layer
● To explain detailed concepts on the Network Layer.
● To give students the understanding of the Transport Layer and the Physical Layer.

Prerequisites: Basics of trees and graphs

Detailed Syllabus:

Modules	Topics	Course content	Periods
I	**Overview of Computer Networks and the Physical Layer**	Introduction- Data Communications, Network Criteria and Structures, Network Types. Network Models- Protocol Layering, TCP/IP Protocol Suite, the OSI Model. Introduction to Physical Layer- Data and Signals, Periodic Analog Signals, Digital Signals, Transmission Impairment, Data Rate Limits, Performance. Digital Transmission- Digital-To-Digital Conversion, Analog-To-Digital Conversion, Transmission Modes. Analog Transmission- Digital-To-Analog Conversion, Analog-To-Analog Conversion. Bandwidth Utilization: Multiplexing And Spectrum Spreading- Multiplexing, Spread Spectrum. Transmission Media- Guided Media, Unguided Media. Switching- Introduction, Circuit-Switching, Packet Switching.	12

II	The Data-Link Layer	The Data-Link Layer- Introduction, Link-Layer Addressing. Error Detection and Correction- Basic concepts, Block Coding, Cyclic Codes, Checksum, Forward Error Correction. Data Link Control (DLC)- DLC Services, Data-Link Layer Protocols. Media Access Control (MAC)- Random Access, Controlled Access, Channelization. Wired LANs: Ethernet- Ethernet Protocol, Standard Ethernet, Fast Ethernet, Gigabit Ethernet. Wireless LANs- Introduction, IEEE 802.11 Project, Bluetooth, WiMAX. Connecting Devices and Virtual LANs- Connecting Devices, Virtual Lans.	12
III	The Network Layer	Introduction to Network Layer- Network-Layer Services, Packet Switching, Performance, IPv4 Addresses, Forwarding of IP Packets. Network-Layer Protocols- INTERNET PROTOCOL (IP), ICMPv4, MOBILE IP. Unicast Routing- Basic concepts, Routing Algorithms, Unicast Routing Protocols. Multicast Routing- Unicasting versus Multicasting versus Broadcasting, Multicasting Basics, Intradomain Multicast Protocols, Interdomain Multicast Protocols. Next Generation IP- IPv6 Addressing, The IPv6 Protocol, The ICMPv6 Protocol, Transition From IPv4 to IPv6.	12
IV	The Transport Layer and The Physical Layer	The Transport Layer- Introduction, Transport-Layer Protocols, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), SCTP. The Application Layer- Introduction, Client-Server Programming. Standard Client-Server Protocols- HTTP, Electronic Mail, TELNET, SSH, DNS.	12
		Total	**48**

Text Books:

1. *Data Communications and Networking,* Forouzan, 4th Edition, 2017, McGraw Hill Education.
2. *Computer Networks*, Andrew. S. Tanenbaum and David J. Wetherall, 5th Edition, 2013, Pearson Education India.
3. *Computer Networking: A Top - Down Approach,* James F. Kurose, 6th Edition, 2017, Pearson Education.

Reference Books:

1. Sanjay Sharma, *Computer Networks*, 1st Edition, 2013, S. K. Kataria & Sons.
2. Forouzan, *Computer Networks: A Top - Down Approach*, 1st Edition, 2017, McGraw Hill Education.
3. Narasimha Karumanchi, *Elements of Computer Networking: An Integrated Approach*, 1st Edition, 2017, Careermonk Publications.
4. Peterson, *Computer Networks - A System Approach*, 5th Edition, 2011, Elsevie

Facilitating the Achievement of Course Learning Outcomes

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
Independently understand basic computer network technology and identify the different types of network topologies and protocols. • Enumerate the layers of the OSI model and TCP/IP. Explain the function(s) of each layer. • Identify the different types of	i) Each topic to be expounded with adequate examples. ii) Class discussions and question- answer rounds are encouraged iii) theoretical problems solving is part of the class	(a) Participation in class discussions (b)Continuous Evaluation(30Marks) (i)15 marks on ☐ Assignments ☐ Class tests. ☐ viva-voce or

network devices and their functions within a network • Understand and building the skills of subnetting and routing mechanisms. • Familiarity with the basic protocols of computer networks, and how they can be used to assist in network design and implementation.	to grasp the underlying concepts iv) Students have to go through case studies for real time experience v) Students to be encouraged to give short presentations.	presentation (ii) Mid-term examinations :10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.	

Paper II/Subject Name: Modern Operating Systems	**Subject Code: CAP054C202**
L-T-P-C – 4-0-0-4 **Credit Units: 04**	**Scheme of Evaluation: T**

Objective:

The objectives of the course are:

- To give students an introduction to Operating Systems and Process Management.
- To explain detailed concepts on the CPU, Deadlocks, and Memory Management.
- To teach the concepts of Storage and Input/ Output Management.
- To provide an understanding of the advanced topics like Protection, Security, Virtual machines and Distributed Systems.

Prerequisites: Fundamentals of Computer Organization and Architecture

Detailed Syllabus:

Modules	Topics	Course content	Periods
I	**Operating Systems Overview**	Computer System Overview-Basic Elements, Instruction Execution, Interrupts, Memory Hierarchy, Cache Memory, Direct Memory Access, Multiprocessor and Multicore Organization. Operating system overview-objectives and functions, Evolution of Operating System.- Computer System Organization Operating System Structure and Operations- System Calls, System Programs, OS Generation and System Boot, OS Operations, Kernel Data Structures, OS Services	12
II	**Process Management**	Processes – Process Concept, Process Scheduling, Operations on Processes, Inter-process Communication; CPU Scheduling – Scheduling criteria, Scheduling algorithms, Multiple-processor scheduling, Real time scheduling; Threads- Overview, Multithreading models, Threading issues; Process Synchronization – The critical-section problem, Synchronization hardware, Mutex locks, Semaphores, Classic problems of synchronization, Critical regions, Monitors; Deadlock – System model, Deadlock characterization, Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from deadlock.	12
III		Main Memory – Background, Swapping, Contiguous Memory Allocation, Paging, Segmentation, Segmentation with paging, 32 and 64 bit architecture Examples; Virtual Memory – Background, Demand Paging, Page Replacement, Allocation, Thrashing; Allocating	12

	Memory Management and File Systems	Kernel Memory. File-System Interface- The concept of Files, Access Methods, Directory and Disk Structure, File-System Mounting, File Sharing, Protection. File-System Implementation- File-System Structure, Directory Implementation, Allocation Methods, Free-Space Management, Disk Scheduling, Disk Management, Swap-Space Management, RAID Structure, Stable-Storage.	
IV	Case Study	OS Security, Unix Primer, Search and sort tools, AWK tool in Unix, Unix Kernel Architecture, Shell Script in Unix, AWK tool in Unix, Make tool in UNIX, System Administration in Unix, Source Code control system in Unix, X Windows in Unix, Linux System – Design Principles, Kernel Modules, Process Management, Scheduling, Memory Management, Input-Output Management, File System, Inter-process Communication;	12
		Total	**48**

Text Books:

1. *Operating System Concepts,* Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, 7th Edition, 2006, Wiley.

Reference Books:

1. William Stallings, *Operating Systems: Internals and Design Principles*, 7th Edition, 2013, Pearson Education India.
2. Andrew S. Tanenbaum and Herbert Bos, *Modern Operating Systems*, 4th Edition, 2014, Pearson Education India
3. Achyut Godbole and Atul Kahate, *Operating Systems*, 3rd Edition, 2017, McGraw Hill Education.

Facilitating the Achievement of Course Learning Outcomes

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
•Learn the fundamentals of Operating Systems and the mechanisms of OS to handle processes and threads and their communication. •Learn the mechanisms involved in memory management in contemporary OS. •Gain knowledge on distributed operating system concepts that includes architecture, Mutual exclusion algorithms, deadlock detection algorithms and agreement protocols. •Know the components and management aspects of concurrency management. •Learn programmatically to implement simple OS mechanisms.	i) Each topic to be expounded with adequate examples. ii) Class discussions and question- answer rounds are encouraged iii) theoretical problems solving is part of the class to grasp the underlying concepts iv) Students have to go through case studies for real time experience v) Students to be encouraged to give short presentations.	(a) Participation in class discussions (b)Continuous Evaluation(30Marks) (i)15 marks on ☐ Assignments ☐ Class tests. ☐ viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.

Paper III/ Subject Name: Advanced Database Management Systems	**Subject Code: CAP054C203**
L-T-P-C – 4-0-0-4 **Credit Units: 04**	**Scheme of Evaluation: T**

Objective:

The objectives of the course are:
- To provide an overview of Databases, Transactions and Data Models.
- To give students an exposure to Database Design, E-R Model, Relational Model, and UML.
- To teach concepts on Relational Algebra, Relational Calculus and SQL.

- To give students the idea about Transaction management and Concurrency control in DBMS.

Prerequisites: Fundamentals of Data Structures

Detailed Syllabus:

Modules	Topics	Course content	Periods
I	**Introduction to Databases, Transactions and Data Models**	What is database system, purpose of database system, Database Administrators, view of data, relational databases, and database architecture. Transaction management. The importance of data models, Basic building blocks, Business rules, The evolution of data models, Degrees of data abstraction.	**12**
II	**Database Design ,E-R Model, Relational Model, and UML**	Database design and E-R Model- overview, E-R Model, Constraints, E-R Diagrams, E-R Design Issues, weak entity sets, Codd's rules, Relational Schemas. Introduction to UML. Relational database model- Logical view of data, keys, integrity rules. Relational Database design- features of good relational database design, atomic domain and Normalization (1NF, 2NF, 3NF, BCNF).	**12**
III	**Relational Algebra, Relational Calculus and SQL**	Relational algebra- introduction, Selection and projection, set operations, renaming, Joins, Division, syntax, semantics. Operators, grouping and ungrouping, Relational comparison. Relational Calculus- Tuple relational calculus, Domain relational Calculus, calculus vs algebra, computational capabilities. Constraints, Views and SQL- What is constraints, types of constrains, Integrity constraints. Views- Introduction to views, data independence, security, updates on views, comparison between tables and views. SQL- data definition, Data types, DML and DML, Queries, aggregate function, Null Values, nested sub queries, Joined relations. Triggers. Use of RDBMS software like MS-Access, MySQL, MS-SQL server, Oracle, PostgreSQL.	**12**
IV	**Transaction management and Concurrency Control**	Transaction management, ACID properties, serializability and concurrency control, Lock based concurrency control (2PL, Deadlocks), Time stamping methods, optimistic methods, database recovery management.	**12**
		Total	**48**

Text Book:

1. *Fundamentals of Database System,* Elmasri and Navathe, 7th Edition, 2016, Pearson Education Asia
2. *Database System Concepts*, Henry F Korth, Abraham Silberschatz, 6th Edition, 2013, Mc Graw Hill.
3. *Introduction to Database Management System*, Atul Kahate, 1st Edition, 2004, Pearson Educations

4. *DataBase Management System*, Paneerselvam, 2nd Edition, 2011, PHI Learning

Reference Books:

1. C.J.Date*, An Introduction to Database Systems,* 8th Edition, 2003, Pearson Education Asia
2. Bibin C. Desai, *An Introduction to Database Systems*, Revised Edition, 2012, Galgotia Publications

Facilitating the Achievement of Course Learning Outcomes

Course Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
On completion of this course the students will be expected to: ● Learn about basic database related concepts. ● Have an insight on Relational Database Modeling and the Structured Query Language. ● Learn about Database Design including Normalization and Functional Dependencies. ● Have the understanding of the advanced topics like Query Optimization, Transaction Processing	● Each topic to be explained with examples. ● Students to be motivated to discover the relevant concepts to take part in discussions and ask questions. ● Students to be given homework/assignments to make their concept clear. ● Discuss and solve the problems in the class.	● Participation in class discussions ● Continuous Evaluation(30Marks) (i)15 marks on Assignments, class tests, viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance:5 marks End-term examinations:70 marks.

