Semester-V

Sr. No.	Course Type	Course Code	Course Name	Credits	Details of Sessional Marks				ESM	Total Marks
					CT	TA	Lab	Total		
1	PCC	ECS-351	Computer Networks	4 (2-1-2)	15	20	15	50	50	100
2	PCC	ECS-353	Database Management Systems	4 (2-1-2)	15	20	15	50	50	100
3	PCC	ECS-355	Design & Analysis of Algorithms	5 (3-1-2)	15	20	15	50	50	100
4	PCC	ECS-357	Theory of Automata & Formal Languages	3 (2-1-0)	30	20	-	50	50	100
5	PCC	ECS-359	Data Science	3 (2-1-0)	30	20	-	50	50	100
6	OEC (Maths)	BMA-351	Operation Research	3 (3-0-0)	30	20	-	50	50	100
Total Credits				**22**						600

Semester-VI

Sr. No.	Course Type	Course Code	Course Name	Credits	Details of Sessional Marks				ESM	Total Marks
					CT	TA	Lab	Total		
1	PCC	ECS-352	Compiler Design	4 (3-1-0)	30	20	-	50	50	100
2	PCC	ECS-354	Object Oriented Systems	3 (2-0-2)	15	20	15	50	50	100
3	PCC	ECS-356	Computer Graphics	3 (2-1-0)	30	20	-	50	50	100
4	PCC	ECS-358	Soft Computing	3 (2-1-0)	30	20	-	50	50	100
5	PCC	ECS-360	Internet of Things	3 (2-1-0)	30	20	-	50	50	100
6	PCC	ECS-362	Network Security	3 (3-0-0)	30	20	-	50	50	100
7	OEC (HSS)	HHS-352	Entrepreneurship Development	3 (3-0-0)	30	20	-	50	50	100
	Total Credits			**22**						700

Ankit

COMPUTER NETWORKS (ECS-351)

Type	L	T	P	Credits
PCC	2	1	2	4

Prerequisite:

Course Content:

Unit-1:
Introduction Concepts: Goals and Applications of Networks, Network structure and architecture, The OSI reference model, services, Network Topology Design – Delay Analysis, Back Bone Design, Local Access Network Design. Physical Layer Transmission Media, Switching methods, ISDN, Terminal Handling.

Unit-2:
Medium Access sub layer: Medium Access sub layer - Channel Allocations, LAN protocols - ALOHAprotocols - Overview of IEEE standards - FDDI. Data Link Layer - Elementary Data Link Protocols, Sliding Window protocols, Error Handling.

Unit-3:
Network Layer: Network Layer - Point - to Pont Networks, routing, Congestion control Internetworking -TCP / IP - IP packet, IP address, IPv6. '

Unit-4:
Transport Layer: Transport Layer - Design issues, connection management, session Layer-Design issues, remote procedure call. Presentation Layer-Design issues, Data Compression techniques, cryptography - TCP - Window Management.

Unit-5:
Application Layer: Application Layer: File Transfer, Access and Management, Electronic mail,Virtual Terminals, Other application, Example Networks - Internet and Public Networks.

Lab Work:

1. Implementation of the Data Link Layer framing method such as character stuffing and bit stuffing in C.
2. Implementation of CRC algorithm in C.
3. Implementation of a Hamming (7, 4) code to limit the noise. We have to code the 4 bit data into 7 bit data by adding 3 parity bits. Implementation will be in C.
4. Implementation of LZW compression algorithm in C.
5. Write a socket program in C to implement a listener and a talker.
6. Simulation of a network of 3 nodes and measure the performance on the same network usingnetwork simulator ns3.
7. Simulation of wireless network and its performance evaluation using network simulator ns3.

8. Write a program in C to encrypt and decrypt 64-bit text using DES algorithm.

Text and References Books:

1. Forouzen, "Data Communication and Networking", TMH
2. A.S. Tannenbaum, "Computer Networks", 3rd Edition, Prentice Hall India, 1997.
3. S. Keshav, "An Engineering Approach on Computer Net working", Addison Wesley, 1997
4. W. Stallings, "Data and Computer Communication", Mac-millan Press, 1989

Course Outcomes:

1. Explain the functions of the different layer of the OSI Protocol. (Understand)
2. Design of wide-area networks (WANs), local area networks (LANs) and Wireless LANs(WLANs) based on available network devices. (Apply, Analyze)
3. Develop network programming application for a given problem related to TCP/IP protocol stack.(Apply, Analyze)
4. Understand and analyze different routing algorithms. (Understand, Analyze)
5. Understand the use of IP addressing schemes as per IPV4 and IPV6. (Understand)
6. Modify the existing protocols of TCP/IP protocol stack for performance improvement. (Apply,Analyze)

DATABASE MANAGEMENT SYSTEMS (ECS-353)

Type	L	T	P	Credits
PCC	2	1	2	4

Prerequisite:

Course Content:

Unit-1:

Introduction: An overview of database management system, database system Vs file system, Database system concepts and architecture, data models schema and instances, data independence and database language and interfaces, Data definitions language, DML, Overall Database Structure. Data Modeling using the Entity Relationship Model: ER model concepts, notation for ER diagram, mapping constraints, keys, Concepts of Super Key, candidate key, primary key, Generalization, aggregation, reduction of an ER diagrams to tables, extended ER model, relationships of higher degree.

