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)

Artificial Intelligence and Data Science (AI&DS)

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	21AD51	Management and Entrepreneurship	AI&DS	AI&DS	3	0	0	03	50	50	100	3
2	IPCC	21AD52	Programming in Java	AI&DS	AI&DS	2	0	2	03	50	50	100	4
3	PCC	21AD53	Database Management System	AI&DS	AI&DS	3	0	2	03	50	50	100	4
4	IPCC	21AD54	Automata Theory	AI&DS	AI&DS	3	0	0	03	50	50	100	3
5	PCC	21AD55	Principles of Artificial Intelligence	AI&DS	AI&DS	3	0	2	03	50	50	100	3
6	PEC	21AD56X	Professional Elective -1	AI&DS	AI&DS	3	0	0	03	50	50	100	3
7	OEC	21AD57X	Open Elective - 1	AI&DS	AI&DS	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, AI&DS: Artificial Intelligence and Data Science, 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**
21AD561	Web Technology	21AD571	Introduction to Data Structure and Algorithm
21AD562	Liner Algebra	21AD572	Introduction to Database Management System
21AD563	Data Mining	21AD573	Programming in Java
		21AD574	Introduction to Artificial Intelligence
		21AD575	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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(Effective from the academic year 2021–2022)

Artificial Intelligence and Data Science (AI & DS)

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	21AD61	Application Development using Python	AI&DS	AI&DS	3	0	2	03	50	50	100	4
2	IPCC	21AD62	Big Data Analytics	AI&DS	AI&DS	3	0	2	03	50	50	100	4
3	IPCC	21AD63	Principles of Data Science	AI&DS	AI&DS	3	0	2	03	50	50	100	4
4	PCC	21AD64	Cloud Computing	AI&DS	AI&DS	3	0	0	03	50	50	100	3
5	PEC	21AD65X	Professional Elective - 2	AI&DS	AI&DS	3	0	0	03	50	50	100	3
6	OEC	21AD66X	Open Elective – 2	AI&DS	AI&DS	3	0	0	03	50	50	100	3
7	MP	21ADP67	Mini Project	AI&DS	AI&DS	0	0	2	NA	50	-	50	1
Total						**18**	**00**	**08**	**18**	**350**	**300**	**650**	**22**

Note: PCC: Professional Core Courses, IPCC: Integrated Professional Core Courses, AI&DS: Artificial Intelligence and Data Science, MP: Mini Project, PEC: Professional Elective Course, OEC: Open Elective Course and INT: Internship.

Professional Elective - 3		**Open Elective - 2**	
Course Code	**Course Title**	**Course Code**	**Course Title**
21AD651	Research Methodology and Intellectual Property Rights	21AD661	Introduction to Internet of Things
21AD652	Machine Learning	21AD662	Introduction to Machine Learning
21AD653	Image Processing	21AD663	Introduction to Cyber Security
21AD654	Social Network Analysis	21AD664	Introduction to Web Technology
		21AD665	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 (21AD51)

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 (21AD52)

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 (21AD53)

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, 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.
- Demonstrate the Basics Concepts and SQL Queries of Database Management System
- Analyze 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 (21AD54)

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 Artificial Intelligence (21AD55)

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	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.	**10 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.	**10 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.	**10 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.	**10 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.	**10 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.

Professional Elective – 1

Web Technology (21AD561)

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

Linear Algebra (21AD562)

