MYSORE UNIVERSITY SCHOOL OF ENGINEERING

Scheme of Teaching and Examination 2021-2022(As per NEP-2020)
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
(Effective from the academic year 2021–2022)

COMPUTER SCIENCE AND DESIGN (CS&D)

V-SEMESTER

Sl. No.	Course & Course Code		Course Title	Teaching Dept.	Paper Setting Board	Teaching Hours/week			Examination				Credits
						Theory lectures	Tutorial	Practical/ Drawing	Examination in Hours	CIE Marks	SEE Marks	Total Marks	
						L	T	P					
1	HSMC	21CD51	Management and Entrepreneurship	HSMC	HSMC	3	0	0	03	50	50	100	3
2	IPCC	21CD52	Programming in Java	CS & D	CS & D	2	0	2	03	50	50	100	3
3	IPCC	21CD53	Database Management System	CS & D	CS & D	3	0	2	03	50	50	100	4
4	PCC	21CD54	Automata Theory	CS & D	CS & D	3	0	0	03	50	50	100	3
5	PCC	21CD55	Principles of Computer System and Design	CS & D	CS & D	3	0	2	03	50	50	100	4
6	PEC	21CD56X	Professional Elective -1	CS & D	CS & D	3	0	0	03	50	50	100	3
7	OEC	21CD57X	Open Elective - 1	CS & D	CS & D	3	0	0	03	50	50	100	3
8	INT	21INT58	Summer Internship - 1	Completed during the vacation of IV and V semesters		0	0	2	NA	50	-	50	1
Total						**20**	**00**	**08**	**21**	**400**	**350**	**750**	**24**

Note: PCC: Professional Core Courses, IPCC: Integrated Professional Core Courses, CS& D: Computer Science and Design, HSMC: Humanity Social Science and Management Courses, PEC: Professional Elective Course, OEC: Open Elective Course and INT: Internship.

Professional Elective-1		**Open Elective - 1**	
Course Code	**Course Title**	**Course Code**	**Course Title**
21CD561	Web Technology	21CD571	Introduction to Data Structure and Algorithm
21CD562	Operations Research	21CD572	Introduction to Database Management System
21CD563	Simulation and Modelling	21CD573	Programming in Java
		21CD574	Introduction to Artificial Intelligence
		21CD575	Introduction to Python Programming

Credit Definition:
1-hour lecture**(L)** per week per semester = **1 Credit**
2-hour tutorial **(T)** per week per semester = **1 Credit**
2-hour Practical/Drawing **(P)** per week per semester = **1 Credit**

Four-credit courses are to be designed for **50** hours of Teaching-Learning process.
Three credit courses are to be designed for **40** hours of Teaching-Learning process.
Two credit courses are to be designed for **25** hours of Teaching-Learning process.
One credit course is to be designed for **15** hours of Teaching-Learning process.

AICTE Activity Points: In case students fail to earn the prescribed activity Points, an Eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of the degree only after the release of the Eighth semester Grade Card.

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Scheme of Teaching and Examination 2021-2022(As per NEP-2020)
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COMPUTER SCIENCE AND DESIGN (CS&D)

VI-SEMESTER

Sl. No.	Course & Course Code		Course Title	Teaching Dept.	Paper Setting Board	Teaching Hours/week			Examination				Credits
						Theory lectures	Tutorial	Practical/ Drawing	Examination in Hours	CIE Marks	SEE Marks	Total Marks	
						L	T	P					
1	IPCC	21CD61	Computer Networks and Security	CS & D	CS & D	3	0	2	03	50	50	100	4
2	IPCC	21CD62	System Programming and Compiler Design	CS & D	CS & D	3	0	2	03	50	50	100	4
3	IPCC	21CD63	Object oriented and Design and Analysis	CS & D	CS & D	3	0	2	03	50	50	100	4
4	PCC	21CD64	Cloud Computing	CS & D	CS & D	3	0	0	03	50	50	100	3
5	PEC	21CD65X	Professional Elective -2	CS & D	CS & D	3	0	0	03	50	50	100	3
6	OEC	21CD66X	Open Elective – 2	CS & D	CS & D	3	0	0	03	50	50	100	3
7	MP	21CDP67	Mini Project	CS & D	CS & D	0	0	2	NA	50	-	50	1
Total						**18**	**0**	**08**	**18**	**350**	**300**	**650**	**22**

Note: ESC: Engineering Science Courses, EEC: Engineering Elective Course, OEC: Open Elective Course, CS&D: Computer Science and Design, MP: Mini Project, PEC: Professional Elective Course, OEC: Open Elective Course and INT: Internship

Professional Elective - 2		**Open Elective - 2**	
Course Code	**Course Title**	**Course Code**	**Course Title**
21CD651	Research Methodology and Intellectual Property Rights	21CD661	Introduction to Internet of Things
21CD652	C# and .NET Framework	21CD662	Introduction to Machine Learning
21CD653	Application Development using Python Programming	21CD663	Introduction to Cyber Security
21CD654	Computer Graphics	21CD664	Introduction to Web Technology
		21CD665	Animation and Visualization

Students can select any one of the open electives offered by any department.
Selection of an open elective is not allowed provided,

- The candidate has studied the same course during the previous semesters of the programme.
- The syllabus content of open elective is similar to that of Departmental core courses or professional electives.
- A similar course, under any category, is prescribed in the higher semesters of the programme.

Registration to electives shall be documented under the guidance of Programme Coordinator/ Adviser/Mentor.

Mini-project work: Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multidisciplinary Mini project can be assigned to an individual student or to a group having not more than 4 students.

CIE procedure for Mini project:

(i) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide. The CIE marks awarded for the Mini-project work, shall be based on the evaluation of project report, project presentation skill and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

(ii) Interdisciplinary: Continuous Internal Evaluation shall be group wise at the college level with the participation of all the guides of the college. The CIE marks awarded for the Mini-project, shall be based on the evaluation of project report, project presentation skill and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

AICTE Activity Points: In case students fail to earn the prescribed activity Points, an Eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of the degree only after the release of the Eighth semester Grade Card.

Management and Entrepreneurship (21CD51)

Semester V			
No. of Teaching hour/Week	3	**CIE Marks**	50
No. of Tutorial hours/week	0	**SEE Marks**	50
Total No. of Lecture hours	40	**Exam Hours**	03
L:T:P	3:0:0	**Credits**	03

Modules	Course Content	Teaching Hours
Module 1	**Introduction:** meaning, nature and characteristics of management, scope and functional areas of management, goals of management, levels of management, brief overview of evolution of management theories, Planning- Nature, importance, types of plans, steps in planning, Organizing- nature and purpose, types of organization, Staffing- meaning, process of recruitment and selection.	**08 Hours**
Module 2	**Directing and Controlling:** meaning and nature of directing, leadership styles, motivation theories, Communication- meaning and importance, Coordination- meaning and importance, Controlling- meaning, steps in controlling, methods of establishing control.	**08 Hours**
Module 3	**Project Management**: Project/Program/Portfolio Management, Phases in Project Life Cycle, Top Down and Bottoms up Estimation, WBS, Stake Holder Management. Identification of new ideas, Evaluation of Alternatives. **Human Resource Management:** Functions of HRM, Recruitment and Selection, Interviewing Candidates. Human Resource Development, Training and Development, Performance Appraisal and Employee Compensation	**08 Hours**
Module 4	**Marketing Management**: Introduction, 5 Ps of Marketing, product life cycle, market Strategy. **Financial Management**: Introduction, Types of Finance, Balance Sheet and Profit and Loss account statement, working capital, International Finance	**08 Hours**
Module 5	**Entrepreneurship:** Introduction, Management & Administration, Types of ownership and Organization structures. Concept of Entrepreneur, kind of Entrepreneurs, Entrepreneurship development and Govt. support in India. Role of Entrepreneurs in Economic Development. **Micro and Small Enterprises:** Definition of micro and small enterprises, characteristics and advantages of micro and small enterprises, steps in establishing micro and small enterprises, Introduction to IPR.	**08 Hours**

Course outcomes:

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

- Explain the development of management thought and Concept of Entrepreneurs.
- Evaluate the human behavior concepts and HRM.
- Make use of IPRs and institutional support in entrepreneurship
- Apply the project management tools to manage projects.
- Illustrate financial statements and concepts of Marketing.

Reference Books:

1. K R Phaneesh, *Management and Entrepreneurship* - (Sixth Edition) Sudha Publication, Year 2013.
2. P. C. Tripathi, P. N. Reddy, *Principles of Management* 4th / 6th Edition Tata McGraw Hill, 2010.
3. Vasant Desai, *Dynamics of Entrepreneurial Development & Management* Himalaya Publishing House.
4. Poornima M Charantimath, *Entrepreneurship Development -Small Business Enterprises* Pearson Education – 2006.
5. Kanishka Bedi, *Management and Entrepreneurship* Oxford University Press-2017.

Programming in Java (21CD52)

Semester V			
No. of Teaching hour/Week	2	**CIE Marks**	50
No. of Practical hours/week	2	**SEE Marks**	50
Total No. of Lecture hours	40	**Exam Hours**	03
L:T:P	2:0:1	**Credits**	03

Modules	Course Content	Teaching Hours
Module 1	**Introduction to Java:** Basics of Java programming, Data types, Variables, Operators, Control structures including selection, Looping, Java methods, Overloading, Math class, Arrays in java, Java Is a Strongly Typed Language, The Primitive Types, Integers, Floating-Point Types, Characters, Booleans, A Closer Look at Literals, Type Conversion and Casting, Automatic Type Promotion in Expressions, A Few Words About Strings	**08 Hours**
Module 2	**Objects and Classes:** Basics of objects and classes in java, Constructors, Finalizer, Visibility modifiers, Methods and objects, Inbuilt classes like String, Character **Operators:** Arithmetic Operators, The Bitwise Operators, Relational Operators, Boolean Logical Operators, The Assignment Operator, The ? Operator, Operator Precedence, Using Parentheses. **Control Statements**: Java's Selection Statements, Iteration Statements, Jump Statements.	**08 Hours**
Module 3	**Event and GUI programming:** Event handling in java, Event types, Mouse and key events, GUI Basics, Panels, Frames, Layout Managers: Flow Layout, Border Layout, Grid Layout, GUI components like Buttons,Check Boxes, Radio Buttons, Labels, Text Fields, Text Areas, Combo Boxes, Lists, Scroll Bars, Sliders, Windows, Menus, Dialog Box, Applet and its life cycle.	**08 Hours**
Module 4	**Packages and Interfaces:** Packages, Access Protection, Importing Packages, Interfaces. **Exception Handling:** Exception-Handling Fundamentals, Exception Types, Uncaught Exceptions, Using try and catch, Multiple catch Clauses, Nested try Statements, throw, throws, finally, Java's Built-in Exceptions, Chained Exceptions, Using Exceptions.	**08 Hours**
Module 5	**I/O Programming:** Text and Binary I/O, Binary I/O classes, Object I/O, Random Access Files. **Multithreading in Java:** Thread life cycle and methods, Runnable interface, Thread synchronization, Exception handling with try-catch-finally, Collections in java, Introduction to JavaBeans.	**08 Hours**

Course outcomes:

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

- Show competence in the use of the Java programming language in the development of small to medium-sized application programs that demonstrate professionally acceptable coding and performance standard.
- Develop computer programs to solve real world problems in Java.
- Demonstrate an introductory understanding of graphical user interfaces, multi-threaded programming, and event-driven programming.