Unit-2:

Relational data Model and Language: Relational data model concepts, integrity constraints: entity integrity, referential integrity, Keys constraints, Domain constraints, relational algebra, relational calculus, tuple and domain calculus, Introduction to SQL: Characteristics of SQL,

Advantage of SQL.SQL data types and literals, Types of SQL commands, SQL operators and their procedure, Tables, views and indexes. Queries and sub queries, Aggregate functions. Insert, update and delete operations, Joins, Unions, Intersection, Minus, Cursors in SQL.

Unit-3:

Data Base Design & Normalization: Functional dependencies, normal forms, first, second, third normal forms, BCNF, inclusion dependences, loss less join decompositions, normalization using FD, MVD, and JDs, alternative approaches to database design.

Unit-4:

Transaction Processing Concepts: Transaction system, Testing of serializability, Serializability of schedules, conflict & view serializable schedule, recoverability, Recovery from transaction failures,log based recovery, checkpoints, deadlock handling.

Unit-5:

Concurrency Control Techniques: Concurrency control, locking Techniques for concurrency control, Time stamping protocols for concurrency control, validation based protocol, multiple granularity, Multi version schemes, Recovery with concurrent transaction.

Lab Work:

1. Write the queries for Data Definition and Data Manipulation language.
2. Write SQL queries using Logical operators (=, <, >, etc.).
3. Write SQL queries using SQL operators (Between…. AND, IN(List), Like, ISNULL and withnegating expressions).
4. Write SQL query using character, number, date and group functions.
5. Write SQL queries for Relational Algebra (UNION, INTERSECT, and MINUS, etc.).
6. Write SQL queries for extracting data from more than one table (Equi-Join, Non-Equi-Join, Outer Join)
7. Write SQL queries for sub queries, nested queries.
8. Write programs by the use of PL/SQL.
9. Concepts for ROLL BACK, COMMIT & CHECK POINTS.
10. Create VIEWS, CURSORS, and TRIGGRS & write ASSERTIONS.
11. Create FORMS and REPORTS.

*Students are advised to use **Developer 2000/Oracle-9i** version or other latest version for above listed experiments. However depending upon the availability of software‟s, students may use **Power Builder**
/SQL SERVER. Students may also work on a Mini Project to understand the important concepts ofDatabase.

Text and References Books:

1. Date C J, “An Introduction to Database System”, Addision Wesley
2. Korth, Silbertz, Sudarshan, “Database Concepts”, McGraw Hill
3. Elmasri, Navathe, “Fundamentals of Database Systems”, Addision Wesley
4. Leon & Leon, “Database Management System”, Vikas Publishing House.

5. Bipin C. Desai, "An introduction to Database Systems", Galgotia Publication
6. Majumdar & Bhattacharya, "Database Management System", TMH
7. Ramakrishnan, Gehrke, "Database Management System", McGraw Hill
8. Kroenke, "Database Processing: Fundamentals, Design and Implementation", Pearson Education.
9. Maheshwari Jain, "DBMS: Complete Practical Approach", Firewall Media, New Delhi.

Course Outcomes:

1. Understand and Develop Entity Relationship (ER) and Relational Models for a given
   application. (Understand, Apply)
2. Develop and manipulate relational database using Structured Query Language and relationallanguages. (Apply)
3. Develop a normalized database for a given application by incorporating various constraints likeintegrity and value constraints. (Apply)
4. Understand and apply transaction processing concepts and convert schedules to serializableschedules. (Understand, Apply)
5. Illustrate different concurrency control mechanisms to preserve data consistency in a multi-user environment. (Apply)

DESIGN & ANALYSIS OF ALGORITHMS (ECS-355)

Type	L	T	P	Credits
PCC	3	1	2	5

Prerequisite:

Course Content:

Unit-1:
Algorithms definition and introduction, Analysis of algorithms, Growth of Functions, Master's Theorem, Designing of Algorithms, Partitioning Algorithms, Divide and Conquer design and analysis techniques: Merge Sort and Quick Sort, Sorting and order Statistics: Heap sort, Sorting in linear time, Medians and Order Statistics.

Unit-2:
Advanced Data Structures: Introduction of Red-Black Trees, Augmenting Data Structure, B-Trees, Binomial Heaps, Fibonacci Heaps, Data Structure for Disjoint Sets, Amortized Analysis.

Unit-3:
Advanced Design and Analysis Techniques: Dynamic Programming, Greedy Algorithms, Back-Tracking, Branch and Bound with their applications.

