JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY
(Established by H.P.State Legislative vide Act No. 14 of 2002)
Waknaghat, P.O. Dumehar Bani, Kandaghat, Distt. Solan – 173234 (H.P.) INDIA
Website :www.juit.ac.in
Phone No. (91) 01792-257999 (30 Lines)
Fax : (91) 01792 245362

| | |
|---|---|
| **Criteria** | 2 Teaching-learning and Evaluation |
| **Key Indicator** | 2.6 Student Performance and Learning Outcomes |
| **Metric** | 2.6.1 The institution has stated learning outcomes (generic and programme specific) / graduate attributes which are integrated into assessment process and widely publicized through the website and other documents |

## COs of All Courses – Department of Computer Science & Engineering and Information Technology (BTech-CSE)

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY
IQAC
WAKNAGHAT

**Semester: I**

| SNo | Course Codes | Course Name | Course Outcomes |
|---|---|---|---|
| 1 | 10B11CI111 | Introduction to Computer and Programming | CO1: Students will be acquainted with Data & Instruction representation,<br>CO2: To gain knowledge of Architecture and functional operation of computer peripherals.<br>CO3: To learn User-interface of DOS, Windows and UNIX.<br>CO4: Ability to design, develop, test and document structured programs in C language. |
| 2 | 10B17CI171 | Computer Programming Lab | CO1: Understand the terminology used in computer programming<br>CO2: Design programs involving decision structures, loops and functions.<br>CO3: Understand the dynamics of memory by the use of pointers.<br>CO4: Enhance programming skills through problem solving and code development of small-size software applications. |
| 3 | 18811CI111 | Programming for Problem Solving Lab | CO1: Students will be acquainted with Data & Instruction representation,<br>CO2: To gain knowledge of Architecture and functional operation of computer peripherals.<br>CO3: To learn User-interface of DOS, Windows and UNIX.<br>CO4: Ability to design, develop, test and document structured programs in C language. |
| 4 | 18811CI111 | Programming for Problem Solving | CO1: Understand the terminology used in computer programming<br>CO2: Design programs involving decision structures, loops and functions.<br>CO3: Understand the dynamics of memory by the use of pointers.<br>CO4: Enhance programming skills through problem solving and code development of small-size software applications. |
| 5 | 10817CI171 | Computer Programming Lab | CO1: Understand the terminology used in computer programming<br>CO2: Design programs involving decision structures, loops and functions.<br>CO3: Understand the dynamics of |

| | | | |
|---|---|---|---|
| | | | memory by the use of pointers.<br>CO4: Enhance programming skills through problem solving and code development of small-size software applications. |
| 6 | 19B11CI111 | Programming for Problem Solving-II | CO-1 To formulate simple algorithms for arithmetic and logical problems.<br>CO-2 To translate the algorithms to programs (in C language).<br>CO-3 To test and execute the programs and correct syntax and logical errors.<br>CO-4 To implement conditional branching, iteration and recursion.<br>CO-5 To decompose a problem into functions and synthesize a complete program using divide and conquer approach.<br>CO-6 To use arrays, pointers and structures to formulate algorithms and programs.<br>CO-7 To apply programming to solve matrix addition and multiplication problems and searching and sorting problems.<br>CO-8 To apply programming to solve simple numerical method problems, namely rot finding of function, differentiation of function and simple integration. |
| 7 | 19B17CI171 | Programming for Problem Solving-II Lab | CO-1 Develop problem solving ability using programming.<br>CO- 2 To impart adequate knowledge on the need of programming languages and problem solving techniques.<br>CO-3 To develop a methodological way of problem solving.<br>CO-4 Analyze and construct effective algorithms.<br>CO-5 Employ good programming practices such as incremental development, data integrity checking and adherence to style guidelines.<br>CO-6 Learn a programming approach to solve problems. |