Reference Books:

1. Y. Daniel Liang, *Introduction to Java Programming (Comprehensive Version)*, Seventh Edition, Pearson.
2. Sachin Malhotra, Saurabh Chaudhary, *Programming in Java*, Oxford University Press.
3. Doug Lowe, Joel Murach , Andrea Steelman, *Murach's Beginning Java 2*, SPD.
4. Horstmann, Cornell, *Core Java Volume-I Fundamentals*, Eight Edition,
5. Pearson Education.
6. Herbert Schild, *The Complete Reference, Java 2* (Fourth Edition), TMH.
7. D. S. Malik, *Java Programming*, Cengage Learning.

Database Management System (21CD53)

Semester V			
No. of Lecture hour/Week	3	**CIE Marks**	50
No. of Practical hours/week	2	**SEE Marks**	50
Total No. of Lecture hours	50	**Exam Hours**	03
L: T:P	3:0:1	**Credits**	04

Modules	Course Content	Teaching Hours
Module 1	**Introduction to Databases:** Introduction, Characteristics of database approach, Advantages of using the DBMS approach, History of database applications. **Overview of Database Languages and Architectures:** Data Models, Schemas and Instances. Three schema architecture, Data independence, Database languages and interfaces, The Database System Environment. **Conceptual Data Modelling using Entities and Relationships:** Entity types, Entity sets, Attributes, Roles and Structural constraints, Weak entity types, ER diagrams, Examples.	**10 Hours**
Module 2	**Relational Model:** Relational Model Concepts, Relational Model Constraints and Relational database schemas, Update operations, Transactions, and dealing with constraint violations. **Relational Algebra:** Unary and Binary relational operations, additional relational operations (aggregate, grouping, etc.) Examples of Queries in relational algebra. **Mapping Conceptual Design into a Logical Design:** Relational Database Design using ER-to-Relational mapping.	**10 Hours**
Module 3	**SQL:** SQL data definition and data types, specifying constraints in SQL, retrieval queries in SQL, INSERT, DELETE, and UPDATE statements in SQL, Additional features of SQL. **Advances Queries:** More complex SQL retrieval queries, Specifying constraints as assertions and action triggers, Views in SQL, Schema change statements in SQL. **Database Application Development:** Accessing databases from applications, An introduction to JDBC, JDBC classes and interfaces, SQLJ, Stored procedures, Case study: The internet Bookshop.	**10 Hours**
Module 4	**Normalization:** Database Design Theory – Introduction to Normalization using Functional and Multivalued Dependencies, Informal design guidelines for relation schema, Functional Dependencies, Normal Forms based on Primary Keys, Second and Third Normal Forms, Boyce-Codd Normal Form, Multivalued Dependency and Fourth Normal Form, Join Dependencies and Fifth Normal Form. Examples on normal forms. **Normalization Algorithms:** Inference Rules, Equivalence, and Minimal Cover, Properties of Relational Decompositions, Algorithms for Relational Database Schema Design, Nulls, Dangling tuples, and Alternate relational designs.	**10Hours**

Module 5	**Transaction Processing:** Introduction to Transaction Processing, Transaction and System Concepts, Desirable Properties of Transactions, characterizing schedules based on recoverability, characterizing schedules based on Serializability, Transaction support in SQL. **Concurrency Control in Databases:** Two-phase locking techniques for Concurrency control, Concurrency control based on Timestamp ordering, Multiversion Concurrency control techniques, Validation Concurrency control techniques, Granularity of Data items and Multiple Granularity Locking.	**10 Hours**

Course outcomes:

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

- Identify, analyse and define database objects, enforce integrity constraints on a database using RDBMS.
- Use Structured Query Language (SQL) for database manipulation and also demonstrate the basic of query evaluation.
- Design and build simple database systems and relate the concept of transaction, concurrency control and recovery in database.
- Demonstrate the Basics Concepts and SQL Queries of Database Management System
- Analyse the various constraints to populate the database through SQL Queries.
- Implement different working concepts of DBMS using SQL Queries
- Present the result of database creation and querying process, document it.

Reference Books:

1. Ramez Elmasri, Shamkant B. *Navathe Fundamentals of Database Systems*, 7th Edition, Pearson, 2017.
2. Ramakrishnan, Gehrke, *Database Management Systems*, 3rd Edition, McGraw Hill, 2014.
3. Silberschatz Korth, Sudharshan, *Database System Concepts*, 6th Edition, McGraw Hill, 2013.
4. Coronel, Morris, Rob, *Database Principles Fundamentals of Design, Implementation and Management*, Cengage Learning, 2012.

Automata Theory and Computability (21CD54)

Semester V			
No. of Lecture hour/Week	3	**CIE Marks**	50
No. of Tutorial hours/week	0	**SEE Marks**	50
Total No. of Lecture hours	40	**Exam Hours**	03
L: T: P	3:0:0	**Credits**	03

Modules	Course Content	Teaching Hours
Module 1	**Why study the Theory of Computation, Languages and Strings:** Strings, Languages. A Language Hierarchy, Computation. **Finite State Machines (FSM):** Deterministic FSM, Regular languages, Designing FSM, Nondeterministic FSMs, From FSMs to Operational Systems, Simulators for FSMs, Minimizing FSMs, Canonical form of Regular languages, Finite State Transducers, Bidirectional Transducers.	**08 Hours**
Module 2	**Regular Expressions (RE):** what is a RE, Kleene"s theorem, Applications of REs, Manipulating and Simplifying REs. Regular Grammars: Definition, Regular Grammars and Regular languages. Regular Languages (RL) and Non-regular Languages: How many RLs, to show that a language is regular, Closure properties of RLs, to show some languages are not RLs.	**08 Hours**
Module 3	**Context-Free Grammars (CFG):** Introduction to Rewrite Systems and Grammars, CFGs and languages, designing CFGs, simplifying CFGs, proving that a Grammar is correct, Derivation and Parse trees, Ambiguity, Normal Forms. Pushdown Automata (PDA): Definition of non-deterministic PDA, Deterministic and Non-deterministic PDAs, Non - determinism and Halting, alternative equivalent definitions of a PDA, alternatives that are not equivalent to PDA.	**08 Hours**
Module 4	**Algorithms and Decision Procedures for CFLs:** Decidable questions, Un-decidable questions. Turing Machine: Turing machine model, Representation, Language acceptability by TM, design of TM, Techniques for TM construction. Variants of Turing Machines (TM), The model of Linear Bounded automata.	**08 Hours**
Module 5	**Decidability:** Definition of an algorithm, decidability, decidable languages, Undecidable languages, halting problem of TM, Post correspondence problem. Complexity: Growth rate. of functions, the classes of P and NP, Quantum Computation: quantum computers, Church-Turing thesis. **Applications:** G.1 Defining syntax of programming language, Appendix J: Security	**08 Hours**

Course Outcome:

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

- Acquire fundamental understanding of the core concepts in automata theory and Theory of Computation.
- Learn how to translate between different models of Computation (e.g., Deterministic and Non-deterministic and Software models).
- Design Grammars and Automata (recognizers) for different language classes and become knowledgeable about restricted models of Computation (Regular, Context Free) and their relative powers.
- Develop skills in formal reasoning and reduction of a problem to a formal model, with an emphasis on semantic precision and conciseness.
- Classify a problem with respect to different models of Computation.

Reference Books:

1. John E Hopcroft, Rajeev Motwani, Jeffery D Ullman, *"Introduction to Automata Theory, Languages, and Computation"*, 3rd Edition, Pearson Education, 2013.
2. Michael Sipser, *"Introduction to the Theory of Computation"*, 3rd edition, Cengage learning,2013.
3. John C Martin, *"Introduction to Languages and The Theory of Computation"*, 3rd Edition, Tata Mc Graw –Hill Publishing Company Limited, 2013.
4. Peter Linz, *"An Introduction to Formal Languages and Automata"*, 3rd Edition, Narosa Publishers, 1998.
5. Basavaraj S. Anami, Karibasappa K G, *"Formal Languages and Automata theory"*, Wiley India, 2012.
6. C K Nagpal, *"Formal Languages and Automata Theory"*, Oxford University press, 2012.
7. Elaine Rich, *"Automata, Computability and Complexity"*, 1st Edition, Pearson education, 2012/2013.
8. K L P Mishra, N Chandrasekaran, *"Theory of Computer Science"*, 3rd Edition, PhI, 2012.

