

अमृतं तु विद्या

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मगध विश्वविद्यालय

New Syllabus

for

Master of Computer Applications (MCA)
Year 2024

मगध विश्वविद्यालय

MASTER OF COMPUTER APPLICATIONS (MCA)
MAGADH UNIVERSITY, BIHAR

COURSE STRUCTURE AND SYLLABUS(CBCS)

MCA (Master of Computer Applications)

Table 1: Course Structure

Semester-I

SI No.	Name of Course	Type of Course	L-T-P	Credit	Marks
1	Computer Architecture	CC-1 (Th)	5-1-0	5	100
2	Object Oriented Programming with JAVA	CC-2 (Th)	4-1-0	3	100
3	JAVA Programming Lab	CC-2 (P)	0-0-4	2	100
4	Relational Database Management Systems (RDBMS)	CC-3 (Th)	4-1-0	3	100
5	RDBMS Lab	CC-3 (P)	0-0-4	2	100
6	Data Structure through 'C'	CC-4 (Th)	4-1-0	3	100
7	Data Structures Lab	CC-4 (P)	0-0-4	2	100
8	Environment Sustainability & Swachchha Bharat Abhiyan Activities	AECC- 1	5-1-0	5	100
				Total Credit - 25	

Semester-II

SI No.	Name of Course	Type of Course	L-T-P	Credit	Marks
1	Statistical Computing and Discrete Mathematics	CC-5 (Th)	5-1-0	5	100
2	Operating Systems & Shell Programming	CC-6 (Th)	4-1-0	3	100
3	Operating Systems and Linux Lab	CC-6 (P)	0-0-4	2	100
4	Internet of Things	CC-7 (Th)	5-1-0	5	100
5	Software Engineering	CC-8 (Th)	5-1-0	5	100
6	Web Technologies	CC-9 (Th)	4-1-0	3	100
7	Web Technologies Lab	CC-9 (P)	0-0-4	2	100
8	Ability Enhancement Course/Skill Enhancement Course (from basket of Table-4)	AEC-1/SEC-1	5-1-0	5	100
				Total Credit - 30	

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Semester-III

SI No.	Name of Course	Type of Course	L-T-P	Credit	Marks
1	Theory of Computation & Compiler Design	CC- 10 (Th)	5-1-0	5	100
2	Machine Learning with Python	CC-11 (Th)	4-1-0	3	100
3	Machine Learning with Python Lab	CC-11 (P)	0-0-4	2	100
4	Data Communication & Computer Networks	CC-12 (Th)	5-1-0	5	100
5	Data Mining and Warehousing	CC-13 (Th)	4-1-0	3	100
6	Data Mining and Warehousing Lab	CC-13 (P)	0-0-4	2	100
7	Cryptography and Network Security	CC-14 (Th)	5-1-0	5	100
8	Human values & Professional Ethics and gender sensitization	AECC-2	5-1-0	5	100
				Total Credit - 30	

Semester-IV

SI No.	Name of Course	Type of Course	L-T-P	Credit	Marks
1	Major Project Dissertation and Viva voce (Based on field work/ Industrial Training)	EC	0-0-12	10	100
2	CC-5 of other Department of Social Science or selected from SWAYAM PG Courses	DSE-1	5-1-0	5	100
	Or				
4	Generic Elective (from the basket of Table-3)	GE-1	5-1-0	5	100
				Total Credit - 15	
				Total credits-100	

***L/T/P: (Lecture/ Tutorial/Practical: Number of classes per week**

(CC) : Core Course

(EC) : Elective Course

(DSE) : Discipline Specific Elective Course

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(AEC/SEC) : Ability Enhancement Course/Skill Enhancement Course(From the Basket)

(AECC) : Ability Enhancement Compulsory Course

(GE) : Generic Elective Course (from the basket)

Table 2: Basket of GE-1

- No SQL Databases
- Design and Analysis of Algorithms
- Mobile Application Development
- Artificial Intelligence
- Accounting for Managers
- Soft Computing
- Software Project Management
- Cloud Computing
- Optimization Techniques
- Cyber Security
- Any other Courses decided by B.O.C.S. and duly approved by Academic Council.
- Any P.G. course selected from SWAYAM.

Table 3: Basket of AEC-1/SEC-1

- Business Communication and Employability Skills
- Web Designing
- Financial Risk Management
- Solid waste Management
- Mushroom Culture
- Bio-fertilizer production
- Environmental Law
- Tourism & Hospitality Management
- Life skill & skill development
- Yoga Studies
- Any other Courses decided by B.O.C.S. and duly approved by Academic Council.
- Any P.G. Courses selected from SWAYAM. related to Skill Enhancement

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I-Semester	L	T	P	C
	5	1	0	5
COMPUTER ARCHITECTURECC-1 (Th)				

Course Objectives:

- Conceptualize the basics of organizational and architectural issues of a digital computer.
- Learn the functions of each element of a memory hierarchy.
- Study various data transfer techniques in digital computer.

Course Outcomes (COs): At the end of the course, student will be able to:

CO₁: Understand the basic organizations of computer and different instructions and addressing modes.

CO₂: Analyze the concept of pipelining, segment registers and pin diagram of CPU.

CO₃: Understand and analyze various issues related to memory hierarchy.

CO₄: Evaluate various modes of data transfer between CPU and I/O devices.

CO₅: Examine various inter connections with structures of multi processors.

Unit-1. Digital logic Fundamentals: Number systems, Boolean algebra, Gates, Simplification of Boolean expressions. Combinational logic: adders, subtractors, multiplexer / De- multiplexers, Decoders, Encoders. Sequential Logic circuit: Flip-Flops, counters, Registers and D/A and A/D converter. **(Lecture 16)**

Unit-2. Introduction to Intel's 8086/88: Register model, Bus interface Unit, Execution unit, Control Unit: hardwired and micro-programmed control unit. Memory organization: basic memory cell RAM. ROM and DRAM associative, cache and virtual memory organizations. **(Lecture 12)**

Unit-3. Assembly Language Programming: Instruction formats, addressing modes, Intel8086/88 Instruction mnemonics, timing, data transfer, arithmetic and machine control Instructions - Introduction to Macro assembler. **(Lecture 10)**

Unit-4. Input/Output organization: Input interface, Data transfer techniques: synchronous, asynchronous, Interrupt driven, Intel 8086/88 interrupt organization, types, DMA, I/O processors, Serial communication. **(Lecture 10)**

Unit-5.Processor Organization : General register organization, stack organization. IBM PC Architecture: Mother Board, display adapters, add on cards, power Supply. Architectural overview of Pentium, P-I, P-II and P-III etc. **(Lecture 12)**

Reference Books:

1. Mano, Computer Systems Architecture. PE.
2. Gibson. Microcomputer Systems the 8086/88 family, PHI
3. Ray and Bhurchandi. Advanced Microprocessors and Peripherals, TMH.
4. Abel. IBM PC Assembly language and Programming, PHI.
5. 8086 Programming and Advance processor Architecture M.T. Savaliya, Wiley India.

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I-Semester	L	T	P	C
	4	1	0	3
OBJECT ORIENTED PROGRAMMING WITH JAVA (CC-2 TH.)				

Course Objectives:

- To understand the basic concepts of object-oriented programming concepts.
- To introduce the principles of inheritance and polymorphism and demonstrate how they are related to the design of abstract classes
- To understand the implementation of packages and interfaces
- To introduce the concept of multithreading and exception handling
- To learn and understand the design of Graphical User Interface using applets and swing controls

Course Outcomes (COs): At the end of the course, student will be able to:

CO₁: Describe the uses OOPS concepts.

CO₂: Apply OOP concepts to solve real world problems

CO₃: Distinguish between the concept of packages and interfaces

CO₄: Demonstrate the exception handling, multithread applications with synchronizations.

CO₅: Design the GUI based applications using AWT and Swings.

CO₆: Discuss the Collection Framework.

CO₇: Discuss J2EE architecture enterprises-based application development and fulfill live business prospects

UNIT I:

Basics of Object-Oriented Programming (OOP): Need for OO paradigm, A way of viewing world-Agents, responsibility, messages, methods, classes and instances, class hierarchies (Inheritance), method binding, overriding and exceptions, summary of OOP concepts, coping with complexity, abstraction mechanisms. **Java Basics:** Data types, variables, scope and life time of variables, arrays, operators, expressions, control statements, type conversion and costing, simple java program, classes and objects-concepts of classes, objects, constructor's methods, access control, this keyword, garbage collection, overloading methods and constructors, parameter passing, recursion, string handling. **(Lecture 10)**

UNIT II:

Inheritance: Hierarchical abstractions, Base class object, subclass, subtype, substitutability, forms of inheritance- specialization, specification, construction, extension, limitation, combination, benefits of inheritance costs of inheritance. Member access rules, super uses, using final with inheritance, polymorphism, abstract classes. **Packages and Interfaces:** Defining, Creating and Accessing a package, Understanding CLASSPATH, importing packages, differences between classes and interfaces, defining an interface, implementing interface, applying interfaces variables in interface and extending interfaces. **(Lecture 10)**

UNIT III:

Exception handling and Multithreading: Concepts of exception handling, benefits of exception handling, Termination or presumptive models, exception hierarchy, usage of try, catch, throws and finally, built in exceptions, creating own exception sub classes. Differences between multi-threading and multitasking, thread life cycle, creating threads, synchronizing threads, daemon threads, thread groups. **(Lecture 10)**

UNIT IV:

Swings: Introduction, limitations of AWT, MVC architecture, components, containers, exploring swing-JFrame and JComponent, Icons and Labels, text fields, buttons-The JButton class, Check boxes, Radio Buttons, Combo boxes, Tabbed panes, Scroll panes, Trees and Tables. **(Lecture 10)**

UNIT V:

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Introduction to Servlets: Common Gateway Interface (CGI), Life cycle of a Servlet, deploying a Servlet, The Servlet API, Reading Servlet parameters, Reading Initialization parameters, Handling Http Request & Responses, Using Cookies and Sessions, connecting to a database using JDBC. **Introduction to JSP:** The Anatomy of a JSP Page, JSP Processing, Declarations, Directives, Expressions, Code Snippets, implicit objects, Using Beans in JSP Pages, Using Cookies and session for session tracking, connecting to database in JSP. Client-side Scripting: Introduction to JavaScript, JavaScript language – declaring variables, scope of variables, functions. event handlers (onClick,onSubmit etc.), Document Object Model, Form validation.(Lecture 10)

Text Books:

- 1) Java-The complete reference,7/e, Herbert Schildt, TMH
- 2) JAVA: How to program, 8/e, Dietal ,Dietal,PHI
- 3) Introduction of programming with JAVA, S.Dean,TMH
- 4) Introduction to Java programming, 6/e, Y.Daniel Liang, Pearson

Reference Books:

- 1) Core Java 2, Vol 1(Vol 2) Fundamentals(Advanced), 7/e, Cay.S.Horstmann, Gary Cornell, Pearson
- 2) Big Java2, 3/e, Cay.S. Horstmann, Wiley
- 3) Object Oriented Programming through Java, P.Radha Krishna, University Press
- 4) JAVA& Object Orientation an Introduction, 2/e, John Hunt, Springer
- 5) Introduction to JAVA Programming, 7/e, Y. Daniel Liang, Pearson. , TMH

I-Semester	L	T	P	C
	0	0	4	2
JAVA PROGRAMMING LAB (CC-2 P.)				

Course Objectives:

- To understand how to design, implement, test, debug, and document programs that use basic data types and computation, simple I/O, conditional and control structures, string handling and functions.
- To understand the importance of Classes & objects along with constructors, Arrays and Vectors.
- Discuss the principles of inheritance, interface and packages and demonstrate through problem analysis assignments how they relate to the design of methods, abstract classes and interfaces and packages.
- To understand importance of multi-threading& different exception handling mechanisms.
- To learn experience of designing, implementing, testing, and debugging graphical user interfaces in Java using applet and AWT that respond to different user events.
- To understand Java Swings for designing GUI applications based on MVC architecture

Course Outcomes(COs): At the end of the course, student will be able to:

CO₁: Apply OOPS concepts to solve real world problems.

CO₂: Implement different forms of inheritance.

CO₃: Create packages and to reuse them.

CO₄: Implement multi-threaded programs using synchronization concepts.

CO₅: Create user defined exceptions.

CO₆: Design GUI applications using AWT and SWINGS.

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Practical

- Based on Unit 1 (CC-2Th.)
- Based on Unit 2 (CC-2Th.)
- Based on Unit 3 (CC-2Th.)
- Based on Unit 4 (CC-2Th.)
- Based on Unit 5 (CC-2Th.)
-

USE OF OWN LAPTOP WILL BE ALLOWED IN PRACTICAL.