Unit-4:
Graph Algorithms: Elementary Graphs Algorithms, Minimum Spanning Trees, Single-source ShortestPaths, All-Pairs Shortest Paths, Traveling Salesman Problem and Maximum Flow

Unit-5:

Selected Topics: Randomized Algorithms, String Matching, Non-deterministic Algorithms: P, NP, NPHard and NP Completeness, Approximation Algorithms, PRAM Algorithms.

Lab Work:

Programming assignments on each of the following algorithmic strategy:

1. Divide and conquer method (quick sort, merge sort, Strassen's matrix multiplication).
2. Greedy method (knapsack problem, job sequencing, optimal merge patterns, minimal spanningtrees).
3. Dynamic programming (multistage graphs, OBST, 0/1 knapsack, traveling salespersonproblem).
4. Back tracking (n-queens problem, graph coloring problem, Hamiltonian cycles).
5. Sorting: Insertion sort, Heap sort, Bubble sort.
6. Searching: Sequential and Binary Search.
7. Selection: Minimum/ Maximum, K_{th} smallest element.

Text and References Books:

1. Coreman, Rivest, Lisserson: "Algorithm", PHI.
2. Basse, "Computer Algorithms: Introduction to Design & Analysis", Addison Wesley.
3. Horowitz & Sahni, "Fundamental of Computer Algorithm", Universities Press

Course Outcomes:

1. Understand and apply mathematical preliminaries to the analysis and design stages of differenttypes of algorithms. (Understand, Apply)
2. Analyze worst-case time complexity of various algorithms using asymptotic methods.(Analyze)
3. Understand and apply the divide-and-conquer paradigm and synthesize divide-and-conquer algorithms on problems of Sorting, Searching, finding MST etc. (Understand, Apply)
4. Describe the greedy paradigm and explain when an algorithmic design situation calls for it. Fora given problem develop the greedy algorithms. (Apply, Analyze)
5. Apply the dynamic-programming paradigm to model engineering problems using graph andwrite the corresponding algorithm to solve the problems. (Apply)
6. Explain the ways to analyze randomized and approximation algorithms (Apply, Analyze)

THEORY OF AUTOMATA & FORMAL LANGUAGES (ECS-357)

Type	L	T	P	Credits
PCC	2	1	0	3

Prerequisite:

Course Content:

Unit-1:
Defining Languages and Grammars, Chomsky hierarchy, Kleene closures, Regular Expressions, FiniteAutomata (FA), Transition Graph, Generalised Transition Graph.

Unit-2:
Nondeterministic finite Automata (NFA), Deterministic finite Automata (DFA), Construction of DFA from NFA and optimization, Partitioning Algorithm, Equivalence of DFA and NFA and their optimization, FA with output: Moore machine, Mealy machine and their Equivalence, Applications and Limitation of FA.

Unit-3:
Arden Theorem, Pumping Lemma for regular expressions, Myhill-Nerode theorem, Context free grammar: Ambiguous Grammars and Simplification, Normal forms for CFGs, Pumping lemma for CFLs, Decidability of CFGs, Ambiguous to Unambiguous CFG.

Unit-4:
Push Down Automata (PDA): Description and definition, Working of PDA, Acceptance of a string by PDA, PDA and CFG Equivalence, Deterministic and non-deterministic PDA, Introduction to auxiliaryPDA and Two Stack PDA.

Unit-5:
Turing machines (TM): Basic model, definition and representation, Language acceptance by TM, TM and Type – 0 Grammar, Integer function computation by TM, Halting problem of TM, Modifications in TM, Universal TM, Properties of recursive and recursively enumerable languages, decision problem, Un-decidability of Post Correspondence Problem, Church‟s Thesis, Recursive functiontheory, Godel Numbering.

Text and References Books:

1. Hopcroft, Ullman, “Introduction to Automata Theory, Language and Computation”, Nerosa
   Publishing House
2. K.L.P. Mishra and N. Chandrasekaran, “Theory of Computer Science (Automata, Languagesand Computation)”, PHI.
3. Martin J. C., “Introduction to Languages and Theory of Computations”, TMH
4. Papadimitrou, C. and Lewis, C.L., “Elements of theory of Computations”, PHI
5. Cohen D. I. A., “Introduction to Computer theory”, John Wiley & Sons
6. Kumar Rajendra, “Theory of Automata (Languages and Computation)”, PPM

Course Outcomes:

1. Describe the capabilities and limitations of the abstract machines including finite automata, pushdown automata, and Turing machines and their associated languages. (Understand)
2. Construct finite automata, pushdown automata, Turing machines for the given grammar andvice versa. (Apply)

3. Show that a language is not regular / not context-free using pumping lemma. (Apply)
4. Outline the characteristics of P, NP and NP Complete problems in the context of Turingmachines. (Understand)

DATA SCIENCE (ECS-359)

Type	L	T	P	Credits
PCC	2	1	0	3

Prerequisite:

Course Content:

Unit-1: **Introduction to Data Science: Basics of Data Science**
Data science, Data Analytics, Machine Learning (Supervised, Unsupervised Learning & reinforcement), Deep Learning (Artificial Neural Networks, CNN), Working with data sources – (SQL Server, .csv file, excel file etc.), Real world Applications of Machine Learning & Deep Learning, Scope of Data Science.