Principles of Computer System and Design (21CD55)

Semester V			
No. of Teaching hour/Week	3	**CIE Marks**	50
No. of Practical hours/week	2	**SEE Marks**	50
Total No. of Lecture hours	50	**Exam Hours**	03
L:T:P	3:0:1	**Credits**	04

Modules	Course Content	Teaching Hours
Module 1	Systems and complexity, fundamental abstractions, naming introduction, Names and layers, Unix file system case study, Client/service modularity, NFS case study.	**10 Hours**
Module 2	Virtualization abstractions-Threads Virtual Memory Bounded Buffer Operating System Interface, virtual links-An Interface for SEND and RECEIVE with Bounded Buffers Sequence Coordination with a Bounded Buffer Race Conditions Locks and Before-or-After Actions Deadlock Implementing ACQUIRE and RELEASE, Memory modularity, virtual memory Virtual processor threads	**10 Hours**
Module 3	Designing for performance-Performance Metrics Capacity, Utilization, Overhead, and Useful Work Latency Throughput, scheduling-Scheduling Resources Scheduling metrics Scheduling Policies First-Come, First-Served Shortest-job-first Round-Robin Priority Scheduling	**10 Hours**
Module 4	Network properties- Isochronous and Asynchronous Multiplexing Packet Forwarding; Delay Buffer Overflow and Discarded Packets Duplicate Packets and Duplicate Suppression Damaged Packets and Broken Links Reordered Delivery, network layers-Addressing Interface Managing the Forwarding Table: Routing Hierarchical Address Assignment and Hierarchical Routing Reporting Network Layer Errors Network Address Translation.	**10 Hours**
Module 5	Network case studies-Case Study: Mapping the Internet to the Ethernet, fault tolerance-Faults, Failures and Modules. The Fault-Tolerance Design Process. Redundancy-Systematically Applying Redundancy, Atomicity-All-or-Nothing Atomicity in a Database All-or-Nothing Atomicity in the Interrupt Interface	**10 Hours**

Course outcomes:

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

- Have a broad introduction to the main principles and abstractions for engineering computer systems
- Critique real world examples.
- In-depth studies of their use on computer systems across a variety of designs.
- Designs of an operating system, a client/server application, a database server, or a fault-tolerant disk cluster.

Reference Books:

1. Jerome E. Saltzer, M. Frans Kaashoek Morgan Kaufmann, "*Principles of Computer System Design",* first edition, 2009.
2. Don Norman, *The design of everyday things,* Basic books ,2013.

Professional Elective – 1

Web Technology (21CD561)

Semester V			
No. of Teaching hour/Week	3	**CIE Marks**	50
No. of Tutorial hours/week	0	**SEE Marks**	50
Total No. of Lecture hours	40	**Exam Hours**	03
L:T:P	3:0:0	**Credits**	03

Modules	Course Content	Teaching Hours
Module 1	**Introduction to HTML**: What is HTML and Where did it come from?, HTML Syntax, Semantic Markup, Structure of HTML Documents, Quick Tour of HTML Elements, HTML5 Semantic Structure Elements, Introduction to CSS, What is CSS, CSS Syntax, Location of Styles, Selectors, The Cascade: How Styles Interact, The Box Model, CSS Text Styling	**08 Hours**
Module 2	**HTML Tables and Forms:** Introducing Tables, Styling Tables, Introducing Forms, Form Control Elements, Table and Form Accessibility, Microformats, Advanced CSS: Layout, Normal Flow, Positioning Elements, Floating Elements, Constructing Multicolumn Layouts, Approaches to CSS Layout, Responsive Design, CSS Frameworks	**08 Hours**
Module 3	**JavaScript:** Client-Side Scripting, what is JavaScript and What can it do? JavaScript Design Principles, Where does JavaScript Go?, Syntax, JavaScript Objects, The Document Object Model (DOM), JavaScript Events, Forms, Introduction to Server-Side Development with PHP, What is Server-Side Development, A Web Server's Responsibilities, Quick Tour of PHP, Program Control, Functions.	**08 Hours**
Module 4	**PHP**: Arrays and Superglobals, Arrays, $_GET and $_POST Superglobal Arrays, $_SERVER Array, $_Files Array, Reading/Writing Files, PHP Classes and Objects, Object-Oriented Overview, Classes and Objects in PHP, Object Oriented Design, Error Handling and Validation, What are Errors and Exceptions?, PHP Error Reporting, PHP Error and Exception Handling	**08 Hours**
Module 5	**Managing State:** The Problem of State in Web Applications, Passing Information via Query Strings, Passing Information via the URL Path, Cookies, Serialization, Session State, HTML5 Web Storage, Caching, Advanced JavaScript and jQuery, JavaScript Pseudo-Classes, jQuery Foundations, AJAX, Asynchronous File Transmission, Animation, Backbone MVC Frameworks, XML Processing and Web Services, XML Processing, JSON, Overview of Web Services	**08 Hours**

Course outcomes:

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

- Adapt HTML and CSS syntax and semantics to build web pages.
- Construct and visually format tables and forms using HTML and CSS.
- Develop Client-Side Scripts using JavaScript and Server-Side Scripts using PHP to
- generate and display the contents dynamically.
- Appraise the principles of object-oriented development using PHP.
- Inspect JavaScript frameworks like jQuery and Backbone which facilitates developer to focus on core features.

Reference Books:

1. Randy Connolly, Ricardo Hoar, *Fundamentals of Web Development*, 1st Edition, Pearson Education India.
2. Robin Nixon, *Learning PHP, MySQL &JavaScript with jQuery, CSS and HTML5*, 4thEdition, O'Reilly Publications, 2015.
3. Luke Welling, Laura Thomson, *PHP and MySQL Web Development*, 5th Edition, Pearson Education, 2016.
4. Nicholas C Zakas, *Professional JavaScript for Web Developer*, 3rd Edition, Wrox/Wiley India, 2012.
5. David Sawyer Mcfarland, *JavaScript & jQuery: The Missing Manual*, 1st Edition, O'Reilly/Shroff Publishers & Distributors Pvt Ltd, 2014.
6. Zak Ruvalcaba Anne Boehm, *Murach's HTML5 and CSS3*, 3rd Edition, Murachs/Shroff Publishers & Distributors Pvt Ltd, 2016.

Professional Elective – 1

Operations Research (21CD562)

Semester V			
No. of Teaching hour/Week	3	**CIE Marks**	50
No. of Tutorial hours/week	0	**SEE Marks**	50
Total No. of Lecture hours	40	**Exam Hours**	03
L:T:P	3:0:0	**Credits**	03

Modules	Course Content	Teaching Hours
Module 1	**Introduction to Linear Programming:** Introduction, The origin, nature and impact of OR; Defining the problem and gathering data; Formulating a mathematical model; Deriving solutions from the model; Testing the model; Preparing to apply the model; Implementation. **Introduction to Linear Programming Problem (LPP):** Prototype example, Assumptions of LPP, Formulation of LPP and Graphical method various examples.	**08 Hours**
Module 2	**Simplex Method – 1:** The essence of the simplex method; Setting up the simplex method; Types of variables, Algebra of the simplex method; the simplex method in tabular form; Tie breaking in the simplex method, Big M method, Two phase method	**08 Hours**
Module 3	**Simplex Method – 2:** Duality Theory - The essence of duality theory, Primal dual relationship, conversion of primal to dual problem and vice versa. The dual simplex method	**08 Hours**
Module 4	**Transportation and Assignment Problems:** The transportation problem, Initial Basic Feasible Solution (IBFS) by North West Corner Rule method, Matrix Minima Method, Vogel's Approximation Method. Optimal solution by Modified Distribution Method (MODI). The Assignment problem; A Hungarian algorithm for the assignment problem. Minimization and Maximization varieties in transportation and assignment problems.	**08 Hours**
Module 5	**Game Theory:** The formulation of two persons, zero sum games; saddle point, maximin and minimax principle, Solving simple games - a prototype example; Games with mixed strategies; Graphical solution procedure.	**08 Hours**

Course outcomes:

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

- Select and apply optimization techniques for various problems.
- Model the given problem as transportation and assignment problem and solve.
- Apply game theory for decision support system.

Reference Books:

1. D.S. Hira and P.K. Gupta, *Operations Research,* (Revised Edition), Published by S.Chand & Company Ltd, 2014
2. S Kalavathy, *Operation Research*, Vikas Publishing House Pvt Limited, 01-Aug-2002
3. S D Sharma, *Operation Research*, Kedar Nath Ram Nath Publishers.

Professional Elective – 1

Simulation and Modelling (21CD562)

Semester V			
No. of Teaching hour/Week	3	**CIE Marks**	50
No. of Tutorial hours/week	0	**SEE Marks**	50
Total No. of Lecture hours	40	**Exam Hours**	03
L:T:P	3:0:0	**Credits**	03

Modules	Course Content	Teaching Hours
Module 1	**Introduction:** Significance of simulation and modelling, Advantages and disadvantages of Simulation; Areas of application, Systems and system environment; Components of a system; Discrete and continuous systems, Model of a system; Types of Models, Discrete-Event System Simulation, Simulation examples: Simulation of queuing systems. **General Principles, Simulation Software**: Concepts in Discrete-Event Simulation. The Event-Scheduling/Time-Advance Algorithm, Manual simulation Using Event Scheduling	**08 Hours**
Module 2	**Statistical Models in Simulation**: Review of terminology and concepts, Useful statistical models, Discrete distributions. Continuous distributions, Poisson process, Empirical distributions. **Queuing Models**: Characteristics of queuing systems, Queuing notation, Long-run measures of performance of queuing systems, Long-run measures of performance of queuing systems, Steady-state behaviour of M /G/1 queue, Networks of queues,	**08 Hours**
Module 3	**Random-Number Generation**: Properties of random numbers; Generation of pseudo-random numbers, Techniques for generating random numbers, Tests for Random Numbers, Random-Variate Generation: Inverse transform technique, Acceptance-Rejection technique.	**08 Hours**
Module 4	**Input Modelling:** Data Collection; Identifying the distribution with data, Parameter estimation, Goodness of Fit Tests, fitting a non-stationary Poisson process, selecting input models without data, Multivariate and Time-Series input models. **Estimation of Absolute Performance**: Types of simulations with respect to output analysis, Stochastic nature of output data, Measures of performance and their estimation	**08 Hours**

Module 5	**Measures of performance and their estimation:** Output analysis for terminating simulations, Output analysis for steady-state simulations. **Verification, Calibration and Validation:** Optimization: Model building, verification and validation, Verification of simulation models, Verification of simulation models, Calibration and validation of models, Optimization via Simulation.	**08 Hours**

Course outcomes:

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

- Explain the system concept and apply functional modelling method to model the activities of a static system
- Describe the behaviour of a dynamic system and create an analogous model for a dynamic system;
- Simulate the operation of a dynamic system and make improvement according to the simulation results.