I-Semester	L	T	P	C
	4	1	0	3

RELATIONAL DATABASE MANAGEMENT SYSTEMS CC-3 (Th)

Course Objectives:

This Course will enable students to

- Explain the concept of databases, database management systems, database structures and how they work.
- Make use of Entity-Relationship Modeling and Relational Modeling for creating simple databases from the real-world scenarios.
- Write relational algebra and structured query language (SQL) statements.
- Normalize a database using Normalization Rules.
- Discuss the issues associated with Transaction Management and Recovery, Tree Structured and Hash-Based Indexing

Course Outcomes (COs): At the end of the course the student will be able to:

CO₁: Illustrate the concept of databases, database management systems, database languages, database structures and their work

CO₂: Apply ER modeling and Relational modeling for designing simple databases.

CO₃: Summarize the concepts related to relational model and SQL and Write database queries using relational algebra and structured query language.

CO₄: Design and develop databases from the real world by applying the concepts of Normalization.

CO₅: Outline the issues associated with Transaction Management and Recovery, Tree Structured and Hash-Based Indexing.

UNIT I:

Overview of Database Languages and Architectures: Data Models, Schemas and Instances, Three-Schema Architecture and Data Independence, Database Languages and Interfaces, The Database System Environment, Centralized and Client/Server Architecture for DBMSs, Classification of Database Management Systems. **(Lecture 10)**

UNIT II:

Introduction to Database Design: Database Design and ER Diagrams, Entities, Attributes and Entity Sets, Relationships and Relationship Sets, Additional Features of the ER Model, Conceptual Design with the ER Model, Conceptual Design for Large Enterprises

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Relational Model: Introduction to the Relational Model, Integrity Constraints over Relations, Enforcing Integrity Constraints, Querying Relational Data, Logical Database Design: ER to Relational. **(Lecture 10)**

UNIT III:

Relational Algebra: Selection and Projection, Set Operations, Joins, Division, More Examples of Algebra Queries.

SQL: Queries, Constraints, Triggers: The Form of a Basic SQL Query, UNION, INTERSECT and EXCEPT, Nested Queries, Aggregate Operators, Null Values, Complex Integrity Constraints in SQL, Triggers and Active Databases, Designing Active Databases. Introduction to Views, Destroying/Altering Tables and Views, Renaming. Procedure, Function-pre defined and User defined, Cursor, Index, Sequence. **(Lecture 10)**

UNIT IV:

Introduction to Normalization Using Functional and Multivalued Dependencies: Informal Design Guidelines for Relation Schema, Functional Dependencies, Normal Forms Based on Primary Keys, General Definitions of Second and Third Normal Forms, Boyce-Codd Normal Form, Multivalued Dependency and Fourth Normal Form, Join Dependencies and Fifth Normal Form. **(Lecture 10)**

UNIT V:

Transaction Management and Concurrency Control: Transaction Concept, A Simple Transaction Model, Storage Structure, ACID Properties, Serializability, Transaction Isolation Levels, Concurrency Control, Lock-Based Protocols, Validation-Based Protocols. **(Lecture 10)**

(Note: For Practical Examples Please Go Through Reference 1)

Text Books:

- 1) Database Management Systems, 3/e, Raghurama Krishnan, Johannes Gehrke, Mc Graw-Hill
- 2) Database System Concepts, 6/e, Abraham Silberschatz, Henry F. Korth, S. Sudarshan, Mc Graw-Hill
- 3) Database Systems, 6/e RamezElmasri, Shamkant B. Navathe, Pearson

Reference Books:

- 1) Database Systems, 9/e, Carlos Coronel, Steven Morris, Peter Rob, Cengage
- 2) Introduction to Database Systems, 8/e, C J Date, Pearson

I-Semester	L	T	P	C
	0	0	4	2
RELATIONAL DATABASE MANAGEMENT SYATEMS LAB(CC-3 P.)				

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- 1) This Course will enable students to
- 2) Populate and query a database using SQL DDL/DML Commands
- 3) Declare and enforce integrity constraints on a database
- 4) Writing Queries using advanced concepts of SQL
- 5) Programming PL/SQL including procedures, functions, cursors and triggers

Course Outcomes:

- 1) At the end of the course the student will be able to:
- 2) Utilize SQL to execute queries for creating database and performing data manipulation operations
- 3) Examine integrity constraints to build efficient databases
- 4) Apply Queries using Advanced Concepts of SQL
- 5) Build PL/SQL programs including stored procedures, functions, cursors and triggers

Practical

- Based on Unit 1 (CC-3Th.)
- Based on Unit 2 (CC-3Th.)
- Based on Unit 3 (CC-3Th.)
- Based on Unit 4 (CC-3Th.)
- Based on Unit 5 (CC-3Th.)
-

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Text Books:

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

I-Semester	L	T	P	C
	3	1	0	4
DATA STRUCTURE THROUGH 'C' (CC-4. Th)				

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The objective of this course is to explore basic data structures such as stacks and queues, introduce a variety of data structures such as hash tables, search trees, tries, heaps, graphs, sorting and pattern matching algorithms

Course Outcomes (CO): *At the end of the course, student will be able to:*

CO₁: Implement basic programs by using C or C++ concepts.

CO₂: Select the data structures that efficiently model the information in a problem

CO₃: Assess efficiency trade-offs among different data structure implementations or combinations

CO₄: Implement and know the application of algorithms for sorting and pattern matching.

UNIT I:

Introduction to C: Constants and variables, Operators and Expressions, Managing Input and Output operators, Decision making-branching and looping, Functions, Structures and Unions, Pointers. **(Lecture 10)**

UNIT II:

Data structure: Definition, types of data structures Recursion Definition, Design Methodology and Implementation of recursive algorithms, Linear and binary recursion. Preliminaries of algorithms, analysis and complexity. **Linear list** – Singly linked list, Double linked list and circular linked list -implementation, insertion, deletion and searching operations on linear list. **(Lecture 10)**

UNIT III:

Stacks-Operations, array and linked representations of stacks, stack applications, **Queues**-operations, array and linked representations. **Hash Table Representation:** hash functions, collision resolution-separate chaining, open addressing-linear probing, quadratic probing, double hashing and rehashing, extendible hashing. **(Lecture 10)**

UNIT IV:

Sorting Techniques: Insertion sort, selection sort, exchange-bubble sort, quick sort and merge sort Algorithms. **Trees:** Binary Trees, terminology, representation and traversals- pre, post & in order traversals. **Search Trees:** Binary Search Trees, Definition, Implementation, Operations- Searching, Insertion and Deletion **(Lecture 10)**

Text Books:

- 1) Let Us C: Authentic Guide to C Programming Language, 17th ed., Yashavant Kanetkar, BPB Publications.
- 2) Data Structures Using C. 2nd Edition, Reema Thareja, Oxford
- 3) Data Structures and Algorithm Analysis in C, 2nd ed, Mark Allen Weiss

Reference Books:

- 1) Data Structures: A Pseudocode Approach with C, 2nd Edition, R. F. Gilberg and B.A. Forouzan, Cengage Learning.
- 2) Programming in ANSI C, 5th ed, E. Balaguruswamy, TMH

I-Semester	L	T	P	C
	0	0	2	2
DATA STRUCTURE LAB (CC-4 P.)				

Course Objectives: This Course will enable students to

- Design and implement various data structures.
- Implement operations like searching, insertion, and deletion, traversing mechanism
- Develop applications using data structure algorithms.

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Course Outcomes (COs): At the end of the course, student will be able to

- Implement various basic data structures and its operations.
- Apply sorting and searching algorithms to given numbers
- Implement various tree operations.
- Implement various graphs algorithms.
- Develop applications using various data structures.

Practical

- Based on Unit 1 (CC-4Th.)
- Based on Unit 2 (CC-4Th.)
- Based on Unit 3 (CC-4Th.)
- Based on Unit 4 (CC-4Th.)
- Based on Unit 5 (CC-4Th.)
-

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I-Semester	L	T	P	C
	5	1	0	5 (3+2)
Ability Enhancement Compulsory Course 1 (AECC-1)				

A – Environmental Sustainability (3 Credits)

B – Swachh Bharat Abhiyan Activities (2 Credits)

Each credit requires 10 hours of teaching – learning for theory and 20 hours for practical, assignment and fieldwork.

A – Unit -1 Environmental Ethics and Ecosystem: Concept of sustainable development with reference to human values in Western and Indian perspective, Sustainable development and conservation of natural resources (Nature, Factors, Structure, Development and people participation) development, Environment-rural and urban concept of ecosystem. **(Lecture 12)**

A – Unit-2 Development and its Effect on Environment: Environment pollution – water, air, noise etc. due to urbanization, industrial civilization, Concept of global warming, climatic change, greenhouse effect, acid rain, ozone layer depletion. Menace of encroachment of exotic plants particularly parthenium and trees with special reference to impact on habit and habitant on indigenous flora and fauna.

A – Unit-3 Concept of Biodiversity and its Conservation: Environmental degradation and conservation, Government policies, social effects and role of social reforms in this direction. Role of science in conservation of environment, concept of three Rs (reduce, reuse, recycle). Need of environmental education and awareness program and ecological economics. **(Lecture 12)**

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A – Unit-4 Swachh Bharat Abhiyan:The concept of Swachhta as personal, Gandhian approach towards social and environmental moral values and concept of swachhta and its relation to moral up gradation of society and freedom struggle. Awareness programs related to swachhta. Role of Swachchagrahis in Swachh Bharat Abhiyan.**(Lecture 12)**

Sanitation and hygiene, Way sanitation is needed, sanitation and human rights, plantation, value of nature, concept of community participation and role of state agencies, case study of sanitation, Effects of cleanliness, Diseases – infection and vector born idea of spread of diseases through body and other biological fluids and excreta.**(Lecture 12)**

B – Unit-5Assignment /Practical/ Fieldwork based on unit – 4

Or

Alternative of unit – 4 and unit – 5, a student can also enroll for Swachh Bharat internship program of MHRD

Semester-II

II-Semester	L	T	P	C
	5	1	0	5
STATISTICAL COMPUTING AND DISCRETE MATHEMATICS (CC-5 TH.)				

Course Objectives: This course is aimed at enabling the students to:

- Understand the mathematical fundamentals that are prerequisites for varieties of courses like Data Mining, Network Addresses, analysis of Web traffic, Computer Security, Software Engineering, Computer Architecture, Operating Systems, Distributed Systems, Bioinformatics, Machine Learning.
- Develop the understanding of the mathematical and logical basis to implement many modern techniques in computer science & technology like machine learning, programming language design and concurrency.
- Study various sampling and classification problems.

Course Outcomes:

After the completion of the course, students will be able to:

CO₁: Apply the basic rules and theorems of probability theory such as Baye's Theorem, determine probabilities that help to solve engineering problems and to determine the expectation and variance of a random variable from its distribution.

CO₂: Able to perform and analyze sampling, means, proportions, variances and estimates of the maximum likelihood based on population parameters.

CO₃: Learn how to formulate testing hypotheses about sample means, variances and proportions and to draw conclusions based on the results of statistical tests.

CO₄: Understand various concepts of number theory.

CO₅: Apply graph theory for real time problems like network routing problem.

UNIT I:

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Basic Probability and Random Variables: Random Experiments, Sample Spaces Events, the Concept of Probability the Axioms of Probability, Some Important Theorems on Probability Assignment of Probabilities, Conditional Probability Theorems on Conditional Probability, Independent Events, Bayes Theorem or Rule. Random Variables, Discrete Probability Distributions, Distribution Functions for Random Variables, Distribution Functions for Discrete Random Variables, Continuous Random Variables.