Unit-2: Data Analysis
Data Definitions and Analysis Techniques: Elements, Variables, and Data categorization; Levels of Measurement; Data management and indexing; Introduction to statistical learning and Python Programming
Descriptive Statistics; Measures of central tendency; Measures of location of dispersions; Basic analysis techniques: Statistical hypothesis generation and testing; Chi-Square test; t-Test; Analysis of variance; Correlation analysis; Maximum likelihood test; Data analysis techniques: Regression analysis; Classification techniques; Clustering; Association rules analysis

Unit-3: Data Modelling
Data Modelling: Introduction; Uses of Data Modelling Tools; Three Perspectives of a Data Model; Data Modelling Techniques: Linear Regression; Non-linear models; Supported Vector Machines.

Unit-4: **Data Manipulation and Visualization** :Understanding Pandas and its architecture, Getting to know Series and Data Frames, Columns and Indexes, Getting Summary Statistics of the Data, Data Alignment, Ranking & Sorting, Combining/Splitting Data Frames, Reshaping, Grouping , Data visualization (Scatter Plot, Histogram, Bar chart, Pie chart etc.)

Unit-5: Applications of Data Science
CASE STUDIES: **Banking Case Study:** Applications of Analytics in the Banking Sector; Predicting Bank-Loan Default; Predicting Fraudulent Activity; Logistic Regression Model; **Telecommunication Case Study:** Types of Telecommunications Networks; Role of Analytics in the Telecommunications Industry; Predicting Customer Churn-Network Analysis and Optimization-Fraud Detection.

Text and References Books:

1. Lillian Pierson, "Data Science For Dummies", For Dummies; 2nd edition.

2. Joel Grus, "Data Science From Scratch: First Principles with Python", Shroff/O'Reilly; Second Edition.
3. Jake VanderPlas, "Python Data Science Handbook Essential tools for Working with Data"
4. Allen B. Downey, "Think Stats Exploratory Data Analysis in Python", Green Tea Press
5. Wes McKinney, "Python for Data Analysis: Data Wrangling with Pandas and IPython"
6. John D. Kelleher and Brendan Tierney "Data Science" The MIT Press; Illustrated edition
7. Andrew Oleksy, "Data Science with R: A Step By Step Guide with Visual Illustrations & Examples"
8. Nina Zumel and John Mount, "Practical Data Science with R", Dreamtech/Manning, 2014
9. Roger D. Peng, "R Programming for Data Science", Lean publishing, 2015.

Course Outcomes:

1. This course create develop relevant **programming** abilities in the student.
2. This course create demonstrate proficiency with statistical **analysis of data**.
3. This course develops the ability to build and assess data-based **models**.
4. This course executes statistical analyses with professional statistical **software**.
5. This course demonstrates skill in **data management**.
6. Students will apply data science concepts and methods to **solve** problems in real-world contexts and will **communicate** these solutions effectively

COMPILER DESIGN (ECS-352)

Type	L	T	P	Credits
PCC	3	1	0	4

Prerequisite: Theory of Automata and Formal Languages (ECS-357)

Course Content:

Unit-1:
Introduction to Compiler, Phases and passes, Bootstrapping, Finite automata & regular expressions and their applications to lexical analysis, Implementation of lexical analyzers, lexical-analyzer generator, LEX-compiler, The syntactic specification of Programming languages: Context free grammars, derivation and parse trees, capabilities of CFG, Application of grammars in syntax analysis, ambiguity and BNF notation, YACC.

Unit-2:
Basic Parsing Techniques: Parsers, top down parsing, Shift reduces parsing, operator precedence parsing, predictive parsers. Automatic Construction of efficient Parsers: LR parsers, the canonical Collection of LR(0) items, constructing SLR parsing tables, constructing Canonical LR parsing tables, Constructing LALR parsing tables, using ambiguous grammars, an automatic parser generator, implementation of LR parsing tables, constructing LALR sets of items.

Unit-3:
Syntax-directed Translation: Syntax-directed Translation schemes, Implementation of Syntax directed Translators, Intermediate code, postfix notation, Parse trees & syntax trees, three address code, quadruple & triples, translation of assignment statements, Boolean expressions, statements that alter the flow of control, postfix translation, translation with a top down parser. More about translation: Array references in arithmetic expressions, procedures call, declarations, Case statements.

Unit-4:
Symbol Tables: Data structure and representing scope information, Run-Time Administration: Implementation of simple stack allocation scheme, storage allocation in block structured language. Error Detection & Recovery: Lexical Phase errors, syntactic phase errors semantic errors.

Unit-5:
Introduction to code optimization: Loop optimization, the DAG representation of basic blocks, valuenumbers and algebraic laws, Global Data-Flow analysis.