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 Vectors**: Vectors and Linear Combinations Lengths and Dot Products Matrices . Solving Linear Equations Vectors and Linear Equations The Idea of Elimination Elimination Using Matrices Rules for Matrix Operations Inverse Matrices. Elimination = Factorization: A = LU Transposes and Permutations.	**08 Hours**
Module 2	**Vector Spaces and Subspaces:** Spaces of Vectors The Nullspace of A: Solving Ax = 0 and Rx = 0 The Complete Solution to Ax = b Independence, Basis and Dimension Dimensions of the Four Subspaces **Orthogonality:** Orthogonality of the Four Subspaces Projections	**08 Hours**
Module 3	**Determinants:** The Properties of Determinants Permutations and Cofactors Cramer's Rule, Inverses, and Volumes Eigenvalues and Eigenvectors Introduction to Eigenvalues Diagonalizing a Matrix	**08 Hours**
Module 4	**The Singular Value Decomposition (SVD):** Image Processing by Linear Algebra Bases and Matrices in the SVD Principal Component Analysis (PCA by the SVD) The Geometry of the SVD	**08 Hours**
Module 5	**Linear Transformations:** The Idea of a Linear Transformation The Matrix of a Linear Transformation The Search for a Good Basis	**08 Hours**

Course outcomes:

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

- Explain linear equations, linear models, projections, linear transformations
- Illustrate orthogonal projections and apply Eigen vectors to solve differential equations.
- Apply singular value decomposition and analyze singular value decomposition to develop applications in image processing

Reference Books:

1. Gilbert Strang *Introduction to linear algebra*, 5th edition, Wellesley - Cambridge press.
2. David C Lay *Linear Algebra and its Application*, 4th Edition, Addison Wesley.

Professional Elective – 1

Data Mining (21AI563)

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	**Data Mining:** Data, Types of Data, Data Mining Functionalities, Interestingness Patterns, Classification of Data Mining systems, Data mining Task primitives, Integration of Data mining system with a Data warehouse, Major issues in Data Mining, Data Pre-processing.	**08 Hours**
Module 2	**Association Rule Mining:** Mining Frequent Patterns, Associations and correlations, Mining Methods, Mining Various kinds of Association Rules, Correlation Analysis, Constraint based Association mining. Graph Pattern Mining, SPM.	**08 Hours**
Module 3	**Classification:** Classification and Prediction, Basic concepts, Decision tree induction, Bayesian classification, Rule, based classification, Lazy learner.	**08 Hours**
Module 4	**Clustering and Applications:** Cluster analysis, Types of Data in Cluster Analysis, Categorization of Major Clustering Methods, Partitioning Methods, Hierarchical Methods, Density, Based Methods, Grid, Based Methods, Outlier Analysis	**08 Hours**
Module 5	**Advanced Concepts:** Basic concepts in Mining data streams, Mining Time, series data, Mining sequence patterns in Transactional databases, Mining Object, Spatial, Multimedia, Text and Web data, Spatial Data mining, Multimedia Data mining, Text Mining, Mining the World Wide Web.	**08 Hours**

Course outcomes:

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

- Apply pre-processing methods for any given raw data.
- Extract interesting patterns from large amounts of data.
- Discover the role played by data mining in various fields.
- Choose and employ suitable data mining algorithms to build analytical applications.
- Evaluate the accuracy of supervised and unsupervised models and algorithms.

Reference Books:

1. Jiawei Han & Micheline Kamber, *Data Mining – Concepts and Techniques* –, 3rd Edition Elsevier.
2. Margaret H Dunham, *Data Mining Introductory and Advanced topics* –PEA.
3. Pang-Ning Tan, Michael Steinbach, Vipin Kumar: *Introduction to Data Mining*, Pearson, First impression,2014.
4. Jiawei Han, Micheline Kamber, Jian Pei: *Data Mining -Concepts and Techniques*, 3rd Edition, Morgan Kaufmann Publisher, 2012.

Open Elective – 1

Introduction to Data Structures and Algorithms (21AD571)

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.
- Analyze the performance of the algorithms, state the efficiency using asymptotic notations and analyze 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 (21AD572)

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 (21AD573)

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, ASecond 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 (21AD574)

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:

5. Elaine Rich, Kevin Knight, Shivashankar Nair, *Artificial Intelligence*, Tata McGraw Hill.
6. Patrick Henry Winston, *Artificial Intelligence*, AWL.
7. Dan W. Patterson, *Artificial Intelligence and Expert systems*, PHI.
8. Nils J Nilson, *Artificial Intelligence*, Elsevier, Morgan Kaufmann.