Reference Books:

1. Jerry Banks, John S. Carson II, Barry L. Nelson, David M. Nicol: *Discrete-Event System Simulation*, 5th Edition, Pearson Education, 2010.
2. Lawrence M. Leemis, Stephen K. Park: *Discrete – Event Simulation: A First Course*, Pearson Education, 2006.
3. Averill M. Law: *Simulation Modeling and Analysis*, 4th Edition, Tata McGrawHill, 2007

Open Elective – 1

Introduction to Data Structures and Algorithms (21CD571)

Semester V			
No. of Lecture hour/Week	3	**CIE Marks**	50
No. of Practical hours/week	0	**SEE Marks**	50
Total No. of Lecture hours	40	**Exam Hours**	03
L: T:P	3:0:0	**Credits**	03

Modules	Course Content	Teaching Hours
Module 1	**Introduction to C:** Constants, variables, data types, input output operations, operators and expressions, control statements, arrays, strings, string handling functions, structures, unions and pointers, Dynamic Memory Allocation.	**08 Hours**
Module 2	**Algorithms:** Introduction to algorithms, Performance Analysis: Estimating Space complexity and Time complexity of algorithms, Asymptotic notations, Introduction to data structures, Types of data structures.	**08 Hours**
Module 3	**Stacks:** Definition, Stack Operations, Array Representation of Stacks, Stack Applications: Polish notation, Infix to postfix conversion, evaluation of postfix expression. **Queues:** Definition, Array Representation, Queue Operations, Circular Queues, Deque, Priority Queues,	**08 Hours**
Module 4	**Linked Lists**: Definition, Representation of linked lists in Memory, Singly linked list, Doubly linked lists, Circular linked lists. **Trees:** Terminology, Binary Trees, Array and linked Representation of Binary Trees, Binary Tree Traversals, Threaded binary trees, Binary Search Trees, Expression Tree	**08Hours**
Module 5	**Graphs:** Definitions, Terminologies, Matrix and Adjacency List Representation of Graphs, Graph Traversal methods: Breadth First Search and Depth First Search **Hashing:** Hash Table organizations, Hashing Functions. **Files and Their Organization:** Data Hierarchy, File Attributes Text Files and Binary Files, Basic File Operations.	**08 Hours**

Course outcomes:

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

- Use stack, Queue, Lists, Trees and Graphs in solving real world problems.
- Implement all data structures in a high-level language for problem solving.
- Analyse and compare various linear and non-linear data structures.
- Analyse the performance of the algorithms, state the efficiency using asymptotic notations and analyse mathematically the complexity of the algorithm.

Reference Books:

1. Ellis Horowitz, Sartaj Sahni, *Fundamentals of Data Structures in C*, 2nd Edition, Universities Press, 2014.
2. Seymour Lipschutz, *Data Structures Schaum's Outlines*, Revised 1st Edition, McGraw Hill, 2014.
3. Gilberg, Forouzan, *Data Structures: A Pseudo-code approach with C*, 2nd Edition, Cengage Learning, 2014.
4. Reema Thareja, *Data Structures using C*, 3rd Edition, Oxford press, 2012.
5. Anany Levitin, *Introduction to the Design and Analysis of Algorithms*, 2nd Edition, Pearson, 2009.
6. Ellis Horowitz, Satraj Sahni, Rajasekaran, *Computer Algorithms/C++*, 2nd Edition, Universities Press, 2014.

Open Elective – 1

Introduction to Database Management System (21CD57)

Semester V			
No. of Lecture hour/Week	3	**CIE Marks**	50
No. of Practical hours/week	0	**SEE Marks**	50
Total No. of Lecture hours	40	**Exam Hours**	03
L: T:P	3:0:0	**Credits**	03

Modules	Course Content	Teaching Hours
Module 1	**Introduction to Databases:** Introduction, Characteristics of database approach, Advantages of using the DBMS approach, History of database applications. **Overview of Database Languages and Architectures:** Data Models, Schemas, and Instances. Three schema architecture and data independence, database languages, and interfaces, The Database System environment.	**08 Hours**
Module 2	**Relational Model:** Relational Model Concepts, Relational Model Constraints and relational database schemas, Update operations, transactions, and dealing with constraint violations. **Mapping Conceptual Design into a Logical Design:** Relational Database Design using ER-to-Relational mapping	**08 Hours**
Module 3	**Relational Algebra**: Selection and projection set operations, renaming, joins, division, Examples of algebra over views. **Relational calculus:** Tuple relational calculus, Domain relational calculus. **Overview of the SQL Query Language:** Basic Structure of SQL Queries, Set Operations, Aggregate Functions – GROUPBY, HAVING, Nested Sub queries, Views, Triggers.	**08 Hours**
Module 4	**Normalization:** Introduction to Normalization using Functional and Multivalued Dependencies: Informal design guidelines for relation schema, Functional Dependencies, Normal Forms based on Primary Keys, Second and Third Normal Forms, Boyce-Codd Normal Form, Multivalued Dependency and Fourth Normal Form, Join Dependencies and Fifth Normal Form. Examples on normal forms.	**08Hours**
Module 5	**Transaction Processing:** Introduction to Transaction Processing, Transaction and System concepts, Desirable properties of Transactions, characterizing schedules based on recoverability, characterizing schedules based on Serializability, **Concurrency Control in Databases:** Two-phase locking techniques for Concurrency control, Concurrency control based on Timestamp ordering, Multiversion Concurrency control techniques.	**08Hours**

Course outcomes:

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

- Identify, analyze and define database objects, enforce integrity constraints on a database using RDBMS.
- Use Structured Query Language (SQL) for database manipulation and also demonstrate the basic of query evaluation.
- Design and build simple database systems and relate the concept of transaction, concurrency control and recovery in database.

Reference Books:

1. Ramez Elmasri, Shamkant B. Navathe, *Fundamentals of Database Systems*, 7th Edition, Pearson, 2017.
2. Ramakrishnan, Gehrke, *Database Management Systems*, 3rd Edition, McGraw Hill, 2014.
3. Silberschatz Korth, Sudharshan, *Database System Concepts*, 6th Edition, McGraw Hill, 2013.
4. Coronel, Morris, Rob, *Database Principles Fundamentals of Design, Implementation and Management*, Cengage Learning, 2012.

Open Elective – 1

Programming in JAVA (21CD573)

Semester VI			
No. of Teaching hour/Week	3	**CIE Marks**	50
No. of Tutorial hours/week	0	**SEE Marks**	50
Total No. of Lecture hours	40	**Exam Hours**	03
L:T:P	3:0:0	**Credits**	03

Modules	Course Content	Teaching Hours
Module 1	**An Overview of Java**: Features of Java, JVM, Object-Oriented Programming, A First Simple Program, A Second Short Program, Two Control Statements, Using Blocks of Code, Lexical Issues, The Java Class Libraries. **Data Types Variables, and Arrays:** Java Is a Strongly Typed Language, The Primitive Types, Integers, Floating-Point Types, Characters, Booleans, A Closer Look at Literals, Variables, Type Conversion and Casting, Automatic Type Promotion in Expressions, Arrays, A Few Words About Strings.	**08 Hours**
Module 2	**Operators:** Arithmetic Operators, The Bitwise Operators, Relational Operators, Boolean Logical Operators, The Assignment Operator, The? Operator, Operator Precedence, Using Parentheses. **Control Statements**: Java's Selection Statements, Iteration Statements, Jump Statements. **Introducing Classes:** Class Fundamentals, Declaring Objects, Assigning Object Reference Variables, Introducing Methods, Constructors, this Keyword, Garbage Collection, The finalize( ) Method, A Stack Class.	**08 Hours**
Module 3	**A Closer Look at Methods and Classes:** Overloading Methods, Using Objects as Parameters, A Closer Look at Argument Passing, Returning Objects, Recursion, Introducing Access Control, Arrays Revisited. **Inheritance:** Inheritance, Using super, Creating a Multilevel Hierarchy, When Constructors Are Called, Method Overriding, Dynamic Method Dispatch, Using Abstract Classes, Using final with Inheritance, The Object Class. **Multithreading:** Life cycle of a thread, Creating and Running a thread, Concurrency Problem.	**08 Hours**
Module 4	**Packages and Interfaces:** Packages, Access Protection, Importing Packages, Interfaces. **Exception Handling:** Exception-Handling Fundamentals, Exception Types, Uncaught Exceptions, Using try and catch, Multiple catch Clauses, Nested try Statements, throw, throws, finally, Java's Built-in Exceptions, Creating Your Own Exception Subclasses, Chained Exceptions, Using Exceptions.	**08 Hours**

Module 5	**Enumerations:** Enumerations, Type Wrappers. **String Handling:** The String Constructors, String Length, Special String Operations, Character Extraction, String Comparison, Searching Strings, Modifying a String. Data Conversion Using valueOf( ), Changing the Case of Characters Within a String, Additional String Methods, String Buffer, StringBuilder.	**08 Hours**

Course outcomes:

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

- Explain the object-oriented concepts and JAVA.
- Develop computer programs to solve real world problems in Java.
- Develop simple GUI interfaces for a computer program to interact with users.

Reference Books:

1. Herbert Schildt, *Java The Complete Reference*, 7th Edition, Tata McGraw Hill, 2007.
2. Mahesh Bhave and Sunil Patekar, *"Programming with Java"*, First Edition, Pearson Education,2008.
3. Rajkumar Buyya,S Thamarasi selvi, xingchen chu, *Object oriented Programming with java*, Tata McGraw Hill education private limited.
4. E Balagurusamy, *Programming with Java A primer*, Tata McGraw Hill companies.
5. Anita Seth and B L Juneja, *JAVA One step Ahead*, Oxford University Press, 2017.

Open Elective – 1

Introduction to Artificial Intelligence (21CD574)

Semester V			
No. of Teaching hour/Week	3	**CIE Marks**	50
No. of Tutorial hours/week	0	**SEE Marks**	50
Total No. of Lecture hours	40	**Exam Hours**	03
L:T:P	3:0:0	**Credits**	03

Modules	Course Content	Teaching Hours
Module 1	Introduction, goals of AI, Types of AI, Types of agents, Intelligent Agent, Agent environment, Turing Test and Chatterbots, AI and Society, Applications of AI, Advantages, Disadvantages.	**08 Hours**
Module 2	Propositional Logic – Syntax, Semantics, Proof Systems, Resolution, Horn Clauses, Computability and Complexity, Applications and Limitations. First Order Predicate logic – Syntax, Semantics, Quantifiers and Normal Forms, Proof Calculi, Resolution, Automated Theorem Provers, Mathematical Examples, Applications. Limitations of Logic – The Search Space Problem, Decidability and Incompleteness, Modelling Uncertainty.	**08 Hours**
Module 3	Knowledge representation: Knowledge based agent in AI, Architecture of knowledge based agent, Inference system, Operations performed by KBA, Generic KBA, Levels of KBA, approaches to design KBA, Types of Knowledge, Relationship between knowledge and Intelligence, AI knowledge cycle, Approaches to knowledge representation, Requirements for knowledge representation system, Techniques for knowledge representation.	**08 Hours**
Module 4	Search algorithms: Properties of search algorithms, Types of search algorithms - Uninformed search algorithm, Informed search algorithms, Hill climbing algorithm, Means-Ends analysis, Adversarial search, Min-Max algorithm, Alpha-Beta pruning.	**08 Hours**
Module 5	AI Applications, Expert Systems Learning, Language Models, Information Retrieval, Information Extraction, Natural Language Processing, Machine Translation, Speech Recognition, Robot – Hardware, Perception, Planning, Moving.	**08 Hours**

Course outcomes:

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

- Ability to apply Artificial Intelligence techniques for problem solving.
- Explain the limitations of current Artificial Intelligence techniques.