(Lecture 12)

UNIT II:

Sampling and Estimation Theory: Population and Sample, Statistical Inference Sampling with and Without Replacement Random Samples, Random Numbers Population Parameters Sample Statistics Sampling Distributions, Frequency Distributions, Relative Frequency Distributions, Computation of Mean, Variance, and Moments for Grouped Data. Unbiased Estimates and Efficient Estimates Point Estimates and Interval Estimates. Reliability Confidence Interval Estimates of Population Parameters, Maximum Likelihood Estimates.**(Lecture 12)**

UNIT III:

Tests of Hypothesis and Significance: Statistical Decisions Statistical Hypotheses. Null Hypotheses Tests of Hypotheses and Significance Type I and Type II Errors Level of Significance Tests Involving the Normal Distribution One-Tailed and Two-Tailed Tests P Value Special Tests of Significance for Large Samples Special Tests of Significance for Small Samples Relationship between Estimation Theory and Hypothesis Testing Operating Characteristic Curves. Power of a Test Quality Control Charts Fitting Theoretical Distributions to Sample Frequency Distributions, The Chi-Square Test for Goodness of Fit Contingency Tables Yates' Correction for Continuity Coefficient of Contingency.**(Lecture 12)**

UNIT IV:

Algebraic Structures and Number Theory: Algebraic Systems, Examples, General Properties, Semi Groups and Monoids, Homomorphism of Semi Groups and Monoids, Group, Subgroup, Abelian Group, Homomorphism, Isomorphism. Properties of Integers, Division Theorem, The Greatest Common Divisor, Euclidean Algorithm, Least Common Multiple, Testing for Prime Numbers, The Fundamental Theorem of Arithmetic, Modular Arithmetic (Fermat's Theorem and Euler's Theorem).**(Lecture 12)**

UNIT V:

Graph Theory: Basic Concepts of Graphs, Sub graphs, Matrix Representation of Graphs: Adjacency Matrices, Incidence Matrices, Isomorphic Graphs, Paths and Circuits, Eulerian and Hamiltonian Graphs, Multigraphs, Planar Graphs, Euler's Formula, Graph Colouring and Covering, Chromatic Number, Spanning Trees, Algorithms for Spanning Trees (Problems Only and Theorems without Proofs).**(Lecture 12)**

Text Books:

- 1) Foundation Mathematics for Computer Science, 1st Edition, John Vince, Springer, 2015
- 2) Probability & Statistics, 3rd Edition, Murray R. Spiegel, John J. Schiller and R. Alu Srinivasan, Schaum's Outline Series, Tata McGraw-Hill Publishers, 2018
- 3) Probability and Statistics with Reliability, 2nd Edition, K. Trivedi, Wiley, 2011
- 4) Discrete Mathematics and its Applications with Combinatorics and Graph Theory, 7th Edition, H. Rosen, Tata McGraw Hill, 2003

Reference Books:

- 1) Probability and Computing: Randomized Algorithms and Probabilistic Analysis, 1st Edition, M. Mitzenmacher and E. Upfal, 2005
- 2) Applied Combinatorics, 6th Edition, Alan Tucker, Wiley, 2012

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II-Semester	L	T	P	C
	4	1	0	3
OPERATING SYSTEMS & SHELL PROGRAMMING (CC-6 TH.)				

The objectives of this course are to:

- Conceptualize the basics of functional issues of an Operating System.
- Learn the function of each element of an Operating System.
- Study various management techniques in Operating System.

Course Outcomes (COs): At the end of the course, students will be able to:

CO₁: Understand the basic structure of computers Operating System.

CO₂: Analyze the concept of process management.

CO₃: Understand and analyze various issues related to memory management

CO₄: Evaluate various modes of I/O devices management

CO₅: Examine shell programming.

Unit-1. Introduction: Definition, Design Goals, Evolution; Concept of User, job and Resources, Batch Processing, Multi-programming, Time sharing: Structure and Functions of Operating System. **(Lecture 10)**

Unit-2. Process Management: Process states, State Transitions, Process Control block, Context Switching. Process Scheduling. Scheduling algorithm, Threads, Inter process synchronization and communication-need, Mutual exclusion, semaphore, Monitors, Messages, Deadlock, Deadlocks Prevention, Deadlocks Avoidance, Deadlocks Detection. **(Lecture 10)**

Unit-3. Memory Management: Address Binding, Dynamic Loading and Linking Concepts, Logical and Physical Addresses, Contiguous Allocation. Fragmentation, Paging. Segmentation, Combined Systems, Virtual Memory, Demand Paging, Page fault, Page replacement algorithms, Global Vs Local Allocation, Thrashing, Working Set Model, Paging. **(Lecture 10)**

Unit-4. File and Secondary Storage Management: File Attributes, File Types, File Access Methods, Directory Structure, File System Organization and Mounting. Allocation Methods, Free Space management; Disk Structure, Logical and physical View, Disk Head Scheduling, Formatting, Swap management, Operating System Security, Case Study of UNIX/ LINUX and WINDOWS Operating System. **(Lecture 10)**

Unit-5. Shell programming: Need of Shell programming, types of Shells in Linux/Unix, Shell variables: User Defined Variables, environment variables, predefined variables, reading values into user defined variables, command substitution computation on shell variable handling shell variables, passing arguments to the shell, shift command, conditional execution operators, conditional statements, test command, Iterative statements for, while, until, break, continue statements , practical examples on shell programming, Exercises on shell programming. **(Lecture 10)**

Reference Books:

- 1) Chauhan, Principles of Operating System, OUP
- 2) A. Tanenbaum, Operating System, PE.
- 3) W. Stalling. Operating System, PHI.
- 4) Yashwant Kanitkar. Unix Shell Programming, BPB.

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- 5) Silberschatz and Galvin, Operating System Concepts, Addison wesiey.
 6) Operating Systems, 6th Edition, William Stallings, PHI/Pearson
 7) Unix and Shell Programming by B.M. Harwani, OXFORD University Press

II-Semester	L	T	P	C
	0	0	4	2
OPERATING SYSTEM AND LINUX LAB (CC-6 P.)				

Course Objectives:

This Course will enable students to implement CPU scheduling algorithms, Disk scheduling algorithms, Execute different types of Linux commands and Write shell scripts

Course Outcomes(COs): At the end of the course, student will be able to:

CO₁: Implement various CPU scheduling algorithms and compare results.

CO₂: Implement various disk scheduling algorithms and compare results.

CO₃: Implement page replace algorithms.

CO₄: Implement various memory management techniques.

CO₅:Execute basic Linux commands.

OPERATING SYSTEM LINUX LAB (CC-6 P.)

Practical

- Based on Unit 1 (CC-6Th.)
- Based on Unit 2 (CC-6Th.)

- Based on Unit 3 (CC-6Th.)
- Based on Unit 4 (CC-6Th.)
- Based on Unit 5 (CC-6Th.)
-

USE OF OWN LAPTOP WILL BE ALLOWED IN PRACTICAL.

II-Semester	L	T	P	C
	5	1	0	5

INTERNET OF THINGS (CC-7 TH.)

Course Objectives:

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

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

• Design and carry out an empirical evaluation of different algorithms on problem formalization, and state the conclusions which the evaluation supports.

Course Outcomes(COs): At the end of the course, student will be able to:

CO₁: Explain the definition and usage of the term 'the internet of things' in different contexts.

CO₂: Discover the various network protocols used in IoT.

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CO₃: Define the role of big data, cloud computing and data analytics in a typical IoT system.

CO₄: Compare and contrast the threat environment based on industry and/or device type.

CO₅: Design a simple IoT system made up of sensors, wireless network connections, data analytics and display/actuators, and write the necessary control software.

UNIT I:

The Internet of Things: An Overview of Internet of things, Internet of Things Technology, behind Io Ts Sources of the Io Ts, M2M Communication, Examples of IoTs, Design Principles for Connected Devices Internet Connectivity Principles, Internet connectivity, Application Layer Protocols: HTTP, HTTPS, FTP, Telnet.(**Lecture 12**)

UNIT II:

Business Models for Business Processes in the Internet of Things, IoT/M2M systems LAYERS AND designs standardizations, Modified OSI Stack for the IoT/M2M Systems,ETSI M2M domains and High-level capabilities, Communication Technologies, Data Enrichment and Consolidation and Device Management Gateway Ease of designing and affordability.(**Lecture 12**)

UNIT III:

Design Principles for the Web Connectivity for connected-Devices, Web Communication protocols for Connected Devices, Message Communication protocols for Connected Devices, Web Connectivity for connected-Devices.(**Lecture 12**)

UNIT IV:

Data Acquiring, Organizing and Analytics in IoT/M2M, Applications /Services /Business Processes, IOT/M2M Data Acquiring and Storage, Business Models for Business Processes in the Internet of Things, Organizing Data, Transactions, Business Processes, Integration and Enterprise Systems.(**Lecture 12**)

UNIT V:

Data Collection, Storage and Computing Using a Cloud Platform for IoT/M2M Applications/Services, Data Collection, Storage and Computing Using cloud platform Everything as a service and Cloud Service Models, IOT cloud-based services using the Xively (Pachube/COSM), Nimbits and other platforms Sensor, Participatory Sensing, Actuator, Radio Frequency Identification, and Wireless, Sensor Network Technology, Sensors Technology,Sensing the World.(**Lecture 12**)

Text Books:

- 1) Internet of Things: Architecture, Design Principles And Applications, 1st ed, Rajkamal, McGraw Hill Higher Education, 2017.
- 2) Internet of Things, 1st ed, A.Bahgya and V.Madisetti, Univesity Press, 2014

Reference Books:

- 1) Designing the Internet of Things, 1st ed, Adrian McEwen and Hakim Cassimally, Wiley, 2013.

II-Semester	L	T	P	C
	5	1	0	5
SOFTWARE ENGINEERING (CC-8 TH.)				

Course Objectives:

- To understand the nature of software development and software life cycle models
- To understand methods of capturing, specifying, visualizing and analyzing software requirements.
- Understand the concept of Design patterns and its importance.

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- Understand the behavioral knowledge of the problems and solutions.
- Relate the Creational, Structural, behavioral Design patterns.
- Apply the suitable design patterns to refine the basic design for given context.

Course Outcomes(COs): At the end of the course, students will be able to:

COs Define various software application domains and remember different process models used in software development.

CO₁: Explain needs for software specifications and also, they can classify different types of software requirements and their gathering techniques.

CO₂: Convert the requirements model into the design model and demonstrate use of software and user interface design principles.

CO₃: Illustrate the appropriate design patterns to solve object-oriented design problems.

CO₄: Apply structural patterns to solve design problems.

CO₅: Evaluate the design solutions by using behavioral patterns.

UNIT I:

Introduction to Software Engineering: The evolving role of software, Changing Nature of Software, Software myths, **The software problem:** Cost, schedule and quality, Scale and change.

Software Process: Process and project, component software process, **Software development process models:** Waterfall model, prototyping, iterative development, relational unified process, time boxing model, Extreme programming and agile process, using process models in a project, Project management process. **(Lecture 12)**

UNIT II:

Software requirement analysis and specification: Value of good SRS, requirement process, requirement specification, functional specifications with use-cases, other approaches for analysis, validation, **Planning a software project:** Effort estimation, project schedule and staffing, quality planning, risk management planning, project monitoring plan, detailed scheduling. **(Lecture 12)**

UNIT III:

Software Architecture: Role of software architecture, architecture views, components and connector view, architecture styles for C & C view, documenting architecture design, evaluating architectures, **Design:** Design concepts, function-oriented design, object-oriented design, detailed design, verification, metrics. **Software Testing:** Introduction, verification and validation, White box and black box techniques. **(Lecture 12)**

UNIT IV:

Introduction: History and Origin of Patterns, Design Patterns in MVC, Describing Design Patterns, How Design Patterns Solve Design Problems, selecting a Design Pattern, Using a Design Pattern
Design Patterns-1: Creational, Abstract Factory-Builder, Factory Method, Prototype-Singleton. **(Lecture 12)**

UNIT V:

Design Patterns-2: Structural Patterns: Adapter, Bridge, Composite, Decorator, Façade, Flyweight, Proxy
Design Patterns-3: Behavioral Patterns, Chain of Responsibility, Command-Interpreter, Iterator- Mediator, Memento, Observer, State, Strategy, Template Method, Visitor. **(Lecture 12)**

Text Books:

- 1) Software Engineering: A Practitioner's Approach, Roger S. Pressman, 10th ed, Mc Graw Hill.
- 2) Erich Gamma, Richard Helm, Ralph Johnson, John Vlissides, Design patterns: Elements of Reusable object-oriented software, Addison-Wesley, 1995.

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3) James W Cooper, Java Design Patterns - A Tutorial, Addison-Wesley

Reference Books:

- 1) Software Engineering, 8/e, Sommerville, Pearson
- 2) Software Engineering principles and practice, W S Jawadekar, TMH
- 3) Craig Larman, Applying UML and Patterns: An Introduction to object- Oriented Analysis and Design and iterative development, 3rd Edition, Pearson, 2005.
- 4) Thomas J Mowbray and Raphael Malveau, CORBA and Design Patterns, John Wiley, 1997.
- 5) William J Brown, Anti-Patterns: Refactoring Software, Architectures and Projects in Crisis, John Wiley, 1998.

II-Semester	L	T	P	C
	4	1	0	3
WEB TECHNOLOGIES (CC-9 TH.)				

Course Objectives: • To Learn PHP language for server-side scripting • To introduce XML and processing of XML Data with Java • To introduce Server-side programming with Java Servlets and JSP • To introduce Client-side scripting with JavaScript.

Course Outcomes (COs): At the end of the course, student will be able to

CO₁: Analyze a web page and identify its elements and attributes.

CO₂: To acquire knowledge of xml fundamentals and usage of xml technology in electronic data interchange.

CO₃: Build dynamic web pages using JavaScript (client-side programming).

CO₄: To design and develop web-based enterprise systems for the enterprises using technologies like jsp and servlet.

CO₅: Build web applications using PHP.

