M.Sc. Computer Science

Scheme of CBCS for MSC (CS)

Code	Semester I	Theory/ Practical		Internal		Hp W	Pp W	C
		Max	Min	Max	Min			
CS101T	Computer System Architecture	40	14	10	4	4		4
CS102T	Software Engineering and Modeling	40	14	10	4	4		4
CS103T	Information Security	40	14	10	4	4		4
CS104T	Computer Oriented Statistical Analysis	40	14	10	4	4		4
CS105T	Java with GUI and web technologies	40	14	10	4	4		4
CS101P	Assembly Language Lab	34	12				4	2
CS104P	Statistical Analysis Lab using MATLAB/SPSS	33	12				4	2
CS105P	Java with GUI and web technologies Lab	33	12				4	2
SBC106	Skill Based Course							1
Total Marks / CR		**350**						**27**
Code	Semester II	Max	Min	Max	Min	Hp W	Pp W	C
CS201T	Automata Theory	40	14	10	4	4		4
CS202T	Computer Graphics	40	14	10	4	4		4
CS203T	Relational Database Management System	40	14	10	4	4		4
CS204T	Operation Research	40	14	10	4	4		4
CS205T	Big Data Analytics	40	14	10	4	4		4
CS202P	Computer Graphics Lab	34	12				4	2
CS203P	SQL and PL/SQL Lab	33	12				4	2
CS205P	Big Data Analytics Lab	33	12				4	2
SBC206	Skill Based Course							1
Total Marks / CR		**350**						**27**
Code	Semester III	Max	Min	Max	Min	Hp W	Pp W	C
CS301T	Advanced Computer Networks	40	14	10	4	4		4
CS302T	Data Mining	40	14	10	4	4		4
CS303T	Analysis and Design of Algorithms	40	14	10	4	4		4
CSE 304T	Artificial Intelligence / Digital Marketing	40	14	10	4	4		4
OE 305T	Macro-Economic Analysis / Management Concepts and Organizational Behavior / Cyber Security	40	14	10	4	4		4
CS302P	Data Mining Lab	34	12				4	2
CS303P	Analysis and Design of Algorithms Lab	33	12				4	2
CSE 304P	Prolog Programming Lab / Big Data Analytics Lab	33	12				4	2
SBC306	Skill Based Course							1
Total Marks / CR		**350**						**27**
Code	Semester IV	Max	Min	Max	Min	Hp W	Pp W	C

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CS401T		Compiler Design	40	14	10	4	4		4
CS402T		Cloud Computing	40	14	10	4	4		4
CS E	403 T	Software Project Management	40	14	10	4	4		4
		TCP/IP Concepts							
OE	404 T	Indian Economy	40	14	10	4	4		4
		Citizen and Civic Awareness							
		Economics of Gender and Development							
		Data Science using Python							
P405		Major Project/ Research Project	Project/100			Viva -50 Min- ·17	12		6
			Pre-25	File-75	Min-35				
SBC406		Skill Based Course							1
Total Marks / CR			350						23
Grand Total/ CR			1400				88	16	104

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Lectures/Unit	Credits		Theory		Internals		Practical	
			Max	Min	Max	Min	Max	Min
14	T	P	40	14	10	4	34	12
	4	2						

Course objective: To study the basic organization and architecture of digital computers, digital logics and microprogramming. Will provide understanding to design algorithm for computer hardware with respect to mathematical operation also can learn the concepts of parallel processing, pipelining and inter processor communication.

Course outcome: Students will be able to understand the architectural working of computer and can be used in the design and application of computer systems or as foundation for more advanced computer related studies.

UNIT-I

DIGITAL LOGIC CIRCUITS: Logic gates, AND, OR, NOT, GATE and their truth tables, NOR NAND & XOR gates. BOOLEAN ALGEBRA: De-morgan's theorem. MAP SIMPLIFICATION: Minimization techniques, K-Map. Sum of product & product of sums. COMBINATIONAL & SEQUENTIAL CIRCUITS: Half adder, full adder, full subtractor, Flip-Flops-RS ,T and Master-Slave JK, Shift registers, counters.

UNIT-II

Computer Arithmetic: Arithmetic Algorithms - Addition & Subtraction (with signed Magnitude data, hardware implementation, Hardware Algorithm, Addition and Subtraction with Signed-2's Complement Data, Multiplication Algorithms -Hardware implementation for signed Magnitude data, Hardware Algorithm, Booth's Algorithm, Array Multiplier, Division algorithm- Hardware implementation for signed Magnitude data, Divide overflow, Hardware Algorithm. Floating point Arithmetic Operations- Register Configuration, Addition, Subtraction, Multiplication and Division.

UNIT-III

Introduction to Parallel Processing: Parallelism in Uni-Processor Systems, Parallel Processing Mechanisms, Parallel Computer Structures: Pipeline Computers, Array Computers, Multiprocessors Systems, Performance of Parallel Computers, Dataflow and New Concepts, Architectural Classification Schemes, Applications of Parallel Processing.

UNIT-IV

Pipeline & Vector Processing: Principles of pipelining, Arithmetic pipeline, Instruction Pipeline Vector Processing, Matrix multiplication, Memory Interleaving, Supercomputers, Array Processor (Attached Array and SIMD).

UNIT-V

Introduction to Assembly Language, Name field, operator field, comment field, program data (Number, Character), variable (Byte, word, array), named constant, Basic instructions (MOV,XCHG, ADD,SUB,INC,DEC). Program Structure: memory model, data segment, stack segment, code segment. Input and output instruction. Flow control instruction (conditional jump, branching structure, looping structure, logic and shift instruction, stack application, Procedure.

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Text Books: -
Computer System Architecture, by Morris Mano, PHI.
Computer Architecture & Parallel Processing by Hwang, Briggs, McGraw-Hill.
Reference Books:-
Computer Organization and Design, 3rd edition by David Patterson and John Hennessy's,
Tanenbaum, A. S. Structured Computer Organization, 3rd Ed., Prentice Hall, 1990.

Practical List

1. Write a program for printing a character.
2. Display a message on screen.
3. Print characters starting from A to Z.
4. Write a program for Xchg operation.
5. Write a program to add two numbers.
6. Write a program to subtract two numbers.
7. Perform jump operation.
8. Write a program to multiply two numbers.
9. Print 10 times hello using loop.
10. Print all 255 ASCII Characters.
11. Program for reversing a string.
12. Program for creating an array.
13. Write a program for comparing two values.
14. Program to compare any number with 5.

M.Sc. Computer Science

St. Aloysius College(Autonomous), Jabalpur
Semester I
Core Paper- CS102T
Subject: Software Engineering and Modeling

Lectures/Unit	Credits		Theory		Internals	
			Max	Min	Max	Min
14	T	P	40	16	10	5
	4	0				

UNIT I
Software Processes: Define Software Engineering, Processes, Process Models, projects and products, component software processes, characteristics of a software process, software development process, project management process. Software requirement Analysis and Specification: Software requirement, need for SRS, characteristics of an SRS, component of an SRS, structure of requirement document validation, requirement reviews.

UNIT II
Planning Software Project: Cost estimation, uncertainties in cost estimation, building cost estimation models, on size estimation, COCOMO model, project scheduling, average estimation, project scheduling and milestones, staffing and personnel planning, team structure, software configuration management plans, quality assurance plans, verification and validation, project monitoring plans, risk management.

UNIT III
Function Oriented Design: Design principles, coupling, cohesion, design notation and specification, structured design methodology, verification, network metrics, stability metrics, information flow metrics. OO Modeling Concepts, Class Modeling- Object and class concepts, Link and association concepts, generalization and inheritance, Advanced class modeling-Concepts, association ends, N-ary associations, aggregation, abstract classes, multiple inheritance. State Modeling- Events, states, transitions and conditions, concurrency, interaction Modeling- use case models, sequence models, activity models.

UNIT IV
Testing Methods: Software testing fundamentals, test case design, white box testing, control structure testing, black - box testing, testing for specialized environments. **Software Testing Strategies:** A strategic Approach to software testing, strategic issues, unit testing, validation testing, system testing, the art of debugging.

UNIT V
Re-Engineering: Software re-engineering, software maintenance, software reengineering process model, reverse engineering, reverse engineering user interfaces restructuring, code restructuring, data restructuring, forward engineering the economics of reengineering. **Client / Server software Engineering:** The structure of Client/server systems, software engineering for c/s systems, analysis modeling issues, design for c/s systems, testing issues. **Computer-Aided software Engineering:** What is case, building blocks for case, taxonomy of case tools, integrated case environments, the integration architecture, case repository.

Textbooks:
Software Engineering, A Practitioners Approach Tata Mc Graw hill by Pressman Rogers
Reference Books:
An Integrated Approach to Software Engineering by Pankaj Jalote.
Software Engineering Concepts by R.E. Fairly, Mc Graw Hill.
Software Project Management by Boyce

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St. Aloysius College(Autonomous), Jabalpur
Semester-I
Core Paper- CS103T
Subject: Information Security

Lectures/Unit	Credits		Theory		Internals	
			Max	Min	Max	Min
14	T	P	40	16	10	5
	4	0				

Course Objectives:
- Aware and Understand the Challenges and Scope of Information Security.
- Gain the Knowledge of Basic Security Concepts.
- Learn and Understand the Importance of Cryptographic Algorithms and Their Uses.
- Learn and Understand Access Control Mechanism Used for User Authentication and Authorization.