Reference Books:

1. Elaine Rich, Kevin Knight, Shivashankar Nair, *Artificial Intelligence*, Tata McGraw Hill.
2. Patrick Henry Winston, *Artificial Intelligence*, AWL.
3. Dan W. Patterson, *Artificial Intelligence and Expert systems*, PHI.
4. Nils J Nilson, *Artificial Intelligence*, Elsevier, Morgan Kaufmann.

Open Elective – 1

Introduction to Phyton Programming (21CD575)

Semester V			
No. of Teaching hour/Week	3	**CIE Marks**	50
No. of Tutorial hours/week	0	**SEE Marks**	50
Total No. of Lecture hours	40	**Exam Hours**	03
L:T:P	3:0:0	**Credits**	03

Modules	Course Content	Teaching Hours
Module 1	**Introduction data, expressions, statements:** Introduction: Creativity and motivation, understanding programming, Terminology: Interpreter and compiler, Running Python, The First Program; Data types: Int, float, Boolean, string, and list, variables, expressions, statements, Operators and operands.	**08 Hours**
Module 2	**Control Flow, Loops:** Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (ifelif-else); Iteration: while, for, break, continue, pass statement.	**08 Hours**
Module 3	**Functions and strings:** Functions: Function calls, adding new functions, definition and uses, local and global scope, return values. **Strings:** strings, length of string, string slices, immutability, multiline comments, string functions and methods;	**08 Hours**
Module 4	**Lists, Tuples, Dictionaries Lists:** List operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters, List Comprehension; **Tuples:** tuple assignment, tuple as return value, tuple comprehension; Dictionaries: operations and methods, comprehension;	**08 Hours**
Module 5	**Regular expressions, files and exception:** Regular expressions, Character matching in regular expressions, extracting data using regular expressions, Escape character **Files and exception:** Text files, reading and writing files, command line arguments, errors and exceptions, handling exceptions, modules	**08 Hours**

Course outcomes:

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

- Understand Python syntax and semantics and be fluent in the use of Python flow control and functions.
- Demonstrate proficiency in handling Strings and File Systems.
- Represent compound data using Python lists, tuples, Strings, dictionaries.
- Read and write data from/to files in Python Programs.

Reference Books:

5. Al Sweigart, *Automate the Boring Stuff with Python,*1st Edition, No Starch Press, 2015. (Available under CC-BY-NC-SA license at https://automatetheboringstuff.com/)
6. Charles R. Severance, *"Python for Everybody: Exploring Data Using Python 3"*, 1st edition, Create Space Independent Publishing Platform, 2016. http://do1.dr-chuck.com/pythonlearn/EN_us/pythonlearn.pdf
7. R. Nageswara Rao, *Core Python Programming*, Dream Tech publication
8. Vamsi Kurama, *Python Programming: A Modern Approach*, Pearson
9. Reema theraja, *Python Programming*, OXFORD publication

Computer Networks and Security (21CD61)

Semester VI			
No. of Lecture hour/Week	3	**CIE Marks**	50
No. of Practical hours/week	2	**SEE Marks**	50
Total No. of Lecture hours	50	**Exam Hours**	03
L: T: P	3:0:1	**Credits**	04

Modules	Course Content	Teaching Hours
Module 1	**Application Layer:** Principles of Network Applications: Network Application Architectures, Processes Communicating, Transport Services Available to Applications, Transport Services Provided by the Internet, Application-Layer Protocols. **The Web and HTTP:** Overview of HTTP, Non-persistent and Persistent Connections, HTTP Message Format, User-Server Interaction: Cookies, Web Caching, The Conditional GET, File Transfer: FTP Commands & Replies, **Electronic Mail in the Internet:** SMTP, Comparison with HTTP, Mail Message Format, Mail Access Protocols, DNS; The Internet's Directory Service: Services Provided by DNS, Overview of How DNS Works, DNS Records and Messages, Peer-to-Peer Applications: P2P File Distribution, Distributed Hash Tables, Socket Programming: creating Network Applications: Socket Programming with UDP, Socket Programming with TCP.	**10 Hours**
Module 2	**Transport Layer:** Introduction and Transport-Layer Services: Relationship Between Transport and Network Layers, Overview of the Transport Layer in the Internet, Multiplexing and Demultiplexing: Connectionless Transport: UDP,UDP Segment Structure, UDP Checksum, Principles of Reliable Data Transfer: Building a Reliable Data Transfer Protocol, Pipelined Reliable Data Transfer Protocols, Go-Back-N, Selective repeat, Connection-Oriented Transport TCP: The TCP Connection, TCP Segment Structure, Round-Trip Time Estimation and Timeout, Reliable Data Transfer, Flow Control, TCP Connection Management, Principles of Congestion Control: The Causes and the Costs of Congestion, Approaches to Congestion Control, Network-assisted congestion-control example, ATM ABR Congestion control, TCP Congestion Control: Fairness**.**	**10 Hours**
Module 3	**The Network layer:** What's Inside a Router: Input Processing, Switching, Output Processing, Where Does Queuing Occur? Routing control plane, IPv6, A Brief foray into IP Security, Routing Algorithms: The Link-State (LS) Routing Algorithm, The Distance-Vector (DV) Routing Algorithm, Hierarchical Routing, Routing in the Internet, Intra-AS Routing in the Internet: RIP, Intra-AS Routing in the Internet: OSPF, Inter/AS Routing: BGP, Broadcast Routing Algorithms and Multicast.	**10 Hours**

Module 4	**Network Security:** Overview of Network Security: Elements of Network Security, Classification of Network Attacks, Security Methods, Symmetric-Key Cryptography: Data Encryption Standard (DES), Advanced Encryption Standard (AES), Public-Key **Cryptography:** RSA Algorithm, Diffie-Hellman Key-Exchange Protocol, Authentication: Hash Function, Secure Hash Algorithm (SHA), Digital Signatures, Firewalls and Packet Filtering, Packet Filtering, Proxy Server.	**10 Hours**
Module 5	**Multimedia Networking:** Properties of video, properties of Audio, Types of multimedia Network Applications, streaming stored video: UDP Streaming, HTTP Streaming, Adaptive streaming and DASH, content distribution Networks **Voice-over-IP:** Limitations of the Best-Effort IP Service, Removing Jitter at the Receiver for Audio, Recovering from Packet Loss Protocols for Real-Time Conversational Applications, RTP, SIP.	**10 Hours**

Course Outcome:

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

- Explain principles of application layer protocols.
- Recognize transport layer services and infer UDP and TCP protocols.
- Classify routers, IP and Routing Algorithms in network layer.
- Understand the Wireless and Mobile Networks covering IEEE 802.11 Standard.
- Describe Multimedia Networking and Network Management.

Reference Books:

1. Behrouz A Forouzan, *Data and Communications and Networking*, Fifth Edition, McGraw Hill, Indian Edition.
2. Larry L Peterson and Brusce S Davie, *Computer Networks*, fifth edition, Elsevier.
3. Andrew S Tanenbaum, *"Computer Networks"*, fifth edition, Pearson.
4. Mayank Dave, *Computer Networks*, Second edition, Cengage Learning.
5. James F Kurose and Keith W Ross, *Computer Networking, A Top-Down Approach*, Sixth edition, Pearson,2017.
6. Nader F Mir, *Computer and Communication Networks*, 2nd Edition, Pearson, 2014.
7. Stallings William, *Cryptography and Network Security - Principles and Practice*, Seventh Edition, Pearson, 2017.

System Programming and Compiler Design (21CD62)

Semester VI			
No. of Teaching hour/Week	3	**CIE Marks**	50
No. of Practical hours/week	2	**SEE Marks**	50
Total No. of Lecture hours	50	**Exam Hours**	03
L:T:P	3:0:1	**Credits**	04

Modules	Course Content	Teaching Hours
Module 1	**Introduction to System Software**, Assemblers: Basic assembler functions, machine dependent assembler features, machine independent, assembler features, assembler design options. basic loader functions	**10 Hours**
Module 2	**Lexical Analysis:** The Structure of a Compiler, The Evolution of Programming Languages, The Role of the Lexical Analyser, Input Buffering, Specification of Tokens, Recognition of Tokens	**10 Hours**
Module 3	**Syntax Analysis:** Introduction, Context-Free Grammars, Writing a Grammar, Top-Down Parsing, Bottom-Up Parsing, Introduction to LR Simple LR, More Powerful LR Parsers	**10 Hours**
Module 4	**Syntax-Directed Translation:** Syntax-Directed Definitions, Evaluation Orders for SDD's, Applications of Syntax-Directed Translation, Syntax-Directed Translation Schemes, Implementing L-Attributed SDD's	**10 Hours**
Module 5	**Code Generation:** Variants of Syntax Trees, Three-Address Code, Translation of Expressions, Type Checking, Issues in the Design of a Code Generator, The Target Language, Optimization of Basic Blocks	**10 Hours**

Course outcomes:

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

- Understanding system software fundamentals.
- Understanding the structure of lexical analysers.
- Design and develop syntax analysers for writing grammars.
- Design and develop lexical analysers, parsers and code generators for compilation.

Reference Books:

1. Alfred V Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman , *Compilers-Principles, Techniques and Tools*, Pearson, 2nd edition, 2007.
2. Leland. L. Beck, D Manjula, *System Software*, 3rd edition, 2012.
3. D. M. Dhamdhere, *System software and operating system*, TMG.