Text and References Books:

1. Aho, Sethi & Ullman, "Compiler Design", Addition Wesley.
2. Kenneth C. Louden, “Compiler Construction: Principles and Practice”, Thomson BrooksPublication.
3. Allen I. Holub, “Compiler Design in C”, PHI Publications.

Course Outcomes:

1. Describe the role of each phase of a compiler with its construction tools. (Understand)
2. Develop a Lexical Analyzer for recognizing tokens of a given language with an understandingof symbol table management and error handling. (Apply)
3. Construct top-down, bottom-up, operator precedence and SLR parsers with an understandingof Context Free Grammars and syntax analysis. (Apply)
4. Design and develop semantic analyzers for type-checking and intermediate code generators totranslate the source program into an intermediate code. (Apply)
5. Construct code optimizers to optimize the target code generated. (Apply)

OBJECT ORIENTED SYSTEM (ECS-354)

Type	L	T	P	Credits
PCC	2	0	2	3

Prerequisite:

Course Content:

Unit-1:
Object Oriented Design and Modeling: Object oriented fundamentals, Objects and Classes, Object- Oriented Design Process, importance of modeling, principles of modeling, OOAD Methods, Software Development Life Cycle, Introduction to Unified Process, Introduction to UML: UML Terminology, conceptual model of the UML, Use of UML in Unified Process.

Unit-2:
Basic Structural Modeling: Classes, Relationships, common Mechanisms, and diagrams. Class & Object Diagrams: Terms, concepts, modeling techniques for Class & Object Diagrams, Links and Associations, Link Attributes and Link Classes, Generalization and Inheritance, Aggregation and Composition, Qualified Association, Handling multiplicity in Object creation, Abstract Classes, Specifying constraints in Class Diagrams, Advanced Structural Modeling: Advanced classes, advanced relationships, Interfaces, Types and Roles, Packages, Use Case Modeling: Use Cases and Use Case Diagrams, Use Case driven Methodology.

Unit-3:
Behavioral Modeling: Interactions and Interaction Diagrams, Use-Case Realization: Scenario, Events Trace Diagram, Collaboration Diagrams, State Chart Diagrams, Nested State Diagrams, Activity Diagrams, Advanced Behavioral Modeling Concepts, Architectural Modeling: Component, Deployment, Component diagrams and Deployment diagrams. Elementary Design Patterns, The MVC Architecture Pattern, Features of Elegant Software Design: Elegant variable, Elegant Classes, Elegant Methods, Elegant Packages, Introduction to Object Oriented Software Quality Metrics.

Unit-4:
Java Programming: Introduction to Java Programming, Operator, Data type, Variable, Arrays, Control Statements, Methods & Classes, Inheritance, Package and Interface,

Exception Handling, Multithread programming, I/O, Java Applet, String handling, Networking, Event handling.

Introduction to Advance Java Programming: Demonstration of concepts through example programs for AWT, Java Swing, Java Beans, Java Servlets, JSP, Modern Object Technologies and Web Services.

Lab Work:

1. Write a program in Java, to implements the Stack data Structure.
2. Write a program in Java to implement a simple Bank Account.
3. Write a program in Java showing the action from three threads using a suitable example
4. Write a program of threads in Java showing inter leaving of actions from two threads: t1 & t2 synchronizing on a shared object. Let t1 print message Ping → and t2 prints message ← Pong. Take as command line arguments the following inputs to the program:

   Sleep interval for thread t1Sleep interval for thread t2Messages per cycle Number of Cycles
5. Write a program in Java which converts a text file into all capital letters.
6. Write a program to create a sequential file that could store details about five products. Details include product code, cost, no. Of items available and number of items available and are provided through keyboard.
7. Create a Person class with private instance variables for Person's name and birth date. Add appropriate accessor methods to access the variables. Then create a subclass CollegeGraduate with private instance variables for the student's GPA and year of graduation and appropriate accessors for these variables. Don't forget to include appropriate constructors for your classes. Then create a class with a main() method that manages your classes.
8. Develop an applet that receives three numeric values from the user and displays the largest of the three on the screen. Write a HTML page that embeds this applet.
9. Write an applet which draws a human face with ovals and arcs.
10. Write servlets that accepts user preferences (color, hobby etc.) from user, saves it as cookie onuser machine and reads the cookie from the user machine.
11. Write an AWT application with checkbox such that all cable TV channels will be displayedfrom the selected category.
12. Create a simple Swing based applet that displays two buttons. Each time a button is clicked, amessage is displayed that states which button was clicked.
13. Create JSP code that uses a persistant cookie (i.e. a cookie with an expiration date in the future) to keep track of how many times the client computer has visited the page. Use setMaxAge method to remain on the client's computer for one month. Display the number ofpage hits (i.e. cookie's value) every time the page loads.
14. Write JSP program that asks user his favourite color as request parameter and sets it as thebackground color of the page or sets the background color white if the

parameter value is null.

15. Write a program in Java to show the mouse click event. The program should change thebackground colour of window randomly at each mouse click.