Course Outcome:
1. Principles of Cryptography and Cryptanalysis Including Symmetric and Asymmetric Encryption Hashing and Digital Signatures.
2. Identify and Classify Particular Examples of Attacks.
3. Implement the Various Security Algorithms.
4. Analyze the Root Causes of Attacks & Suggest Appropriate Solution for Different Types of Security Breach Scenario.

Unit I: Introduction to Information Security, Component of Information System, Information Security Dimensions, Security System development Life Cycle, Security Professional and Organization, Security Threats, Security Attacks, Software Development Security Problems, Ethics and Information Security.

Unit II: Risk Management: Risk Identification, Risk Assessment, Risk Control Strategies, Selecting a Risk Control Strategy, Security Planning: The Information Security Blueprint, Continuity Strategies for Security Planning. Security Technologies: Access Control, Firewalls, Protecting Remote Connections.

Unit III: Security Technology: Intrusion Detection and Prevention Systems, Honeypots, Honeynets, and Padded Cell Systems, Scanning and Analysis Tools, Biometric Access Controls. Data Security: Cryptography Terminologies, Substitution Cipher, Transposition Cipher, Exclusive OR, Vernam Cipher, Book or Running Key Cipher, Hash Functions,

Unit IV: Cryptographic Algorithms: Symmetric Encryption, Asymmetric Encryption, Cryptographic Tools: Public-Key Infrastructure (PKI), Digital Signatures, Digital Certificates, Hybrid Cryptography Systems, Steganography, Protocols for Secure Communications, Attacks on Cryptosystems

Unit V: Database Security: Database Security Layers, Database-Level Security, Database Backup and Recovery, Database Auditing and Monitoring, Network Security, Computer Security, Application Security, Security Management. Physical Security,

Text books
1. William Stallings Cryptography and Network Security PHI.
2. Bruce Schneier- the Mathematics of Encryption- American Mathematical Society

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Semester I
Core Paper- CS104T
Subject: Computer Oriented Statistical Analysis

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Lectures/Unit	Credits		Theory		Internals		Practical	
			Max	Min	Max	Min	Max	Min
14	T	P	40	14	10	4	33	12
	4	2						

Course Objective: The objective of this paper is to comprehend the methods of obtaining and analyzing data, in order to draw inference for making decisions. The course also briefs scientific methods for statistical analysis.

Course Outcome: Upon completion of the program, students will be able to demonstrate knowledge of:

1. Standard statistical distributions.
2. Fixed-sample and large-sample statistical properties of point and interval estimators.
3. How to design hypothesis and surveys for efficiency.

UNIT-I

Correlation and Regression Analysis: Introduction, Methods of Correlation (Karl Pearson's, Direct Method, Deviations taken from Assumed mean), Regression Equations X on Y, Y on X (Deviation taken from Arithmetic and Assumed Means), Standard Error of Estimate.

UNIT-II

Statistical Inference: Hypothesis Testing, Estimation, Test of Significance for large samples (Standard Error of Mean), Test of Significance for small samples (t and Z test), Chi-square test and Goodness of Fit, Variance Ratio test (F-test).

UNIT-III

Analysis of Variance and Time Series: Introduction, Assumptions, Techniques (One Way and Two-Way ANOVA), Utility and Components of Time Series.

UNIT-IV

Statistical Quality Control: Introduction, Control Charts and its Types, Setting up a Control Procedure, XChart, RChart, Control Chart for C, P, Advantages and Limitations of SQC, Acceptance Sampling.

UNIT-V

Business Forecasting: Introduction, Role, Steps, Methods, Theories and Cautions. **Statistical Decision Theory:** Introduction, Ingredients, Optimal Decisions and Miscellaneous Illustrations using Decision Tree Analysis.

Textbooks

Statistical Methods by S.P. Gupta

Reference Books:

Statistical Methods by N.G. Das

Statistical Analysis Handbook by Dr. Michael J De Smith

List of Practical's

1. WAP in Matlab to perform t-test
2. WAP in Matlab to perform Z-test
3. WAP in Matlab to perform F-test
4. WAP in Matlab to perform Chi-squaretest
5. WAP in Matlab to perform One way ANOVA
6. WAP in Matlab to perform Two way ANOVA

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Semester-I

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Semester -I

Core Paper- CS105T
Subject- Java with GUI and web technologies

Lectures/Unit	Credits		Theory		Internals		Practical	
			Max	Min	Max	Min	Max	Min
14	T	P	40	14	10	4	33	12
	4	2						

Course objective:

- To understand the concepts and features of object-oriented programming.
- To examine key aspects of java Standard API library such as util, io, applets, swings, GUI based controls.
- To learn java's exception handling mechanism, multithreading, packages and interfaces.
- To develop skills in internet programming using applets and swings.
- To develop skills of client-side scripting.
- To familiarize the student with client server architecture and development of web application using Java technologies. Students will gain the skills and project-based experience needed to enter into Web Application and Development careers.

Course Outcome:

The students will be able to comprehend classical problems using Java Programming, implement frontend and backend of an application and also build real world applications.

They will be able to write a well formed / valid XML document, can establish connectivity to database, and perform Server-Side application using JSP and Servlet.

UNIT-I

Introduction of Java, **Applet Class:** Life Cycle of an Applet, The Applet Tag and their attributes, Passing Parameter to an Applet, Graphics in Applet. **AWT:** Event Handling: Event Handling Mechanism, the Delegation Event Model, Event Classes, Sources of Events, Event Listener Interfaces.

UNIT-II

AWT controls, Adapter Classes, Layout Managers and Menus.

Swings: JButton, JLabel, JTextField, JTextArea, JPasswordField, JCheckBox, JRadioButton, JComboBox, JTable, JList, JScrollBar, JMenuItem & JMenu, JPopupMenu , JCheckBoxMenuItem , JTree , JTabbedPane , JPanel , JFrame, JScrollPane.

UNIT-III

Java Database Connectivity(JDBC): Introduction, JDBC Driver, DB Connectivity steps, Connectivity with Oracle, MySQL and MS Access, Connection Interface, Statement Interface, ResultSet Interface, Prepared Statement.

UNIT-IV

Servlet: Servlet API, Servlet interface, Generic Servlet class, Http Servlet class, Life Cycle of a Servlet, Servlet Request Interface, Request Dispatcher interface, Servlet Config Interface, Servlet Context Interface, cookies, hidden form field, Http Session.

Data Access with Servlets: Connecting to a Database, Retrieving Data.

UNIT-V

JSP Overview: JSP- Life Cycle: JSP Compilation, JSP Initialization, JSP Execution, JSP Cleanup. **JSP Syntax:** The Scriptlet, JSP Declarations, JSP Expression, JSP Comments, JSP Directives, JSP Actions, JSP Implicit Objects, Control Flow Statements, Decision Making Statements, Loop Statements, JSP Operators, JSP Literals, **JSP Directives, JSP- Client Request:** The HttpServletRequest Object, HTTP Header Request Example. **JSP- Server Response:** The HttpServletResponse Object, HTTP Header Response Example. **JSP Form Processing:** GET method, POST method, Reading Form Data using JSP.

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Text Books:
- The Complete Reference: Java 2 – 5Ed, Herbert Schildt, Tata McGraw-Hill Publishing
- Company Limited.
- Java Servlet Programming Bible, S. Rajagopalan, R. Rajamani, R. Krishnaswamy, and S. Vijendran, WILEY dreamtech India Pvt. Lmt.
- The Complete Reference: Java 2 – 5Ed, Herbert Schildt, Tata McGraw – Hill Publishing Company Limited.

Reference Books:
- Java Examples in a Nutshell - by David Flanagan
- The Java AWT Reference by John Zukowski Publisher: O'Reilly & Associates, Inc.
- The Java Class Libraries: An Annotated Reference by Patrick Chan, Rosanna Lee
- Publisher: Addison-Wesley
- Designing Better Apps and Applets with Java by Peter Coad, Mark Mayfield
- Java Servlet Programming Bible
- Database Programming with JDBC and Java - by George Reese

Practical List
1. WAP to demonstrate object cloning.
2. WAP to demonstrate WAP to demonstrate use of super keyword.
3. WAP to demonstrate use of this keyword.
4. WAP to demonstrate use of inner class.
5. WAP to demonstrate use of static keyword.
6. WAP to demonstrate multiple inheritances using interface.
7. WAP to run multiple threads at a time.
8. WAP to demonstrate use of user defined Package.
9. WAP to demonstrate thread synchronization.
10. WAP to demonstrate Layout managers.
11. WAP to demonstrate adapter classes.
12. WAP to create registration form with proper layout.
13. WAP to demonstrate login form.
14. Create a servlet that prints today's date.
15. Create a servlet for a login page. If the username and password are correct then it says message "Hello <username>" else a message "login failed".
16. create a servlet that uses Cookies to store the number of times a user has visited servlet.
17. Create a servlet that displays some header information from your request as well as any form data.
18. Create a servlet filter that changes all text to upper case.
19. Create a JSP that prints current date and time.
20. Create a JSP that adds and subtracts two numbers.
21. Create a JSP that prints odd numbers that come within a range.
22. Create a JSP for login module.