Object Oriented Design and Analysis (21CD63)

Semester VI			
No. of Lecture hour/Week	3	**CIE Marks**	50
No. of Practical hours/week	2	**SEE Marks**	50
Total No. of Lecture hours	50	**Exam Hours**	03
L: T: P	3:0:1	**Credits**	04

Modules	Course Content	Teaching Hours
Module 1	**Advanced object and class concepts:** Association ends; N-ary associations; Aggregation; Abstract classes; Multiple inheritance; Metadata; Reification; Constraints; Derived Data; Packages. State Modeling: Events, States, Transistions and Conditions, State Diagrams, State diagram behaviour	**10 Hours**
Module 2	**Use Case Modelling and Detailed Requirements:** Overview; Detailed object-oriented Requirements definitions; System Processes-A use case/Scenario view; Identifying Input and outputs-The System sequence diagram; Identifying Object Behaviour-The state chart Diagram; Integrated Object-oriented Models	**10 Hours**
Module 3	**Process Overview, System Conception and Domain Analysis:** Process Overview: Development stages; Development life Cycle; System Conception: Devising a system concept; elaborating a concept; preparing a problem statement. Domain Analysis: Overview of analysis; Domain Class model: Domain state model; Domain interaction model; Iterating the analysis	**10 Hours**
Module 4	**Use case Realization:** The Design Discipline within up iterations: Object Oriented Design-The Bridge between Requirements and Implementation; Design Classes and Design within Class Diagrams; Interaction Diagrams-Realizing Use Case and defining methods; Designing with Communication Diagrams; Updating the Design Class Diagram; Package Diagrams-Structuring the Major Components; Implementation Issues for Three-Layer Design.	**10 Hours**
Module 5	**Design Patterns**: Introduction: what is a design pattern?, Describing design patterns, the catalogue of design patterns, Organizing the catalogue, How design patterns solve design problems, how to select a design patterns, how to use a design pattern; Creational patterns: prototype and singleton (only); structural patterns adaptor and proxy.	**10 Hours**

Course outcomes:

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

- Describe the concepts of object-oriented and basic class modelling.
- Draw class diagrams, sequence diagrams and interaction diagrams to solve problems.
- Choose and apply a befitting design pattern for the given problem.

Reference Books:

4. Michael Blaha, James Rumbaugh, *Object Oriented Modelling and Design with UML*, 2nd Edition, Pearson Education, 2005.
5. Satzinger, Jackson and Burd, *Object-Oriented Analysis & Design with the Unified Process*, Cengage Learning, 2005.
6. Erich Gamma, Richard Helm, Ralph Johnson and john Vlissides, *Design Patterns – Elements of Reusable Object-Oriented Software*, Pearson Education, 2007.

Cloud Computing (21CD64)

Semester VI			
No. of Teaching hour/Week	3	**CIE Marks**	50
No. of Tutorial hours/week	0	**SEE Marks**	50
Total No. of Lecture hours	40	**Exam Hours**	03
L:T:P	3:0:0	**Credits**	03

Modules	Course Content	Teaching Hours
Module 1	**Introduction:** Cloud Computing at a Glance, The Vision of Cloud Computing, Defining a Cloud, A Closer Look, Cloud Computing Reference Model, Characteristics and Benefits, Challenges Ahead, Historical Developments. **Virtualization:** Introduction, Characteristics of Virtualized, Environments, Taxonomy of Virtualization Techniques, Execution Virtualization.	**08 Hours**
Module 2	**Virtualization and Cloud Computing:** Other Types of Virtualization, Pros and Cons of Virtualization, Technology Examples. Web 2.0, Service-Oriented Computing, Utility-Oriented Computing, Building Cloud Computing Environments, Application Development, Infrastructure and System Development, Computing Platforms and Technologies.	**08 Hours**
Module 3	**Cloud Computing Architecture:** Introduction, Cloud Reference Model, Architecture, Infrastructure / Hardware as a Service, Platform as a Service, Software as a Service, Types of Clouds, Public Clouds, Private Clouds, Hybrid Clouds, Community Clouds, Open Challenges. **Cloud Security**: Risks, Top concern for cloud users, privacy impact assessment, trust, OS security, VM Security.	**08 Hours**
Module 4	**Concurrent Computing:** Thread Programming, Introducing Parallelism for Single Machine Computation, Programming Applications with Threads, what is a Thread? Thread APIs, Techniques for Parallel Computation with Threads, **Multithreading with Aneka:** Introducing the Thread Programming Model, Aneka Thread vs. Common Threads, Programming Applications with Aneka Threads, Aneka Threads Application Model.	**08 Hours**
Module 5	**Data Intensive Computing:** Map-Reduce Programming, Data-Intensive Computing, Characterizing Data-Intensive Computations, Challenges Ahead, Historical Perspective, Technologies for Data-Intensive Computing, Storage Systems, Programming Platforms, Aneka MapReduce Programming. **Cloud Applications:** HealthCare: ECG analysis in the cloud, Biology: gene expression data analysis for cancer diagnosis, Geoscience: satellite image processing	**08 Hours**

Course outcomes:

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

- Explain cloud computing, virtualization and classify services of cloud computing
- Illustrate architecture and programming in cloud
- Describe the platforms for development of cloud applications and list the application of cloud.

Reference Books:

1. Rajkumar Buyya, Christian Vecchiola, Thamarai Selvi, *Mastering Cloud Computing*, McGraw Hill Education.
2. Dan C. Marinescu Morgan Kaufmann, *Cloud Computing Theory and Practice*, , Elsevier, 2013.

Professional Elective - 2

Research Methodology and Intellectual Property Rights (21CD651)

Semester VI			
No. of Teaching hour/Week	3	**CIE Marks**	50
No. of Tutorial hours/week	0	**SEE Marks**	50
Total No. of Lecture hours	40	**Exam Hours**	03
L:T:P	3:0:0	**Credits**	03

Modules	Course Content	Teaching Hours
Module 1	**Research methodology:** Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, Plagiarism, Research ethics	**08 Hours**
Module 2	**Results and analysis:** Importance and scientific methodology in recording results, importance of negative results, different ways of recording, industrial requirement, artifacts versus true results, types of analysis (analytical, objective, subjective), hypothesis, concept, theory, model etc.	**08 Hours**
Module 3	**Technical writing**: Effective technical writing, how to write a manuscript/ response to reviewers' comments, preparation of research article/ research report, Writing a Research Proposal – presentation and assessment by a review committee.	**08 Hours**
Module 4	**Intellectual property rights:** Nature of Intellectual Property: Patents, Designs, Trade Mark and Copyright. Process of Patenting and Development: technological research, innovation, patenting & development. Procedure for grants of patents, Patenting under PCT**.**	**08 Hours**
Module 5	**Patent rights and new developments in IPR:** Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications. New Developments in IPR, Administration of Patent System.	**08 Hours**

Course outcomes:

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

- Understand that today's world is controlled by Computer, Information Technology, buttomorrow world will be ruled by ideas, concept, and creativity.
- Understand research problem formulation & Analyze research related information andFollow research ethics.
- Correlate the results of any research article with other published results. Write a review article in the field of engineering.
- Appreciate the importance of IPR and protect their intellectual property. Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

Reference Books:

1. Ranjit Kumar, *Research Methodology- A step by step guide for beginners*, Pearson Education, Australia, 2005.
2. Ann M. Korner, *Guide to Publishing a Scientific paper*, Bio script Press 2004.
3. T. Ramappa, "*Intellectual Property Rights Under WTO*", S. Chand, 2008.

Professional Elective - 2

C# and .Net Framework (21CD652)

Semester VI			
No. of Teaching hour/Week	3	**CIE Marks**	50
No. of Tutorial hours/week	0	**SEE Marks**	50
Total No. of Lecture hours	40	**Exam Hours**	03
L:T:P	3:0:0	**Credits**	03

Modules	Course Content	Teaching Hours
Module 1	**Introduction to C# Part-I:** Understanding C#, .NET, overview of C#, Variables, Data Types, Operators, Expressions, Branching, Looping, Methods, implicit and explicit casting.	**08 Hours**
Module 2	**Part-II:** Constants, Arrays, Array Class, Array List, String, String Builder, Structure, Enumerations, boxing and unboxing.	**08 Hours**
Module 3	**Object Oriented Concepts-I:** Class, Objects, Constructors and its types, inheritance, properties, indexers, index overloading, polymorphism.	**08 Hours**
Module 4	**Object Oriented Concepts-II** Sealed class and methods, interface, abstract class, abstract and interface, operator overloading, delegates, events, errors and exception, Threading.	**08 Hours**
Module 5	**Introduction to .NET FRAMEWORK:** Assemblies, Versioning, Attributes, reflection, viewing meta data, remoting, security in .NET, Environment Setup of .NET Core and create a small project.	**08 Hours**

Course outcomes:

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

- Understand the basics of C# and .NET.
- Learn the variables and constants of C#.
- Know the object-oriented aspects and applications.
- Learn the basic structure of .NET framework.
- Learn to create a simple project of .NET Core.

Reference Books:

1. Herbert Schildt, "*The Complete Reference: C# 4.0*", Tata McGraw Hill, 2012.
2. Christian Nagel et al. "*Professional C# 2012 with .NET 4.5*", Wiley India, 2012.
3. Andrew Troelsen, "*Pro C# 2010 and the .NET 4 Platform*, Fifth edition, A Press, 2010.
4. Ian Griffiths, Matthew Adams, Jesse Liberty, "*Programming C# 4.0*", Sixth Edition, O"Reilly, 2010

Professional Elective - 2

Application Development using Phyton Programming (21CD653)

Semester VI			
No. of Teaching hour/Week	3	**CIE Marks**	50
No. of Tutorial hours/week	0	**SEE Marks**	50
Total No. of Lecture hours	40	**Exam Hours**	03
L:T:P	3:0:0	**Credits**	03