Unit I: Web Basics- Introduction, Concept of Internet- History of Internet, Protocols of Internet, World Wide Web, URL, Web Server, Web Browser. **HTML- Introduction**, History of HTML, Structure of HTML Document: Text Basics, Structure of HTML Document: Images and Multimedia, Links and webs, Document Layout, Creating Forms, Frames and Tables, Cascading style sheets. **(Lecture 12)**

Unit II: XML Introduction- Introduction of XML, Defining XML tags, their attributes and values, Document Type Definition, XML Schemes, Document Object Model, XHTML Parsing XML Data – DOM and SAX Parsers in java. **(Lecture 12)**

Unit III: Scripting Language JavaScript, Advantages of JavaScript, JS object Model, HandlingEvent, Operators and Syntax of JS, Function, Event Handling, Validation. **Introduction** of JQuery Installation of JQuery, JQuery Syntax, JQuery Form Data Handling, EventHandling, Validation of Data, Showing/Hiding Elements. **(Lecture 12)**

Unit IV: Introduction to PHP: Declaring variables, data types, arrays, strings, operators, expressions, control structures, functions, reading data from web form controls like text boxes, radio buttons, lists etc., Handling File Uploads. Connecting to database (MySQL as reference), executing simple queries, handling results, Handling sessions and cookies File Handling in PHP: File operations like opening, closing, reading, writing, appending, deleting etc. on text and binary files, listing directories. Built-in functions of PHP addslashes, explode, md5, implode, trim, strtolower, strtoupper, trim, ltrim, rtrim. **(Lecture 12)**

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Unit V:Application OOPS in PHP,Inheritance, Constructor and Destructor in PHP,Final Class in PHP,Introduction of MVC PHP,Database Connection using MySql Application using INSERT,Update,Search,Delete,Relational Query data view. Introduction of AJAX,Advantage of AJAX, INSERT,UPDATE,DELETE, using AJAX with MySql.**(Lecture 12)**

Text Books: 1) Web Technologies, Uttam K Roy, Oxford University Press.

2) The Complete Reference PHP — Steven Holzner, Tata McGraw-Hill. **Reference Books:** 1) Web Programming, building internet applications, Chris Bates 2nd edition, Wiley Dreamtech.

3) Java Server Pages —Hans Bergsten, SPD O'Reilly.

4) Java Script, D.Flanagan 4) Beginning Web Programming-Jon Duckett WROX.

II-Semester	L	T	P	C
	0	0	4	2
WEB TECHNOLOGIES LAB (CC-9 P.)				

Course Objectives:

- To implement the web pages using HTML and apply styles.
- Able to develop a dynamic webpage by the use of java script.
- Design to create structure of web page, to store the data in web document, and transport information through web.
- Able to write a well-formed / valid XML document.

Course Outcomes (COs): At the end of the course, students will be able to:

CO₁: Create dynamic and interactive web pages using HTML, CSS & Java Script.

CO₂: Experiment with Learn and implement XML concepts.

CO₃: Develop web applications using PHP.

CO₄: Show the Install Tomcat Server and execute client-server programs.

CO₅: Implement programs using Ruby programming.

WEB TECHNOLOGIES LAB (CC-9 P.)

Practical

- Based on Unit 1 (CC-9Th.)
- Based on Unit 2 (CC-9Th.)
- Based on Unit 3 (CC-9Th.)
- Based on Unit 4 (CC-9Th.)
- Based on Unit 5 (CC-9Th.)
-

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II-Semester	L	T	P	C
	5	1	0	5
EMPLOYABILITY SKILLS (AEC-1/SEC-1)				

Course Objectives:

The main of this course is

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- To learn how to make effective presentations and impressive interviews
- To learn skills for discussing and resolving problems on the work site
- To assess and improve personal grooming
- To promote safety awareness including rules and procedures on the work site
- To develop and practice self-management skills for the work site

Course Outcomes:

By the end of this course, the student

CO₁: Recite the soft skills

CO₂: Make presentations effectively with appropriate body language

CO₃: Be composed with positive attitude

CO₄: Apply their core competencies to succeed in professional and personal life

A list of vital employability skills from the standpoint of engineering students with discussion how to potentially develop such skills through campus life.

1) Soft Skills: An Introduction – Definition and Significance of Soft Skills; Process, Importance and Measurement of Soft Skill Development.

2) Self-Discovery: Discovering the Self; Setting Goals; Beliefs, Values, Attitude, Virtue.

3) Positivity and Motivation: Developing Positive Thinking and Attitude; Driving out Negativity; Meaning and Theories of Motivation; Enhancing Motivation Levels.

4) Time Management – Concept, Essentials, Tips.

5) Personality Development – Meaning, Nature, Features, Stages, Models; Learning Skills; Adaptability Skills.

6) Decision-Making and Problem-Solving Skills: Meaning, Types and Models, Group and Ethical Decision-Making, Problems and Dilemmas in application of these skills.

7) Conflict Management: Conflict - Definition, Nature, Types and Causes; Methods of Conflict Resolution.

8) Stress Management: Stress - Definition, Nature, Types, Symptoms and Causes; Stress Analysis Models and Impact of Stress; Measurement and Management of Stress

9) Leadership and Assertiveness Skills: A Good Leader; Leaders and Managers; Leadership Theories; Types of Leaders; Leadership Behavior; Assertiveness Skills.

Note: The student shall be instructed to Record a 2 min video and add to profile before and after taking the course. Students are to be involved in Role Play, Team dynamics, Group Discussion and outcomes are to be recorded.

Reference Books:

- 1) Barun K. Mitra, Personality Development and Soft Skills, Oxford University Press, 2011.
- 2) S.P. Dhanavel, English and Soft Skills, Orient Blackswan, 2010.
- 3) R.S.Aggarwal, A Modern Approach to Verbal & Non reasoning, S.Chand& Company Ltd., 2018.Ltd.
- 4) Raman, Meenakshi& Sharma, Sangeeta, Technical Communication Principles and Practice, Oxford University Press, 2011.
- 5) Managing Soft Skills for Personality Development – edited by B.N.Ghosh, McGraw Hill India, 2012.
- 6) English and Soft Skills – S.P.Dhanavel, Orient Blackswan India, 2010.

OR

II-Semester	L	T	P	C
	5	1	0	5
WEB DESIGNING (AEC-1/SEC-1)				

Course Objectives:

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- To implement the web pages using HTML and apply styles.
- Able to develop a dynamic webpage by the use of java script.
- Design to create structure of web page, to store the data in web document, and transport information through web.

Course Outcomes (COs): At the end of the course, students will be able to:

CO₁: Create dynamic and interactive web pages using HTML, CSS & Java Script

CO₂: Experiment with Learn and implement XML concepts

CO₃: Develop web applications using PHP

CO₄: Show the Install Tomcat Server and execute client-server programs

CO₅: Implement programs using Ruby programming

Unit -1: HTML4.0 & HTML5.0:- What is Markup Language, Basic Structure of HTML, Head Section and Elements of HeadSection, MetaTags, Csstags, ScriptTag, Table Tag, DivTag, HeaderTags, Paragraph, Span, Pre Tags, Anchor Links and Named Anchors, ImageTag, ObjectTag, IframeTag, Forms, Form Tag, Attributes of Form, POST and GET Method, Fieldset and Legend, Text input, Text area, Checkbox and Radio Button, Dropdown, List and Optgroup, File Upload and Hidden Fields, Introduction to HTML5, Features of HTML5, HTML5, DocType, NewStructure, Tags, Section, Nav, Article, Aside, Header, Footer. **(Lecture 12)**

Unit 2 :- Introduction to Cascading Style, Types of CSS, ID Selector, Tag Selector, Class Selector, Sub Selector, Child Combinatory Selector, CSS Properties, Background Properties, Block Properties, Box Properties, List Properties, Border Properties, Positioning Properties, Conversion of Table to CSS Layout, CSS Menu Design (Horizontal, Vertical), Form Designing, Text-Shadow Property, Text-Stroke Property, Rounded Corners, Box Shadows, CSS Gradients, CSS Multiple backgrounds, Opacity Property, Transition effect, Transform effect, Animation effects, CSS Media Queries Using CSS3 in Practical Layout Introduction to Responsive Design, Mobile first design concepts, Installation of Bootstrap, Grid System, Forms, Buttons. **(Lecture 12)**

Unit 3: Introduction to Java Script, JavaScript Types, Variables in JS, Operators in JS, Conditions Statements, Java Script Loops, JS Popup Boxes, JS Events, JS Arrays, JS Functions, Validation of Forms, Introduction to jQuery, jQuery Features, Installing jQuery, jQuery Syntax, jQuery Ready Function, jQuery Selectors, jQuery Actions. **(Lecture 12)**

Unit 4: Introduction to PHP: Declaring variables, data types, arrays, strings, operators, expressions, control structures, functions, reading data from web form controls like text boxes, radio buttons, lists etc., Connecting to database (MySQL as reference), executing simple queries, handling results, Handling sessions and cookies. Built-in functions of PHP addslashes, explode, md5, implode, trim, strtolower, strtoupper, trim, ltrim, rtrim. **(Lecture 12)**

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Unit 5: Application OOPS in PHP, Inheritance, Constructor and Destructor in PHP, Final Class in PHP, Introduction of MVC PHP, Database Connection using MySql Application using INSERT, Update, Search, Delete, Relational Query data view. Introduction of AJAX, Advantage of AJAX, INSERT, UPDATE, DELETE, using AJAX with MySql. **(Lecture 12)**

Text Books:

- 1) Mastering HTML, Dreamtech.
- 2) The Complete Reference PHP — Steven Holzner, Tata McGraw-Hill. Reference Books:
- 3) Web Programming, building internet applications, Chris Bates 2nd edition, Wiley Dreamtech.
- 4) Java Server Pages — Hans Bergsten, SPD O'Reilly.
- 5) Java Script, D.Flanagan
- 6) Beginning Web Programming-Jon Duckett WROX.

III-Semester	L	T	P	C
	5	1	0	5
THEORY OF COMPUTATION & COMPILER DESIGN (CC-10)				

Course Objectives:

- To familiarize various types of computation models.
- To give an overview of the mathematical proof and Automata theory
- To study the design technique of DFA N DFA, PDA and Turing Machine.

Course Outcomes: At the end of the course, student will be able to

CO₁: understand different mathematical model and proof, to determine the capability of modern computer.

CO₂: understand different Grammar, to determine the capability of grammar in modern computer.

CO₃: understand different Languages, to determine the capability of different languages used in modern computer.

CO₄: understand different COMPILERS, Lexical Analysis & SYNTAX ANALYSIS.

CO₅: understand assembly codes generation and optimization.

UNIT I

Formal Languages, Finite Automata – Regular Expressions to Automata – Minimizing DFA. Automata with Output Moore Machine and Mealy Machine, Arden's Theorem Algebraic Laws for Regular Expressions, Properties of Regular Languages and Pumping Lemma. **(Lecture 12)**

Unit II

Grammar, Ambiguity in Grammar & Language, Chomsky Classification of Language, Normal Form-BNF, CNF and GNF, Reduction of CFG. **(Lecture 12)**

Unit III

Pushdown Automata and Context Free Grammar, Turing machine, Recursive Enumerable Language and Recursive, Church Thesis, Universal Turing Machine, The Halting Problems, Decidability/Un-decidability. **(Lecture 12)**

Unit IV -INTRODUCTION TO COMPILERS, Lexical Analysis & SYNTAX ANALYSIS Structure of a compiler, Lexical Analysis, Role of Lexical Analyzer Input Buffering –Specification of Tokens – Recognition of Tokens – Lex. Role of Parser – Grammars – Error Handling – Context-free grammars – Writing a grammar –Top Down Parsing –

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General Strategies Recursive Descent Parser Predictive Parser-LL(1) Parser-Shift Reduce Parser-LR Parser- LR (0)Item Construction of SLR Parsing Table, CLR Parsing and -Introduction to LALR Parser – Error Handling and Recovery in Syntax Analyzer-YACC.(Lecture 12)

UNIT V - INTERMEDIATE CODE GENERATION,RUN-TIME ENVIRONMENT, CODE GENERATION & OPTIMIZATION

Syntax Directed Definitions, Evaluation Orders for Syntax Directed Definitions, Intermediate Languages: Syntax Tree, Three Address Code, Types and Declarations, Translation of Expressions, Storage Organization, Stack Allocation Space, Access to Non-local Data on the Stack, HeapManagement. Principal Sources of Optimization, Peep-hole optimization, DAG- Optimization of Basic Blocks Global Data Flow Analysis, Efficient Data Flow Algorithm.(Lecture 12)

Reference Book

1. "Compilers: Principles, Techniques, & Tools 2nd Edition" by Alfred V Aho and Ravi Sethi
2. Compiler Design" by O G Kakde
3. Compiler Design by Manoj B Chandak&Khushboo P Khurana
4. Introduction to Automata Theory, Languages, and Computation
By John E. Hopcroft
5. Introduction to the Theory of Computation By Michael Sipser
- 6.An Introduction to Formal Languages and Automata
By Peter Linz
7. Theory of Computer Science: Automata, Languages and Computation BY K. L. P. Mishra, N. CHANDRASEKARAN .