Semester-II
Core Paper- CS201T
Subject- Automata Theory

Lectures/Unit	Credits		Theory		Internals	
			Max	Min	Max	Min
14	T	P	40	14	10	4
	4	0				

Course objective: This course is designed with the objective to give understanding of several formal mathematical models of computation to the students. Students will learn about automaton, their grammar and they are able to describe how they relate it to formal languages. Students will understand what is possible and what is not possible with computers. They will understand different types of problems such as P, NP, NP complete and NP hard problem.

Course outcome: At the end of the course, the student will be able to analyze different computational models. They will be able to apply rigorously formal mathematical methods to prove properties of languages, grammars and automata. They will be able to identify the limitations of some computational models and possible methods of proving them.

UNIT-I

Fundamentals – alphabets, strings, languages, problems, graphs, trees, Finite State Systems, definitions, Finite Automaton model, acceptance of strings, and languages, Deterministic finite automaton and Nondeterministic finite automaton, transition diagrams, transition tables, proliferation trees and language recognizers, equivalence of DFA's and NFA's. Finite automata with ε-moves, significance, acceptance of languages, ε-closure.

UNIT-II

Minimization of finite automata, Finite automata with output– Moore and Melay machines. Regular Languages: regular sets, regular expressions, identity rules, constructing finite automata for a given regular expressions, conversion of finite automata to regular expressions. Pumping lemma of regular sets and its applications, closure properties of regular sets. Grammar Formalism: Regular grammars–right linear and left linear grammars.

UNIT-III

Context free grammar, derivation trees, sentential forms, right most and leftmost derivation of strings, ambiguity. Context Free Grammars: Simplification of Context Free Grammars, Chomsky normal form, Greibach normal form.

UNIT-IV

Pumping lemma for context free languages and its applications, closure of properties of CFL (proofs omitted). Push Down Automata: PDA definition, model, acceptance of CFL, acceptance by final state and acceptance by empty state and its equivalence. Turing Machine: TM definition, model, design of TM, computable functions, unrestricted grammars, recursively enumerable languages.

UNIT-V

Linear bounded automata and Context sensitive language. Computability Theory: Chomsky hierarchy of languages. Definitions of P and NP problems, NP complete and NP hard problems.

Text Books:

1. J. E. Hopcroft, J. D. Ullman, Introduction to Automata Theory, Languages, and Computation
2. Perter Linz, An Introduction to Formal Languages and Automata

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Reference Books:

1. John C. Martin, Introduction to Languages and the Theory of Computation
2. Mishra, Chandrashekaran, Theory of Computer Science

Semester II
Core Paper- CS202T
Subject: Computer Graphics

Lectures/Unit	Credits		Theory		Internals		Practical	
			Max	Min	Max	Min	Max	Min
14	T	P	40	14	10	4	34	12
	4	2						

Course objective: The objective is to introduce the use of the components of graphics and will be familiar with building approach of algorithms related to them. The course will comprehend the basic principles of 2-dimensional and 3-dimensional computer graphics, an understanding of how to scan, convert the basic geometrical primitives, how to transform the shapes to fit them as per the picture definition and provide an understanding of mapping the world coordinates to device coordinates.

Course outcome: Student will be able to implement the basic concepts and various algorithms to scan, convert the basic geometrical primitives, transformations, area filling, clipping, viewing, projections and transformations.

UNIT-I

A brief background about applications of Computer Graphics. Overview of graphic systems, video display devices, refresh cathode ray tubes, raster and random screen display, color CRT monitors, flat panel displays, LCD's. Design and architecture of raster scan and random scan display systems. A brief introduction to input devices and hardcopy devices. Output primitives, DDA and Bresenham's 2D line drawing algorithms, parallel line algorithms.

UNIT-II

Midpoint circle generating algorithm, Ellipse generating algorithm, other curves, filled area primitives, scan line polygon fill algorithm, inside outside test, boundary fill algorithms, flood fill algorithm, character generation, attributes of output primitive, line and curve attributes, character attributes.

UNIT-III

Anti-aliasing, two dimensional geometric transformations, composite transformations. General composite transformations and computational efficiency, other transformations, affined transformation, two dimensional viewing, window to view port coordinate transformations.

UNIT-IV

Clipping operations, Cohen Sutherland line clipping, Liang Barsky line clipping, Nicholl-Lee- Nicholl line clipping, polygon clipping, Sutherland Hodgeman and Weiler Atherton polygon clipping, text and curve clipping.Three dimensional concepts, display methods, polygon surfaces, quadric surfaces and super quadrics.

UNIT-V

Three dimensional geometric and modeling transformations, general three dimensional rotation. Three dimensional viewing, pipeline projections, parallel and perspective projections, view volume and general projective transformations. Visible surface detection methods, Back Face detection, Depth Buffer

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Method, A buffer method, Depth sorting method.
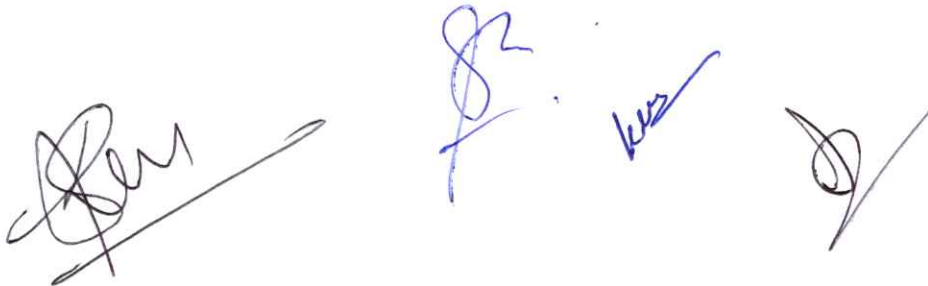
Text Book:
Donald Hearn and M. Pauline Baker, Second Edition, PHI 1997.
Reference Books:
J. D. Foley, A van Dam, S. K. Feiner, J. F. Hughes, Addison Wesley Publ. Company,
1997 Jim Blinn, Jim Blinn's Corner : A trip down the graphics pipeline, Morgan
Kaufman, 2000. Computer Graphics by schaum's outlines.

Practical List
1. Program to generate a pixel on screen.
2. Program to draw four connected pixels (Rectangle shape).
3. Program to generate line using DDA algorithm.
4. Program to plot line using slope and intercept.
5. Program to plot line using Bressenhams algorithm.
6. Program to generate circle using mid-point circle algorithm.
7. Program to translate line and rectangle.
8. Program to scale line and rectangle.
9. Program to generate ellipse.
10. Program to generate ellipse using mid-point algorithm.

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Subject: Relational Database Management System

Lectures/Unit	Credits		Theory		Internals		Practical	
			Max	Min	Max	Min	Max	Min
14	T	P	40	14	10	4	33	12
	4	2						

Course Objective: To give knowledge of the Relational Model of Data Management. This course contains approaches to organize, store, retrieve and process data, architecture and design techniques for effective implementation, different anomalies, their solutions, a platform for understanding of SQL and PL/SQL, distributed database, transection concurrency and recovery.

Course Outcome: Student will be able learn database creation and modification. Data definition, manipulation, control using SQL command. They will learn the concepts of joining the database which will help them access data from different relations. Students will be able to implement the programming using PL/SQL for automated and fast database activities.

UNIT-I
Introduction: Advantages of DBMS approach, various views of data, data independence, schema & sub-schema, Primary concepts of data models, Database languages, transaction management, database administrator, & uses, data dictionary, overall system architecture. ER Model: Basic concepts, design issues, mapping constraints, keys, ER diagram, weak & strong entity sets, specialization & generalization, aggregation, inheritance, design of ER schema, reduction of ER schema to tables.

UNIT-II
Domain Relation & Keys: Domains, relations, kinds of relation, relational databases, various types of keys, candidate, primary, alternate & foreign keys. Relation algebra & SQL: The structure, relation algebra with extended operations, modification of database, idea of relational calculus, basic structure of SQL, set operation, aggregate function, null values, nested sub queries, derived relations, views, modification of database, join relations, DDL & SQL.

UNIT-III
Functional dependencies & Normalization: Base definition, trivial and nontrivial dependencies, closure set of dependencies, & of attributes, irreducible set of dependencies, introduction to normalization, non-loss decomposition, FD diagram, I,II & III NF, dependencies prevention, BCNF, multivalued dependencies, preventions, BCNF, Multivalued dependencies & 4NF, Join dependencies & 5NF. Database Integrity: General idea, Integrity rule, domain rules, attributes, relation, rules, database rule, assertions, triggers, integrity& SQL.

UNIT-IV
Distributed databases: Basic idea, distributed, data storage, data replication, data fragmentation, horizontal, vertical, & mixed fragmentation. Emerging field in DBMS: Object- Oriented database- basic idea & the model object structures Object, class, inheritance, multiple object identify, data warehousing terminology, definitions, characteristics, data mining & its overview, database on WWW, multimedia database difference with conventional DBMS, issues, similarity based retrieval continuous media data, multimedia data formats, video servers.

UNIT-V

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Unit – V

Transaction Management-concurrency & recovery, ACID properties, transaction state, implementation of atomicity and durability, concurrent execution. Basic idea of serializability, concurrency control, deadlock, failure classification, Storage structure- types; stable storage implementation, data access. Recovery & Atomicity: Log based recovery, deferred database modifications, immediate database modification, and check points.