Paper IV/ Subject Name: Pattern Recognition		Subject Code: CAP054C204
L-T-P-C – 4-0-0-4	Credit Units: 04	Scheme of Evaluation: T

Objective:

The objectives of the course are:

● To explain the design and construction and a pattern recognition system and the major approaches in statistical and syntactic pattern recognition.
● To provide an exposure to the theoretical issues involved in pattern recognition system design.
● To teach the working knowledge of implementing pattern recognition techniques and the scientific Python computing environment.

Prerequisites: Concepts of Data Mining and Digital Image Processing

Detailed Syllabus:

Modules	Topics	Course content	Periods
I	**Introduction**	Pattern Recognition: Definition, Applications and Examples, Clustering Vs Classification, Supervised Vs Unsupervised, Basic of Linear Algebra, Vector Spaces, Basics of Probability, Basics of Estimation Theory, Decision Boundaries, Decision Regions, Metric Spaces	12

II	**Classification**	Bayes Decision Rules, Error Probability, Examples, Normal Distribution, Linear Discriminant Function, Non-Linear Decision Boundaries, Mahalanobis Distance, K-NN Classifier, Single and Multi Layer Perceptron, Training Set, Test Set, Standardization and Normalization	12
III	**Clustering**	Basics, Similarity/Dissimilarity Measures, Clustering Criteria, Different distance functions and similarity measures, within cluster distance criterion, K-means algorithm, Single linkage and complete linkage algorithms, MST,K-medoids, DBSCAN, Data sets: Visualization, Unique Clustering	12
IV	**Decision Making, Cluster Analysis and Feature Extraction**	Baye's theorem, multiple features, decision boundaries, estimation of error rates, histogram, kernels, window estimators, nearest neighbour classification, maximum distance pattern classifiers, adaptive decision boundaries. Unsupervised learning, hierarchical clustering, graph theories approach to pattern clustering, fuzzy pattern classifiers, application of pattern recognition in medicine. Structural PR, SVMs, FCM ,Soft-Computing and Neuro-Fuzzy Techniques, Real-Life Examples	12
Total			**48**

Text Book:
1. *Pattern Recognition and Image Analysis,* Earl Gose, Richard Johnsonbaugh, Steve Jost, DSKT Edition, PHI
2. *Pattern Classification and Scene Analysis,* Duda & Hart, 1st Edition, Wiley

Reference Books:

1. K. Fukunaga , *Statistical pattern Recognition*, 2nd Edition, 2000, Academic Press
2. S.Theodoridis and K.Koutroumbas, Pattern Recognition, 4th Edition, 2005, Academic Press.

Facilitating the Achievement of Course Learning Outcomes

Learning Outcomes	**Teaching and Learning Activity**	**Assessment Tasks**
•Learn the design and construction and a pattern recognition system •Understand the working knowledge of implementing pattern recognition techniques and the scientific Python computing environment. Analyze the different features extracted from datasets	i) Each topic to be expounded with adequate examples. ii) Class discussions and question-answer rounds are encouraged iii) theoretical problems solving is part of the class to grasp the underlying concepts iv) Students have to go through case studies for real time experience v) Students to be encouraged to give short presentations.	(a) Participation in class discussions (b)Continuous Evaluation(30Marks) (i)15 marks on ⬚ Assignments ⬚ Class tests. ⬚ viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.

Paper V/Subject Name: Advanced Computer Networks Lab	Subject Code: CAP054C211
L-T-P-C – 0-0-4-2 Credit Units: 02	Scheme of Evaluation: P

Objective:

The objectives of the course are:

- To give students practical experience on the use of various devices as well as simulation tools for Have practical experience on the use of various devices as well as simulation tools for Computer Networking.
- To provide a practical experience on the implementation on various protocols of Computer Networks.
- To teach the analysis of the performance of the protocols in different layers.
- To give a practical experience on the analysis of various routing algorithms.

Prerequisites: None

Detailed Syllabus:

Minimum 10 Laboratory experiments based on the following-

1. Installation of Operating System, Installation of Utility Software and Applications.
2. Study of Local Area Network (LAN) with emphasis to the following-
   1. Study of different network cables and devices.
   2. Study of college LAN with references to network IP and design a LAN for it.
   3. Study of basic network command and network configuration command.
   4. Study of LAN transmission media's, topologies, interconnection devices & LAN standards.
   5. Implementation of Subnetting.
3. Token bus and token ring protocol to create scenario and study the performance of token bus and token ring protocols through simulation.
4. Case study of client/server scenario. Observing the difference between UDP and TCP servers. Study of Socket Programming and Client – Server model.
5. To observe the working of TCP three-way hand-shaking procedure. Locating different packets like, SYN, SYN-ACK and ACK. Comparing different fields of these packets.
6. Write a program for Hamming Code generation for error detection and correction.
7. Using TCP/IP sockets, write a client-server program to make client sending the file name and the server to send back the contents of the requested file if present.
8. Implementation of Stop and Wait Protocol and Sliding Window Protocol.
9. Write a code simulating ARP /RARP protocols.
10. Write a code simulating PING and TRACEROUTE commands.
11. Create a socket for HTTP for web page upload and download.
12. Write a program to implement RPC (Remote Procedure Call).

13. Applications using TCP Sockets like Echo client & echo server, Chat etc.
14. File Transfer Applications using TCP and UDP Sockets like DNS, SNMP, File Transfer.
15. Study of Network simulator (NS) and Simulation of Congestion Control Algorithms using NS.
16. Perform a case study about the different routing algorithms to select the network path with its optimum and economical during data transfer, like Link State routing, Flooding, Distance vector, etc.

Text Books:

1. *Data Communications and Networking,* Forouzan, 4th Edition, 2017, McGraw Hill Education.
2. *Computer Networks*, Andrew. S. Tanenbaum and David J. Wetherall, 5th Edition, 2013, Pearson Education India.
3. *Computer Networking: A Top - Down Approach,* James F. Kurose, 6th Edition, 2017, Pearson Education.

Reference Books:

1. Sanjay Sharma, *Computer Networks*, 1st Edition, 2013, S. K. Kataria & Sons.
2. Forouzan, *Computer Networks: A Top - Down Approach*, 1st Edition, 2017, McGraw Hill Education.
3. Narasimha Karumanchi, *Elements of Computer Networking: An Integrated Approach*, 1st Edition, 2017, Careermonk Publications.
4. Peterson, *Computer Networks - A System Approach*, 5th Edition, 2011, Elsevier.

Facilitating the Achievement of Course Learning Outcomes

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
•Know about different Network components. •Learn about client-server programming •Learn and differentiate between TCP and UDP servers •Learn about network simulators.	i) Each topic to be expounded with adequate examples. ii) Class discussions and question- answer rounds are encouraged iii) theoretical problems solving is part of the class to grasp the underlying concepts iv) Students have to go through case studies for real time experience v) Students to be encouraged to give short presentations.	(a) Participation in class discussions (b)Continuous Evaluation(30Marks) (i)15 marks on ⬜ Assignments ⬜ Class tests. ⬜ viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.

Paper VI/ Subject Name: Advanced Database Management Systems Lab	Subject Code: CAP054C212

L-T-P-C – 0-0-4-2	Credit Units: 02	Scheme of Evaluation: P

Objective:

The objectives of the course are:

- To provide in-depth knowledge on database concepts.
- To teach the concepts of relational data model.
- To impart practical to experience designing and constructing data models and using SQL to interface to both multi-user DBMS packages and to desktop DBMS packages.
- To explain the usage of DDL and DML commands in RDBMS.
- To make the students practice advanced concepts in databases, like High Level Language Extensions with cursors, triggers, procedures and functions.

Prerequisites: Concepts of Computer Programming and Data Structures

Detailed Syllabus:

Minimum 20 Laboratory experiments based on the following-

1. DDL Commands in RDBMS, DML Commands in RDBMS
2. High Level Language Extensions with Cursors.
3. High Level Language Extensions with Triggers
4. Procedures and Functions.
5. Embedded SQL
6. Database Design using ER model and Normalization.
7. A full-fledged case study for designing of a DBMS for an information system.

Text Book:

1. *Fundamentals of Database System,* Elmasri and Navathe, 7th Edition, 2016, Pearson Education Asia
2. *Database System Concepts*, Henry F Korth, Abraham Silberschatz, 6th Edition, 2013, Mc Graw Hill.
3. *Introduction to Database Management System*, Atul Kahate, 1st Edition, 2004, Pearson Educations
4. *DataBase Management System*, Paneerselvam, 2nd Edition, 2011, PHI Learning

Reference Books:

1. C.J.Date*, An Introduction to Database Systems,* 8th Edition, 2003, Pearson Education Asia
2. Bibin C. Desai, *An Introduction to Database Systems*, Revised Edition, 2012, Galgotia Publications

Facilitating the Achievement of Course Learning Outcomes

Course Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
On completion of this course the students will be expected to: ● Have a practical review of the concepts of DDL and DML commands. ● Have a practical exposure to the usage of Cursors and Triggers. ● Have the practical experience of Procedures and functions, along with hands on experience with Embedded SQL. ● Have the practical experience of a real life information system's DBMS design, as well as know how to tackle the challenges faced during such a real life project.	● Each topic to be explained with examples. ● Students to be motivated to discover the relevant concepts to take part in discussions and ask questions. ● Students to be given homework/assignments to make their concept clear. ● Discuss and solve the problems in the class.	● Participation in class discussions ● **Continuous Evaluation: 25%** (Skill Test, lab copy, viva, lab involvement: Any Three) ● **Attendance: 5**% ● **End term examination:** 70 %

Paper VIII/ Subject Name: Individual and Intrapersonal Behaviour	Subject Code: BHS984A203
L-T-P-C – 1-0-0-1 **Credit Units: 01**	**Scheme of Evaluation: T**

Objective:

The objectives of the course are:

● To provide students with a platform to understand individual and interpersonal behavior within an organization, thus building insight into the dynamics of employee attitudes, satisfaction, conflict and power politics.

Prerequisites: None

Detailed Syllabus:

Modules	Topics	Course content	Periods
I	**Nature and Effects of Employee Attitudes**	Nature of employee attitudes: job satisfaction, job involvement, organizational commitment, work moods Effects of employee attitudes: employee performance, turnover, absences and tardiness, theft, violence, other effects	3
II	**Organizations and Individuals**	Quality of work life, A rationale, Job enlargement versus job enrichment, Applying job enrichment, Core dimensions: A job characteristics, Approach, Enrichment versus motivation, Social cues affect perceptions, Contingency factors affecting enrichment, Individual's responsibilities to the organization, Organizational citizenship, Dues-Paying, Blowing the whistle on unethical behaviour, Mutual trust	3
III	**Conflict in Organization**	The nature of conflict, Levels of conflict, Sources of conflict, Effects of conflict	3
IV	**Assertive Behaviour, Power, politics**	Assertive behavior: interpersonal orientations, facilitating smooth relations, stroking Power and Politics: types of power, effects of power bases, organizational politics, influence and political power	3
		Total	12

Text Books:

1. *Organizational Behaviour: Human behavior at work,* Newstrom, J. W., 2007, Tata McGraw-Hill, New Delhi.