Text and Reference Books:

1. Balagurusamy E, "Programming in JAVA", TMH
2. Herbert Schildt, "The Complete Reference JAVA", TMH
3. Bruce Eckel, "Thinking in Java", Prentice Hall PTR.
4. Grady Booch, James Rumbaugh, Ivar Jacobson: The Unified Modeling Language User Guide,Pearson Education.
5. Mark Priestley: Practical Object-Oriented Design with UML, TATA Mc-GrawHill.
6. Meilir Page-Jones: Fundamentals of Object Oriented Design in UML, Pearson Education.
7. Pascal Roques: Modeling Software Systems Using UML2, WILEY-Dreamtech India Pvt. Ltd.
8. Appling UML and Patterns: An introduction to Object – Oriented Analysis and Design andUnified Process, Craig Larman, Pearson Education.
9. Atul Kahate: Object Oriented Analysis & Design, The McGraw-Hill Companies.

Course Outcomes:

1. Analyse information systems in real-world settings and use an object-oriented method for
   analysis and design. (Analyse)
2. Understand features of object-oriented design such as encapsulation, polymorphism, inheritance, and UML. (Understand)
3. Understand and prepare different types of UML diagrams like use case diagrams, interaction diagrams, nested state diagrams, state chart diagrams, activity diagram etc. (Understand, Apply)
4. Understand and appreciate the use of Design Patterns in the Software Development. (Understand, Apply)
5. Understand the core and advance Java Programming features and apply them in complexproblem solving. (Understand, Apply)

COMPUTER GRAPHICS (ECS-356)

Type	L	T	P	Credits
PCC	2	1	0	3

Prerequisite:

Course Content:

Unit-1:

Line generation: Points and Lines, Planes, Pixels and Frame buffers, vector and character generation. Graphics Primitives: Display devices, Primitive devices, Display File Structure,

Display control text, Line-drawing Algorithms**:** DDA Algorithm Bresenham's line Algorithm, Circle-generating Algorithm**:** Midpoint Circle of Algorithm, Polygon Filling Algorithm.

Unit-2:

2-D Viewing and Clipping: Point Clipping, Line Clipping, Cohen-Sutherland Line Clippings, Cyrus- Beck Line Clipping Algorithm, Polygon Clipping: Sutherland Hodgman Algorithm, Polygon: Polygon Representation, Entering polygons, Filling polygons, Segments: Segments table, Creating deleting andrenaming segments, Visibility.

Unit-3 :

2-D and 3-D Transformations: Basic Transformations: Translation, Rotation, Scaling, Shear, Composite Transformations: Rotations about a point, Reflection about a line, Homogeneous Coordinate Systems, 3-D Transformations, 3-D geometry primitives, Viewing Transformation, Projections: Parallel Projection, Orthographic & Oblique Projections, Perspective Projections. Interaction: Hardware input devices handling algorithms, Event handling echoing, Interactive techniques.

Unit-4:

Hidden Line and Surface: Back face removal algorithms, hidden line methods, Rendering and Illumination: Introduction to curve and Surfaces generation, Bezier, Hermite and B-spline algorithms and their comparisons.

Unit-5:

Multimedia and Animation: Basic of Animation, Types of Animation, Simulating, Accelerations, Computer Animation Tools, Multimedia Applications, Concepts of Hypertext/Hypermedia, Images, Audio and Video**,** Multimedia Tools.

Text and Reference Books:

1. Rogers, "Procedural Elements of Computer Graphics", McGraw Hill
2. Baker and Hearn, "Computer Graphics", PHI Publication.
3. Newman and Sproul, "Principle of Interactive Computer Graphics", McGraw Hill
4. Steven Harrington, "Computer Graphics", A Programming Approach, 2nd Edition
5. Rogar and Adams, "Mathematical Elements of Computer Graphics", McGraw Hill.

Lab Work:

Write Program in C or C++ for the following.

1. Implementation of line generation using slope's method, DDA and Bresenham's algorithms.
2. Implementation of circle generation using Mid-point method and Bresenham's algorithm.
3. Implementation of ellipse generation using Mid-point method.
4. Implementation of polygon filling using Flood-fill, Boundary-fill and Scan-line algorithms.
5. Implementation of 2-D transformation: Translation, Scaling, Rotation, Mirror Reflection andShearing (write a menu driven program).
6. Implementation of Line Clipping using Cohen-Sutherland algorithm and Bisection Method.

7. Implementation of Polygon Clipping using Sutherland-Hodgman algorithm.
8. Implementation of 3-D geometric transformations: Translation, Scaling and rotation.
9. Implementation of Curve generation using Interpolation methods.
10. Implementation of Curve generation using B-spline and Bezier curves.
11. Implementation of any one of Back face removal algorithms: Depth-Buffer algorithm,Painter's algorithm, Warnock's algorithm, Scan-line algorithm.