Text Books:
- Data base concepts by Henry F. Korth, MGH
- An Introduction to database system by Bipin C. Desai, Galgotia Pub.

Reference Books:
- Database Management system by Arun K. Majumdar & P. Bhattacharya, TMH Pub.
- Principles of Database system by Jeffrey O. Ullman, Galgotia Pub, Co. Ltd.
- Principles of Database Management system by James Martin, PHI

Suggested Practical List

I)   Sample Table – Worker

WORKER_ID	FIRST_NAME	LAST_NAME	SALARY	JOINING_DATE	DEPARTMENT
001	Monika	Arora	100000	2014-02-20 09:00:00	HR
002	Niharika	Verma	80000	2014-06-11 09:00:00	Admin
003	Vishal	Singhal	300000	2014-02-20 09:00:00	HR
004	Amitabh	Singh	500000	2014-02-20 09:00:00	Admin
005	Vivek	Bhati	500000	2014-06-11 09:00:00	Admin
006	Vipul	Diwan	200000	2014-06-11 09:00:00	Account
007	Satish	Kumar	75000	2014-01-20 09:00:00	Account
008	Geetika	Chauhan	90000	2014-04-11 09:00:00	Admin

II)   Sample Table -- Bonus

WORKER_REF_ID	BONUS_DATE	BONUS_AMOUNT
1	2016-02-20 00:00:00	5000
2	2016-06-11 00:00:00	3000
3	2016-02-20 00:00:00	4000
1	2016-02-20 00:00:00	4500
2	2016-06-11 00:00:00	3500

III)   Sample Table -- Title

WORKER_REF_ID	WORKER_TITLE	AFFECTED_FROM
1	Manager	2016-02-20 00:00:00
2	Executive	2016-06-11 00:00:00
8	Executive	2016-06-11 00:00:00
5	Manager	2016-06-11 00:00:00
4	Asst. Manager	2016-06-11 00:00:00
7	Executive	2016-06-11 00:00:00
6	Lead	2016-06-11 00:00:00
3	Lead	2016-06-11 00:00:00

1. Write an SQL query to fetch "FIRST_NAME" from Worker table using the alias name as <WORKER_NAME>.
2. . Write an SQL query to fetch "FIRST_NAME" from Worker table in upper case.
3. . Write an SQL query to fetch unique values of DEPARTMENT from Worker table.
4. . Write an SQL query to print the first three characters of FIRST_NAME from Worker table.
5. . Write an SQL query to find the position of the alphabet ('a') in the first name column 'Amitabh' from Worker table.
6. Write an SQL query to print the FIRST_NAME from Worker table after removing white spaces from the right side.
7. Write an SQL query to print the DEPARTMENT from Worker table after removing white spaces from the left side.
8. Write an SQL query that fetches the unique values of DEPARTMENT from Worker table and prints its length.
9. Write an SQL query to print the FIRST_NAME from Worker table after replacing 'a' with 'A'.
10. Write an SQL query to print the FIRST_NAME and LAST_NAME from Worker table into a single column COMPLETE_NAME. A space char should separate them.
11. Write an SQL query to print all Worker details from the Worker table order by FIRST_NAME Ascending.
12. Write an SQL query to print all Worker details from the Worker table order by FIRST_NAME Ascending and DEPARTMENT Descending.
13. Write an SQL query to print details for Workers with the first name as "Vipul" and "Satish" from Worker table.
14. Write an SQL query to print details of Workers with DEPARTMENT name as "Admin".
15. Write an SQL query to print details of the Workers whose FIRST_NAME contains 'a'.
16. Write an SQL query to print details of the Workers whose FIRST_NAME ends with 'a'.
17. Write an SQL query to print details of the Workers whose FIRST_NAME ends with 'h' and contains six alphabets.
18. Write an SQL query to print details of the Workers whose SALARY lies between 100000 and 500000.
19. Write an SQL query to print details of the Workers who have joined in Feb'2014.
20. Write an SQL query to fetch the count of employees working in the department 'Admin'.
21. Write an SQL query to fetch worker names with salaries >= 50000 and <= 100000.
22. Write an SQL query to fetch the no. of workers for each department in the descending order.
23. Write an SQL query to print details of the Workers who are also Managers.
24. Write an SQL query to fetch duplicate records having matching data in some fields of a table.

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Core Paper- CS204T
Subject: Operation Research

Lectures/Unit	Credits		Theory		Internals	
			Max	Min	Max	Min
14	T	P	40	14	10	4
	4	0				

Course Objective: Students will acquire the knowledge and understanding of the mathematical tools that are needed to solve optimization problems, understand the development of reports that describes the formulation of the problem techniques to solve, analyze the results, finally prepare optimal solution used for decision making processes in Management Engineering.

Course Outcome: After the completion of the course students are able to solve and formulate the optimization problems. Develop models for shortest path, critical path, minimum cost flow, and assignment and transshipment problems.

UNIT-I

Linear programming – Mathematical formulation of problems, graphical solution, simplex method, two phase method, Big M method, concept of duality, dual simplex method, degeneracy and its resolution, sensitivity analysis.

UNIT-II

Assignment problems – Mathematical formulation, Hungarian method for solution, unbalanced assignment problem, infeasible assignment, Crew based problems, transportation problems – Vogel's approximation method, optimal solution by stepping stone method and modified distribution method, degeneracy in transportation problems, transshipment problems.

UNIT-III

Game theory, two person zero sum game, minimax (maximin) criterion, solution of games with saddle point and without saddle point, equivalence of the rectangular game and linear programming and solution by simplex method, concept of dominance, graphical method for 2 x n and m x 2 games, algebraic method for a general game, iterative method, sequencing problems of n jobs through 2 machines, 3 machines, and n jobs through m machines.

UNIT-IV

Replacement problems – replacement of items that deteriorate with time, money value and present work factor, replacement policy when money value changes, replacement of items that are failed completely, group replacement of items, integer programming, nonlinear programming problem, Kuhn Tucker conditions, graphical solution, quadratic programming, solution by Wolf's method.
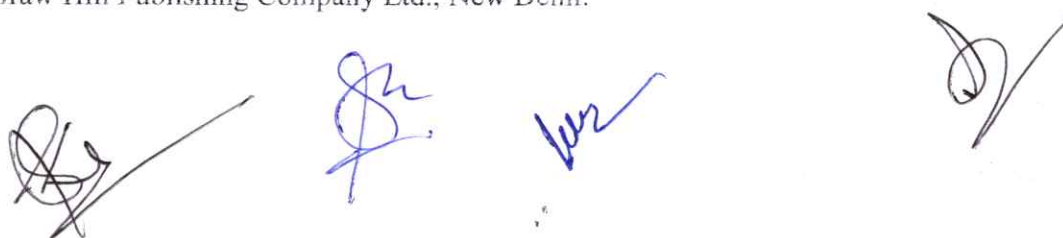
UNIT-V

Dynamic programming – minimum path problems, problems on single additive constraint additive separable return, single multiplicative constraint additive separable return, single additive constraint multiplicative separable return, serial multistage model. Development of CPM/PERT technique, constraint of network diagram, determination of critical path, probability of completing the project by scheduled date.

Text Books:
Operations Research: S.D.sharma
Reference Books:-
Introduction to Operation research: A Computer Oriented Algorithmic Approach Gillett Billy E
Tata Mc-Graw Hill Publishing Company Ltd., New Delhi.

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Semester II

Core Paper- CS203T
Subject: Big Data Analytics

Lectures/Unit	Credits		Theory		Internals		Practical	
			Max	Min	Max	Min	Max	Min
14	T	P	40	14	10	4	34	12
	4	2						

Course Objective: The aim of this course is to give understanding of Big Data, its security provision, concepts of Hadoop, different techniques and tool used in Hadoop, MapReduce, HBase, Deployment process, Data Manipulation, Joins etc.

Course Outcome:
Student will be able to learn
- concepts of Big Data,
- application methods of Big data analytics in industry,
- social networking, different software used for data analysis.

Unit- 1: Data Analytics, Types, Phases, Quality and Quantity of data, Big Data Introduction , Data Storage and Analysis, Comparison with Other Systems, Rational Database Management System , Grid Computing, Volunteer Computing, industry examples of big data, web analytics, big data and marketing, fraud and big data, risk and big data, big data and healthcare, advertising and big data, big data technologies, introduction to Hadoop, open source technologies, cloud and big data, mobile business intelligence, Crowd sourcing analytics, inter and trans firewall analytics.