Reference Books:

1. Robbins, S. P., Judge, T. A. & Sanghi, S., *An Essentials of Organizational Behaviour,* 2010, Dorllings Kindersley, India

Facilitating the Achievement of Course Learning Outcomes

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
•Understand individual and interpersonal behavior within an organization, thus building insight into the dynamics of employee attitudes, satisfaction, conflict and power politics.	i) Each topic to be expounded with adequate examples. ii) Class discussions and question-answer rounds are encouraged iii) theoretical problems solving is part of the class to grasp the underlying concepts iv) Students have to go through case studies for real time experience v) Students to be encouraged to give short presentations.	(a) Participation in class discussions (b)Continuous Evaluation(30Marks) (i)15 marks on ⬚ Assignments ⬚ Class tests. ⬚ viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.

Paper IX/ Subject Name: : Business Environment and Communication	Subject Code: CEN984A201
L-T-P-C – 1-0-0-1 Credit Units: 01	Scheme of Evaluation: T

Objective:

The objectives of the course are:

● To give a comprehensive view of corporate communication, cross cultural communication by engaging them to meaningful discussion and interactive activities

Prerequisites: Basic understanding of communication in organizations.

Detailed Syllabus:

Modules	Topics	Course content	Periods
I	**Corporate Communication**	Focus areas of Corporate Communication, Crisis Communication (Conceptual understanding, Dealing with a Crisis, Role of Internal Communication in handling Crisis), Cross Cultural Communication (Understanding Culture, Workplace Culture, Culture and Non-Verbal, Managing Global Teams)	3

II	Communication in Teams	Definition, Understanding Team and Group, Stages of Group Formation , Johari Window and Team Communication, Roles in a Team, Advantages and Challenges of Working in a Team, Essential Facts about being a part of a Team, Types of Teams, Team Conflicts	3
III	Business Etiquettes Cross Cultural Communication	Constituents of Etiquettes and Importance, Conduct at the workplace, Dining and gifts, Meeting, Customers and clients, Business Etiquettes and Modern Technology, Communicating in a Diverse Work Environment - Concepts of Culture, Cultural Nuances -Hierarchy & Status, Individualism and Teamwork, Punctuality, Technology, cultural contexts International Communication - Proverbs and Culture, Intercultural Communication and the Workplace, Cultural Conflicts, Resolving Cultural Conflicts	3
IV	Improving Technical Writing Skills	Report Writing - Importance and use, Characteristics of Reports. Categories of Reports, Formats, Prewriting, Structure of Reports (Manuscript format), Types of Reports, Writing the Report	3
		Total	**12**

Text Books:

1. *Business Communication for Managers*, Mehra, Payal, 1st Impression, 2012, Dorling Kindersley (India) Pvt. Ltd.

Reference Books:

1. Mukherjee, Hory Sankar, *Business Communication: Connecting At Work,* 1st Edition, 2013, Oxford University Press.
2. Verma, Shalini, *Business Communication: Essential Strategies for Twenty-first Century Managers*, 2nd Edition, 2014, Vikas Publishing House Pvt. Ltd.

Facilitating the Achievement of Course Learning Outcomes

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
•Know communication skills required in corporation and work as a team, comprehend cross cultural communication and improve their technical writing skills.	i) Each topic to be expounded with adequate examples. ii) Class discussions and question- answer rounds are encouraged iii) theoretical problems solving is part of the class to grasp the underlying concepts iv) Students have to go through case studies for real time experience v) Students to be encouraged to give short presentations.	(a) Participation in class discussions (b)Continuous Evaluation(30Marks) (i)15 marks on ⬝ Assignments ⬝ Class tests. ⬝ viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.

9. Detailed Syllabus of Semester-III

PaperI/ Subject Name: Design and Analysis of Algorithms		Subject Code: CAP054C301
L-T-P-C – 4-0-0-4	Credit Units: 04	Scheme of Evaluation: T

Objective:

The objectives of the course are:

● To teach the fundamental algorithms
● To explain how to analyse the performance of algorithms
● To teach the fundamental algorithmic design strategies

Prerequisites: Fundamentals of Data Structures and Basic Mathematics

Detailed Syllabus:

Modules	Topics	Course content	Periods
I	Introduction	Fundamental characteristics of an algorithm. Basic algorithm analysis – Asymptotic analysis of complexity bounds – best, average and worst-case behaviour, standard notations for expressing algorithmic complexity. Empirical measurements of performance, time and space trade-offs in algorithms. Using recurrence relations to analyse recursive algorithms – illustrations using recursive algorithms.	12
II	Fundamental Algorithm Strategies	Brute-Force, Greedy, Branch-and-Bound, Backtracking and Dynamic Programming methodologies as techniques for design of algorithms – Illustrations of these techniques for Problem-Solving. Heuristics – characteristics and their domains of applicability. Design of algorithms for String/ Texmatching problems, Huffman Code and Data compression problems, Subset-sum and Knapsack problems.	12

III	Graph and Tree Algorithms	Depth- and Breadth- First traversals. Shortest path algorithms, Transitive closure, Minimum Spanning Tree, Topological sort, Network Flow problems.	12
IV	Tractable and Intractable Problems	Computability. The Halting problem. Computability classes – P, NP, NP-complete and NP-hard. Cook's theorem. Standard NP complete problems Reduction techniques. Approximation algorithms, Randomized algorithms, Class of problems beyond NP – PSPACE.	12
		Total	**48**

Text Book:

1. *Introduction to Algorithms,* T. H. Cormen, C. E. Leiserson, R. L. Rivest, 3rd Edition, 2009, The MIT Press, Cambridge, Massachusetts.

Reference Books:

1. Aho, Hopcroft & Ullman, *The Design and Analysis of Algorithms*, Addison- Wesley
2. Horowitz & Sahani, *Fundamentals of Algorithms,* 2nd Edition, 2009, Galgotia Publications

Facilitating the Achievement of Course Learning Outcomes

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
•Describe the major modern algorithms and selected techniques that are essential to today's computers. •Decide on the suitability of a specific algorithm design technique for a given problem. •Apply the algorithms and design techniques to solve problems, and mathematically evaluate the quality of the solutions.	i) Each topic to be expounded with adequate examples. ii) Class discussions and question- answer rounds are encouraged iii) theoretical problems solving is part of the class to grasp the underlying concepts iv) Students have to go through case studies for real time experience v) Students to be encouraged to give short presentations.	(a) Participation in class discussions (b)Continuous Evaluation(30Marks) (i)15 marks on ⮚ Assignments ⮚ Class tests. ⮚ viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.

Paper II/ Subject Name: Web Technologies		Subject Code: CAP054C302
L-T-P-C – 4-0-0-4	Credit Units: 04	Scheme of Evaluation: T

Objective:

The objectives of the course are:

- To give students an introduction to the Internet and Web Page Design.
- To provide detailed concepts on Web Browsers, Markup Language Basics and XML.
- To impart detailed concepts on Web Server Side technologies.
- To give students exposure to some Advanced Web Technologies and the Web Security.

Prerequisites: Fundamentals of Computer Programming

Detailed Syllabus:

Modules	Topics	Course content	Periods
I	**Introduction to Internet and Web Page Design**	Internet basics: History and basic idea of Internet; Internet services: telnet, e-mail, ftp, WWW. Web page design: Designing web pages with HTML- use of tags, hyperlinks, URLs, tables, text formatting, graphics & multimedia, imagemap, frames and forms in web pages. Use of Cascading Style Sheet in web pages. Creating interactive and dynamic web pages with JavaScript: JavaScript overview; constants, variables, operators, expressions & statements; user-defined & built-in functions; client-side form validation; using properties and methods of built-in objects.	12
II	**Web Browsers, Markup Language Basics and XML**	Web Browsers: functions and working principle of web browsers; plug-ins & helper applications; conceptual architecture of some typical web browsers. Markup language basics: Standard Generalized Markup Language (SGML)- structures, elements, Content models, DTD, attributes, entities. Extensible Markup Language (XML): Introduction- using user-defined tags in web pages; displaying XML contents; XML DTDs; use of XSL.	12
III	**Web Server Side**	Introduction to Client/Server Computing: client-server computing basics; types of Client/Server systems; middleware; N-tired systems: 2-tier/3-tier/4-tier systems; Fat Clients versus Fat Servers.Web Servers: Web services and web server functionality; web server composition; registration; HTTP, IP address, DNS & ports; conceptual architecture of some typical web servers. Server-side scripting: overview of CGI, ASP, and JSP. Server side scripting using PHP; PHP basics, HTML form data handling, Web database connectivity- introduction to ODBC; PHP with database connectivity.	12

IV	Advanced Web Technologies and Web Security	Exposure to Advanced Web Technologies: Distributed Object based models- DCOM, CORBA, EJB; Web services and Related Technologies- ISAPI, SOAP, UDDI, WSDL; Other Advanced Web Technologies- AJAX, ISAPI, .NET. Web Security: Firewalls- definition and uses, network layer firewalls and application layer firewalls; Proxy servers, HTPS for secure web communication.	12
		Total	**48**

Text Book:

1. *Web Technologies,* Godbole and Khate, 3rd Edition, 2017, McGraw Hill Education.

Reference Books:

1. Kogent Learning Solutions Inc., *Web Technologies: HTML, Javascript, PHP, Java, JSP, XML and AJAX, Black Book*, 1st Edition, 2009, Dreamtech Press.
2. Uttam K. Roy, *Web Technologies*, 1st Edition, 2010, Oxford.
3. N. P. Gopalan and J. Akilandeswari, *Web Technology: A Developer's Perspective*, 2nd Edition, 2014, Prentice-Hall of India Pvt. Ltd.
4. Jackson, *Web Technologies: A Computer Science Perspective*, 1st Edition, 2007, Pearson Education India.

Facilitating the Achievement of Course Learning Outcomes

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
• Analyze a web page and identify its elements and attributes. • Create web pages using HTML and Cascading Style Sheets. • Build dynamic web pages using JavaScript (Client side programming). • Create XML documents and Schemas. • Build interactive web applications using AJAX.	i) Each topic to be expounded with adequate examples. ii) Class discussions and question- answer rounds are encouraged iii) theoretical problems solving is part of the class to grasp the underlying concepts iv) Students have to go through case studies for real time experience v) Students to be encouraged to give short presentations.	(a) Participation in class discussions (b)Continuous Evaluation(30Marks) (i)15 marks on ⬚ Assignments ⬚ Class tests. ⬚ viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.

Paper III/ Subject Name: Advanced Software Engineering	Subject Code: CAP054C303
L-T-P-C – 4-0-0-4	Credit Units: 04 Scheme of Evaluation: T

Objective:

The objectives of the course are:

- To explain the basics and life cycle of software engineering.
- To discuss different system process models
- To explain the basic concepts of software testing.