**Semester: II**

| SNo | Course Codes | Course Name | Course Outcomes |
|---|---|---|---|
| 1. | 18B11CI211 | Data Structures | CO-1 To gain knowledge on the notions of data |

|  |  |  |  |
|---|---|---|---|
|  |  | and Algorithms | structure, Abstract Data Type.<br>CO-2 For a given algorithm student will able to analyze the algorithms to determine the time and computation complexity and justify the correctness.<br>CO-3 For a given Search problem (Linear Search and Binary Search) student will able to implement it.<br>CO-4 For a given problem of Stacks, Queues and linked list student will able to implement it and analyze the same to determine the time and computation complexity.<br>CO-5 Student will able to implement Graph search and traversal algorithms and determine the time and computation complexity.<br>CO-6 Student will able to write an algorithm Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort and compare their performance in term of Space and Time complexity. |
| 2. | 18B11CI271 | Data Structures and Algorithms Lab | CO-1 To gain knowledge on the notions of data structure, Abstract Data Type<br>CO-2 To have hands on skills to evaluate different kinds of linked lists and their applications in day to day problem solving.<br>CO-3 To have hands on skills to evaluate different kinds stacks and their applications and implementations in day to day problem solving<br>CO-4 To have hands on skills to evaluate different kinds queues and their applications and implementations in simulations.<br>CO-5 To acquire knowledge of various sorting algorithms<br>CO-6 To learn Searching: Balanced tree, red-black tree, lower bounds for searching<br>CO-7 To learn to code for operations on Tree or BST (Creation; Traversing like preorder,post-order and in-order; Searching element; finding height etc.)<br>CO-8 Introduction to Heaps<br>CO-9 To learn to code for operations on Graphs (Creation; entering info, printing output and deleting; traversal of BFS and DFS algorithm) |
| 3. | 10B11CI211 | Data Structures | CO 1: Understand the notions of data structure, Abstract Data Type.<br>CO 2: Explore asymptotic notations and role of algorithm complexity in computing<br>CO 3: Evaluate different kinds of linked lists and their applications in day to day problem solving.<br>CO 4: Evaluate different kinds stacks and their applications and implementations in day to day problem solving.<br>CO 5: Evaluate different kinds queues and their applications and implementations in simulations. |

|  |  |  |  |
|---|---|---|---|
|  |  |  | CO 6: To acquire knowledge of various sorting algorithms<br>CO 7: To learn Searching: Balanced tree, red-black tree, lower bounds for searching<br>CO 8: To gain understanding of Graph: representation and algorithms<br>CO 9: To have exposure to hashing, and its various implementations of searching and hashing algorithms |
| 4. | 10B17CI271 | Data Structures and Computer Programming Lab | CO-1: Develop problem solving ability using Programming.<br>CO-2: Develop ability to design and analyze algorithms.<br>CO-3: Introduce students to data abstraction and fundamental data structures.<br>CO-4: Develop ability to design and evaluate Abstract Data Types and data structures.<br>CO-5: Apply data structure concepts to various examples and real life applications |
| 5. | 14B21CI211 | Basic Data Structures | CO1: To gain knowledge on the notions of data structure, Abstract Data Type.<br>CO2: To have exposure to Big(O) notation and role of algorithm complexity in computing<br>CO3: To have hands on skills to evaluate different kinds of linked lists and their applications in day to day problem solving.<br>CO4: To have hands on skills to evaluate different kinds stacks and their applications and implementations in day to day problem solving.<br>CO5: To have hands on skills to evaluate different kinds queues and their applications and implementations in simulations.<br>CO6: To acquire knowledge of various sorting algorithms<br>CO7: To learn Searching: Balanced tree, red-black tree, lower bounds for searching<br>CO8: To gain understanding of Graph: representation and algorithms<br>CO9: To have exposure to hashing, and its various implementations of searching and hashing algorithms. |

**Semester: III**

| SNo | Course Codes | Course Name | Course Outcomes |
|---|---|---|---|
| 1. | 10811CI311 | Object Oriented Programming | CO1: Explain what constitutes an object-oriented approach to programming and identify potential |