Unit- 2:Introduction to NoSQL, aggregate data models, aggregates, key, value and document data models, relationships, graph databases, schema less databases, materialized views, distribution models, sharding, version, Map reduce, partitioning and combining, composing map, reduce calculations

Unit- 3:Data format, analyzing data with Hadoop, scaling out, Hadoop streaming, Hadoop pipes, design of Hadoop distributed file system (HDFS), HDFS concepts, Java interface, data flow, Hadoop I/O, data integrity, compression, serialization, Avro, file, based data structures

Unit- 4:MapReduce workflows, unit tests with MRUnit, test data and local tests, anatomy of MapReduce job run, classic Map, reduce, YARN, failures in classic Map, reduce and YARN, job scheduling, shuffle and sort, task execution, MapReduce types, input formats, output formats

Unit- 5:Hbase, data model and implementations, Hbase clients, Hbase examples, praxis. Cassandra, Cassandra data model, cassandra examples, cassandra clients, Hadoop integration. Pig, Grunt, pig data model, Pig Latin, developing and testing Pig Latin scripts. Hive, data types and file formats, HiveQL data definition, HiveQL data manipulation, HiveQL queries, case study.
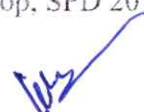
Text Books and Reference Books:
Tom White, "Hadoop: The Definitive Guide", 4th Edition, O'Reilley, 2012.
Eric Sammer, "Hadoop Operations",1st Edition, O'Reilley, 2012.
Essential Reading / Recommended Reading
Vignesh Prajapati, Big data analytics with R and Hadoop, SPD 2013.

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Semester-III

Core Paper- CS301T
Subject: Advanced Computer Networks

Lectures/Unit	Credits		Theory		Internals	
			Max	Min	Max	Min
14	T	P	40	14	10	4
	4	0				

Course Objective: To comprehend the switching mechanism of computer network, internet address system, different routing protocol, user account management, network resource management, security techniques, services, attacks, cryptography, encryption technique and virus threats.

Course Outcome: Students will be able to understand the concepts of packets in networks, work and role of various protocols used to achieve different purposes, IPv4 and IPv6 internet addressing, user management for networks system.

UNIT-I

Users of computer Network, Network Hardware, Network Software, Protocol Hierarchies, Design issue for the layers, Interfaces and services, connection oriented and connection-less services, service primitives, the relationship of services to protocols, Reference Models, comparison of OSI and TCP/IP Reference models, Data communication services.

UNIT-II

Physical layer, Transmission media, Magnetic media, Wireless Transmission, Modulation and Multiplexing, Network Switching, The telephone system, Narrowband and Broadband ISDN and ATM, communication satellites.

UNIT-III

Data Link Layer, Design Issues, Services provided to the Network layer, error detection and correction, elementary data link protocols, sliding window protocols, Media Access Sublayer: Channel Access, Multiple Access Protocols.

UNIT-IV

Network layer design issues, routing algorithms, the optimality principle, shortest path routing, Flooding, Flow-based Routing, Distance vector and link state routing broadcast and multicast routing, congestion control algorithms, general principles of congestion control, Traffic shaping, choke packets, load shedding, jitter control, Internetworking, IPv4, IPv6.

UNIT-V

The Transport Layer, The Transport services, Quality at service, Transport service primitives, addressing establishing a connection, releasing a connection, Flow-control and Buffering, Multiplexing, crash recovery, The internet Transport protocols, TCP service model, TCP segment header, TCP connection management, TCP transmission policy, TCP congestion control, TCP timer management UDP, Performance Issues.

Text Book:
Computer Networks, 3rd edition, 1997, by A.S Tanenbaum. PHI.
Reference Book:
Data and Computer Communication, 1996, William Stallings. PHI

Semester III
Core Paper-CS302T
Subject: Data Mining

Lectures/Unit	Credits		Theory		Internals		Practical	
			Max	Min	Max	Min	Max	Min
14	T	P	40	14	10	4	34	12
	4	2						

Course Objective: The objective of the course is to comprehend data analysis and models for respective application and also to develop research interest towards the advancement in Data Mining.

Course Outcome: After the completion of the course students will be able to develop algorithms for data mining models and they will also be able to compare and evaluate different data mining techniques like classification, prediction, clustering and association rules to solve real world problems.

UNIT-I

Introduction of data mining: KDD process and Data Mining, KDD steps, Types of data for Data Mining, Data Mining functionalities: Data Characterization, Data Discrimination, Mining frequent patterns, Association, Correlation, Classification, Prediction, Cluster analysis, Outlier Analysis and Evolution analysis. Classification of Data Mining systems, Data Mining task primitives, Major issues in Data Mining.

UNIT-II

Data Preprocessing: Needs for Data Preprocessing, Data Cleaning, Data Integration and Transformation, Data Normalization, Data Reduction, Principal Component Analysis (PCA), Discretization and Concept Hierarchy Generation.

UNIT-III

Association Rule Mining: Frequent itemsets, closed itemsets, and association rules. Support and Confidence. Apriori Algorithms for mining frequent itemsets. Generating association rules from frequent itemsets. Improving the efficiency of Apriori algorithm-Dynamic Hashing and Pruning(DHP), Partitioning methods, FP-Growth algorithm for mining frequent itemsets without Candidate Generation.

UNIT-IV

Classification and Prediction: Issues Regarding Classification and Prediction, Classification by Decision Tree Induction, Bayesian Classification, Classification by Back propagation, Classification Based on Concepts from Association Rule Mining, Other Classification Methods, Prediction, Classifier Accuracy.

UNIT-V

Cluster Analysis: Introduction, Types of Data in Cluster Analysis, A Categorization of Major Clustering Methods, Partitioning Methods, Hierarchical Methods, Density-Based Methods, Grid-Based Methods, Model-Based Clustering Methods, Outlier Analysis.

Text Books:

Data Mining -- Concepts and Techniques - Jiawei Han & Micheline Kamber Harcourt, India.
Building the DataWarehouse- W. H. Inmon, Wiley Dreamtech India Pvt. Ltd..

Reference Books:

Data Mining Techniques-Arun K Pujari
Data Warehousing Fundamentals-Paulraj Pannaiah

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The Data Warehouse Life Cycle Tool Kit-Ralph Kimball
Data Mining Introductory and Advanced Topics-Margaret H Dunham

Practical List

- Create data frame in R

- Implement Data Preprocessing using R
- Implement Data Reduction technique PCA using R
- Implement Naïve Bayes in R
- Implement K-Means in R
- Implement data visualization in R
- Implement decision trees in R
- Implement associations in R.

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Subject: Analysis and Design of Algorithms

Lectures/Unit	Credits		Theory		Internals		Practical	
			Max	Min	Max	Min	Max	Min
14	T	P	40	14	10	4	33	12
	4	2						

Course objective: The objective of the course is to teach techniques for effective problem solving in computing. The use of different paradigms of problem solving will be used to illustrate clever and efficient ways to solve a given problem. In each case emphasis will be placed on rigorously proving correctness of the algorithm. In addition, the analysis of the algorithm will be used to show the efficiency of the algorithm over the naive techniques.

Course outcome: The students will be able to apply the algorithms and design techniques to solve problems. They will be able to analyze the complexities of the problems in different domains and can prove the correctness and analyze the running time of the basic algorithms for classic problems in various domains.

UNIT-I
Introduction: Algorithm, Fundamentals of Algorithmic Problem Solving, Important Problem Types. Fundamentals of the Analysis of Algorithm: The Analysis Framework, Asymptotic Notations and Basic Efficiency Classes, Brute Force Search: Selection Sort, Bubble Sort, Sequential Search, Brute-Force String Matching, Exhaustive Search, Depth-First Search, Breadth-First Search.

UNIT-II
Decrease–&–Conquer: Insertion Sort, Topological Sorting, Binary Search, Interpolation Search
Divide-and-Conquer: Merge Sort, Quick Sort, Multiplication of Large Integers, Strassen's Matrix Multiplication

UNIT-III
Transform-and-Conquer: Presorting, Balanced Search Trees, Heaps and Heap Sort, Problem Reduction. Space and Time Trade-Offs: Hashing, B-Trees, Dynamic Programming: Knapsack Problem, Optimal Binary Search Trees, Warshall's and Floyd's Algorithms.

UNIT-IV
Greedy Technique: Prim's Algorithm, Kruskal's Algorithm, Dijkstra's Algorithm, Huffman Trees and Codes. Iterative Improvement: Simplex Method, Maximum-Flow Problem. Limitations of Algorithm Power: Lower-Bound Arguments, Decision Trees, P, NP, and NP-Complete Problems.

UNIT-V
Backtracking: n-Queens Problem, Hamiltonian Circuit Problem, Subset-Sum Problem, Branch-and-Bound: Assignment Problem, Knapsack Problem, Traveling Salesman Problem, Approximation Algorithms for the Knapsack Problem.

Text Books:
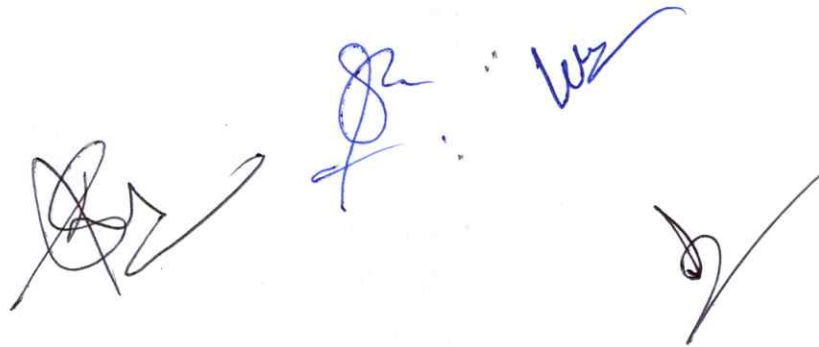1. Anany Levitin, Introduction to the Design and Analysis of Algorithms (3e)

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Reference Books:

1. Richard Neapolitan, Foundations of Algorithms
2. Thomas H. Cormen, Introduction to Algorithms
3. E.Horowitz, S. Sahni, Fundamentals of Computer Algorithms
4. A.V. Aho, J.V. Hopcroft, J.D. Ullmann, The Design and Analysis of Computer Algorithms
5. Donald E Knuth,The Art of Programming_Volumes-1, 2, 3, 4

Practical List

1. To find HCF and LCM of two numbers
2. Code and analyses to find median element in an array of integers.
3. Code and analyze to find majority element in an array of integers.
4. Code and analyze to sort an array of integers using merge sort
5. Code and analyze to sort an array of integers using quick sort
6. To implement maximum and minimum problem using divide and conquer strategy
7. To implement binary search using divide and conquer strategy
8. To implement program of Heap Sort.
9. WAP of minimum spanning tree using Kruskal algorithm.
10. WAP of minimum spanning tree using Prim's algorithm.