● To make the students understand about testing and test cases

Prerequisites: None

Detailed Syllabus:

Modules	Topics	Course content	Periods
I	**Introduction**	Introduction to Software Engineering, Defining Software, Changing Nature of Software, attributes of a good Software, Software Product, Software Development Life Cycle, Software Processes, Software Engineering Practices, Software Myths	**12**
II	**System Process Models**	Generic Process Model (Defining Framework Activity, Identifying Task Set), Process Assessment & Improvement, Waterfall Process Model, Incremental Process Model, Spiral Process Model, Prototyping Software Process Model, Evolutionary Process Model, Component Based Process Model, Introduction to basic concepts of Agile Software Development	**12**
III	**Types of Testing and Test Cases**	Dynamic Testing: Black Box Testing, White box testing, Grey box testing,Functional Testing: GUI Testing, Boundary Value Analysis, Equivalence Class Partition, Error guessing, Negative testing, Back End testing, Database Testing, Compatibility Testing, Security testing, Portability testing, Configuration Testing, Recovery testing, Performance testing: Load testing, Stress testing, Soak testing, Spike testing, Scalability testing, Volume testing, Unit Testing, Integration Testing, Regression Testing, Sanity Testing, System Testing, Acceptance Testing, Non-Functional Testing, Compatibility Testing, Data Flow/Control Testing.Test cases and use case design, Test Case Parameters, Write/Review/Execute Test cases, Test Case Design Templates, Requirement Traceability Matrix (RTM), Setting up Test Data, Importance of Test Data in Testing, Gathering Test Data, Advantages of Test Data Gathering, Managing Test data and creating Data Repositories.	**12**
IV	**Test Strategy and Execution**	Learn Test Execution Life Cycle Process, Understand Different levels of Test Execution, Sanity/ Smoke Testing, Test Batches or Test Suite Preparation and Execution, Retesting, Regression Testing, What is Bug Leakage, Test Design. What is Test Plan?, Contents of test plan, Master test plan and testing level test plan, Entry and Exit criteria, Test Coverage, Test Responsibilities, Adhoc testing, Exploratory Testing General risks in test environment .	**12**
		Total	**48**

Text Books:

1. *Fundamentals of Software Engineering*, Rajib Mall,, Prentice Hall of India

2. *Software Testing*, Patton, Ron, 5th Edition, 2005 Pearson Education

3. *Software Testing: Principles and Practices,* Desikan, Srinivasan, Gopalaswamy, Ramesh, 1st Edition, 2005, Pearson Education

Reference Books:

1. Jalote, Pankaj, *An Integrated Approach To Software Engineering*, 3rd Edition, 2005, Narosa Publishing House.

Facilitating the Achievement of Course Learning Outcomes

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
1. Explain various phases of software development lifecycle 2. Analyze and document the requirement specifications for a software project 3. Develop the process model using standard tools and methodologies 4. Implement a quality software project through effective team-building planning, scheduling and risk assessment.	i) Each topic to be expounded with adequate examples. ii) Class discussions and question- answer rounds are encouraged iii) theoretical problems solving is part of the class to grasp the underlying concepts iv) Students have to go through case studies for real time experience v) Students to be encouraged to give short presentations.	(a) Participation in class discussions (b)Continuous Evaluation(30Marks) (i)15 marks on ⬚ Assignments ⬚ Class tests. ⬚ viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.

PaperIV/Subject Name: Design and Analysis of Algorithm Lab	Subject Code: CAP054C311
L-T-P-C – 0-0-4-2 Credit Units: 02	Scheme of Evaluation: P

Objective:

The objectives of the course are:

- To teach the fundamental algorithms
- To explain how to analyze the performance of algorithms
- To teach the fundamental algorithmic design strategies

Prerequisites: Concepts of Computer Programming and Data Structures

Detailed Syllabus:

Minimum 20 Laboratory experiments based on the following-

1. Implementation of different sorting algorithms.
2. Implementation of KRUSKAL ALGORITHM.
3. Implementation of PRIM'S ALGORITHM
4. Implementation of KNAPSACK PROBLEM
5. Implementation of MULTISTAGE GRAPH
6. Implementation of ALL PAIR SHORTEST PATH ALGORITHM
7. Implementation of EIGHT QUEEN PROBLEM
8. Implementation of TRAVELING SALES MAN Problem

Text Book:

1. *Introduction to Algorithms,* T. H. Cormen, C. E. Leiserson, R. L. Rivest, 3rd Edition, 2009, The MIT Press, Cambridge, Massachusetts.

Reference Books:

1. Aho, Hopcroft & Ullman, *The Design and Analysis of Algorithms*, Addison- Wesley
2. Horowitz & Sahani, *Fundamentals of Algorithms,* 2nd Edition, 2009, Galgotia Publications

Facilitating the Achievement of Course Learning Outcomes

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
•Describe the major modern algorithms and selected techniques that are essential to today's computers. •Decide on the suitability of a specific algorithm design technique for a given problem. •Apply the algorithms and design techniques to solve problems, and mathematically evaluate the quality of the solutions.	i) Familiarization with essential tools , language and software has been inducted ii) Related concept are discussed before each practical iii) student are encourage to take up real problem and solve in group iv) Case study and its practical implementation is a part of the curriculum v) Students to be encouraged to take up software development in related fields	(a) Participation in Practical Assignments (b)Continuous Evaluation(30Marks) (i)15 marks on ⯌ Lab Assignments ⯌ viva-voce (ii) Skill Test crries:10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.

Paper V/ Subject Name: Web Technologies Lab	Subject Code: CAP054C312
L-T-P-C – 0-0-4-2	**Credit Units: 02**	**Scheme of Evaluation: P**

Objective:

The objectives of the course are:

- To give students a practical introduction to the Internet and Web Page Design.
- To explain practical concepts on Web Browsers, Markup Language Basics and XML.
- To teach concepts on Web Server Side technologies.
- To give students hands-on exposure to some Advanced Web Technologies and the Web Security.

Prerequisites: Computer Programming Fundamentals

Detailed Syllabus:

Minimum 10 Laboratory experiments based on the following-

1. Web page design: Designing web pages with HTML- use of tags, hyperlinks, URLs, tables, text formatting, graphics & multimedia, imagemap, frames and forms in web pages.
2. Use of Cascading Style Sheet in web pages.
3. Creating interactive and dynamic web pages with JavaScript: JavaScript overview; constants, variables, operators, expressions & statements; user-defined & built-in functions; client-side form validation; using properties and methods of built-in objects.
4. Extensible Markup Language (XML): Introduction- using user-defined tags in web pages; displaying XML contents; XML DTDs; use of XSL.
5. Server-side scripting: overview of CGI, ASP, and JSP.
6. Server side scripting using PHP; PHP basics, HTML form data handling, Web database connectivity- introduction to ODBC; PHP with database connectivity.
7. Exposure to Advanced Web Technologies (as far as possible; not to be made compulsory): Distributed Object based models- DCOM, CORBA, EJB; Web services and Related Technologies- ISAPI, SOAP, UDDI, WSDL; Other Advanced Web Technologies- AJAX, ISAPI, .NET. Web Security.

Text Book:

1. *Web Technologies,* Godbole and Kahate, 3rd Edition, 2017, McGraw Hill Education.

Reference Books:

1. Kogent Learning Solutions Inc., *Web Technologies: HTML, Javascript, PHP, Java, JSP, XML and AJAX, Black Book*, 1st Edition, 2009, Dreamtech Press.
2. Uttam K. Roy, *Web Technologies*, 1st Edition, 2010, Oxford.
3. N. P. Gopalan and J. Akilandeswari, *Web Technology: A Developer's Perspective*, 2nd Edition, 2014, Prentice-Hall of India Pvt. Ltd.
4. Jackson, *Web Technologies: A Computer Science Perspective*, 1st Edition, 2007, Pearson Education India.

Facilitating the Achievement of Course Learning Outcomes

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
•Learn web page designing in detail using various client side and server side scripting. •Learn CSS. •Understand the development of XML documents. Know about AJAX	i) Familiarization with essential tools , language and software has been inducted ii) Related concept are discussed before each practical iii) student are encourage to take up real problem and solve in group iv) Case study and its practical implementation is a part of the curriculum v) Students to be encouraged to take up software development in related fields	(a) Participation in Practical Assignments (b)Continuous Evaluation(30Marks) (i)15 marks on ⯀ Lab Assignments ⯀ viva-voce (ii) Skill Test crries:10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.

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Objective:

The objectives of the course are:
● To enhance communication skills by giving adequate exposure in Non-verbal communication, conversation skills, group discussions and other related skills.

Prerequisites: Basic awareness of tools of communication.

Detailed Syllabus:

Modules	Topics	Course content	Hours
I	**Non-verbal Communication**	Kinesic Communication, Characteristics of non-verbal communication, Classification of non-verbal communication (Ekman's classification of communicative movements, face facts, positive genres, negative genres, lateral genres, Responding to power posturing, Guidelines for developing non-verbal communication, Communication breakdown	8
II	**Conversations, Dialogues and Debates**	Purpose of general conversation (Tips and features of good conversation), Short conversations, Telephonic skills, Situational Dialogues and Role plays	11
III	**CVs, Personal Interviews and Group Discussions**	Applying for jobs, Writing a CV, The relationship between a Resume and an Application Letter, Guidelines for preparing a good CV, Guidelines for preparing a good application letter, Interviews, Group Discussion – Practical	14
IV	**Developing Reading Skills**	Introduction, Purpose of reading, Soft skills for reading, Reading Comprehension: types of texts, Reading Practice	6
		Total	**39**

Text Books:

1. *Business Communication: Concepts, Cases and Applications*, Chaturvedi, P.D. and Chaturvedi, Mukesh, 2nd Edition, 2011, Dorling Kindersley (India)Pvt. Ltd, pp: 99-108, 217-230

Reference Books:

1. Kumar, Sanjay and Lata, Pushp, *Communication Skills: A Workbook,* 1st Edition, Oxford University Press, pp: 329-348.

Facilitating the Achievement of Course Learning Outcomes

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
Have a sound knowledge of non-verbal communication and develop skills like Conversation, Group discussions and Reading skills	i) Each topic to be expounded with adequate examples. ii) Class discussions and question-answer rounds are encouraged iii) theoretical problems solving is part of the class to grasp the underlying concepts iv) Students have to go through case studies for real time experience v) Students to be encouraged to give short presentations.	(a) Participation in class discussions (b)Continuous Evaluation(30Marks) (i)15 marks on ⬚ Assignments ⬚ Class tests. ⬚ viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.

10. Detailed Syllabus of Department Specific Electives

ELECTIVE-I

Paper VII/Subject Name: Data Science using R	Subject Code: CAP054D401
L-T-P-C – 3-1-0-4 **Credit Units: 04**	**Scheme of Evaluation: T**

Objective:

The objectives of the course are:

- To introduce the mathematical foundations required for data science.
- To explain the first level data science algorithms and a data analytics problem solving framework
- To introduce a practical capstone case study
- To teach R and Python as a tool for Data Analytics technique

Prerequisites: Basic concepts of Mathematics, Computer Programming, Data Structures and Databases

Detailed Syllabus:

Modules	Topics	Course content	Periods
I	**Introduction**	Introduction to Data Science , Data Analytics, Big Data ,Areas and Application of Data Sciences, Mathematical foundation of Data Science , descriptive statistics, notion of probability, distributions, mean, variance, covariance, covariance matrix, understanding univariate and multivariate normal distributions, introduction to hypothesis testing, confidence interval for estimates ,Statistical Inference:, Introduction to R and Python : Import –Export functions, DPLYR functions , Data Visualization .	**12**
II	**Algorithms for Data Sciences**	Introduction to machine learning, Linear regression and regularization, Model selection and evaluation, Classification: kNN, decision trees, Classification: SVM, Ensemble methods: random forests, Intro to probability: Naïve Bayes and logistic regression, Clustering: k-means, hierarchical clustering	**12**
III	**Recommendation Systems**	Algorithms for Recommendation Engine, Dimensionality Reduction, Singular Value Decomposition, Principal Component Analysis , Case Study	**12**
IV	**Information retrieval and Data Visualization**	Text mining and information retrieval :Mining Social-Network Graphs, Social networks as graphs, Clustering of graphs, Direct discovery of communities in graphs ,Partitioning of graphs, Neighbourhood properties in graphs ,Data Visualization, Basic principles, ideas and tools for data visualization	**12**
	Total		**48**

Text Book:

1. *Doing Data Science, Straight Talk From The Frontline*, Cathy O'Neil and Rachel Schutt, 1st Edition, 2014, O'Reilly

Reference Books:

1. James, G., Witten, D., Hastie, T., Tibshirani, R., *An introduction to statistical learning with applications in R,* 7th Edition, 2014, Springer.
2. Murphy, K, *Machine Learning, A Probabilistic Perspective,* 2012, MIT Press.
3. Mohammed J. Zaki and Wagner Miera Jr., *Data Mining and Analysis: Fundamental Concepts and Algorithms*, 1st Edition, 2014, Cambridge University Press.