III-Semester	L	T	P	C
	4	1	0	3
MACHINE LEARNING WITH PYTHON (CC-11 TH.)				

Course Objectives:

From the course the student will learn

- To design and analyze various machine learning algorithms and techniques with a modern outlook focusing on recent advances.
- Explore supervised and unsupervised learning paradigms of machine learning.
- To explore Deep learning technique and various feature extraction strategies.

Course Outcomes(CO's): At the end of the course, student will be able to

- Illustrate and comprehend the basics of Machine Learning with Python
- Demonstrate the algorithms of Supervised Learning and be able to differentiate linear and logistic regressions
- Demonstrate the algorithms of Unsupervised Learning and be able to understand the clustering algorithms
- Evaluate the concepts of binning, pipeline Interfaces with examples
- Apply the sentiment analysis for various case studies

UNIT I:

Introduction to Machine Learning with Python: Introduction to Machine Learning, basic terminology, Types of Machine Learning and Applications, Using Python for Machine Learning: Installing Python and packages from the Python Package Index, Introduction to NumPy, SciPy, matplotlib and scikit-learn, tiny application of Machine Learning.(Lecture 10)

UNIT II:

Supervised Learning: Types of Supervised Learning, Supervised Machine Learning Algorithms: k-Nearest Neighbors, Regression Models, Naive Bayes Classifiers, Decision Trees, Ensembles of Decision Trees, Kernelized Support Vector Machines, Uncertainty Estimates from Classifiers.(Lecture 10)

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UNIT III:

Building good training datasets: Dealing with missing data, handling categorical data, partitioning a data set into separate training and test datasets, bringing features onto the same scale, selecting meaningful features, assessing feature importance with random forests. **Compressing data via dimensionality reduction:** Unsupervised dimensionality reduction via PCA, Supervised data compression via linear discriminant analysis. **(Lecture 10)**

UNIT IV:

Learning best Practices for Model Evaluation and Hyperparameter tuning: streamlining workflows with pipelines, using k-fold cross validation to assess model performance, debugging algorithms with learning and validation curves, fine tuning machine learning models via grid search, looking at different performance evaluation metrics. **Combining different model sfor Ensemble learning:** learning with ensembles, combining classifiers via majority vote, bagging-building an ensemble of classifiers from bootstrap samples, leveraging weak learners via adaptive boosting. **(Lecture 10)**

UNIT V:

Working with Text Data (Data Visualization): Types of Data Represented as Strings, Example Application: Sentiment Analysis of Movie Reviews, Representing Text Data as a Bag of Words, Stop Words, Rescaling the Data with tf-idf, Investigating Model Coefficients, Approaching a Machine Learning Problem, Testing Production Systems, Ranking, Recommender Systems and Other kinds of Learning. **(Lecture 10)**

Text Books:

- 1) Introduction to Machine Learning with Python: A Guide for Data Scientists, Andreas C. Muller & Sarah Guido, Orielly Publications, 2019.
- 2) Python Machine Learning, Sebastian Raschka & Vahid Mirjalili, 3rd Edition, 2019.
- 3) Machine Learning using Python, Manaranjan Pradhan, U Dinesh Kumar, Wiley, 1st Edition, 2019

Reference Books:

- 1) Machine Learning, Tom M. Mitchell, Mc Graw-Hill Publication, 2017
- 2) Building Machine Learning Systems with Python, Luis Pedro Coelho, Willi Richert, 2nd Edition, 2015.
- 3) Programming and Problem Solving with Python, Ashok Namdev Kamthane, Amit Ashok Kamthane, TMH, 2019.

III-Semester	L	T	P	C
	0	0	4	2

MACHINE LEARNING WITH PYTHON LAB (CC-11 P.)

Course Objectives:

- Make use of Data sets in implementing the machine learning algorithms
- Implement the machine learning concepts and algorithms in any suitable language of choice.
- Design Python programs for various Learning algorithms.

Course Outcomes(COs): At the end of the course, student will be able to

- Implement procedures for the machine learning algorithms
- Design Python programs for various Learning algorithms
- Apply appropriate data sets to the Machine Learning algorithms

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- Identify and apply Machine Learning algorithms to solve real world problems

Note: Consider any dataset from Kaggle

Practical

- Based on Unit 1 (CC-11Th.)
- Based on Unit 2 (CC-11Th.)

- Based on Unit 3 (CC-11Th.)

- Based on Unit 4 (CC-11Th.)

- Based on Unit 5 (CC-11Th.)
-

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III-Semester	L	T	P	C
	5	1	0	5
DATA COMMUNICATION AND COMPUTER NETWORK(CC-12 TH.)				

Course Objectives:

At the end of the course, the students will be able to:

- Understands the fundamental concepts of computer networking and OSI Reference model.
- Familiarize the student with the basic taxonomy and terminology of the computer networking area.
- Learn and understand the advanced networking concepts, preparing the student for entry advanced courses in computer networking.
- Develop and gain expertise in some specific areas of networking such as the design and maintenance of individual networks.

Course Outcomes (COs): At the end of the course, student will be able to

- Explain the network architecture, TCP/IP and OSI reference models
- Identify and understand various techniques and modes of transmission
- Demonstrate the data link protocols, multi-channel access protocols and IEEE 802 standards for LAN
- Describe routing and congestion in network layer with routing algorithms and classify IPV4 addressing scheme
- Discuss the elements and protocols of transport layer
- Develop network security and define various protocols such as FTP, HTTP, Telnet, DNS

UNIT I:

Introduction: Network Topologies WAN, LAN, MAN. Reference models- The OSI Reference Model- the TCP/IP Reference Model - A Comparison of the OSI and TCP/IP Reference Models. **Physical Layer** – Introduction to physical layer-Data and Signals, Periodic analog signals, digital signals, transmission impairment, ,Data rate limits, performance -Introduction to Guided Media- Twisted-pair cable, Coaxial cable and Fiber optic cable and Unguided media: Wireless-Radio waves, microwaves, infrared.(Lecture 12)

UNIT II:

The Data Link Layer - Services Provided to the Network Layer – Framing – Error Control – Flow Control, Error Detection and Correction – Error-Correcting Codes – Error Detecting Codes. **Elementary Data Link Protocols-** A Utopian Simplex Protocol-A Simplex Stop and Wait Protocol for an Error free channel-A Simplex Stop and Wait Protocol for a Noisy Channel, Sliding Window Protocols-A One Bit Sliding Window Protocol-A Protocol Using Go-Back-N- A Protocol Using Selective Repeat.(Lecture 12)

UNIT III:

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The Medium Access Control Sub layer-The Channel Allocation Problem-Static Channel Allocation-Assumptions for Dynamic Channel Allocation, Multiple Access Protocols-Aloha-Pure aloha- slotted aloha-Carrier Sense Multiple Access Protocols- Collision-Free Protocols-Limited Contention Protocols. **Wireless LAN Protocols**- Ethernet-Classic Ethernet Physical Layer-Classic Ethernet MAC Sub-layer Protocol-Ethernet Performance-Fast Ethernet- Wireless LANs-The 802.11 Architecture and Protocol Stack-The 802.11 Physical Layer-The 802.11 MAC Sub-layer Protocol- The 805.11 Frame Structure-Services. **(Lecture 12)**

UNIT IV:

The Network Layer Design Issues – Store and Forward Packet Switching-Services Provided to the Transport layer- Implementation of Connectionless Service-Implementation of Connection Oriented Service- Comparison of Virtual Circuit and Datagram Networks, Routing Algorithms-The Optimality principle-shortest path, Flooding, Distance vector, Link state, Hierarchical. **Congestion Control Algorithms**-General principles of congestion control, Congestion prevention policies, Approaches to Congestion Control-Traffic Aware Routing- Admission Control-Traffic Throttling-Load Shedding. **Internet Working**: How networks differ- How networks can be connected- Tunneling, internetwork routing-, Fragmentation, network layer in the internet – IP protocols-IP Version 4 protocol-, IP addresses-, Subnets-IP Version 6-The main IPV6 header- Internet control protocols- ICMP-ARP-DHCP.**(Lecture 12)**

UNIT V:

The Transport Layer: Transport layer protocols: Introduction-services- port number-User data gram protocol-User datagram-UDP services-UDP applications-Transmission control protocol: TCP services- TCP features- Segment- A TCP connection- windows in TCP- flow control-Error control. **Application Layer** -- World Wide Web: HTTP, FTP-Two connections-control connection-Data connection-security of FTP-Electronic Mail-Architecture- web based mail- email security- TELENET-local versus remote Logging. **Domain Name System**: Name Space, DNS in Internet, - Resolution-Caching- Resource Records- DNS messages- Registrars-security of DNS Name Servers.**(Lecture 12)**

Text Books:

- 1) Computer Networks: Andrew S Tanenbaum David J. Wetherall, 5/e, Pearson
- 2) Data communications and networking: Behrouz Forouzan, 5/e, McGraw Hill

Reference Books:

- 1) Computer Networks – A System Approach, Peterson, Bruce Davie, 2/e ,
Harcourt Asia
- 2) Compute communications and networking technologies, Gallo, Hancock,
Cengage
- 3) An Engineering approach to compute networking, Kesha, Pearso

III-Semester	L	T	P	C
	4	1	0	3
DATA MINING AND WAREHOUSING (CC-13 TH.)				

Course Objectives:

- Be familiar with mathematical foundations of data mining tools.
- Understand and implement classical models and algorithms in data warehouses and data mining
- Characterize the kinds of patterns that can be discovered by association rule mining, classification and clustering.
- Develop skill in selecting the appropriate data mining algorithm for solving practical problems.

Course Outcomes (COs): At the end of the course, student will be able to

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- Understand the basics of types of data, quality of data, suitable techniques required for preprocessing and measures required to perform data analysis
- Describe the need of classification, identify suitable technique(s) to perform classification, model building and evaluation
- Identify the requirements and usage of association rule mining on categorical and continuous data.
- Compare and identify suitable clustering algorithm(s) (apply with open-source tools), interpret, evaluate and report the result
- Describe the requirements and the need of web mining

UNIT I:

Introduction to Data mining, types of Data, Data Quality, Data Processing, Measures of Similarity and Dissimilarity, Exploring Data: Data Set, Summary Statistics, Visualization, Data Warehouse, OLAP and multi-dimensional data analysis. **(Lecture 10)**

UNIT II:

Classification: Basic Concepts, Decision Trees and model evaluation: General approach for solving a classification problem, Decision Tree induction, Model over fitting: due to presence of noise, due to lack of representation samples, Evaluating the performance of classifier. Nearest Neighborhood classifier, Bayesian Classifier, Support vector Machines: Linear SVM, Separable and Non-Separable case. **(Lecture 10)**

UNIT III:

Association Analysis: Problem Definition, Frequent Item-set generation, rule generation, compact representation of frequent item sets, FP-Growth Algorithms. Handling Categorical, Continuous attributes, Concept hierarchy, Sequential, Sub graph patterns. **(Lecture 10)**

UNIT IV:

Clustering: Over view, K-means, Agglomerative Hierarchical clustering, DBSCAN, Cluster evaluation: overview, Unsupervised Cluster Evaluation using cohesion and separation, using proximity matrix, Scalable Clustering algorithm. **(Lecture 10)**

UNIT V:

Web data mining: Introduction, Web terminology and characteristics, Web content mining, Web usage mining, web structure mining, Search Engines: Characteristics, Functionality, Architecture, Ranking of Webpages, Enterprise search. **(Lecture 10)**

Text Books:

- 1) Introduction to Data Mining, Tan, Steinbach and Vipin Kumar, Pearson Education, 2016
- 2) Data Mining: Concepts and Techniques, 2nd Edition, Jiawei Han and Micheline Kamber, ELSEVIER

Reference Books:

- 1) Data Mining: The Textbook, Springer, May 2015, Charu C. Aggarwal.

III-Semester	L	T	P	C
	0	0	4	2
DATA MINING AND WAREHOUSING LAB (CC-13 P.)				

Course Objectives:

- Be familiar with mathematical foundations of data mining tools.
- Understand and implement classical models and algorithms in data warehouses and data mining

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- Characterize the kinds of patterns that can be discovered by association rule mining, classification and clustering.
- Develop skill in selecting the appropriate data mining algorithm for solving practical problems.

Course Outcomes (COs): At the end of the course, student will be able to

- Understand the basics of types of data, quality of data, suitable techniques required for preprocessing and measures required to perform data analysis
- Describe the need of classification, identify suitable technique(s) to perform classification, model building and evaluation
- Identify the requirements and usage of association rule mining on categorical and continuous data.
- Compare and identify suitable clustering algorithm(s) (apply with open-source tools), interpret, evaluate and report the result
- Describe the requirements and the need of web mining

Practical

- Based on Unit 1 (CC-13Th.)
- Based on Unit 2 (CC-13Th.)
- Based on Unit 3 (CC-13Th.)
- Based on Unit 4 (CC-13Th.)
- Based on Unit 5 (CC-13Th.)
-

USE OF OWN LAPTOP WILL BE ALLOWED IN PRACTICAL.