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Semester III
Computer Science Elective Paper- CSE304T
Subject: Artificial Intelligence

Lectures/Unit	Credits		Theory		Internals		Practical	
			Max	Min	Max	Min	Max	Min
14	T	P	40	14	10	4	33	12
	4	2						

Course objective: The objective of the course is to present an overview of artificial intelligence (AI) principles and approaches. Develop a basic understanding of the building blocks of AI as presented in terms of intelligent agents: Search, Knowledge representation, inference, logic, and learning.

Course outcome:
- Understand the knowledge of the building blocks of AI as presented in terms of intelligent agent.
- Analyze and formalize the problem as a state space, graph, design heuristics and select amongst different search or game based techniques to solve them.
- Attain the capability to represent various real life problem domains using logic based techniques and use this to perform inference and planning.

UNIT-I
What is Artificial Intelligence, what is an AI technique, criteria for success, Problems, Problem spaces and search, Production system, Problem characteristics, Hill-climbing, Best-First search, AO algorithm, constraint satisfaction.

UNIT-II
Natural language Processing, Introduction, overview of Linguistics, Grammars and language, Basic Parsing techniques, Semantic analysis and representation, structure, Natural Language generation, Natural Language Systems.

UNIT-III
Knowledge Representation Issues, Approaches to knowledge Representation, Representing simple facts in logic, computable functions and predicates, Procedural vs. Declarative knowledge, forward vs. Backward Reasoning matching, control knowledge.

UNIT-IV
Expert systems, Rule-Based system architecture, Non-productive system Architecture, dealing with uncertainty, knowledge acquisition and validation, knowledge system building tools. Pattern Recognition, Recognition and classification process, learning classification patterns, Recognizing and understanding speech.

UNIT-V
Prolog programming-Introduction to prolog, Facts and predicates, data types, simple input/output, arithmetic operators in prolog, rules: if-then, queries, relation, recursion, structures and list, functions in prolog, matching, applications of prolog.

Text Books:
Artificial Intelligence by Rich and Knight
Introduction to AI and expert system by Patterson

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References:
Principles of AI by Nilson
https://www.youtube.com/watch?v=SykxWpFwMGs
https://www.youtube.com/playlist?list=PLWPirh4EWFpEYxjEJyDoqplBhJF91Mwkp

Practical List
1. Addition of two numbers.
2. Find factorial of a number.
3. Calculate average of three numbers.
4. Calculate Simple Interest.
5. Calculate Compound Interest.
6. Calculate area of a circle.
7. Convert Farenheit to Celsius.
8. Print Count-Down.
9. Print Count-Up.
10. To build family tree.
11. Print square of a given number.
12. Query about weather.(Q1. Find cities that are hot in summer. Q2. Find all cities that are warm. Q3. Find all the cities that are hot in summer and warm in winter.).
13. Ask user to enter your name and printout the name.
14. Input a character and print its ASCII value.
15. Create salary structure and query about customer balance.
16. Update the database using query window.
17. Male(albert)
    Male(bob)
    Male(bill)
    Male(Charlie)
    Male(dan)
    Male(Edward)
    Female(alice)
    Female(betsy)
    Female(Diana)
    a) Write a query to print list of all males.
    b) Write a query to print list of all females.
    c) Write a query to print combination of all males and females.

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Lectures/Unit	Credits		Theory		Internals	
			Max	Min	Max	Min
14	T	P	40	14	10	4
	4	0				

Course Objective: The objective of this course is to understand structured digital marketing plan and budget, to identify the correct measures to set objectives and evaluate digital marketing and to review and prioritize the strategic options for boosting customer acquisition, conversion, and retention using digital marketing.

Course outcome: After the completion of the course the students will be able to use digital marketing in a rapidly changing business landscape. They will be able to use the key elements of a digital marketing strategy, measure the effectiveness of a digital marketing campaign, work on SEO digital marking tool and implement ecommerce and payment gateway.

UNIT-I:Digital Marketing Fundamentals: Marketing v/s Sales, Marketing Mix and 4 Ps, What is Digital Marketing, Inbound vs Outbound Marketing, Content Marketing, Understanding Traffic, Understanding Leads, Strategic Flow for Marketing Activities. **Website Planning and Structure:** WWW, Domains, Buying a Domain, Website Language & Technology, Core Objective of Website, and Flow, One Page Website,

UNIT-II: Strategic Design of Home Page, Strategic Design of Products & Services Page, SEO Overview Google Analytics Tracking Code, Website Auditing. **Facebook Marketing Fundamentals:** Profiles and Pages, Business Categories, Getting Assets Ready, Creating Facebook Pages, Page Info and Settings, Facebook Page Custom URL, Invite Page Likes, Featured Video, Pin Post and Highlights, Scheduling Posts, Facebook Events, Reply and Message, Facebook Insights Reports, Competitor's Facebook Page, Ban User on Facebook Page.

UNIT-III:Google Adwords Basics: Understanding Adwords, Google Ad Types, Pricing Models, PPC Cost Formula, Ad Page Rank, Billing and Payments, Adwords User Interface, Keyword Planning, Keywords Control, Creating Ad Campaigns, Creating Text Ads, Creating Ad Groups, Bidding Strategy for CPC. **YouTube Marketing Fundamentals:** Video Flow, Google Pages for YouTube Channel, Verify Channel, Webmaster Tool –Adding Asset, Associated Website Linking, Custom Channel URL Channel ART, Channel Links, Channel Keywords, Branding Watermark, Featured Contents on Channel, Channel Main Trailer, Uploading Videos, Uploading Defaults, Creator Library.

UNIT-IV:Ecommerce and Payment Gateway: eCommerce Business, Planning eCommerce Website, Product Placements, Product Grouping, Promoting eCommerce Website, Remarketing Products, Understanding Coupon System, Appointing Affiliates for Products, Cross/Up/Down Selling, Payment Gateway in India, Application and Documentation, Collecting Online Payment, Web Store using Payment Gateway, Web Fronts using Payment Gateway, Invoice Payments through Emails, SMS Invoice Payments, Integrating Payment Gateway, Payment Links and its Promotion, Affiliates for Payment Links.

UNIT-V:Search Engine Optimization: Understanding SEO, SEO Keyword Planning, Meta Tags and Meta Description, Website Content Optimization, Back Link Strategies, Internal and External Links, Optimizing Site Structure, Keywords in Blog and Articles, On Page SEO, Off Page SEO, Local SEO,

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Mobile SEO, eCommerce SEO, Optimizing with Google Algorithms, Using WebMasterTool, Measuring SEO Effectiveness.

Reference Books

- Blanchard O. (2014) Social Media ROI: Managing and Measuring Social Media Efforts in Your Organization
- Pulizzi, J. (2013) Epic Content Marketing
- Marketing on Facebook – Best practice guide (2013) Facebook Marketing Press
- Chaffey, D., & Ellis-Chadwick, F. (2012) Digital Marketing: Strategy, Implementation and Practice, 5/E, Pearson
- Tapp, A., & Whitten, I., & Housden, M. (2014) Principles of Direct, Database and Digital Marketing, 5/E, Pearson
- Tasner, M. (2015) Marketing in the Moment: The Digital Marketing Guide to Generating More Sales and Reaching Your Customers First,2/E, Pearson

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Lectures/Unit	Credits		Theory		Internals	
			Max	Min	Max	Min
14	T	P	40	14	10	4
	4	0				

Course Objective: Cyber security is one of the greatest challenges of contemporary society, and it will only become more complicated as we progress therefore the depth of knowledge and wealth of skills required to engage with and overcome these challenges. Cyber security comprises technologies, processes and controls that are designed to protect systems, networks and data from cyber-attacks. Effective cyber security reduces the risk of cyber-attacks, and protects organizations and individuals from the unauthorized exploitation of systems, networks and technologies.

Course Outcome: The study of Cyber Security helps to gather and analyze data, and learn techniques to accurately present and communicate findings. It aims to empower and enhance proficiency in cyber security among learners and provides guidance on cyber security trends, industry best practices, protective measures against cyber threats, and more. A solid cyber security foundation will identify technology gaps and propose the appropriate action to take to mitigate the risk of an attack. This provides organizations the confidence to build their cyber security strategies.

UNIT-I: Cyberspace, Information Security, Introduction of Cyber Crime, definition, origin, Cybercriminals- hungry for recognition, not interested in recognition, the insiders, cyber terrorism, Challenges of cybercrime.