Modules	Course Content	Teaching Hours
Module 1	**Python Basics:** Entering Expressions into the Interactive Shell, The Integer, Floating-Point, and String Data Types, String Concatenation and Replication, Storing Values in Variables, Your First Program, Dissecting Your Program, Flow control, Boolean Values, Comparison Operators, Boolean Operators, Mixing Boolean and Comparison Operators, Elements of Flow Control, Program Execution, Flow Control Statements, Importing Modules, Ending a Program Early with sys.exit(), Functions, def Statements with Parameters, Return Values and return Statements, The None Value, Keyword Arguments and print(), Local and Global Scope, The global Statement, Exception Handling, A Short Program: Guess the Number	**08 Hours**
Module 2	**Lists:** The List Data Type, Working with Lists, Augmented Assignment Operators, Methods, Example Program: Magic 8 Ball with a List, List-like Types: Strings and Tuples, References, Dictionaries and Structuring Data, The Dictionary Data Type, Pretty Printing, Using Data Structures to Model Real-World Things, Manipulating Strings, Working with Strings, Useful String Methods, Project: Password Locker, Project: Adding Bullets to Wiki Markup	**08 Hours**
Module 3	**Pattern Matching with Regular Expressions:** Finding Patterns of Text Without Regular Expressions, Finding Patterns of Text with Regular Expressions, More Pattern Matching with Regular Expressions, Greedy and Non greedy Matching, The findall() Method, Character Classes, Making Your Own Character Classes, The Caret and Dollar Sign Characters, The Wildcard Character, Review of Regex Symbols, Case-Insensitive Matching, Substituting Strings with the sub() Method, Managing Complex Regexes, Combining re .IGNORECASE, re .DOTALL, and re .VERBOSE, Project: Phone Number and Email Address Extractor, Reading and Writing Files, Files and File Paths, The os.path Module, The File Reading/Writing Process, Saving Variables with the shelve Module, Saving Variables with the pprint. pformat() Function, Project: Generating Random Quiz Files, Project: Multiclip board, Organizing Files, The shutil Module, Walking a Directory Tree, Compressing Files with the zipfile Module, Project: Renaming Files with American-Style Dates to European-Style Dates,Project: Backing Up a Folder into a ZIP File, Debugging, Raising Exceptions, Getting the Traceback as a String, Assertions, Logging, IDLE‟s Debugger	**08 Hours**

Module 4	**Classes and objects**: Programmer – defined types, Attributes, Rectangles, Instances as return values, Objects are mutable, Copying, Classes and functions, Time, Pure functions, Modifiers, Prototyping versus planning, Classes and methods, Object-oriented features, Printing objects, Another example, A more complicated example, The init method, The __str__ method, Operator overloading, Type-based dispatch, Polymorphism, Interface and implementation, Inheritance, Card objects, Class attributes, Comparing cards, Decks, Printing the deck, Add, remove, shuffle and sort, Inheritance, Class diagrams, Data encapsulation	**08 Hours**
Module 5	**Web Scraping Project:** MAPIT.PY with the web browser Module, Downloading Files from the Web with the requests Module, Saving Downloaded Files to the Hard Drive, HTML, Parsing HTML with the Beautiful Soup Module, Project: "I'm Feeling Lucky" Google Search, Project: Downloading All XKCD Comics, Controlling the Browser with the selenium Module, Working with Excel Spreadsheets, Excel Documents, Installing the openpyxl Module, Reading Excel Documents, Project: Reading Data from a Spreadsheet, Writing Excel Documents, Project: Updating a Spreadsheet, Setting the Font Style of Cells, Font Objects, Formulas, Adjusting Rows and Columns, Charts, Working with PDF and Word Documents, PDF Documents, Project: Combining Select Pages from Many PDFs, Word Documents, Working with CSV files and JSON data, The csv Module, Project: Removing the Header from CSV Files, JSON and APIs, The json Module, Project: Fetching Current Weather Data	**08 Hours**

Course outcomes:

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

- Demonstrate proficiency in handling of loops and creation of functions.
- Identify the methods to create and manipulate lists, tuples and dictionaries.
- Discover the commonly used operations involving regular expressions and file system.
- Interpret the concepts of Object-Oriented Programming as used in Python.
- Determine the need for scraping websites and working with CSV, JSON and other file formats.

Reference Books:

1. Al Sweigart, *Automate the Boring Stuff with Python*,1stEdition, No Starch Press, 2015. (Available under CC-BY-NC-SA license at https://automatetheboringstuff.com/)
2. Allen B. Downey, *Think Python: How to Think Like a Computer Scientist*, 2nd Edition, Green Tea Press, 2015. (Available under CC-BY-NC license at http://greenteapress.com/thinkpython2/thinkpython2.pdf).
3. Gowrishankar S, Veena A, *Introduction to Python Programming*, 1st Edition, CRC Press/Taylor & Francis, 2018.
4. Jake VanderPlas, *Python Data Science Handbook: Essential Tools for Working with Data*, 1st Edition, O"Reilly Media, 2016.

Professional Elective - 2

Computer Graphics (21CD654)

Semester VI			
No. of Teaching hour/Week	3	**CIE Marks**	50
No. of Practical hours/week	0	**SEE Marks**	50
Total No. of Lecture hours	40	**Exam Hours**	03
L:T:P	3:0:0	**Credits**	03

Modules	Course Content	Teaching Hours
Module 1	**Overview:** Computer Graphics and OpenGL: Computer Graphics: Basics of computer graphics, Application of Computer Graphics, Video Display Devices: Random Scan and Raster Scan displays, graphics software.	**08 Hours**
Module 2	**Open GL:** Introduction to OpenGL, coordinate reference frames, specifying two-dimensional world coordinate reference frames in OpenGL, OpenGL point functions, OpenGL line functions, point attributes, line attributes, curve attributes, OpenGL point attribute functions, OpenGL line attribute functions, Line drawing algorithms (DDA, Bresenham‟s), circle generation algorithms (Bresenham‟s).	**08 Hours**
Module 3	**Fill area Primitives**: Polygon fill-areas, OpenGL polygon fill area functions, fill area attributes, general scan line polygon fill algorithm, OpenGL fill-area attribute functions.2DGeometric Transformations: Basic 2D Geometric Transformations, matrix representations and homogeneous coordinates. Inverse transformations, 2DComposite transformations, other 2D transformations, raster methods for geometric transformations, OpenGL raster transformations, OpenGL geometric transformations function	**08 Hours**
Module 4	**Clipping:** clipping window, normalization and viewport transformations, clipping algorithms,2D point clipping, 2D line clipping algorithms: cohen-sutherland line clipping only - polygon fill area clipping: Sutherland-Hodgeman polygon clipping algorithm.y.3DGeometric Transformations: 3D translation, rotation, scaling, composite 3D transformations, other 3D transformations, affine transformations, OpenGL geometric transformations functions.	**08 Hours**
Module 5	**Color Models:** Properties of light, color models, RGB and CMY color models. Illumination Models: Light sources, basic illumination models-Ambient light, diffuse reflection, specular and phong model, Corresponding openGL functions.	**08 Hours**

Course outcomes:

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

- Design and implement algorithms for 2D graphics primitives and attributes.
- Illustrate Geometric transformations on both 2D and 3D objects.
- Apply concepts of clipping and visible surface detection in 2D and 3D viewing, and Illumination Models.

Reference Books:

1. Donald Hearn & Pauline Baker: *Computer Graphics with OpenGL* Version,3rd / 4th Edition, Pearson Education,2011
2. Edward Angel: *Interactive Computer Graphics- A Top Down approach with OpenGL*, 5th edition. Pearson Education, 2008

Open Elective – 2

Introduction To Internet of Things (21CD661)

Semester VI			
No. of Teaching hour/Week	3	**CIE Marks**	50
No. of Tutorial hours/week	0	**SEE Marks**	50
Total No. of Lecture hours	40	**Exam Hours**	03
L:T:P	3:0:0	**Credits**	03

Modules	Course Content	Teaching Hours
Module 1	**Emergence of IoT:** Introduction, Evolution of IoT, Enabling IoT and the Complex Interdependence of Technologies.	**08 Hours**
Module 2	**IoT Sensing and Actuation:** Introduction, Sensors, Sensor Characteristics, Sensorial Deviations, Sensing Types, Actuators, Actuator Types, Actuator Characteristics.	**08 Hours**
Module 3	**IoT Processing Topologies and Types:** Data Format, Importance of Processing in IoT, Processing Topologies, IoT Device Design and Selection Consideration, Sensor Cloud.	**08 Hours**
Module 4	**IoT Connectivity Technologies:** Introduction, IEEE 802.15.4, Zigbee, Thread, ISA100.11A, WirelessHART, RFID, NFC.	**08 Hours**
Module 5	**IoT Communication Technologies:** Introduction, Infrastructure Protocols, Discovery Protocols, Data Protocols, Identification Protocols.	**08 Hours**

Course outcomes:

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

- Understand the evolution of IoT, IoT networking components, and addressing strategies in IoT.
- Analyse various sensing devices and actuator types.
- Demonstrate the processing in IoT.
- Apply different connectivity technologies.
- Understand the communication technologies, protocols and interoperability in IoT.

Reference Books:

1. Sudip Misra, Anandarup Mukherjee, Arijit Roy, "*Introduction to IoT*", Cambridge University Press 2021.
2. S. Misra, C. Roy, and A. Mukherjee, 2020. *Introduction to Industrial Internet of Things and Industry 4.0*. CRC Press.
3. Vijay Madisetti and Arshdeep Bahga, "*Internet of Things (A Hands-on-Approach)*",1st Edition, VPT, 2014
4. Francis daCosta, "*Rethinking the Internet of Things: A Scalable Approach to Connecting Everything*",1st Edition, Apress Publications, 2013

Open Elective – 2

Introduction to Machine Learning (21CD662)

Semester VI			
No. of Lecture hour/Week	3	**CIE Marks**	50
No. of Tutorial hours/week	0	**SEE Marks**	50
Total No. of Lecture hours	40	**Exam Hours**	03
L: T:P	3:0:0	**Credits**	03

Modules	Course Content	Teaching Hours
Module 1	**Introduction to machine learning:** Need for Machine Learning, Machine Learning Explained, and Machine Learning in relation to other fields, Types of Machine Learning. Challenges of Machine Learning, Machine Learning process, Machine Learning applications. **Understanding Data:** What is data, types of data, big data analytics and types of analytics, big data analytics framework, Descriptive statistics, univariate data analysis and visualization	**8 Hours**
Module 2	**Understanding Data** Bivariate and Multivariate data, Multivariate statistics, Essential mathematics for Multivariate data, Overview hypothesis, Feature engineering and dimensionality reduction techniques, **Basics of Learning Theory:** Introduction to learning and its types, Introduction computation learning theory, Design of learning system, Introduction concept learning.	**8 Hours**
Module 3	**Supervised Learning: Regression:** Introduction to linear regression, Gradient descent algorithm, Polynomial regression Regularization techniques: L1 and L2 regularization, Model evaluation: mean squared error, R-squared score. **Supervised Learning:** Classification, Introduction to logistic regression, Decision trees and random forests, Support vector machines (SVM), Evaluation metrics for classification: accuracy, precision, recall, F1-score.	**8 Hours**
Module 4	**Unsupervised Learning: Clustering:** Introduction to clustering algorithms, K-means clustering, Hierarchical clustering, Density-based clustering, Evaluation metrics for clustering: inertia, silhouette score. **Unsupervised Learning: Dimensionality Reduction:** Introduction to dimensionality reduction, Principal Component Analysis (PCA), t-SNE algorithm, Applications of dimensionality reduction	**8 Hours**
Module 5	**Neural Networks:** Introduction to neural networks, Basic structure of a neural network, Activation functions, Backpropagation algorithm, Overfitting and regularization techniques. **Deep Learning:** Introduction to deep learning, Convolutional Neural Networks (CNNs) for image recognition, Transfer learning **Applications of Machine Learning:** Image recognition, Natural Language Processing (NLP), Recommendation systems, Fraud detection, Predictive maintenance.	**8 Hours**

Course Outcome:

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

- Design intelligent agents for solving simple gaming problems.
- Have a good understanding of machine leaning in relation to other fields and fundamental issues and Challenges of machine learning.
- Understand data and applying machine learning algorithms to predict the outputs.
- Model the neuron and Neural Network, and to analyse ANN learning and its applications.