III-Semester	L	T	P	C
	5	1	0	5
CRYPTOGRAPHY AND NETWORK SECURITY (CC-14 TH.)				

Course Objectives:

- To learn various cryptographic algorithms including secret key cryptography, hashes and message digests, public key algorithms,
- To Familiar in design issues and working principles of various authentication protocols and various secure communication standards including Kerberos, IPsec, and S/MIME

Course Outcomes: At the end of the course, student will be able to

- Explain Basic Principles, different security threats, countermeasures, foundation course of cryptography mathematics and Symmetric Encryption.
- Classify the basic principles of Asymmetric key algorithms and operations of asymmetric key cryptography.
- Design Cryptographic Hash Functions as SHA-3 and Digital Signatures as Elgamal
- Explain the concept of Revise Key Management and Distribution and User Authentication
- Determine the knowledge of Network and Internet Security Protocols such as S/MIME

UNIT I:

Basic Principles: Security Goals, Cryptographic Attacks, Services and Mechanisms, Mathematics of Cryptography. **Symmetric Encryption:** Mathematics of Symmetric Key Cryptography, Introduction to Modern Symmetric Key Ciphers, Data Encryption Standard, Advanced Encryption Standard. **(Lecture 12)**

UNIT II:

Asymmetric Encryption: Mathematics of Asymmetric Key Cryptography-Primes, primality Testing, Factorization, Asymmetric Key Cryptography-RSA Cryptosystem, Rabin Cryptosystem, ElGamal Cryptosystem, Elliptic Curve Cryptosystem. **(Lecture 12)**

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UNIT III:

Cryptographic Hash Functions: Applications of Cryptographic Hash Functions, Two Simple Hash Functions Requirements and Security Hash Functions Based on Cipher Block Chaining, Secure Hash Algorithm (SHA), SHA-3. **Digital Signatures:** Elgamal Digital Signature Scheme, Schnorr Digital Signature, NIST Digital Signature Algorithm.(**Lecture 12**)

Unit IV:

Key Management and Distribution: Symmetric Key Distribution Using Symmetric Encryption, Symmetric Key Distribution Using Asymmetric Encryption, Distribution of Public Keys, X.509 Certificates. **User Authentication:** User Authentication, Remote User-Authentication Principle, Remote User-Authentication Using Symmetric Encryption, Kerberos, Remote User-Authentication Using Asymmetric Encryption.(**Lecture 12**)

Unit V: Network and Internet Security

Electronic Mail Security: Internet Mail Architecture, Email Formats, Email Threats and Comprehensive Email Security, S/MIME. **IP Security:** IP Security Policy, Encapsulating Security Payload, Combining Security Associations Internet Key Exchange.(**Lecture 12**)

Text Books:

- 1) Cryptography and Network Security, 3rd Edition Behrouz AForouzan, Deb deep Mukhopadhyay, McGraw Hill,2015
- 2) Cryptography and Network Security, William Stallings, Global Edition, 7e Pearson, 2017

Reference Books:

- 1) Network Security and Cryptography, First Edition, Bernard Meneges, Cengage Learning, 2018

III-Semester	L	T	P	C
	5	1	0	5

Ability Enhancement Compulsory Course 2 (AECC-2)

A – Human Values & Professional Ethics (3 Credits)

B – Gender Sensitization (2 Credits)

Each credit request 10 hours of teaching – learning for theory and 20 hours for practical, assignment and fieldwork.

Unit-1 Variety of Moral Issues, Principals of Ethics and Morality: -

Understanding the Harmony in the Society (society being an extension of family), Integrity, Work Ethic, Courage, Empathy, Self Confidence, Professional Ideas and Virtues, Ethics as a Subset of Morality, Ethics and Organizations, Duties and Rights of employees and employers.(**Lecture 12**)

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Unit-2 Holistic Approach to Corporate Ethics: -

Vend-antic Ethics – Tagore, Vivekanand, Gandhi and Aurobindo on Ethics, Ethics in Finance, Business and Environment, professional Rights, Intellectual Property Rights, Corporate Responsibility, Social Audit and Ethical Investing, Computer and Ethics.(Lecture 12)

Unit-3 Professional Ethics: -

Augmenting Universal Human Order, Characteristics of people-friendly and eco-friendly Production, Strategy for Transition from the Present State to Universal Human Order, At the Level of Individual- as Socially and Ecologically Responsible Technologists and Managers. At the Level of Society- as Mutually Enriching Institutions and Organizations. Case studies of typical holistic technologies and management patterns.(Lecture 12)

Unit-4 Gender – An Overview: -

Gender: Definition, nature and evolution. Culture, tradition, historicity; Gender spectrum: biological, sociological, psychological conditioning; Gender based division of labor – domestic work and use value.(Lecture 12)

Unit-5 Gender – Contemporary Perspectives: -

Gender justice and human rights: internal perspectives, Gender: Constitutional and legal perspectives, media & gender, Gender: emerging issues and challenges.(Lecture 12)

IV-Semester	L	T	P	C
	0	0	12	10
Project & Dissertation (EC)				

Course Objectives:

- To know the final development of Industrial Project.
- To explore tools and practices for working with computer project.
- To learn about stream computing.
- To know about the research that requires the integration of large amounts of data.

Course Outcomes (COs): At the end of the course, student will be able to

- Identify the need-based tools, viz., students can be able to handle and formulate an effective strategy to implement a successful problem-based project.
- Organize the existing technologies and the need of distributed files systems to analyze the Data in an organization.
- To Discuss the cluster and classification techniques.
- This course consists of the development of a realistic application, representative of a typical real life Software System or to carry a research-based project in an area related to CS & IT.

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1. The students are expected to propose, analyze, design, develop, test and implement a real life Software system using recent technologies.
 2. In case of a research-based project, the students are required to follow a proper Research methodology to propose a solution (in terms of a Model/framework/algorithm, etc.) of a research problem related to computer science and IT.
 3. The student will deliver oral presentations, progress reports, and a final report.
- A. Depending on the topic of the project and the chosen software development Methodology, the following themes may be addressed to some extent:
- Software development methodologies, static (products) and dynamic aspects (Processes).
 - Requirement analysis (goals, use cases), software architectures, architectural styles and patterns, model-driven engineering (MDE).
 - Programming techniques, software development environments, refactoring.
 - Software validation through unit test, integration test, functional and structural tests and code reviews.
 - Project management, planning, resource estimation, reporting.
 - Version management by using a version management tool.
 - Examples of kinds of Systems to be developed are distributed systems. Client/ Server systems, web-based systems, secure systems, mobile systems, adaptable systems, optimizations of existing systems or data-intensive systems, etc.
- B. Typical process of research-based problems may include selection of a research topic followed by an extensive literature survey with an aim to find the research gap. Proposing a solution based on the findings (i.e., research gap) and publishing the research work.

GE :-

IV-Semester	L	T	P	C
	5	1	0	5
NoSQL DATABASES (GE-1)				

Course Objectives:

The objective of the course is to:

- Define, compare and use the four types of NoSQL Databases (Document-oriented, Key Value Pairs, Column oriented and Graph)
- Demonstrate an understanding of the detailed architecture, define objects, load data, query data and performance tune Column-oriented NoSQL databases
- Explain the detailed architecture, define objects, load data, query data and performance tune Document oriented NoSQL databases
- Ability to design entity relationship model and convert entity relationship diagrams into RDBMS and formulate SQL queries on the data

Course Outcomes:

After the completion of the course, student will be able to do the following

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- Identify what type of NoSQL database to implement based on business requirements (key-value, document, full text, graph, etc.)
- Apply NoSQL data modeling from application specific queries
- Use Atomic Aggregates and denormalization as data modelling techniques to optimize query processing

UNIT I: Introduction to NoSQL: Definition and Introduction, Sorted Ordered Column-Oriented Stores, Key/Value Stores, Document Databases, Graph Databases, Examining Two Simple Examples, Location Preferences Store, Car Make and Model Database, Working with Language Bindings. **(Lecture 12)**

UNIT II: Interacting with NoSQL: If NoSql Then What, Language Bindings for NoSQL Data Stores, Performing Crud Operations, Creating Records, Accessing Data, Updating and Deleting Data. **(Lecture 12)**

UNIT III: NoSQL Storage Architecture: Working with Column-Oriented Databases, Hbase Distributed Storage Architecture, Document Store Internals, Understanding Key/Value Stores in Memcached and Redis, Eventually Consistent Non-Relational Databases. **(Lecture 12)**

UNIT IV: NoSQL Stores: Similarities Between SqlAndMongodb Query Features, Accessing Data from Column-Oriented Databases Like Hbase, Querying Redis Data Stores, Changing Document Databases, Schema Evolution in Column-Oriented Databases, Hbase Data Import and Export, Data Evolution In Key/Value Stores. **(Lecture 12)**

UNIT V Indexing and Ordering Data Sets: Essential Concepts Behind A Database Index, Indexing And Ordering In Mongodb, Creating and Using Indexes In Mongodb, Indexing And Ordering In Couchdb, Indexing In Apache Cassandra. **(Lecture 12)**

Text Books: 1) Pramod Sadalage and Martin Fowler, NoSQL Distilled, Addison-Wesley Professional, 2012. 2) Dan McCreary and Ann Kelly, Making Sense of NoSQL, Manning Publications, 2013.

Reference Books:

- 1) Shashank Tiwari, Professional NoSQL, Wrox Press, Wiley, 2011, ISBN: 978-0-470-94224-6
- 2) Gaurav Vaish, Getting Started with NoSQL, Packt Publishing, 2013.

IV-Semester	L	T	P	C
	5	1	0	5
DESIGN AND ANALYSIS OF ALGOROTHS(GE-1)				

Course Objectives:

- To provide an introduction to formalisms to understand, analyze and denote time complexities of algorithms
- To introduce the different algorithmic approaches for problem solving through numerous example problems
- To provide some theoretical grounding in terms of finding the lower bounds of algorithms and the NP-completeness

Course Outcomes:

- Describe asymptotic notation used for denoting performance of algorithms
- Analyze the performance of a given algorithm and denote its time complexity using the asymptotic notation for recursive and non-recursive algorithms
- List and describe various algorithmic approaches
- Solve problems using divide and conquer, greedy, dynamic programming, backtracking and branch and bound algorithmic approaches

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- Apply graph search algorithms to real world problems
- Demonstrate an understanding of NP- Completeness theory and lower bound theory

UNIT I:

Introduction: Algorithm, Pseudo code for expressing algorithms, performance Analysis-Space complexity, Time complexity, Asymptotic Notation- Big oh notation, Omega notation, Theta notation and Little oh notation, probabilistic analysis, Amortized analysis. Disjoint Sets- disjoint set operations, union and find algorithms, spanning trees, connected components and bi- connected components.(Lecture 12)

UNIT II:

Divide and conquer: General method, applications-Binary search, Quick sort, Merge sort, Stassen's matrix multiplication. Greedy method: General method, applications-Job sequencing with deadlines, 0/1 knapsack problem, Minimum cost spanning trees, Single source shortest path problem.(Lecture 12)

UNIT III:

Dynamic Programming: General method, applications-Matrix chain multiplication, Optimal binary search trees, 0/1 knapsack problem, All pairs shortest path problem, Travelling sales person problem, Reliability design.(Lecture 12)

UNIT IV:

Backtracking: General method, applications-n-queen problem, sum of subsets problem, graph coloring, Hamiltonian cycles.(Lecture 12)

UNIT V:

Branch and Bound: General method, applications - Travelling sales person problem, 0/1 knapsack problem- LC Branch and Bound solution, FIFO Branch and Bound solution. NP-Hard and NP-Complete problems: Basic concepts, non-deterministic algorithms, NP - Hard and NP Complete classes, Cook's theorem.(Lecture 12)

Text Books:

- 1) Fundamentals of Computer Algorithms, Ellis Horowitz, Satraj Sahni and Rajasekharam, Universities Press
- 2) The Algorithm Design Manual, 2nd edition, Steven S. Skiena, Springer
- 3) Introduction to Algorithms, second edition, T. H. Cormen, C. E. Leiserson, R. L. Rivest and C. Stein, PHI Pvt. Ltd

Reference Books:

- 1) Introduction to the Design and Analysis of Algorithms, Anany Levitin, PEA
- 2) Design and Analysis of Algorithms, Pearson Education, Parag Himanshu Dave, HimansuBalachandra Dave
- 3) Introduction to Design and Analysis of Algorithms A strategic approach, R.C.T. Lee, S.S.Tseng, R.C.Chang and T.Tsai, Mc GrawHill.
- 4) Design and Analysis of algorithms, Pearson education, Aho, Ullman and Hopcroft.