UNIT-II : Classifications of Cybercrimes: E-Mail Spoofing, Spamming, Cyber-defamation , Internet Time Theft, Salami attack/Salami Technique, Data Diddling, Web Jacking, Online Frauds, Software Piracy, Computer Network Intrusions, Password Sniffing, Identity Theft, cyber terrorism, Virtual Crime.
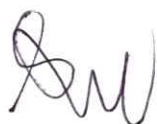
UNIT-III: Cyber Crime and Criminal justice: Concept of Cyber Crime and the IT Act, 2000, Hacking, Teenage Web Vandals, Cyber Fraud and Cheating, Defamation, Harassment and E-mail Abuse, Other IT Act Offences, Monetary Penalties, jurisdiction and Cyber Crimes, Nature of Criminality, Strategies to tackleCyber Crime and Trends.

UNIT-IV: Cyber-offenses: categories of cybercrime, Attacks- passive attacks, active attacks, cyberstalking, stalkers, types of stalkers, Botnet, case studies - Ransomware Aftershock: The Road To Recovery After A Cyber Data Hijack, Cyber Security Protects Sensitive Data

UNIT-V: Tools and Methods in Cybercrime: Proxy Servers and Anonymizers, Password Cracking, Key loggers and Spyware, virus and worms, Trojan Horses, Backdoors, DoS and DDoS Attacks , Buffer and Overflow, Attack on Wireless Networks, Phishing : Method of Phishing, Phishing Techniques, Cyber Detox.
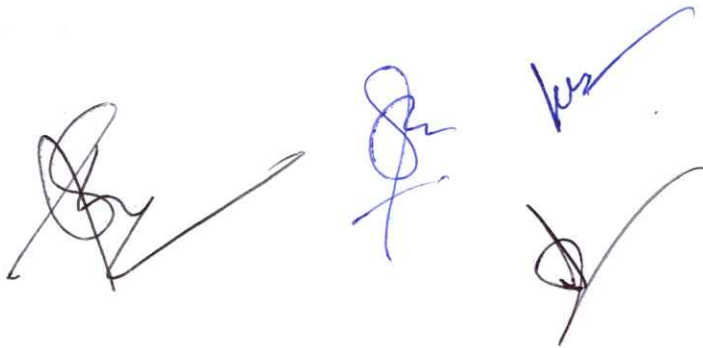
Text Books:
- Data & Network Communication by Michael A. Miller
- Data Communications and Networking, B.A. Forouzan, Tata McGraw-Hill.
- Principles of Cyber crime, Jonathan Clough Cambridge University Press

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- John R. Vacca, Computer Forensics:Computer Crime Scene Investigation, 2nd Edition, Charles RiverMedia, 2005
- Cyber Law Simplified, VivekSood, Pub: TMH.
- Cyber Security by Nina Godbole, SunitBelapure Pub: Wiley-India
- Information Warfare: Corporate attack and defense in digital world, William Hutchinson, MathewWarren, Elsevier.
- Cyber Laws and IT Protection, Harish Chander, Pub:PHI.

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Semester IV

Core Paper- CS401T
Subject: Compiler Design

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Lectures/Unit	Credits		Theory		Internals	
			Max	Min	Max	Min
14	T	P	40	14	10	4
	4	0				

Course objective: The Objectives of this course is to provide in depth knowledge of
- The principles, algorithms, and data structures involved in the design and construction of compilers.
- Different types of grammars associated with compiler and their use.

Course outcome: At the end of this course, the students will be able to understand the phases of compiler, design and implement a Lexical analyzer, design and implement a Parser, storage allocation, to optimize and design code generator.

UNIT-I

Introduction: language processors, phases of a compiler, a model for a compiler front end, syntax-directed translation, parsing, a translator for simple expressions, Lexical Analysis: role of lexical analyzer, input buffering, specification of tokens, Lex lexical analyzer generator, data structures in compilation.

UNIT-II

Top-Down Parsing: Introduction, Context free grammars, writing a grammar, recursive-descent parsing, LL(1) grammars, predictive parsing, preprocessing steps required for predictive parsing. Bottom-Up Parsing: shift reduce parsing, SLR parsing, CLR parsing and LALR parsing, error recovery in parsing, handling ambiguous grammar, parser generator – YACC.

UNIT-III

Semantic Analysis: syntax-directed definitions, evaluation order for SDD's, application of SDT. Intermediate-Code Generation: syntax trees, three-address code, types and declarations, translation of expressions, type checking.

UNIT-IV

Runtime Environment: storage organization, stack allocation of space, heap management, storage allocation for arrays, strings and records, introduction to garbage collection and trace based collection. Code Generation: issues in the design of code generator, target language, addresses in the target code, basic blocks and flow graphs.

UNIT-V

Optimization of basic blocks, peephole optimization, registers allocation and assignment. Code Optimization: principal sources of optimization, data flow analysis, constant propagation, partial redundancy elimination, loops in flow graphs.

Text Books:
1. A. V. Aho, Monica S. Lam, Ravi Sethi, J. D. Ullman, Compilers Principles, Techniques, & Tools, (2e)

Reference Books:
1. Dick Grune, Henry E. Bal, Cariel T. H. Jacobs, Modern Compiler Design
2. Kenneth C. Louden, Compiler Construction Principles and Practice
3. Thomas w. Parsons, Introduction to Compiler Construction
4. Andrew N. Appel, Modern Compiler Implementation in C
5. John R. Levin, Tony Mason, Doug Brown, LEX & YACC
6. Cooper, Linda, Engineering a Compiler

Semester IV
Computer Science Elective Paper- CSE403T
Subject: Cloud Computing

Lectures/Unit	Credits		Theory		Internals	
			Max	Min	Max	Min
14	T	P	40	14 ·	10	4
	4	0				

Course objective: The objective of this course is to familiarize the student with cloud environment, building software systems and components that scale to millions of users in modern internet, cloud concepts capabilities across the various cloud service models including Iaas, Paas, Saas and MCC.

Course outcome: The student will understand the key dimensions of the challenge of Cloud Computing. They will understand services provided by cloud computing, implementation of open cloud, implementation of Small and Medium Businesses, authentication, authorization & accounting (*AAA*) and Mobile Cloud Computing.

UNIT-I

Era of Cloud Computing (CC): introduction, cloud and other similar configurations, CC vs. peer-to-peer architecture, CC vs. client-server architecture, CC vs. GC, components of CC, impact of CC on businesses. Introduction Virtualization: Introduction, virtualization benefits, implementation levels of virtualization, virtualization at the OS level, virtualization structure, open source virtualization technology, Xen virtualization architecture, binary translation with full virtualization, para-virtualization with compiler support, virtualization of CPU, memory, I/O devices, hardware support for virtualization, virtualization in multicore processors. Cloud Computing Services: IaaS, PaaS, leveraging PaaS for productivity, guidelines for selecting a PaaS provider, concerns with PaaS, languages and PaaS, SaaS, DBaaS.

UNIT-II

Cloud Computing and Business Value: key drivers for CC, CC and outsourcing, types of scalability, use of load balancers to enhance scalability, variable operating costs using CC, time-to-market benefits of CC, distribution over the internet, levels of business values from CC. Cloud Types and Models: private cloud, public cloud, hybrid cloud. Open Source Cloud Implementation and Administration: Eucalyptus& OpenSatck cloud architectures, CSB (158) Recent Trends in Cloud Computing and Standards: conflicts of interest for public cloud and IT product providers, BYOD and encryption exposures, cloud standards, cloud ratings, CC trends that are accelerating adoption.

UNIT-III

Host Security in the Cloud: security for virtualization products, host security for SaaS, PaaS, IaaS. Data Security in the Cloud: challenges with cloud data and data·security, data confidentiality and encryption, data availability, data integrity, CSGs. Cloud application requirements, SOA for cloud applications. Adoption and Use of Cloud by Small and Medium Businesses: place of adoption, benefits, adoption phases, vendor roles and responsibilities, selection phases, provider liability, provider capabilities, success factors for CC Adoption process of public clouds by enterprises. Cloud migration techniques, Phases during the migration of an application to the cloud. IT Service Management for Cloud Computing: ITIL based service management, service strategy, service design, service transition, service operations, continual ervice improvement.

UNIT-IV

SLA with Cloud Service Providers: concept, aspects and requirements of SLA, credit calculation, samples 1 and 3. Risks, Consequences, and Costs for Cloud Computing: introduction, risk assessment and management, risk of vendor lock-in, loss of control, not meeting regulatory compliances, resource scarcity, multitenant environment, failure, inadequate SLA, malware and internet attacks, management of cloud resources, network outages, in fracture, legal, licensing, TCO, cloud costs, cost allocations, chargeback

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models and methodology, billable items. AAA Administration for Cloud: AAA model, single sign0on for clouds, industry implementation for AAA, authentication management in the cloud, SAML, authentication for resource utilization.
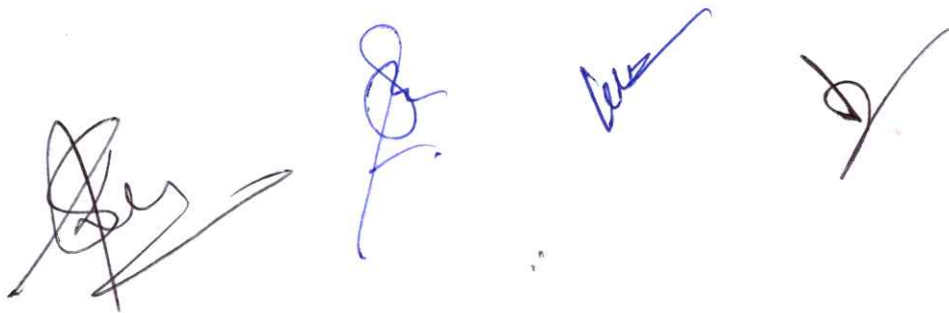
UNIT-V

Security as a Service: benefits of security as a service, concerns with security as a service, security service providers, IdMaaS, attributes of IdMaaS providers.Cloud Certifications and Audits: certifications, cloud audit framework, cloud auditing requirements.Application Security in the Cloud: cloud application SDLC, cloud service reports by providers, application security in IaaS, PaaS and SaaS environments. Mobile Cloud Computing (MCC): Architecture of MCC, benefits of MCC, MCC challenges.