Course Outcomes:

1. Understand and use various mathematical concepts and supporting composite 2-D & 3-D
   graphics transformations for hidden surface detection/ removal and various graphicalalgorithms. (Understand, Apply)
2. Design algorithms for various graphics shapes like ellipse, hyperbola, triangle etc. (Apply)
3. Use of various graphical tools and software in 3D Graphics API (e.g. OpenGL or DirectX).(Apply)
4. Understand and apply geometrical transformation and computer graphics in multidisciplinaryfield of engineering. (Apply)
5. Understand the hardware system architecture for computer graphics - graphics pipeline, framebuffers, and graphic accelerators/co-processors. (Understand)
6. Analyze and implement interactive graphics applications using programming language andgraphics application programming interfaces. (Apply, Analyze)

SOFT COMPUTING (ECS-358)

Type	L	T	P	Credits
PEC	2	1	0	3

Prerequisite:

Course Content:

Unit 1: Introduction to Intelligent Systems and Soft Computing
Characteristic behavior of Intelligent systems, Knowledge based systems, Knowledge Representation and Processing, Soft Computing characteristics, Constitutes of Soft Computing-Fuzzy Logic and Computing, Neural Computing, Evolutionary Computing, Rough Sets, Probabilistic Reasoning and Machine Learning.

Unit 2: Neuro Computing - Supervised Learning
Biological background, Pattern recognition tasks, Features of artificial neural networks, Activationfunctions, Perceptron model, Perceptron for classification and its limitations, Architectures ofmultilayer feed-forward neural networks, Back-propagation learning algorithm, Limitations of MLP. **Unit 3: Neuro Computing - Unsupervised Learning**
Hebb‟s learning rule for competitive learning, Kohonen‟s self-organizing map and network topology, applications of SOM, Hopfield network and its topology, Boltzman Machines, Adaptive Resonance Theory.

Unit 4: Fuzzy Logic and Fuzzy Systems

Evolution of fuzzy logic, fuzzy sets, fuzzy logic operations, fuzzy relations, Fuzzy arithmetic and fuzzy measures. Fuzzy rules and reasoning, Fuzzy inference systems, Fuzzy modeling and decision making, Neuro-fuzzy modeling.

Unit 5: Evolutionary Computing

Biological background and Overview of evolutionary computing, Genetic algorithm and search space, Operators in genetic algorithm- encoding, selection, crossover, and mutation, Classification of GA,

Evolutionary Programming and Strategies, Applications of fuzzy in pattern recognition-character recognition. Applications of evolutionary computing in Image processing and computer vision, applications of Soft computing in mobile ad-hoc networks, Information Retrieval, Semantic web, and Software Engineering.

Text and Reference Books:

1. Fakhreddine O. Karray, Clarence De Silva, 'Soft Computing and Intelligent systems design'
   Pearson Education, ISBN 978-81-317-2324-1.
2. B. K. Tripathy, J. Anuradha, 'Soft Computing: advances and applications', Cengage learning,ISBN-13: 978-81-315-2619-4.
3. S. N. Sivanandam, S. N. Deepa, Principles of Soft Computing, Wiley publications, 2ndEdition.
4. J. S. R. Jang, C. T. Sun, E. Mizutani, 'Neuro-Fuzzy and Soft Computing- A computationalapproach to Learning and Machine Intelligence' PHI.
5. David E. Goldberg, Genetic Algorithms - Pearson Education, 2006.
6. Satish Kumar, "Neural Networks - A Classroom Approach", Tata McGraw-Hill.

Course Outcomes:

1. Understand differential behavior of Human and Intelligent Systems. (Understand)
2. Understand and use supervised and un-supervised learning techniques in ANN. (Understand)
3. Understand and apply different soft computing techniques like Genetic Algorithms, FuzzyLogic, Neural Network and their combination. (Understand, Apply)
4. Correlate human-like processing in problem solving with current technologies in variousdomains like Bio Informatics, Multimedia Systems, Big Data Analytics, etc.
5. Apply evolutionary computing techniques in real life problems. (Apply)

INTERNET OF THINGS (ECS-360)

Type	L	T	P	Credits
PEC	2	1	0	3

Prerequisite: Computer Network (ECS-351)

Course Content:

Unit-1: Introduction

What is the Internet of Things? : History of IoT, About IoT, Overview and Motivations, Examples ofApplications, Internet of Things Definitions and Frameworks: IoT Definitions, IoT Architecture,General Observations, ITU-T Views, Working Definition, IoT Frameworks, Basic Nodal Capabilities **Unit-2: Fundamentals of IoT Mechanisms and Key Technologies** Identification of IoT Objects and Services, Structural Aspects of the IoT, EnvironmentCharacteristics, Traffic Characteristics, Scalability, Interoperability, Security and Privacy, Open Architecture, Key IoT Technologies, Device Intelligence, Communication Capabilities, Mobility Support, Device Power, Sensor Technology, RFID Technology, Satellite Technology,

Unit-3: Radio Frequency Identification Technology

RFID: Introduction, Principle of RFID, Components of an RFID system, Issues EPC Global Architecture Framework: EPCIS & ONS, Design issues, Technological challenges, Security challenges, IP for IoT, Web of Things. Wireless Sensor Networks: History and context, WSN Architecture, the node, Connecting nodes, Networking Nodes, Securing Communication WSN specific IoT applications, challenges: Security, QoS, Configuration, Various integration approaches, Data link layer protocols, routing protocols and infrastructure establishment.