Facilitating the Achievement of Course Learning Outcomes

Course Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
On completion of this course the students will be expected to: • Identify a flow process for data science problems • Classify data science	• Each topic to be explained with examples. • Students to be motivated to discover the relevant concepts to take part in discussions and ask	• Participation in class discussions • Continuous Evaluation(30Marks) (i)15 marks on

problems into standard typology • Develop R or Python codes for data science solutions • Correlate results to the solution approach • Assess the solution approach and Construct use cases to validate approach and identify modifications required	questions. • Students to be given homework/assignments to make their concept clear. • Discuss and solve the problems in the class.	Assignments, class tests, viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance:5 marks End-term examinations:70 marks.

Paper VII/Subject Name: Distributed Systems		Subject Code: CAP054D102
L-T-P-C – 3-1-0-4	**Credit Units: 04**	**Scheme of Evaluation: T**

Objective:

The objectives of the course are:

- To give students an introduction to the characteristics of distributed systems.
- To provide an exposure to processor arrays and multiprocessor multi-computers
- To impart the idea of the distributed architectures, examples of DS and also difference between parallel computing and distributed computing.
- To give students the understanding of transaction processing in distributed manner.

Prerequisites: Concepts of Computer Communication Networks

Detailed Syllabus:

Modules	Topics	Course content	Periods
I	**Introduction to Distributed Systems, Processor Arrays and Multi-Computers**	Computational Demand of Modern Science, Parallel Processing Terminology – Contrasting Pipelining and Data Parallelism, Control Parallelism Scalability, Control-Parallel Approach, Data Parallel Approach Data-Parallel Approach with I/O. Processor Organization, Processor Arrays, Multiprocessors, Multi-computers, Flynn's Taxonomy, Speedup, Scaled Speedup, Parallelizability, Problems Defying Fast Solutions on PRAMS.	12
II	**Distributed Systems and Deadlock**	Examples of Distributed Systems, Difference between Parallel and Distributed systems, Resource Sharing and the Web, Architectural, Models, Fundamental Models, Limitation of Distributed system, Absence of Global Clock, Shared Memory, Logical clocks, Lamport's& Vectors Logical locks.	12

		Deadlock, System Model, Resource Vs Communication Deadlocks, Deadlock Prevention, Avoidance, Detection & Resolution, Centralized Dead Lock Detection, Distributed Dead Lock Detection, Path Pushing Algorithms, Edge Chasing Algorithms.	
III	**Agreement Protocols**	Classification of Agreement Problem, Byzantine Agreement Problem, Consensus Problem, Interactive Consistency Problem, Solution to Byzantine Agreement Problem, Application of Agreement Problem, Atomic Commit in Distributed Database System., Design Issues in Distributed Shared Memory, Algorithm for Implementation of Distributed Shared Memory	**16**
IV	**Distributed Transaction And Recent Research Trends**	Flat and Nested Distributed Transactions, Atomic Commit Protocols, Concurrency Control in Distributed Transactions, Distributed Deadlocks, Transaction Recovery, Replication: Group Communication Fault - Tolerant Services, Highly Available Services, Transactions with Replicated Data, Topics on Recent Research Trends.	**8**
		Total	**48**

Text Book:

1. *Distributed System: Concepts and Design,*Coulouris, Dollimore, Kindberg, 5th Edition, 2011, Pearson Education.

Reference Books:

1. Tanenbaum, A. S, *Distributed Systems Principles and Paradigms,* 2nd Edition, 2015, PHI.

Facilitating the Achievement of Course Learning Outcomes

Course Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
On completion of this course the students will be expected to: • Identify the advantages and challenges in designing distributed algorithms for different primitives like mutual exclusion, deadlock detection, agreement, etc. • Design and develop distributed programs using sockets and RPC/RMI. • Differentiate between different types of faults and fault handling techniques in order to implement fault tolerant systems. • Analyze different algorithms and techniques for the design and development of distributed systems subject to specific design and performance constraints.	• Each topic to be explained with examples. • Students to be motivated to discover the relevant concepts to take part in discussions and ask questions. • Students to be given homework/assignments to make their concept clear. • Discuss and solve the problems in the class.	• Participation in class discussions • Continuous Evaluation(30Marks) (i)15 marks on Assignments, class tests, viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance:5 marks End-term examinations:70 marks.

Objective:

The objectives of the course are:

- To provide the student with knowledge of various levels of analysis involved in NLP.
- To understand language modeling,
- To gain knowledge in automated natural language generation and machine translation

Prerequisites: Concepts of Automata Theory

Detailed Syllabus:

Modules	Topics	Course Contents	Hours
I	**Overview and Language Modeling**	Overview: Origins and challenges of NLP-Language and Grammar-Processing Indian Languages-NLP Applications-Information Retrieval. Language Modeling: Introduction-Various Grammar-based Language Models-Statistical Language Model	9
II	**Word Level, Syntactic and Semantic Analysis**	Word Level Analysis: Introduction- Regular Expressions-Finite-State Automata-Morphological Parsing-Spelling Error Detection and correction-Words and Word classes-Part-of Speech Tagging. Syntactic Analysis: Introduction-Context-free Grammar-ConstituencyParsing-Probabilistic Parsing Semantic Analysis: Introduction- Meaning Representation-Lexical SemanticsAmbiguity-Word Sense Disambiguation. Discourse Processing: Introduction- cohesion-Reference ResolutionDiscourse Coherence and Structure	9
III	**Natural Language Generation and Machine Translation**	Natural Language Generation: Introduction-Architecture of NLG SystemsGeneration Tasks and Representations-Application of NLG. Machine Translation: Introduction-Problems in Machine TranslationCharacteristics of Indian Languages- Machine Translation Approaches-Translation involving Indian Languages	9
IV	**Information Retrieval and Lexical Resources**	Information Retrieval: Introduction-Design features of Information Retrieval Systems-Classical, Non-classical, Alternative Models of Information Retrieval - Evaluation Lexical Resources: Introduction-WordNet-FrameNet-Stemmers-POS TaggerResearch Corpora	9
TOTAL			36

Text Books:

1. *Natural Language Processing and Information Retrieval*, Tanveer Siddiqui, U.S. Tiwary, 1st Edition, 2008, Oxford University Press

Reference Books:

1. Daniel Jurafsky and James H Martin, *Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition*, 2nd Edition, 2008, Prentice Hall.
2. James Allen, Bejamin Cummings, *Natural Language Understanding*, 2nd Edition, 1995, Pearson.

Facilitating the Achievement of Course Learning Outcomes

Course Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
On completion of this course the students will be expected to: • Appreciate the fundamental concepts of Natural Language Processing. • Design algorithms for NLP tasks. • Develop useful systems for language processing and related tasks involving text processing	• Each topic to be explained with examples. • Students to be motivated to discover the relevant concepts to take part in discussions and ask questions. • Students to be given homework/assignments to make their concept clear. • Discuss and solve the problems in the class.	• Participation in class discussions • Continuous Evaluation(30Marks) (i)15 marks on Assignments, class tests, viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance:5 marks End-term examinations:70 marks.

Paper VII/Subject Name: Neural Networks and Fuzzy Logic	Subject Code: CAP054D104
L-T-P-C – 4-0-0-4 Credit Units: 04	Scheme of Evaluation: T

Objective:

The objectives of the course are:

● To teach the concepts of artificial neural networks

- To explain the basic theory and algorithm formulation of Fuzzy logic.
- To describe real world problems

Prerequisites: Concepts of Artificial Intelligence and Mathematics

Detailed Syllabus:

Modules	Topics	Course content	Periods
I	**Introduction**	Biological neurons and McCulloch and Pitts models of neuron, Types of activation functions, Neural networks architectures, Linearly separable and linearly non-separable systems and their examples, Features and advantages of neural networks over statistical techniques, Knowledge representation, learning process, error-correction learning, concepts of supervised learning, and unsupervised learning, Applications of Neural Networks	12
II	**Supervised and Unsupervised Learning Neural Networks**	Single layer perception and multilayer perceptron neural networks, their architecture, Error back propagation algorithm, generalized delta rule, learning factors, step learning, Momentum learning, Concept of training, testing and cross-validation data sets for design and validation of the networks.

Competitive earning networks, kohonen self-organizing networks, K-means and LMS algorithms, RBF neural network, its structure and Hybrid training algorithm for RBF neural networks, Comparison of RBF and MLP networks Learning, Vector Quantization neural network architecture and its training algorithm, Hebbian learning, Hopfield networks. | 12 |
III	**Fuzzy Logic**	Basic Fuzzy logic theory, sets and their properties, Operations on fuzzy sets, Fuzzy relation and operations on fuzzy relations and extension principle, Fuzzy membership functions and linguistic variables, Fuzzy rules and fuzzy reasoning, Fuzzification and defuzzification and their methods, Fuzzy inference systems, Mamdani Fuzzy models, and Fuzzy knowledge based controllers	12
IV	**Applications of Fuzzy Logic and Fuzzy Systems**	Fuzzy pattern recognition, Fuzzy image processing, Simple applications of Fuzzy knowledge based controllers like washing machines, traffic regulations, and lift control	12
	Total		48

Text Books:

1. *Neural Networks, Fuzzy Logic, and Genetic Algorithms,*Rajsekaran and G. A. Vijaylakshmi Pai,1st Edition, 2003, PHI
2. *Neural Network- A Comprehensive Foundation,* Simon Haykin, 2nd Edition, 9th Reprint, 2005, Pearson Education

Reference Books:

1. Timothy J. Ross, *Fuzzy Logic with Engineering Applications*, 3rd Edition, 2010, Wiley India Publications
2. Laurence Fausett, *Fundamentals of Neural Networks*, 1st Edition, 2004, Pearson Education
3. S. N. Sivanandam, S. Sumathi, and S. N. Deepa, *Introduction to Neural Network Using MATLAB*, 1ST Edition, 2012, Tata McGraw-Hill Publications

Facilitating the Achievement of Course Learning Outcomes

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
•Know about different neural networks, their architecture and training algorithm. •Learn the concept of Fuzzy logic, Fuzzy Sets, fuzzy rules and fuzzy reasoning •Get exposed to the applicability of neural networks and fuzzy logic	i) Each topic to be expounded with adequate examples. ii) Class discussions and question- answer rounds are encouraged iii) theoretical problems solving is part of the class to grasp the underlying concepts iv) Students have to go through case studies for real time experience v) Students to be encouraged to give short presentations.	(a) Participation in class discussions (b)Continuous Evaluation(30Marks) (i)15 marks on ⬚ Assignments ⬚ Class tests. ⬚ viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.