Open Elective – 1

Introduction To Phyton Programming (21AD575)

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:

9. 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/)
10. 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
11. R. Nageswara Rao, *Core Python Programming*, Dream Tech publication
12. Vamsi Kurama, *Python Programming: A Modern Approach*, Pearson
13. Reema theraja, *Python Programming*, OXFORD publication

Application Development Using Python (21AD61)

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	**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	**10 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	**10 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	**10 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	**10 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	**10 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.

BIG DATA ANALYTICS (21AD62)

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 Big Data Analytics: Big Data, Scalability and Parallel Processing, Designing Data Architecture, Data Sources, Quality, Pre-Processing and Storing, Data Storage and Analysis, Big Data Analytics Applications and Case Studies.	**08 Hours**
Module 2	Introduction to Hadoop (T1): Introduction, Hadoop and its Ecosystem, Hadoop Distributed File System, MapReduce Framework and Programming Model, Hadoop Yarn, Hadoop Ecosystem Tools. Hadoop Distributed File System Basics (T2): HDFS Design Features, Components, HDFS User Commands. Essential Hadoop Tools (T2): Using Apache Pig, Hive, Sqoop, Flume, Oozie, HBase.	**08 Hours**
Module 3	NoSQL Big Data Management, MongoDB and Cassandra: Introduction, NoSQL Data Store, NoSQL Data Architecture Patterns, NoSQL to Manage Big Data, Shared-Nothing Architecture for Big Data Tasks, MongoDB, Databases, Cassandra Databases.	**08 Hours**
Module 4	MapReduce, Hive and Pig: Introduction, MapReduce Map Tasks, Reduce Tasks and MapReduce Execution, Composing MapReduce for Calculations and Algorithms, Hive, HiveQL, Pig.	**08 Hours**
Module 5	Machine Learning Algorithms for Big Data Analytics: Introduction, Estimating the relationships, Outliers, Variances, Probability Distributions, and Correlations, Regression analysis, Finding Similar Items, Similarity of Sets and Collaborative Filtering, Frequent Item sets and Association Rule Mining. Text, Web Content, Link, and Social Network Analytics: Introduction, Text mining, Web Mining, Web Content and Web Usage Analytics, Page Rank, Structure of Web and analyzing a Web Graph, Social Network as Graphs and Social Network Analytics.	**08 Hours**

Course outcomes:

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

- Understand fundamentals of Big Data analytics.
- Investigate Hadoop framework and Hadoop Distributed File system.
- Illustrate the concepts of NoSQL using MongoDB and Cassandra for Big Data.
- Demonstrate the MapReduce programming model to process the big data along with Hadoop tools.
- Use Machine Learning algorithms for real world big data.
- Analyze web contents and Social Networks to provide analytics with relevant visualization tools.

Reference Books:

1. Raj Kamal and Preeti Saxena, *Big Data Analytics Introduction to Hadoop, Spark, and Machine-Learning*, McGraw Hill Education, 2018.
2. Douglas Eadline, *Hadoop 2 Quick-Start Guide: Learn the Essentials of Big Data Computing in the Apache Hadoop 2 Ecosystem*, 1st Edition, Pearson Education, 2016.
3. Tom White, *Hadoop: The Definitive Guide*, 4th Edition, O'Reilly Media, 2015.
4. Boris Lublinsky, Kevin T Smith, Alexey Yakubovich, *Professional Hadoop Solutions*, 1st Edition, Wrox Press, 2014.
5. Eric Sammer, *Hadoop Operations: A Guide for Developers and Administrators*,1st Edition, O'Reilly Media, 2012.
6. Arshdeep Bahga, Vijay Madisetti, *Big Data Analytics: A Hands-On Approach*, 1st Edition, VPT Publications, 2018.