Text Books:

Kailash J, Jagannath K, Donald J H, Deven Shah,Cloud Computing – Black Book

Reference Books:

1. Rajkumar Buyya, Cloud Computing: Principles and Paradigms
2. Arshdeep Bahga, Vijay Madisetti, Cloud Computing – A Hands-On Approach
3. David E.Y. Sarna, Implementing and Developing Cloud Computing Applications
4. Kai Hwang, Distributed and Cloud Computing From Parallel Processing to Internet of Things

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Semester IV
Core Paper- CS402T
Subject: Software Project Management

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Lectures/Unit	Credits		Theory		Internals	
			Max	Min	Max	Min
14	T	P	40	14	10	4
	4	0				

Course objective: This course introduces the concepts and methods required for the construction of large Software intensive systems. It develops a broad understanding of the discipline of Software Engineering and Management of Software System. This course provides an understanding of both theoretical and methodological issue involved in Modern Software Engineering Project Management and focuses strongly on Practical techniques.

Course outcome: After the completion of the course the students will understand the fundamental principles of Software Project management & will also understand the responsibilities of a Project Manager. They will be familiar with the different methods and techniques used for Project Management and will have good knowledge of the issues and challenges faced during Software Project Management. They will be able to manage Project Scheduling, tracking, Risk analysis, Quality management and Project Cost estimation using different techniques.

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.

UNIT-II
The old way and the new: The principles of conventional software Engineering, principles of modern software management, transitioning to an iterative process. **Life cycle phases:** Engineering and production stages, inception, Elaboration, construction, transition phases. **Artifacts of the process:** The artifact sets, Management artifacts, Engineering artifacts, pragmatic artifacts.

UNIT-III
Model based software architectures: A Management perspective and technical perspective. **Work Flows of the process:** Software process work flows, 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 process, Iteration planning process, pragmatic planning.

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.

UNIT-V:Tailoring the Process: Process discriminants. Future Software Project Management: Modern Project Profiles, Next generation Software economics, modern process transitions. Case Study: The command Center Processing and Display system- Replacement (CCPDS-R).
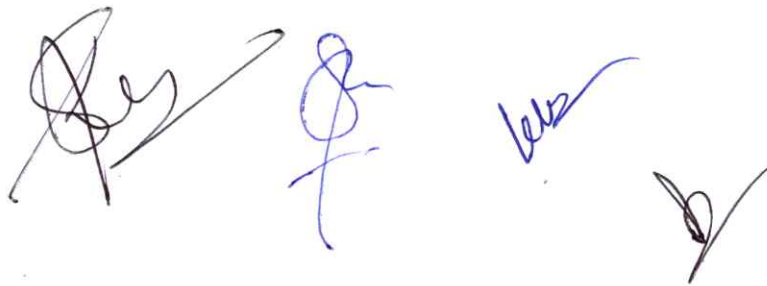
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Text Books:
Software Project Management, Walker Royce: Pearson Education, 2005.
Reference Books:
Software Project Management, Bob Hughes and Mike Cotterell: Tata McGraw-Hill Edition.
Software Project Management, Joel Henry, Pearson Education.

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Computer Science Elective Paper- CSE403T

Subject: TCP/IP Concepts

Lectures/Unit	Credits		Theory		Internals	
			Max	Min	Max	Min
14	T	P	40	14	10	4
	4	0				

Course objective: The objectives of the course is to give the understanding of the standards of TCP / IP protocol and addressing types. The course also includes the study of various protocols like ARP, RARP, UDP, ICMP, IGMP, Multicasting protocols etc.

Course outcome: After the completion of this course the student will understand the functions, data encapsulation of TCP/IP and UDP, the process of packet fragmentation and reassembly. Also the course will comprehend the basic routing functionality using routing protocols.

UNIT-I

Introduction, layering, DNS–encapsulation, de-multiplexing, client/server model, port numbers, standardization process, the internet. Link layer: introduction, Ethernet and IEEE 802 encapsulation, trailer encapsulation, SLIP, PP—Loop back interface, MTU. Internet protocol: introduction, IP header, IP routing, subnet addressing, subnet mask- special case if IP address, a subnet example.

UNIT-II

Introduction to Address Resolution Protocol, an example, ARP cache packet format, ARP examples, proxy ARP, ARP command. RARP: introduction, RARP packet format, RARP examples, RARP server design. ICMP: introduction, ICMP message types, ICMP address mask request and reply-ICMP timestamp request and reply -4.4 BSD processing of ICMP messages.

UNIT-III

Introduction, ping program, IP record route option, IP time stamp option. Trace route Program: introduction, trace route program operation, LAN output, and WAN output- IP source routing option. IP routing: introduction, routing principles, ICMP host, and ICMP redirect errors Dynamic routing, RIP-ASPF, BGP, CIDR. UDP: introduction, UDP header, UDP checksum, IP fragmentation, UDP server design.

UNIT-IV

Introduction to DNS- basics, massage format, simple example, pointer quires, resource records caching, UDP. TFTP: introduction, protocol, security. BOOTP: introduction, packet format, server design, through router. TCP: introduction, services, headers, connection establishment and termination, timeout of connection establishment- maximum segment size- half, close, state transition diagram, reset segment, simultaneous open and close-options, server design.

UNIT-V

Introduction to SNMP, protocol, structure of management information, object identifiers, Management information base, instance identification. Telnet: rlogin protocols, examples, telnet protocol and examples, FTP, protocol, examples, STMP protocols, examples, NFS, TCP/IP Applications.

Text Books:

- Behnrouz A. Forouz, TCP/IP Protocol Suite, IV edition, McGraw-Hill Publishing
- W. Richard Stevens, TCP/IP illustrated Volume, I "The protocols", Addison Wesley Longman.

Jaiswal. S, TCP/IP principles, architecture, protocols and implementation, first Edition, Galgotia publication.

Reference Books: Candace Leiden and Marshall Wilensky, TCP/IP for Dummies

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Lectures/Unit	Credits		Theory		Internals	
			Max	Min	Max	Min
14	T	P	40	14	10	4
	4	0				

Course Objective: Data Science Course will cover basics of data science using python. Concept of linear algebra, statistics and probability and understand how and when they're used in Data Science. Collect, explore, clean, munge and manipulate data.

Course Outcome: After the completion of the course, the students will be able to implement models such as k-nearest neighbours, Naive Bayes, linear and logistic regression, decision trees. The Students will also be able to understand the fundamentals of machine learning and can do further study in this field.

UNIT-I
What is Python, Python Features, Python Applications, Python and PyCharm Installation, Python IDE, Python Code Basics- Python Variables, Python Data Types (Lists, Tuples, Sets, Dictionary, Strings, and Numeric), Python Operators, Python Conditional Statements (If Statement, Elif Statement, Else Statement, Python Loops (While Loop, For Loop and Nested Loop), I/O Operations.

UNIT-II
Python NumPy- array (one, multi-dimensional), NumPy array vs list, NumPy operations (ndim, iemsize, dtype, reshape, slicing, linspace, max/min, addition, vertical and horizontal stacking, ravel). Python Matplotlib, types of plot, Python Pandas, Pandas Operations: Slicing the data frame, Merging & Joining, Concatenation, Changing the index, Change Column headers, Data munging.

UNIT-III
Making sense of Data through Advanced Visualization: Controlling the line properties of a chart, Creating multiple plots, Playing with text, Styling your plots, Box plots, heat maps, Scatter plots with histograms, A scatter plot matrix, Area plots, bubble charts, Hexagon bin plots, Trellis plots.

UNIT-IV
Machine learning techniques using Python, Different types of machine learning, Implementing classification techniques: linear regression and naive Bayes classifier, Implementing clustering techniques: k-means clustering, Hierarchical clustering, Generating Recommendations with Collaborative Filtering: Recommendation data, User-based collaborative filtering. Item-based collaborative filtering,

UNIT-V
Natural Language Processing: Concept and types, Extracting the data from : HTML, Word files, PDF's, steps for text processing : tokenization, stemming, removing stop words, Lemmatizing, standardize text, Word Clouds, n-gram models, Wordtovec, tf-idf algorithm, Implementation of NLP using NLTK.

Text Book: Mastering Python for Data Science by Samir Madhavan.

Reference Book: Data Science from Scratch by Joel Grus