ELECTIVE-II

Paper VII/Subject Name: Bioinformatics		Subject Code: CAP054D201
L-T-P-C – 4-0-0-4	**Credit Units: 04**	**Scheme of Evaluation: T**

Objective:

The objectives of the course are:

- To improve the programming skills of the student.
- To let the students know the recent evolution in biological science

Prerequisites: Fundamentals of Databases and Data Mining

Detailed Syllabus:

Modules	Topics	Course content	Periods
I	**Introduction to Bioinformatics and Computational Biology**	Biological sequences, Biological databases, Genome specific databases, Data file formats, Data life cycle, Database management system models, Basics of Structured Query Language (SQL).	**12**
II	**Dynamic Programming Algorithms**	Sequence Analysis, Pairwise alignment, Dynamic programming algorithms for computing edit distance, string similarity, shotgun DNA sequencing, end space free alignment. Multiple sequence alignment, Algorithms for Multiple sequence alignment, Generating motifs and profiles, Local and Global alignment, Needleman and Wunsch	**12**

		algorithm, Smith Waterman algorithm, BLAST, PSIBLAST and PHIBLAST algorithms.	
III	**Phylogenetics**	Introduction to phylogenetics, Distance based trees UPGMA trees, Molecular clock theory, Ultrametric trees, Parsimonious trees, Neighbour joining trees, trees based on morphological traits, Bootstrapping. Protein Secondary structure and tertiary structure prediction methods, Homology modeling, abinitio approaches, Threading, Critical Assessment of Structure Prediction, Structural genomics.	**12**
IV	**Machine Learning Techniques**	Machine learning techniques: Artificial Neural Networks in protein secondary structure prediction, Hidden Markov Models for gene finding, Decision trees, Support Vector Machines. Introduction to Systems Biology and Synthetic Biology, Microarray analysis, DNA computing, Bioinformatics approaches for drug discovery, Applications of informatics techniques in genomics and proteomics: Assembling the genome, STS content mapping for clone contigs,Functional annotation, Peptide massFingerprinting	**12**
		Total	**48**

Text Book:
1. *Introduction to Bioinformatics*, Lesk, A. K., 4th Edition, 2013, Oxford University Press.
2. *Algorithms on Strings, Trees and Sequences: Computer Science and Computational Biology*, Gusfield, Dan, Cambridge University Press.

Reference Books:

1. Baldi, P, Brunak, S.; *Bioinformatics: The Machine Learning Approach*, 2nd Edition, 2001, MIT Press

Facilitating the Achievement of Course Learning Outcomes

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
•Develop bioinformatics tools with programming skills. •Apply computational based solutions for biological perspectives. •Practice life-long learning of applied biological science	i) Each topic to be expounded with adequate examples. ii) Class discussions and question- answer rounds are encouraged iii) theoretical problems solving is part of the class to grasp the underlying concepts iv) Students have to go through case studies for real time experience v) Students to be encouraged to give short presentations.	(a) Participation in class discussions (b)Continuous Evaluation(30Marks) (i)15 marks on ⬚ Assignments ⬚ Class tests. ⬚ viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.

Paper VII/Subject Name: Wireless Computing	**Subject Code: CAP054D202**
L-T-P-C – 3-1-0-4	**Credit Units: 04**　**Scheme of Evaluation: T**

Objective:

The objectives of the course are:

- To make the students understand the basic concepts of mobile computing.
- To make them familiar with the network protocol stack.
- To explain the basics of mobile telecommunication system.
- To provide an exposure to Ad-Hoc networks.
- To impart knowledge about different mobile platforms and application development

Prerequisites: Concepts of Computer Networks

Detailed Syllabus:

Modules	Topics	Course content	Periods
I	**Introduction**	Mobile Computing – Mobile Computing Vs wireless Networking – Mobile Computing Applications – Characteristics of Mobile computing – Structure of Mobile Computing Application. MAC Protocols – Wireless MAC Issues – Fixed Assignment Schemes – Random Assignment Schemes – Reservation Based Schemes.	12
II	**Mobile Internet Protocol & Transport**	Overview of Mobile IP – Features of Mobile IP – Key Mechanism in Mobile IP route Optimisation. Overview of TCP/IP – Architecture of TCP/IP- Adaptation of tCP Window-Improvement in TCP Performance.	12
III	**Mobile Tele-communication**	Global System for Mobile Communication (GSM) – General Packet Radio Service (GPRS) – Universal Mobile Telecommunication System (UMTS).	8
IV	**Mobile AD-Hoc Networks, Mobile Platforms & Applications**	Ad-Hoc Basic Concepts – Characteristics – Applications – Design Issues – Routing – Essential of Traditional Routing Protocols – Popular Routing Protocols – Vehicular Ad Hoc networks (VANET) – MANET Vs VANET – Security.Mobile Device Operating Systems – Special Constrains & Requirements – Commercial Mobile Operating Systems – Software Development Kit: iOS, Android, BlackBerry, Windows Phone – MCommerce – Structure – Pros & Cons – Mobile Payment System – Security Issues.	16
		Total	**48**

Text Book:

1. *Wireless Network and Mobile Computing,* Koushik Sinha, Sasthi C Ghosh, Bhabani P. Sinha, 1st Edition, 2016, CRC Press
2. *Introduction to Wireless and Mobile Technology,* Dharma Prakash Agarval, Qing and An Zeng, 2nd Edition, 2006, Pearson Education

Reference Books:

1. Uwe Hansmann, Lothar Merk, Martin S. Nicklons and Thomas Stober, *Principles of Mobile Computing,* 2nd Edition, 2002, Springer
2. C.K.Toh, *Ad-hoc Mobile Wireless Networks,* 1st Edition, 2015, Pearson Education.

Facilitating the Achievement of Course Learning Outcomes

Course Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
On completion of this course the students will be expected to: • Understand the basic concepts of mobile computing and the network protocol stack. • Learn the basics of mobile telecommunication system and Ad-Hoc networks. • Gain knowledge about different mobile platforms and application development	• Each topic to be explained with examples. • Students to be motivated to discover the relevant concepts to take part in discussions and ask questions. • Students to be given homework/assignments to make their concept clear. • Discuss and solve the problems in the class.	• Participation in class discussions • Continuous Evaluation(30Marks) (i)15 marks on Assignments, class tests, viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance:5 marks End-term examinations:70 marks.

Paper VII/Subject Name: Soft Computing		Subject Code: CAP05D203
L-T-P-C – 4-0-0-4	**Credit Units: 04**	**Scheme of Evaluation: T**

The objectives of the course are:

- To make the students understand the basics of soft computing and fuzzy logic
- To give an idea of artificial neural networks and its applications
- To explain genetic algorithms with example
- Introduction to Rough set and understand different soft computing tools to solve real life problems.

Prerequisites: Basics of Digital Logic and Artificial Intelligence

Detailed Syllabus:

Modules	Topics	Course content	Periods
I	**Soft Computing and Fuzzy Logic**	Introduction- Overview of Soft Computing, Difference between Soft and Hard computing, Brief descriptions of different components of soft computing including Artificial intelligence systems Neural networks, fuzzy logic, genetic algorithms. Fuzzy sets and Fuzzy logic: Introduction, Fuzzy sets versus crisp sets, operations on fuzzy sets, Extension principle, Fuzzy relations and relation equations, Fuzzy numbers, Linguistic variables, Fuzzy logic, Linguistic hedges, Applications, fuzzy controllers, fuzzy pattern recognition, fuzzy image processing, fuzzy database.	**12**
II	**Artificial Neural Network**	Artificial Neural Network: Introduction, basic models, Hebb's learning, Adaline, Perceptron, Multilayer feed forward network, Back propagation, Different issues regarding convergence of Multilayer Perceptron, Competitive learning, Self-Organizing Feature Maps, Adaptive Resonance Theory, Associative Memories, Applications.	**12**
III	**Genetic Algorithm**	Evolutionary and Stochastic techniques: Genetic Algorithm (GA), different operators of GA, analysis of selection operations, Hypothesis of building blocks, Schema theorem and convergence of Genetic Algorithm, Simulated annealing and Stochastic models, Boltzmann Machine, Applications.	**12**
IV	**Rough Set**	Rough Set: Introduction, Imprecise Categories Approximations and Rough Sets, Reduction of Knowledge, Decision Tables, and Applications.	**12**
Total			**48**

Text Books:

1. *Neural Fuzzy Systems*, Chin-Teng Lin & C. S. George Lee, Prentice Hall PTR.
2. *Fuzzy Sets and Fuzzy Logic,* Klir & Yuan, PHI, 1997.
3. *Neural Networks,* S. Haykin, Pearson Education, 2ed, 2001.
4. *Genetic Algorithms in Search and Optimization, and Machine Learning*, D. E. Goldberg, Addison-Wesley, 1989.

Reference Books:

1. Jang, Sun, & Mizutani*, Neuro-Fuzzy and Soft Computing*, PHI.
2. , V. Kecman, *Learning and Soft Computing,* MIT Press, 2001.
3. Z. Pawlak, *Rough Sets*, Kluwer Academic Publisher, 1991.

Facilitating the Achievement of Course Learning Outcomes

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
• Discuss the ideas of fuzzy sets, fuzzy logic and use of heuristics based on human experience • Relate with neural networks that can learn from available examples and generalize to form appropriate rules for inference systems • Describe with genetic algorithms and other random search procedures useful while seeking global optimum in self-learning situations • Develop some familiarity with current research problems and research methods in Soft Computing Techniques.	i) Each topic to be expounded with adequate examples. ii) Class discussions and question- answer rounds are encouraged iii) theoretical problems solving is part of the class to grasp the underlying concepts iv) Students have to go through case studies for real time experience v) Students to be encouraged to give short presentations.	(a) Participation in class discussions (b)Continuous Evaluation(30Marks) (i)15 marks on ⬚ Assignments ⬚ Class tests. ⬚ viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.

Paper VI/Subject Name: Artificial Intelligence		Subject Code: CAP054D301
L-T-P-C – 4-0-0-4	Credit Units: 04	Scheme of Evaluation: T

Objective:

The objectives of the course are:

- To present an overview of artificial intelligence (AI) principles and approaches.
- To provide a basic understanding of the building blocks of AI as presented in terms of intelligent agents: Search, Knowledge representation, inference, logic, and learning.