Principles of Data Science (21AD63)

Semester VI			
No. of Teaching hour/Week	3	**CIE Marks**	50
No. of Tutorial 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 Data Science:** Benefits and uses – facets of data - Data Science Process: Overview – Defining research goals – Retrieving data – Data preparation - Exploratory Data analysis – build the model– presenting findings and building applications - Data Mining - Data Warehousing – Basic Statistical descriptions of Data	**10 Hours**
Module 2	**Describing Data:** Types of Data - Types of Variables - Describing Data with Tables and Graphs –Describing Data with Averages - Describing Variability - Normal Distributions and Standard (z) Scores	**10 Hours**
Module 3	**Describing Relationships:** Correlation –Scatter plots – correlation coefficient for quantitative data –computational formula for correlation coefficient – Regression –regression line –least squares regression line – Standard error of estimate – interpretation of r2 –multiple regression equations – regression towards mean.	**10 Hours**
Module 4	**Probability:** Hours Basic definitions, Probability, Bayesian versus Frequentist, Frequentist approach, Compound events, Conditional probability, The rules of probability, Collectively exhaustive events, Bayesian ideas revisited, Bayes theorem, Random variables	**10 Hours**
Module 5	**Statistics:** Basic of statistics, obtaining sample data, point estimates sample distributions, confidence intervals, hypothesis test, type I type II errors. hypothesis test for categorical variables.	**10 Hours**

Course outcomes:

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

- Explain different types of data and their relationships.
- Apply mathematical concepts to data science problems
- Analyze and illustrate probability and statistical techniques

Reference Books:

1. Sinan Ozdemir *Principles of Data Science*, PACKT Publisher, First Edition, 2016.
2. Gilbert Strang *Introduction to Linear Algebra*, Wellesley-Cambridge Press, Fifth Edition, 2016.
3. Cathy O'Neil, Rachel Schutt *Doing Data Science: Straight Talk from the Frontline*, O'Reilly Media, 2013

Cloud Computing (21AD64)

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 (21AD651)

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

Introduction to Machine Learning (21AD652)

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	**08 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.	**08 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.	**08 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	**08 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.	**08 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.

Professional Elective – 2

Image Processing (21AD653)

Semester VI			
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 Computer Graphics:** Introduction of Coordinate representation and Pixel, Raster Scan, Random Scan systems, Video controller and raster scan display processor. **Introduction to Image Processing:** Fundamentals, Application, Image processing system components, Image sensing and acquisition, Sampling and quantization, Neighbours of pixel adjacency connectivity, regions and boundaries, Distance measures.	**08 Hours**
Module 2	**Image Enhancement in the Spatial Domain:** Image Sampling and Quantization, Some Basic Relationships Between Pixels, Linear and Nonlinear Operations. Some Basic Intensity Transformation Functions, Histogram Processing, Fundamentals of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters.	**08 Hours**
Module 3	**Image Segmentation:** Introduction, Detection of isolated points, line detection, Edge detection, Edge linking, Region based segmentation- Region growing, split and merge technique, local processing, regional processing, Hough transform, Segmentation using Threshold. **Frequency Domain:** Preliminary Concepts, The Discrete Fourier Transform (DFT) of Two Variables, Properties of the 2-DDFT, Filtering in the Frequency Domain, Image Smoothing and Image Sharpening.	**08 Hours**
Module 4	**Restoration:** Noise models, Restoration using spatial filtering and frequency domain filtering, Position-Invariant degradations, Estimating the Degradation Function, Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering, Constrained Least Squares Filtering. **Morphological Image Processing:** Boundary extraction, Region filtering, Connected component extraction, Convex hull, Thinning, Thickening, skeletons, pruning.	**08Hours**
Module 5	**Image Compression:** Introduction, Coding redundancy, Inter-pixel redundancy, Image compression model, Lossy and Lossless compression, Huffman coding, Arithmetic Coding, LZW coding. **Color Image Processing:** Color Fundamentals, Color Models, Pseudo color Image Processing.	**08Hours**

Course outcomes:

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

- Describe the fundamentals of digital image processing.
- Understand image formation and the role human visual system plays in perception of gray and color image data.
- Apply image processing techniques in both the spatial and frequency (Fourier) domains.
- Design and evaluate image analysis techniques.
- Learn image restoration and enhancement techniques, colour image processing.