IV-Semester	L	T	P	C
	5	1	0	5
MOBILE APPLICATION DEVELOPMENT(GE-1)				

Course Objectives:

- To demonstrate the introduction and characteristics of mobile applications

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- Application models of mobile application frameworks. Managing application data and User-interface design for mobile applications
- Integrating networking, the OS and hardware into mobile-applications
- Addressing enterprise requirements in mobile applications – performance, scalability, modifiability, availability and security
- Testing methodologies for mobile applications– Publishing, deployment, maintenance and management. To demonstrate their skills of using Android software development tools
- To demonstrate their ability to deploy software to mobile devices

Course Outcomes:

Upon completion of the course students should be able to:

- Install and configure Android application development tools
- Design and develop user Interfaces for the Android platform
- Save state information across important operating system events
- Apply Java programming concepts to Android application development

UNIT I:

Introduction to mobile devices: Introduction to Mobile Computing, Introduction to Android Development Environment, Mobile devices vs. desktop devices, ARM and Intel architectures, Screen resolution, Touch interfaces, Application deployment, App Store, Google Play, Windows Store.

Development environments: XCode, Eclipse, VS2012, PhoneGAP, etc.; Native vs. web applications.

Factors in Developing Mobile Applications: Mobile Software Engineering, Frameworks and Tools, Generic UI Development, Android User.(Lecture 12)

UNIT II:

Android User Interface: Measurements – Device and pixel density independent measuring units User Interface (UI) Components – Editable and non-editable Text Views, Buttons, Radio and Toggle Buttons, Checkboxes, Spinners, Dialog and pickers Fragments – Creating fragments, Lifecycle of fragments, Fragment states, adding fragments to Activity, adding, removing and replacing fragments with fragment transactions, interfacing between fragments and Activities, Multi-screen Activities.(Lecture 12)

UNIT III:

Back Ground Running Process, Networking and Telephony Services: Services: Introduction to services – local service, remote service and binding the service, the communication between service and activity, Intent Service.

Multithreading: Handlers, AsyncTask.

Broad cast receivers: Local Broadcast Manager, Dynamic broadcast receiver, System Broadcast. Pending Intent, Notifications.(Lecture 12)

UNIT IV:

Android: Introduction – Establishing the development environment – Android architecture – Activities and views – Interacting with UI – Persisting data using SQLite – Packaging and deployment – Interaction with server-side applications – Using Google Maps, GPS and Wi-Fi – Integration with social media applications.

Android network programming: Http URL Connection, Connecting to REST-based and SOAP based Web services.(Lecture 12)

UNIT V:

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Advanced Topics: Power Management: Wake locks and assertions, Low-level OS support, Writing power-smart applications.

Augmented Reality via GPS and other sensors: GPS, Accelerometer, Camera.

Mobile device security in depth: Mobile malware, Device protections, IOS “Jailbreaking”, Android “rooting” and Windows’ “defenestration”; Security and Hacking: Active Transactions, More on Security, Hacking Android.(Lecture 12)

Text Books:

- 1) Bill Phillips, Chris Stewart, Brian Hardy, and Kristin Marsicano, Android Programming: The Big Nerd Ranch Guide, Big Nerd Ranch LLC, 2nd edition, 2015.
- 2) Valentino Lee, Heather Schneider, and Robbie Schell, Mobile Applications: Architecture, Design and Development, Prentice Hall, 2004.
- 3) Professional Android 4 Application Development, Reto Meier, Wiley India, (Wrox), 2012
- 4) Android Application Development for Java Programmers, James C Sheusi, Cengage Learning, 2013
- 5) Dawn Griffiths, David Griffiths, “*Head First: Android Development*” ,OReilly2015,ISBN: 9781449362188
- 6) Jeff McWherter and Scott Gowell, "Professional Mobile Application Development", Wrox, 2012

Reference Books:

- 1) Beginning Android 4 Application Development, Wei-Meng Lee, Wiley India (Wrox), 2013
- 2) Tomasz Nurkiewicz and Ben Christensen, Reactive Programming with RxJava, O’Reilly Media, 2016.
- 3) Brian Fling, Mobile Design and Development, O’Reilly Media, Inc., 2009.
- 4) Maximiliano Firtman, Programming the Mobile Web, O’Reilly Media, Inc., 2nd ed., 2013.
- 5) Cristian Crumlish and Erin Malone, Designing Social Interfaces, 2nd ed., O’Reilly Media, Inc., 2014.
- 6) Suzanne Ginsburg, Designing the iPhone User Experience: A User-Centered Approach to Sketching and Prototyping iPhone Apps, Addison-Wesley Professional, 2010.

IV-Semester	L	T	P	C
	5	1	0	5
ARTIFICIAL INTELLIGENCE (GE-1)				

Course Objectives:

- To have a basic proficiency in a traditional AI language including an ability to write simple to intermediate programs and an ability to understand code written in that language
- To have an understanding of the basic issues of knowledge representation and blind and heuristic search, as well as an understanding of other topics such as minimax, resolution that play an important role in AI programs
- To have a basic understanding of some of the more advanced topics of AI

Course Outcomes:

- Outline problems that are amenable to solution by AI methods, and which AI methods may be suited to solving a given problem
- Apply the language/framework of different AI methods for a given problem
- Implement basic AI algorithms

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• Design and carry out an empirical evaluation of different algorithms on problem formalization and state the conclusions that the evaluation supports

UNIT I:

Introduction, history, intelligent systems, foundations of AI, applications, tic-tac-toe game playing, development of AI languages, current trends.(Lecture 12)

UNIT II:

Problem solving: state-space search and control strategies: Introduction, general problem solving, characteristics of problem, exhaustive searches, heuristic search techniques, iterative deepening A*, constraint satisfaction Problem reduction and game playing: Introduction, problem reduction, game playing, alpha beta pruning, two-player perfect information games.(Lecture 12)

UNIT III:

Logic concepts: Introduction, propositional calculus, propositional logic, natural deduction system, axiomatic system, semantic tableau system in propositional logic, resolution refutation in propositional logic, predicate logic.(Lecture 12)

UNIT IV:

Knowledge representation: Introduction, approaches to knowledge representation, knowledge representation using semantic network, extended semantic networks for KR, knowledge representation using frames Advanced knowledge representation techniques: Introduction, conceptual dependency theory, script structure, CYC theory, case grammars, semantic web.(Lecture 12)

UNIT V:

Expert system and applications: Introduction phases in building expert systems, expert system versus traditional systems Uncertainty measure: probability theory: Introduction, probability theory, Bayesian belief networks, certainty factor theory, Dempster-Shafer theory. Fuzzy sets and fuzzy logic: Introduction, fuzzy sets, fuzzy set operations, types of membership functions, multi valued logic, fuzzy logic, linguistic variables and hedges, fuzzy propositions, inference rules for fuzzy propositions, fuzzy systems.(Lecture 12)

Text Books:

- 1) Artificial Intelligence- Saroj Kaushik, CENGAGE Learning.
- 2) Artificial intelligence, A modern Approach, 2nd ed, Stuart Russel, Peter Norvig, PEA.

Reference Books:

- 1) Artificial Intelligence- Deepak Khemani, TMH, 2013.
- 2) Introduction to Artificial Intelligence, Patterson, PHI.
- 3) Artificial intelligence, structures and Strategies for Complex problem solving, George F Luger, 5th ed, PEA.

IV-Semester	L	T	P	C
	5	1	0	5

ACCOUNTING FOR MANAGERS (GE-1)

Course Objectives:

- To learn different Accounting Systems, preparation of Financial Statement and uses of different tools for performance evaluation. GAAP Principles
- To understand the concept of financial management and financial interpretations cost and management accounting principles and applications of standard costing and marginal costing analysis

Course Outcomes:

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• The Learner is able to prepare Financial Statements and the usage of various accounting tools for Analysis and to evaluate various techniques for decision making.

UNIT I:

Accounting Generally Accepted Accounting Principles (GAAP) & Accounting standards, Characteristics and limitations of single-entry system, double entry system of accounting, introduction of basis books of accounts, ledgers. Preparation of trail balance – Final accounts – company final accounts – Users of Accounting Information, Role of Accountant in modern Organizations. **(Lecture 12)**

UNIT II:

Financial Management – meaning and scope, role, objectives of time value of money – over vitalization – under capitalization – profit maximization – wealth maximization – EPS maximization.

Ration Analysis - advantages - limitations - Fund flow analysis – meaning, importance, preparation and interpretation of Funds flow and cash flow statements – statements of changes in working capital.

(Lecture 12)

UNIT III:

Costing – nature and importance and basic principles. Elements of cost – Absorption costing Vs. Marginal costing – Financial accounting vs. cost accounting vs. management accounting.

Marginal costing and Break – even Analysis: nature, scope and importance– Practical applications of marginal costing, limitation and importance of cost – volume, profit analysis, short run decisions.

(Lecture 12)

UNIT IV:

Standard costing and budgeting: nature, scope and computation and analysis – materials variance, labor variance and sales variance – cash budget, sales - budget – flexible Budgets, master budgets. **(Lecture 12)**

UNIT V:

Introduction to computerized accounting system: coding logic and codes, master files, transaction files, introduction documents used for data collection, processing of different files and Outputs obtained.

(Lecture 12)

Reference Books:

- 1) Accounting for Management, N.P.Srinivasan and M.SakthivelMurugan
- 2) Financial Accounting, S.N Maheswari and S.K. Maheswari, Vikas.
- 3) Financial Accounting, A. Mukherjee and M. Heneef, TMH.
- 4) Basic Financial Accounting for Management, Ambaresh Gupta, Pearson.
- 5) Accounts And Finance for Non accounts, Chatterjee, D.K. Himalaya.
- 6) Financial Analysis and Accounting, P. PremchandBabu and M. Madan Mohan, Himalaya.
- 7) Essential of Financial Accounting, Ashish, K and Ballacharya, PHI.
- 8) Guide to Financial Management, John Tannent, Viva.

IV-Semester	L	T	P	C
	5	1	0	5
SOFT COMPUTING (GE-1)				

Course Objectives:

- Develop the skills to gain a basic understanding of neural network theory and fuzzy logic theory.
- Introduce students to artificial neural networks and fuzzy theory from an engineering perspective

Course Outcomes:

- Comprehend the fuzzy logic and the concept of fuzziness involved in various systems and fuzzy set theory.

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- Understand the concepts of fuzzy sets, knowledge representation using fuzzy rules, approximate reasoning, fuzzy inference systems, and fuzzy logic
- To understand the fundamental theory and concepts of neural networks, Identify different neural network architectures, algorithms, applications and their limitations
- Understand appropriate learning rules for each of the architectures and learn several neural network paradigms and its applications
- Reveal different applications of these models to solve engineering and other problems.

UNIT I: Fuzzy Set Theory: Introduction to Neuro, Fuzzy and Soft Computing, Fuzzy Sets, Basic function and Terminology, Set-theoretic Operations, Member Function Formulation and Parameterization, Fuzzy Rules and Fuzzy Reasoning, Extension Principle and Fuzzy Relations, Fuzzy If-Then Rules, Fuzzy Reasoning, Fuzzy Inference Systems, Mamdani Fuzzy Models, Sugeno Fuzzy Models, Tsukamoto Fuzzy Models, Input Space Partitioning and Fuzzy Modeling. **(Lecture 12)**

UNIT II: Optimization: Derivative based Optimization, Descent Methods, and The Method of Steepest Descent, Classical Newton's Method, Step Size Determination, Derivative-free Optimization, Genetic Algorithms, Simulated Annealing, and Random Search, Downhill Simplex Search. **(Lecture 12)**

UNIT III: Artificial Neural Networks: Introduction and ANN Structure, Biological neurons and artificial neurons. Model of an ANN, Activation functions used in ANNs, Typical classes of network architectures, Single layer perceptrons, Structure and learning of perceptrons. Feed forward ANN, Structures of Multi-layer feed forward networks, back propagation algorithm, Back propagation - training and convergence. **(Lecture 12)**

UNIT IV: Neuro Fuzzy Modeling: Adaptive Neuro-Fuzzy Inference Systems, Architecture Hybrid Learning Algorithm, Learning Methods that Cross-fertilize ANFIS and RBFN Coactive Neuro Fuzzy Modeling, Framework Neuron Functions for Adaptive Networks Neuro Fuzzy Spectrum. **(Lecture 12)**

UNIT V: Applications Of Computational Intelligence: Printed Character Recognition, Inverse Kinematics Problems, Automobile Fuel Efficiency Prediction, Soft Computing for Coloripe Prediction. **(Lecture 12)**

Text Books:

- 1) "Neuro-Fuzzy and Soft Computing", J.S.R.Jang, C.T.Sun and E.Mizutani, PHI, 2004, Pearson Education 2004
- 2) Satish Kumar, "Neural Networks: A classroom approach", Tata McGraw Hill, 2004.
- 3) "Artificial Intelligence and Intelligent Systems", N.P.Padhy, Oxford University Press, 2006

Reference Books:

- 1) Artificial Intelligence, Second Edition, Elaine Rich & Kevin Knight, Tata McGraw Hill Publishing Comp., New Delhi, 2nd edition-2006
- 2) "Fuzzy Logic with Engineering Applications", Timothy J.Ross, McGraw-Hill, 3rd edition-1997

IV-Semester	L	T	P	C
	5	1	0	5

SOFTWARE PROJECT MANAGEMENT (GE-1)

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Course Objectives:

At the end of the course, the student shall be able to:

- To describe and determine the purpose and importance of project management from the perspectives of planning, tracking and completion of project
- To compare and differentiate organization structures and project structures
- To implement a project to manage project schedule, expenses and resources with the application of suitable project management tools

Course outcomes:

Upon the completion of the course students will be able to: -

- Apply the process to be followed in the software development life-cycle models
- Apply the concepts of project management & planning
- Implement the project plans through managing people, communications and change
- Conduct activities necessary to successfully complete and close the Software projects
- Implement communication, modeling, and construction & deployment practices in software development

UNIT-I:

Conventional Software Management: The waterfall model, conventional software Management performance.