Prerequisites: None

Detailed Syllabus:

Modules	Topics	Course content	Periods
I	**Introduction and Informed Search Strategies**	What is intelligence? Foundations of artificial intelligence (AI). History of AI; Problem Solving- Formulating problems, problem types, states and operators, state space, search strategies. Best first search, A* algorithm, heuristic functions, Iterative deepening A*(IDA), small memory A*(SMA); Game playing - Perfect decision game, imperfect decision game, evaluation function, alpha-beta pruning	12
II	**Reasoning and Planning**	Representation, Inference, Propositional Logic, predicate logic (first order logic), logical reasoning, forward chaining, backward chaining; AI languages and tools - Lisp, Prolog, CLIPS Basic representation of plans, partial order planning, planning in the blocks world, hierarchical planning, conditional planning, representation of resource constraints, measures, temporal constraints	12
III	**Uncertainty and Inductive Learning**	Basic probability, Bayes rule, Belief networks, Default reasoning, Fuzzy sets and fuzzy logic; Decision making- Utility theory, utility functions, Decision theoretic expert	20

		systems.	
		Decision trees, rule based learning, current-best-hypothesis search, least-commitment search , neural networks, reinforcement learning, genetic algorithms; Other learning methods - neural networks, reinforcement learning, genetic algorithms.	
IV	**Communication**	Communication among agents, natural language processing, formal grammar, parsing, grammar	**4**
		Total	**48**

Text Book:
1. *Artificial Intelligence – A Modern Approach,* Stuart Russell and Peter Norvig, 3rd Edition, 2009, Pearson Education Press
2. *Artificial Intelligence,* Kevin Knight, Elaine Rich, B. Nair, 3rd Edition, 2008, McGraw Hill

Reference Books:

1. George F. Luger, *Artificial Intelligence,* 6th Edition, 2009, Pearson Education
2. Nils J. Nilsson, *Artificial Intelligence: A New Synthesis,* 1st Edition, Morgan Kauffman

Facilitating the Achievement of Course Learning Outcomes

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
•Understand the building blocks of AI as presented in terms of intelligent agents: Search, Knowledge representation, inference, logic, and learning. •Have read and analyzed important historical and current trends addressing artificial intelligence.	i) Each topic to be expounded with adequate examples. ii) Class discussions and question- answer rounds are encouraged iii) theoretical problems solving is part of the class to grasp the underlying concepts iv) Students have to go through case studies for real time experience v) Students to be encouraged to give short presentations.	(a) Participation in class discussions (b)Continuous Evaluation(30Marks) (i)15 marks on ⬚ Assignments ⬚ Class tests. ⬚ viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.

Paper VI/Subject Name: Big Data Analytics		Subject Code: CAP054D302
L-T-P-C – 4-0-0-4	Credit Units: 04	Scheme of Evaluation: T

Objective:

The objectives of the course are:

- To give students an exposure to Apache Hadoop Architecture and Ecosystem.
- To provide concepts on HDFS and Map reduce.
- To explain querying data using Hive and Pig.
- To expose students to Real Time Databases using HBase.

Prerequisites: Concepts of Databases.

Detailed Syllabus:

Modules	Topics	Course content	Periods
I	**Overview**	Challenges to conventional database systems, Big Data Attributes, Operational and Analytical Big Data, Divers of Big Data, Data Structures, Big Data Ecosystems, Categories, 3V/ 4V models of Big Data, Applications of Big Data, Challenges of Big Data, Big Data Security, Big Data Generalization, and Acquisition	9
II	**Trends of Computing**	Big Data Computing Paradigm, High Performance Computing, Supercomputers, Clusters, Grid Computing, Cloud Computing, Mobile Computing, Big Data Mining, Big Data Storage Techniques.	9
III	**Big Data Tools, Techniques and Systems**	Introduction to Hadoop, Architecture and Foundation of Hadoop, HDFS, MapReduce, Framework of MapReduce, Processing of Data using MapReduce, Testing and Debugging MapReduce Application, Users of MapReduce, YARN, HBASE, HIVE, Pig, Sqoop, Zookeeper, Oozie	7
IV	**Big Data Models**	SaaS, IaaS, PaaS, IoT and Big Data, Future of Bi Data Paradigm	11
Total			**48**

Text Book:
1. *Big Data Analytics with R and Hadoop,* VigneshPrajapati, 1st Edition, 2013, Packet Publishing.

Reference Books:
1. Benjamin Bengfort and Jenny Kim;,*Big Data Analytics with Hadoop: An Introduction for Data Scientists;,* 1st Edition, 2016, O'Reilly Media.

Facilitating the Achievement of Course Learning Outcomes

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
•Identify Big Data and its Business Implications. •List the components of Hadoop and Hadoop Eco-System. •Access and Process Data on Distributed File System. •Manage Job Execution in Hadoop Environment. •Develop Big Data Solutions using Hadoop Eco System. •Apply Machine Learning Techniques using R.	i) Each topic to be expounded with adequate examples. ii) Class discussions and question- answer rounds are encouraged iii) theoretical problems solving is part of the class to grasp the underlying concepts iv) Students have to go through case studies for real time experience v) Students to be encouraged to give short presentations.	(a) Participation in class discussions (b)Continuous Evaluation(30Marks) (i)15 marks on ⬛ Assignments ⬛ Class tests. ⬛ viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.

ELECTIVE-IV

Objective:

The objectives of the course are:

- To introduce the students the broad perceptive of cloud architectural model and the concept of Virtualization.
- To make students familiar with the lead players in cloud and understand the features of cloud simulator.
- To give students the concepts on applying different cloud programming model as per need and make them able to set up a private cloud.
- To make students understand the design of cloud Services and trusted cloud Computing system.

Prerequisites: Concepts of Networking and Distributed Systems

Detailed Syllabus:

Modules	Topics	Course content	Periods
I	**Cloud Architecture and Model**	Technologies for Network-Based System, System Models for Distributed and Cloud Computing, NIST Cloud Computing Reference Architecture. Cloud Models- Characteristics, Cloud Services, Cloud models (IaaS, PaaS, SaaS), Public vs Private Cloud, Cloud Solutions, Cloud ecosystem, Service management, Computing on demand.	**12**
II	**Virtualization**	Basics of Virtualization, Types of Virtualization, Implementation Levels of Virtualization, Virtualization Structures, Tools and Mechanisms, Virtualization of CPU, Memory, I/O Devices, Virtual Clusters and Resource management, Virtualization for Data-center Automation.	**12**
III	**Cloud Infrastructure and Programming Model**	Cloud Infrastructure- Architectural Design of Compute and Storage Clouds, Layered Cloud Architecture Development, Design Challenges, Inter Cloud Resource Management, Resource Provisioning and Platform Deployment, Global Exchange of Cloud Resources.	**12**
		Programming Model- Parallel and Distributed Programming Paradigms, MapReduce, Twister and Iterative MapReduce, Hadoop Library from Apache, Mapping Applications, Programming Support, Google App Engine, Amazon AWS, Cloud Software Environments, Eucalyptus, Open Nebula,	

		OpenStack, Aneka, CloudSim.	
IV	**Security in The Cloud And Recent Research Trends**	Security Overview, Cloud Security Challenges and Risks, Software-as-a-Service Security, Security Governance, Risk Management, Security Monitoring, Security Architecture Design, Data Security, Application Security, Virtual Machine Security, Identity Management and Access Control, Autonomic Security.Topics on Recent Research Trends.	12
		Total	**48**

Text Book:

1. *Distributed and Cloud Computing, From Parallel Processing to the Internet of Things,* Kai Hwang, Geoffrey C Fox, Jack G Dongarra, 1st Edition, 2011, Morgan Kaufmann Publishers.

Reference Books:

1. Toby Velte, Anthony Velte and Robert Elsenpeter, *Cloud Computing, A Practical Approach,* 1st Edition, 2009, Tata McGraw Hill.

Facilitating the Achievement of Course Learning Outcomes

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
•Understand the fundamental principles of distributed computing •Understand the importance of virtualization in distributed computing and how this has enabled the development of Cloud Computing •Understand the business models that underlie Cloud Computing. •Understand concepts of IAAS, SASS, PAAS	i) Each topic to be expounded with adequate examples. ii) Class discussions and question- answer rounds are encouraged iii) theoretical problems solving is part of the class to grasp the underlying concepts iv) Students have to go through case studies for real time experience v) Students to be encouraged to give short presentations.	(a) Participation in class discussions (b)Continuous Evaluation(30Marks) (i)15 marks on ☐ Assignments ☐ Class tests. ☐ viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.

Paper VII/Subject Name: Cyber Forensics	**Subject Code: CAP054D304**

L-T-P-C – 3-1-0-4　　　　　　　　**Credit Units: 04**　　　　　　　**Scheme of Evaluation: T**

Objective:

The objectives of the course are:

- To provide an understanding Computer forensics fundamentals.
- To explain various computer forensics technologies.
- To provide an understanding of the computer forensics systems.
- To teach methods for data recovery.
- To explain the methods for preservation of digital evidence.

Prerequisites: Fundamentals of Networking and Cryptography.

Detailed Syllabus:

Modules	Topics	Course content	Periods
I	**Computer Forensics Fundamentals**	Introduction to Computer Forensics, Use of Computer Forensics in Law Enforcement, Computer Forensics Assistance to Human Resources/Employment Proceedings, Computer Forensics Services, Benefits of Professional Forensics Methodology.	**7**
II	**Forensics Technologies**	Types of Military Computer Forensic Technology, Types of Law Enforcement: Computer Forensic Technology, Types of Business Computer Forensic Technology, Specialized Forensics Techniques, Hidden Data and How to Find It, Spyware and Adware. Encryption Methods and Vulnerabilities ,Protecting Data from Being Compromised ,Internet Tracing Methods ,Security and Wireless Technologies ,Avoiding Pitfalls with Firewalls ,Biometric Security Systems.	**7**
III	**Forensics Systems**	Internet Security Systems, Intrusion Detection Systems, Firewall Security Systems, Storage Area Network Security Systems, Network Disaster Recovery Systems, Public Key Infrastructure Systems, Wireless Network Security Systems. Satellite Encryption Security Systems, Instant Messaging (IM) Security Systems, Net Privacy Systems, Identity Management Security	**7**
IV	**Data Recovery, Evidence Collection and Data Seizure, Duplication and Preservation of Digital Evidence**	Data Recovery Defined ,Data Backup and Recovery ,The Role of Backup in Data Recovery ,The Data-Recovery Solution ,Hiding and Recovering Hidden Data Why Collect Evidence?, Collection Options ,Obstacles ,Types of Evidence ,The Rules of Evidence ,Volatile Evidence ,General Procedure Collection and Archiving, Methods of Collection, Artifacts. Preserving the Digital Crime Scene, Computer Evidence Processing Step.Computer Image Verification and AuthenticationSpecial Needs of Evidential Authentication, Practical Considerations	**15**
		Total	**36**

Text Book:

1. *Computer Forensics and Investigations*, Nelson, Phillips, Enfinger, Steuart, 3rd Edition, 2008, Cengage Learning, India Edition.
2. *Computer Forensics: Computer Crime Scene Investigation,* John R. Vacca, 2nd Edition, 2005, Charles, River Media.

Reference Books:

1. John R.Vacca, *Computer Forensics,* 3rd Edition, 2005, Cengage Learning
2. Richard E.Smith, *Internet Cryptography*, 3rd Edition, 2008, Pearson Education, 2008.
3. Marjie T.Britz, *Computer Forensics and Cyber Crime: An Introduction*, 3rd Edition, 2013, Prentice Hal,.
4. ChristofPaar, Jan Pelzl, *Understanding Cryptography: A Textbook for Students and Practitioners,* 2nd Edition, 2010, Springer's.

Facilitating the Achievement of Course Learning Outcomes

Course Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
On completion of this course the students will be expected to: • Understand the definition of computer forensics fundamentals. • Describe the types of computer forensics technology. • Analyze various computer forensics systems. • Illustrate the methods for data recovery, evidence collection and data seizure. • Summarize duplication and preservation of digital evidence.	• Each topic to be explained with examples. • Students to be motivated to discover the relevant concepts to take part in discussions and ask questions. • Students to be given homework/assignments to make their concept clear. • Discuss and solve the problems in the class.	• Participation in class discussions • Continuous Evaluation(30Marks) (i)15 marks on Assignments, class tests, viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance:5 marks End-term examinations:70 marks.