Unit-4: Resource Management in the Internet of Things

Clustering, Software Agents, Clustering Principles in an Internet of Things, Architecture, Design Guidelines, and Software Agents for Object Representation, Data Synchronization. Identity portrayal, Identity management, various identity management models: Local, Network, Federated and global web identity, user-centric identity management, device centric identity management and hybrid-identity management, Identity and trust.

Unit-5: Internet of Things Privacy, Security and Governance

Vulnerabilities of IoT, Security requirements, Threat analysis, Use cases and misuse cases, IoT security tomography and layered attacker model, Identity establishment, Access control, Message integrity, Non-repudiation and availability, Security model for IoT. Business models for Internet of Things: Business Models and Business Model Innovation, Value Creation in the Internet of Things, Business Model Scenarios for the Internet of Things.

Text and Reference Books:

1. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of
   M2M Communications", ISBN: 978-1-118-47347-4, Willy Publications
2. Bernd Scholz-Reiter, Florian Michahelles, "Architecting the Internet of Things", ISBN 978- 3642-19156-5 e-ISBN 978-3-642-19157-2, Springer.
3. Parikshit N. Mahalle& Poonam N. Railkar, "Identity Management for Internet of Things", River Publishers, ISBN: 978-87-93102-90-3 (Hard Copy), 978-87-93102-91-0 (ebook).
4. Hakima Chaouchi, "The Internet of Things Connecting Objects to the Web" ISBN: 978- 184821-140-7, Willy Publications.
5. Olivier Hersent, David Boswarthick, Omar Elloumi, The Internet of Things: Key

Applications and Protocols, ISBN: 978-1-119-99435-0, 2nd Edition, Willy Publications.
6. Daniel Kellmereit, Daniel Obodovski, "The Silent Intelligence: The Internet of Things",. Publisher: Lightning Source Inc; 1 edition (15 April 2014). ISBN-10: 0989973700, ISBN-13: 9780989973700. 4. Fang Zhaho, Leonidas Guibas, "Wireless Sensor Network: An informationprocessing approach", Elsevier, ISBN: 978-81-8147-642-5.

Course Outcomes:

1. Understand framework and architecture of Internet of Things. (Understand)
2. Understand key technologies in Internet of Things. (Understand)
3. Explain wireless sensor network architecture and its framework along with WSN applications.(Understand)
4. Explain resource management in the Internet of Things. (Understand)
5. Understand Security measures and design applications based on Internet of Things.(Understand, Apply)

NETWORK SECURITY (ECS-362)

Type	L	T	P	Credits
PEC	3	0	0	0

Prerequisite: Computer Networks ((ECS-351)

Course Content:

Unit-1:
Introduction to security attacks, services and mechanism, introduction to cryptography. Conventional Encryption: Conventional encryption model, classical encryption techniques substitution ciphers and transposition ciphers, cryptanalysis, stereography, stream and block ciphers. Modern Block Ciphers: Block ciphers principals, Shannon‟s theory of confusion and diffusion, fiestal structure, data encryption standard(DES), strength of DES, differential and linear crypt analysis of DES, block ciphermodes of operations, triple DES, IDEA encryption and decryption, strength of IDEA, confidentiality using conventional encryption, traffic confidentiality, key distribution, random number generation.

Unit-2:
Introduction to graph, ring and field, prime and relative prime numbers, modular arithmetic, Fermat's and Euler's theorem, primality testing, Euclid's Algorithm, Chinese Remainder theorem, discrete logarithms. Principals of public key crypto systems, RSA algorithm, security of RSA, key management, Diffie-Hellman key exchange algorithm, introductory idea of Elliptic curve cryptography, Elgamel encryption.

Unit-3:
Message Authentication and Hash Function: Authentication requirements, authentication functions, message authentication code, hash functions, birthday attacks, security of hash functions and MACS, MD5 message digest algorithm, Secure hash algorithm(SHA). Digital

Signatures: Digital Signatures, authentication protocols, digital signature standards (DSS), proof of digital signature algorithm.

Unit-4:

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

Unit-5:

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

Text and References Books:

1. William Stallings, "Cryptography and Network Security: Principals and Practice", Prentice Hall, New Jersy.
2. Johannes A. Buchmann, "Introduction to Cryptography", Springer-Verlag.
3. Bruce Schiener, "Applied Cryptography".

Course Outcomes:

1. Understand and deploy cryptographic techniques to secure data in networks. (Understand, Apply)
2. Analyze the vulnerabilities in any computing system and design a security solution. (Apply,Analyse)
3. Understand and use standard algorithms for confidentiality, integrity and authenticity.(Understand, Apply)
4. Apply various key distribution and management schemes in network system. (Apply)
5. Apply security protocols in various IT applications. (Apply)