Reference Book:

1. S. Sridhar, M Vijayalakshmi *"Machine Learning".* Oxford, 2021.

Open Elective – 2

Introduction to Cyber Security (21CD663)

Semester VI			
No. of Lecture hour/Week	3	**CIE Marks**	50
No. of Tutorial hours/week	0	**SEE Marks**	50
Total No. of Lecture hours	40	**Exam Hours**	03
L: T:P	3:0:0	**Credits**	03

Modules	Course Content	Teaching Hours
Module 1	**Introduction to Cyber Security:** Definition of Cyber Security, Importance of Cyber Security, Cyber Security Threats and Attacks, Cyber Security Vulnerabilities. **Types of Cyber Attacks:** Phishing Attacks, Malware Attacks Denial of Service Attacks, Social Engineering Attacks.	**8 Hours**
Module 2	**Techniques for Protecting Against Cyber Attacks:** Encryption and Cryptography, Firewalls and Intrusion Detection Systems, Access Controls and Password Management, Data Backup and Recovery.	**8 Hours**
Module 3	**Legal and Ethical Issues in Cyber Security:** Privacy and Data Protection, Intellectual Property and Copyright, Cybercrime and Cyber Law, The Legal Perspectives, An Indian Perspective, Cybercrime and the Indian ITA 2000. **Introduction to Cybercrime:** Definition and Origins of the Word, Cybercrime and Information Security, who are Cybercriminals, Classifications of Cybercrimes,	**8 Hours**
Module 4	**Cyber offenses:** How Criminals Plan Them: Introduction, How Criminals Plan the Attacks, Social Engineering, Cyber stalking, Cybercafe and Cybercrimes. **Botnets:** The Fuel for Cybercrime, Attack Vector	**8 Hours**
Module 5	**Tools and Methods Used in Cybercrime:** Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Key loggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography, DoS and DDoS Attacks, Attacks on Wireless Networks. Ethical Hacking and Penetration Testing. **Case Studies in Cyber Security:** Analysis of real-world cyber-attacks, Impact of cyber-attacks on individuals and organizations, best practices for responding to cyber-attacks.	**8 Hours**

Course Outcome:

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

- Describe the basic principles of cyber security and its importance in modern society.
- Identify common types of cyber-attacks, such as phishing, malware, and denial of service attacks, and explain how these attacks work.
- Evaluate different techniques for protecting against cyber-attacks, including encryption, firewalls, and intrusion detection systems.
- Discuss the legal and ethical issues associated with cyber security, such as privacy, intellectual property, and cybercrime.
- Analyze case studies of real-world cyber-attacks and their impact on individuals and organization.

Reference Books:

1. Raef Meeuwisse, *Cybersecurity for Beginners*.
2. P.W. Singer and Allan Friedman, *Cybersecurity and Cyberwar: What Everyone Needs to Know*.
3. Sunit Belapure and Nina Godbole, *Cyber Security: Understanding Cyber Crimes, Computer. Forensics And Legal Perspectives*, Wiley India Pvt Ltd, 2013.
4. Debra Little John Shinder and Michael Cross, *Scene of the cybercrime*, 2nd Edition, Syngress publishing Inc, Elsevier Inc, 2008
5. William Stallings, *Network Security Essentials: Applications and Standards*.
6. Michael T. Goodrich and Roberto Tamassia, *Introduction to Computer Security*.
7. Robert M Slade, "Software Forensics", Tata McGraw Hill, New Delhi, 2005.
8. Bernadette H Schell, Clemens Martin, *Cybercrime*, ABC – CLIO Inc, California, 2004.
9. Nelson Phillips and Enfinger Steuart, *Computer Forensics and Investigations*, Cengage Learning, New Delhi, 2009.
10. Kevin Mandia, Chris Prosise, Matt Pepe, *Incident Response and Computer Forensics*, Tata McGraw -Hill, New Delhi, 2006.

Open Elective – 2

Introduction to Web Technology (21CD665)

Semester VI			
No. of Teaching hour/Week	3	**CIE Marks**	50
No. of Tutorial hours/week	0	**SEE Marks**	50
Total No. of Lecture hours	40	**Exam Hours**	03
L:T:P	3:0:0	**Credits**	03

Modules	Course Content	Teaching Hours
Module 1	**Introduction to WEB Programming:** Internet, WWW, Web Browsers, and Web Servers, URLs, MIME, HTTP, Security, The Web Programmers Toolbox.	**08 Hours**
Module 2	**HTML and XHTML**: Origins of HTML and XHTML, Basic syntax, Standard XHTML document structure, Basic text markup, Images, Hypertext Links, Lists, Tables. Forms, Frames in HTML and XHTML, Syntactic differences between HTML and XHTML.	**08 Hours**
Module 3	**CSS:** Introduction, Levels of style sheets, Style specification formats, Selector forms, Property value forms, Font properties, List properties, Colour, Alignment of text, Background images, tags.	**08 Hours**
Module 4	**Java Script – I:** Object orientation and JavaScript; General syntactic characteristics; Primitives, Operations, and expressions; Screen output and keyboard input.	**08 Hours**
Module 5	**Java Script – II:** Control statements, Object creation and Modification; Arrays; Functions; Constructor; Pattern matching using expressions; Errors, Element access in JavaScript.	**08 Hours**

Course outcomes:

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

- Describe the fundamentals of web and concept of HTML.
- Use the concepts of HTML, XHTML to construct the web pages.
- Interpret CSS for dynamic documents.
- Evaluate different concepts of JavaScript & Construct dynamic documents.
- Design a small project with JavaScript and XHTML.

Reference Books:

1. Robert W Sebesta, *Programming the World Wide Web*, 6th Edition, Pearson Education, 2008.
2. M.Deitel, P.J.Deitel, A.B.Goldberg, *Internet & World Wide Web How to program* , 3rd Edition,Pearson Education / PHI, 2004.
3. Chris Bates, *Web Programming Building Internet Applications*, 3rd Edition, Wiley India, 2006.
4. Xue Bai et al, *The Web Warrior Guide to Web Programming*, Thomson, 2003.
5. Sklar,*The Web Warrior Guide to Web Design Technologies*, 1st Edition, Cengage Learning India.

Open Elective – 2

Animation and Visualization (21CD665)

Semester VI			
No. of Lecture hour/Week	3	**CIE Marks**	50
No. of Tutorial hours/week	0	**SEE Marks**	50
Total No. of Lecture hours	40	**Exam Hours**	03
L: T:P	3:0:0	**Credits**	03

Modules	Course Content	Teaching Hours
Module 1	**Basics of Animations-Development:** Idea Creation, Evolving a Storyline. **Character Design:** The Evolution of 2D Character Design, The Evolution of 3D Character Design, Animation Style, Concept and Environment Design. **Project Financing:** Animation Markets, Scheduling and Budgeting, Investment, Marketing, and Distribution Possibilities.	**08 Hours**
Module 2	**Principles of Animation:** Key Poses, Breakdowns, and Inbetweens, Timing, Extreme Positions, Arcs and Paths of Action, Holds, Emphasis, Anticipation, Weight and Weighted Movement, Flexibility and Fluid Joint Movement, Overlapping Action, Generic Walks, Walk Cycles, Runs and Run Cycles, Silhouetting, Dialogue and Lip Sync, Laughter, Takes, Eyes and Expressions.	**08 Hours**
Module 3	**2D Animation Overview:** It's All about Pencils and Paper Script, The Tools of the Trade. **2D Animation Basics:** Keys, In-betweens, and Timing, Dope (Exposure) Sheets and Production Folders, Flipping and Peg Bars, Using Peg Bars.	**08 Hours**
Module 4	**Visualization Techniques:** Data visualization techniques, Information visualization techniques, Scientific visualization techniques, Introduction to visualization software. **Motion Graphics:** Introduction to motion graphics, Basic motion graphics techniques, Motion graphics software	**08 Hours**
Module 5	**3D Animation Techniques:** Introduction to 3D modelling and animation, Basic 3D modelling techniques, Texturing and lighting, Rigging and animation, Introduction to 3D animation software. **Computer-Generated Imaging:** Introduction to computer-generated imaging, 3D rendering techniques, Compositing techniques, Introduction to CGI software	**08 Hours**

Course Outcome:

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

- Understand the Basics of Animation techniques.
- Describe principles animation techniques.
- Demonstrate the functions of 2D Animation techniques.
- Apply game theory in real-time animated projects.
- Apply the models of the Game theory problems.

Reference Books:

1. Sketching for Beginners: Step-by-step Guide to Getting Started with Your Drawing.
2. Perspective Made Easy (Dover Art Instruction).
3. Roger B Myerson, *Game theory: Analysis of Conflict*, Harvard University Press, 1997.
4. Joel Watson, *An Introduction to Game Theory: Strategy*, W W Norton and Company.
5. Noam Nisan, Tim Roughgarden, Eva Tardos, Vijay V Vazirani, *"Algorithmic Game Theory"*, Cambridge University Press.
6. Richard Williams, *The Animator's Survival Kit*.
7. Ollie Johnston and Frank Thomas, *"The Illusion of Life: Disney Animation"*.
8. Prof. Sham Tickoo, *A Comprehensive Guide Learning: Autodesk*, Maya 2019.
9. Tony White, *Animation from Pencil to Pixels*, Classical Techniques for Digital Animators, Focal Press is an imprint of Elsevier.
10. Martin Osborne, *An introduction to game theory*, Oxford University Press, Indian Edition, 2004.