Evolution of Software Economics: Software Economics, pragmatic software cost estimation.

Improving Software Economics: Reducing Software product size, improving software processes, improving team effectiveness, improving automation, Achieving required quality, peer inspections.

The old way and the new: The principles of conventional software Engineering, principles of modern software management, transitioning to an iterative process. **(Lecture 12)**

UNIT-II:

Life cycle phases: Engineering and production stages, inception, Elaboration, construction, transition phases.

Artifacts of the process: The artifact sets, Management artifacts, Engineering artifacts, programmatic artifacts. **(Lecture 12)**

UNIT- III:

Model based software architectures: A Management perspective and technical perspective.

Work Flows of the process: Software process workflows, Iteration workflows.

Checkpoints of the process: Major mile stones, Minor Milestones, Periodic status assessments.

Iterative Process Planning: Work breakdown structures, planning guidelines, cost and schedule estimating, Iteration planning process, Pragmatic planning. **(Lecture 12)**

UNIT- IV:

Project Organizations and Responsibilities: Line-of-Business Organizations, Project Organizations, evolution of Organizations.

Process Automation: Automation Building blocks, The Project Environment.

Project Control and Process instrumentation: The seven core Metrics, Management indicators, quality indicators, life cycle expectations, pragmatic Software Metrics, Metrics automation. **(Lecture 12)**

UNIT-V:

Agile Methodology, adapting to Scrum, Patterns for Adopting Scrum, Iterating towards Agility.

Fundamentals of DevOps: Architecture, Deployments, Orchestration, Need, Instance of applications,

DevOps delivery pipeline, DevOps eco system. DevOps adoption in projects: Technology aspects, Agiling capabilities, Tool stack implementation, People aspect, processes. **(Lecture 12)**

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Text Books:

- 1) Software Project Management, Walker Royce, PEA, 2005.
- 2) Succeeding with Agile: Software Development Using Scrum, Mike Cohn, Addison Wesley.
- 3) The DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations, Gene Kim, John Willis, Patrick Debois, Jez Humb, 1st Edition, O'Reilly publications, 2016.

Reference Books:

- 1) Software Project Management, Bob Hughes, 3/e, Mike Cotterell, TMH
- 2) Software Project Management, Joel Henry, PEA
- 3) Software Project Management in practice, Pankaj Jalote, PEA, 2005,
- 4) Effective Software Project Management, Robert K. Wysocki, Wiley, 2006
- 5) Project Management in IT, Kathy Schwalbe, Cengage
- 6) Quality Software Project Management, Futrell, Donald F. Shafer, Donald I. Shafer, PEA

IV-Semester	L	T	P	C
	5	1	0	5
CLOUD COMPUTING (GE-1)				

Course Objectives:

The main objective of the course is to implement Virtualization, Task Scheduling algorithms, apply Map-Reduce concept to applications, building Private Cloud and to know the impact of engineering on legal and societal issues involved

Course Outcomes:

At the end of the course, student will be able to

- Interpret the key dimensions of the challenge of Cloud Computing
- Examine the economics, financial, and technological implications for selecting cloud computing for own organization
- Assessing the financial, technological, and organizational capacity of employer's for actively initiating and installing cloud-based applications
- Evaluate own organizations' needs for capacity building and training in cloud computing-related IT areas
- Illustrate Virtualization for Data-Center Automation

UNIT-I:

Systems modeling, Clustering and virtualization: Scalable Computing over the Internet, Technologies for Network based systems, System models for Distributed and Cloud Computing, Software environments for distributed systems and clouds, Performance, Security and Energy Efficiency.

(Lecture 12)

UNIT-II:

Virtual Machines and Virtualization of Clusters and Data Centers: Implementation Levels of Virtualization, Virtualization Structures/ Tools and mechanisms, Virtualization of CPU, Memory and I/O Devices, Virtual Clusters and Resource Management, Virtualization for Data Centre Automation. **(Lecture 12)**

UNIT-III:

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

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UNIT-IV:

Cloud Programming and Software Environments: Features of Cloud and Grid Platforms, Parallel & Distributed Programming Paradigms, Programming Support of Google App Engine, Programming on Amazon AWS and Microsoft Azure, Emerging Cloud Software Environments. **Storage Systems:** Evolution of storage technology, storage models, file systems and database, distributed file systems, general parallel file systems. Google file system, Apache Hadoop, BigTable, Megastore, Amazon Simple Storage Service(S3).**(Lecture 12)**

UNIT-V:

Cloud Resource Management and Scheduling: Policies and Mechanisms for Resource Management Applications of Control Theory to Task Scheduling on a Cloud, Stability of a Two-Level Resource Allocation Architecture, Feedback Control Based on Dynamic Thresholds. Coordination of Specialized Autonomic Performance Managers, Resource Bundling, Scheduling Algorithms for Computing Clouds, Fair Queuing, Start Time Fair Queuing, Borrowed Virtual Time, Cloud Scheduling Subject to Deadlines, Scheduling Map Reduce Applications Subject to Deadlines.**(Lecture 12)**

Text Books:

1. Distributed and Cloud Computing, Kai Hwang, Geoffry C. Fox, Jack J. Dongarra MK Elsevier.
2. Cloud Computing, Theory and Practice, Dan C Marinescu, MK Elsevier.
3. Cloud Computing, A Hands-on approach, ArshadeepBahga, Vijay Madiseti, University Press

Reference Books:

1. Cloud Computing: A Practical Approach. Anthony T.Velte. Toby J.VeFte, Robert Elsenpeter. Tata McGraw Hill. rp2011.
2. Enterprise Cloud Computing GautamShroif, Cambridge University Press. 2010.
3. Cloud Computing: Implementation, Management and Security, John W. Rittinouse, James F Ransome. CRC Press, rp2012.
4. Cloud Application Architectures: Building Applications and Infrastructure in the Cloud. George Reese, O'Really SPD, rp2011.
5. Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance, Tim Mather, Subra Ktriaraswamy, Shahed Latif, O'Redç SPD, rp2011.

Note: The students shall register in any of the Clouds like AWS/Azure, etc and learn about cloud services.

IV-Semester	L	T	P	C
	5	1	0	5
OPTIMIZATION TECHNIQUES (GE-1)				

Course Objectives:

- To understand the theory of optimization methods and algorithms developed for solving various types of optimization problems.
- To develop and promote research interest in applying optimization techniques in problems of Engineering and Technology.
- To apply the mathematical results and numerical techniques of optimization theory to concrete Engineering problems.

Course Outcomes(COs): At the end of the course, student will be able to

- Describe clearly a problem, identify its parts and analyze the individual functions
- Feasibility study for solving an optimization problem
- Becoming a mathematical translation of the verbal formulation of an optimization problem
- To design algorithms, the repetitive use of which will lead reliably to finding an approximate solution

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- Discovery, study and solve optimization problems
- Investigate, study, develop, organize and promote innovative solutions for various applications

UNIT I:

Development: Definition, Characteristics and Phrases, scientific method. Types of models, general methods for solving, operations research modes, **Allocation:** introduction linear programming formulation, graphical solution, simplex methods, artificial variable technique, duality principle. **(Lecture 12)**

UNIT II:

Transportation problem: Formulation, optimal solution, unbalanced transportation, **Assignment problem:** formulation, optimal solution, variations problem, degeneracy i.e., non square $M \times N$ matrix, restrictions, **Sequencing:** Introduction, optimal solution for processing each of n jobs through three machines, travelling salesman problem (i.e.) shortest acyclic route models. **(Lecture 12)**

UNIT III:

Replacement: Introduction, replacement of items that deteriorate when money value is not counted and counted, and replacement of items that fail completely (i.e.) group replacements, **Waiting lines:** Introduction, single channel, Poisson arrivals, exponential service time infinite population and unrestricted queue. **(Lecture 12)**

UNIT IV:

Inventory: Introduction, single item, deterministic models, production is instantaneous or at a constant rate, shortages are allowed or not allowed and with drawls from stock is continuous, purchase inventory model with one price break, shortages are not allowed, instantaneous production demand production or purchase cost is relevant, stochastic models, simple problems. **(Lecture 12)**

UNIT V:

Theory of Games: Introduction, minmax (maximum), criterion and optimal strategy solution of games with saddle points, rectangular without saddle points. **Dynamic programming:** Introduction, Bellman's Principle of optimality, solutions for simple problems, **Project Management:** PERT and CPM, difference between PERT and CPM, PERT/CPM network components and precedence relations, Time Estimates for activities. **(Lecture 12)**

Text Books:

- 1) Operations Research, 2nd Edition, S.D.Sharma, Ramnath, &Kedarnath co, Meerut, 2009
- 2) Operations Research, An introduction, 8th Edition, Taha, Pearson, 2008

Reference Books:

- 1) Operations Research, Revised edition, P.K.Gupta, D.S. Hira, S.Chand, 2014
- 2) Operations Research, Problems & solutions, 2nd Edition, JK Sharma, Macmillan, 2003
- 3) Operations Research, 2nd Edition, Panneerselvam, PHI, 2004

IV-Semester	L	T	P	C
	5	1	0	5
CYBER SECURITY (GE-1)				

Course Objectives:

- To familiarize various types of cyber-attacks and cyber-crimes
- To give an overview of the cyber laws
- To study the defensive techniques against these attacks.

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Course Outcomes: At the end of the course, student will be able to understand cyber-attacks, types of cybercrimes, cyber laws and also how to protect them self and ultimately the entire Internet community from such attacks.

UNIT I:

Introduction to Cyber Security: Basic Cyber Security Concepts, layers of security, Vulnerability, threat, Harmful acts, Internet Governance – Challenges and Constraints, Computer Criminals, CIA Triad, Assets and Threat, motive of attackers, active attacks, passive attacks, Software attacks, hardware attacks, Spectrum of attacks, Taxonomy of various attacks, IP spoofing, Methods of defense, Security Models, risk management, Cyber Threats-Cyber Warfare, Cyber Crime, Cyber terrorism, Cyber Espionage, etc., Comprehensive Cyber Security Policy.(**Lecture 12**)

UNIT II:

Cyberspace and the Law & Cyber Forensics: Introduction, Cyber Security Regulations, Roles of International Law. The INDIAN Cyberspace, National Cyber Security Policy. Introduction, Historical background of Cyber forensics, Digital Forensics Science, The Need for Computer Forensics, Cyber Forensics and Digital evidence, Forensics Analysis of Email, Digital Forensics Lifecycle, Forensics Investigation, Challenges in Computer Forensics, Special Techniques for Forensics Auditing.(**Lecture 12**)

UNIT III:

Cybercrime: Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops.(**Lecture 12**)

UNIT IV:

Cyber Security: Organizational Implications: Introduction, cost of cybercrimes and IPR issues, web threats for organizations, security and privacy implications, social media marketing: security risks and perils for organizations, social computing and the associated challenges for organizations. **Cybercrime and Cyber terrorism:** Introduction, intellectual property in the cyberspace, the ethical dimension of cybercrimes the psychology, mindset and skills of hackers and other cyber criminals.(**Lecture 12**)

UNIT V:

Privacy Issues: Basic Data Privacy Concepts: Fundamental Concepts, Data Privacy Attacks, Data linking and profiling, privacy policies and their specifications, privacy policy languages, privacy in different domains- medical, financial, etc.(**Lecture 12**)

Text Books:

1. Nina Godbole and SunitBelpure, Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley
2. B. B. Gupta, D. P. Agrawal, Haoxiang Wang, Computer and Cyber Security: Principles, Algorithm, Applications, and Perspectives, CRC Press, ISBN 9780815371335, 2018.

Reference Books:

1. Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press.
2. Introduction to Cyber Security, Chwan-Hwa(john) Wu,J. David Irwin, CRC Press T&F Group