Reference Books:

1. Rafel C Gonzalez, Richard E. Woods, *Digital Image Processing*, 3rd Edition, PHI, 2010.
2. S.Jayaraman, S. Esakkirajan T, T. Veerakumar, *Digital Image Processing*, Tata McGraw Hill, 2014.
3. A K. Jain, *Fundamentals of Digital Image Processing*, Pearson, 2004.
4. Rafel C. Gonzalez, Richard E. Woods, *Digital Image Processing Using Matlab*, Pearson Education.

Professional Elective – 2

Social Network Analysis (21AD654)

Semester VI			
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 Social Media Analytics (SMA):** Social media landscape, Need for SMA, SMA in Small organizations, SMA in large organizations, Application of SMA in different areas. **Network fundamentals and models:** The social networks perspective - nodes, ties and influencers, Social network and web data and methods. Graphs and Matrices- Basic measures for individuals and networks. Information visualization.	**08 Hours**
Module 2	**Making connections:** Link analysis. Random graphs and network evolution. Social contexts- Affiliation and identity. **Web analytics tools:** Click stream analysis, A/B testing, online surveys, Web crawling and Indexing. Natural Language Processing Techniques for Micro-text Analysis	**08 Hours**
Module 3	**Content in Social Media:** Introduction to Social Data, Defining Content-Focus on Text and Unstructured data. Finding the Right Data, Using content feature to identify topics. **Social Media Data Analysis:** Data identification, Data Analysis, The Social Analytics Process, Customizing and Modifying Tools, Visually Representing Unstructured Data, Topic Modelling.	**08 Hours**
Module 4	**Facebook Analytics:** Introduction, parameters, demographics. Analyzing page audience. Reach and Engagement analysis. Post-performance on FB. Social campaigns. Measuring and Analyzing social campaigns, defining goals and evaluating outcomes, Network Analysis. **Information Interpretation**: Social information filtering, Social media in public sector, Business use of social media, Common Visualizations, Visualization as an Aid to analytics, Creating features from text: NLP, Identifying opinion.	**08Hours**
Module 5	**Processing and Visualizing Data**: Influence Maximization, Link Prediction, Collective Classification, Applications in Advertising and Game Analytics. Introduction to Python Programming, Collecting and analyzing social media data; visualization and modelling pattern in social media data. **Data-Driven Innovation:** Healthcare, Policy makers, small, medium and large businesses, Social Media services online, Privacy.	**08 Hours**

Course outcomes:

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

- Comprehend social media analytics and its significance.
- Utilize analytics tools' skills required for analyzing the effectiveness of social media.
- Identify the innovation potential and impact of social media data in organizations.

Reference Books:

1. Ganis, Avinash Kohirkar, Matthew, *Social Media Analytics: Techniques and Insights for Extracting Business Value Out of Social Media*, Pearson, 2016.
2. Jennifer Golbeck , *Analyzing the Social Web* , Elsevier, 2013
3. Azizi Othman, *Media Web Mining and Analysis*, Willey, 2019.
4. Marshall Sponder, *Social Media Analytics,* 2nd Edition, McGraw Hill, 2012.

Open Elective – 2

Introduction To Internet of Things (21AD661)

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 (21AD662)

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	**08 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.	**08 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.	**08 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	**08 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.	**08 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 (21AD663)

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.	**08 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.	**08 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,	**08 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	**08 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.	**08 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. SunitBelapure 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 (21AD664)

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.

Open Elective – 2

Animation and Visualization (21AD665)

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.