Paper VII/Subject Name: Internet of Things		Subject Code: CAP054D305
L-T-P-C – 4-0-0-4	**Credit Units: 04**	**Scheme of Evaluation: T**

Objective:

The objectives of the course are:

- To provide a foundation in computing, communication and information technologies.
- To make student realize the revolution of Internet in Mobile Devices, Sensor Networks and Cloud technology.
- To develop the teamwork skills, multidisciplinary approach, and an ability to relate information technology to overcome real world and social issues.
- To induce students with good computing and communication knowledge so as to understand, analyze, design, and innovate a new system

Prerequisites: Concepts of Computer Networks and Programming Language

Detailed Syllabus:

Modules	Topics	Course content	Periods
I	**Introduction**	Fundamentals of Internet of Things, IoT Definition, Characteristics of IoT, IoT Vision, IoT Functional View, Application Areas,opportunity and challenges in IoT. Domain Specific IOTs: Home Automation, Cities, Environment, Energy, Retail, Logistics ,Agriculture, Industry, Health & Life Style	**9**
II	**IoT Technology Fundamentals**	Architectural overview, Components of IoT system, Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, IoT analytics, Knowledge management.	**9**
III	**Design Principles of IoT**	Design principle for connected devices, IoT system layers and design standardization, Networks and Communication: Networking Technology and Communication Technology, Protocols in IOT, Security, Privacy & Trust in IoT	**9**
IV	**Hands on IoT**	IoT Physical Devices & Endpoints**:** What is an IoT Device, Exemplary Device, Board, Linux on Raspberry Pi, Interfaces, Types of sensors.	**9**
Total			**36**

Text Book:
1. *Internet of Things –From Research and Innovation to market Deployment,* Ovidiu Vermesan,Peter Friess, 2014, River Publishers.
2. *From Machine-to-Machine to the Internet of Things Introduction to a New Age of Intelligence*, Jan Ho¨ller, Vlasios Tsiatsis, Catherine Mulligan, Stamatis Karnouskos, Stefan Avesand, David Boyle, 1st Edition, 2012, Academic Press Elsevier.
3. *Internet of Things (A Hands-on Approach),* Vijay Madisetti and Arshdeep Bahga, 1st Edition, 2014, VPT.

Reference Books:

1. Tim O'Reilly & Cory Doctorow, *Opportunities and Challenges in the IoT*, 2015, O'Reily.

2. Pethuru Raj , Anupama C.Raman, *The Internet of Things, Enabling Technologies,platforms and use cases*, 2017, CRC Press

Facilitating the Achievement of Course Learning Outcomes

Course Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
On completion of this course the students will be expected to: • Show the understanding of impact of information technology solutions on the society. • Understand the application areas of IOT. • Understand building blocks of Internet of Things and characteristics. • Explored to the interconnection and integration of the physical world and the cyber space. • Design & develop IOT Devices.	• Each topic to be explained with examples. • Students to be motivated to discover the relevant concepts to take part in discussions and ask questions. • Students to be given homework/assignments to make their concept clear. • Discuss and solve the problems in the class.	• Participation in class discussions • Continuous Evaluation(30Marks) (i)15 marks on Assignments, class tests, viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance:5 marks End-term examinations:70 marks.

Paper VII/Subject Name: Cryptography and Network Security	**Subject Code: CAP054D306**
L-T-P-C – 3-1-0-4	**Credit Units: 04** **Scheme of Evaluation: T**

Objective:

The objectives of the course are:

- To explain about the various encryption techniques.
- To make the students understand the concept of Public key cryptography.
- To teach about message authentication and hash functions.
- To impart knowledge on Network security.

Prerequisites: Concepts of Number Theory and Networking

Detailed Syllabus:

Modules	Topics	Course content	Periods
I	**Introduction to Conventional Cryptography**	Overview: Services, Mechanisms and Attacks; The OSI security architecture; Security Models. Classical Encryption: Symmetric Cipher Model; Substitution Techniques; Block Ciphers and the Data Encryption Standard; Differential and Linear Cryptanalysis; Block Cipher Design Principles; Block Cipher modes of Operation. Finite Fields: Review of Groups, Rings, Fields and Modular Arithmetic. Review of Number Theory. Confidentiality using Symmetric Encryption.	**9**
II	**Advanced Cryptographic Techniques**	Public Key Cryptography: Principles of Public Key Encryption; the RSA algorithm. Key Management. Message Authentication and Hash Functions: Authentication Requirements, Functions, Message Authentication Codes, Hash Functions, Hash Algorithms. Digital Signature and Authentication Protocols: Digital Signatures; Authentication Protocols; Digital Signature Standard.	**9**
III	**Security Protocols**	Security Applications and Protocols- Authentication Applications: Secure HTTP, SSH, Kerberos. Email Security: PGP, S/MIME. IP Security: Overview, IPSec architecture.	**9**
IV	**Web and System Security And Recent Research Trends**	Web Security- SSL and Transport Layer Security; HTTPS. System Security- Intrusion Detection; Malicious Software- Threats and Countermeasures; Firewalls- Design Principles. Topics on Recent Research Trends	**9**
Total			**36**

Text Book:

1. *Cryptography and Network Security- Principles and Practice,* William Stallings, 6th Edition, 2013, Pearson Education.

Reference Books:

1.   Behrouz A. Forouzan, *Cryptography & Network Security,* 3rd Edition, 2016, Tata McGraw Hill.

Facilitating the Achievement of Course Learning Outcomes

Course Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
On completion of this course the students will be expected to: • Classify the symmetric encryption techniques. • Illustrate various Public key cryptographic techniques. • Evaluate the authentication and hash algorithms. • Discuss authentication applications. • Summarize the intrusion detection and its solutions to overcome the attacks and the basic concepts of system level security	• Each topic to be explained with examples. • Students to be motivated to discover the relevant concepts to take part in discussions and ask questions. • Students to be given homework/assignments to make their concept clear. • Discuss and solve the problems in the class.	• Participation in class discussions • Continuous Evaluation(30Marks) (i)15 marks on Assignments, class tests, viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance:5 marks End-term examinations:70 marks.

11. Detailed Syllabus of Ability Enhancement Elective Curses

Subject Name: General Aptitude and Quantitative Reasoning-I		Subject Code: INT054S201
L-T-P-C – 2-0-0-2	Credit Units: 02	Scheme of Evaluation: T

Objective:

The objectives of the course are:

- To formulate the problem quantitatively and use appropriate arithmetical, and/or statistical methods to solve the problem.
- To demonstrate various principles involved in solving mathematical problems and thereby reducing the time taken for performing job functions.
- To interpret quantitative information (i.e., formulas, graphs, tables, models, and schematics) and draw implications from them.

Prerequisites: None

Detailed Syllabus:

Modules	Topics	Course content	Periods
I	**Quantitative Aptitude-I**	Profit loss, ratio, proportion, Sequence and series, permutation, Probability	6
II	**Quantitative Aptitude-II**	Simple interest, Combination, Number system, Compound Interest, Surds, Logarithm.	6
III	**Reasoning-I**	Logical Reasoning basics, Coded Inequalities, Alphanumeric series	6
IV	**Reasoning-II**	Syllogism, Input and Output, Coding and Decoding.	6
Total			24

Text Books:
1. *Quantitative Aptitude*, Dr. R.S. Aggarwal, Old Edition, 2008, S.Chand Publication, New Delhi.
2. *A Modern Approach to Verbal & Non- Verbal Reasoning*, Dr. R.S Agarwal, 2016 Edition, S.Chand Publication, New Delhi.

Reference Books:
1. Abhijit Guha, *Quantitative Aptitude for Competitive Examinations*, 4th Edition, 2014, McGraw Hill Education

2. Arun Sharma, *How to Prepare for Logical Reasoning for the CAT*, 2015, McGraw Hill Education

Facilitating the Achievement of Course Learning Outcomes

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
•Formulate the problem quantitatively and use appropriate arithmetical, and/or statistical methods to solve the problem. •Recall Formulae. •Demonstrate various principles involved in solving mathematical problems and thereby reducing the time taken for performing job functions. •Interpret quantitative information (i.e., formulas, graphs, tables, models, and schematics) and draw implications from them. Critically evaluate various real life situations by resorting to analysis of key issues and factors	i) Each topic to be expounded with adequate examples. ii) Class discussions and question-answer rounds are encouraged iii) theoretical problems solving is part of the class to grasp the underlying concepts iv) Students have to go through case studies for real time experience v) Students to be encouraged to give short presentations.	(a) Participation in class discussions (b)Continuous Evaluation(30Marks) (i)15 marks on ⬜ Assignments ⬜ Class tests. ⬜ viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.

Subject Name: General Aptitude and Quantitative Reasoning-II		Subject Code: INT054S302
L-T-P-C – 2-0-0-2	Credit Units: 02	Scheme of Evaluation: T

Objective:

The objectives of the course are:

● To formulate the problem quantitatively and use appropriate arithmetical, and/or statistical methods to solve the problem.
● To demonstrate various principles involved in solving mathematical problems and thereby reducing the time taken for performing job functions.
● To interpret quantitative information (i.e., formulas, graphs, tables, models, and schematics) and draw implications from them.

Prerequisites: General Aptitude and Quantitative Reasoning-I

Detailed Syllabus:

Modules	Topics	Course content	Periods
I	**Reasoning Aptitude-I**	Logical Reasoning ,Ranking/Direction/Alphabet Test, Data Sufficiency	**6**
II	**Reasoning Aptitude-I**	Puzzle, Tabulation, Blood Relations, Seating Arrangement	**6**
III	**Quantitative Aptitude-I**	Simplification, Mixtures & Allegations, Work & Time, Time & Distance	**6**
IV	**Quantitative Aptitude-II**	Menstruation – Cylinder, Cone, Sphere, Data Interpretation, Ratio & Proportion, Percentage, Number Systems	**6**
		Total	**24**

Text Books:
1. *Quantitative Aptitude*, Dr. R.S. Aggarwal, Old Edition, 2008, S.Chand Publication, New Delhi.
2. *A Modern Approach to Verbal & Non- Verbal Reasoning* , Dr. R.S Agarwal , 2016 Edition, S.Chand Publication, New Delhi.

Reference Books:
1. Abhijit Guha, *Quantitative Aptitude for Competitive Examinations*, 4th Edition, 2014, McGraw Hill Education

2.   Arun Sharma, *How to Prepare for Logical Reasoning for the CAT*, 2015, McGraw Hill Education

Facilitating the Achievement of Course Learning Outcomes

Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
•Formulate the problem quantitatively and use appropriate arithmetical, and/or statistical methods to solve the problem. •Recall Formulae. •Demonstrate various principles involved in solving mathematical problems and thereby reducing the time taken for performing job functions. •Interpret quantitative information (i.e., formulas, graphs, tables, models, and schematics) and draw implications from them. •Critically evaluate various real life situations by resorting to analysis of key issues and factor	i) Each topic to be expounded with adequate examples. ii) Class discussions and question- answer rounds are encouraged iii) theoretical problems solving is part of the class to grasp the underlying concepts iv) Students have to go through case studies for real time experience v) Students to be encouraged to give short presentations.	(a) Participation in class discussions (b)Continuous Evaluation(30Marks) (i)15 marks on ⬚ Assignments ⬚ Class tests. ⬚ viva-voce or presentation (ii) Mid-term examinations :10 marks (iii) Class attendance -5 marks (c) End-term examinations: 70 marks.