| | | | |
|---|---|---|---|
| | | | benefits of Object-oriented programming over other approaches.<br>CO2: Analyze and decompose problem specifications from Object Oriented Perspectives and represent the solution, using UML notation.<br>CO3: Explain the benefits of object oriented design and the types of systems in which it is an appropriate methodology.<br>CO4: Apply an object-oriented approach to developing applications of varying complexities.<br>CO5: Augment a class definition using constructors, destructors, member functions, helper functions and custom input/output operators to add functionality to a programming solution<br>CO6: Manage an object's resources using dynamic memory allocation and deallocation to access data stored outside the object's memory<br>CO7: Read from and write to files using objects from the standard input output library and custom file operators for future restoration<br>CO8: Model specialization using single inheritance and abstract base classes to minimize code duplication<br>CO9: Model polymorphic behavior using coercion, overloading, virtual functions and function templates to amplify reusability of code |
| 2. | 10811CI312 | Database Systems | CO1: Explain the characteristics, architecture of database approach, describe the components, major functions of a database system and give examples of their use.<br>CO2: Compare and contrast appropriate data models, including concepts in modeling notation and how they would be used.<br>CO3: Demonstrate use of the relational algebra operations from mathematical set theory (union, intersection, difference, and Cartesian product) and the relational algebra operations developed specifically for relational databases (select (restrict), project, join, and division).<br>CO4: Create a relational database schema in SQL, use SQL to create a non-procedural query, write a stored procedure that deals with parameters and has some control flow, to provide a given functionality.<br>CO5: Using SQL to implement roles, privileges, access control and authorization policies<br>CO6: Determine the functional dependency between two or more attributes, compute the closure of a set of attributes, evaluate a proposed decomposition, describe the properties of BCNF, PJNF, 5NF.<br>CO7: Explain the use of integrating OO properties with relational modeling |

| | | | |
|---|---|---|---|
| | | | CO8: Give examples of the application of primary, secondary, and clustering indexes, explain the theory and application of internal and external hashing techniques.<br>CO9: Understand a set of query processing strategies and select the optimal strategy.<br>CO10: Understand transaction management, concurrency control techniques and data recovery methods.<br>CO11: Explain the techniques used for data fragmentation, replication, evaluate simple strategies for executing a distributed query and explain how the two-phase commit |
| 3. | 10817CI307 | Unix Programming Lab | CO1: You will be able to run various UNIX commands on a standard UNIX/LINUX Operating system.<br>CO2: You will be able to run C programs on UNIX.<br>CO3: You will be able to do shell programming on UNIX OS.<br>CO4: You will be able to understand and handle UNIX system calls. |
| 4. | 10817CI371 | Objected Oriented Programming Lab | CO1: To learn the concepts of Objects, Classes, Methods, Constructors and Destructors<br>CO2: To learn the designing of complex classes: Friend Functions and Static member functions, Inline functions, constant functions.<br>CO3: To learn Inheritance: Single Inheritance, Multiple Inheritance, Multi-level<br>CO4: Inheritance, Hierarchical Inheritance and Hybrid Inheritance.<br>CO5: To learn the concept of Abstract classes and interfaces<br>CO6: To learn the concepts of Operator overloading and conversion function<br>CO7: To learn File Handling. Writing and reading data from the file, reading and writing the objects into the file.<br>CO8: To learn the Exception Handling: try --catch and finally block, making user-defined exceptions.<br>CO9: To learn the Unified Modeling Language (UML): Use Case Diagrams, State Diagrams, Sequence Diagrams, Communication Diagrams, and Activity Diagrams. |
| 5. | 10817CI372 | Database Systems Lab | CO1: Students get practical knowledge on designing and creating relational database systems.<br>CO2: Understand various advanced queries execution such as relational constraints, joins, set operations, aggregate functions, trigger, views and embedded SQL.<br>CO3: Use of various software to design and build ER Diagrams, UML, Flow chart for related database |

|  |  |  |  |
|---|---|---|---|
|  |  |  | systems.<br>CO4: Students will be able to design and implement database applications on their own |
| 6. | 10828CI408 | Multimedia Development Lab-I | CO1: To learn how to design and develop multimedia for real world e-learning.<br>CO2: To practice software engineering in a learner-oriented project.<br>CO3: To learn and apply cognitive principles of user interface design.<br>CO4: To learn how to implement multimedia e-leaning in Macromedia Flash.<br>CO5: Demonstrate mastery of scripting in a multimedia development environment.<br>CO6: Create multi-user multimedia applications.<br>CO7: Create a 3D multimedia application.<br>CO8: Apply image-processing algorithms to multimedia content within a scripting environment.<br>CO9: Apply current standards and guidelines for multimedia development and delivery.<br>CO10: Create production quality multimedia applications.<br>CO11: Use the basic tools used by an Android programmer.<br>CO12: Configure an Android emulator and a hardware connection to an Android device.<br>CO13: Describe the Android development lifecycle.<br>CO14: Define XML and give examples of how it is used to express data.<br>CO15: Write interactive programs on the Android.<br>CO16: Demonstrate the use of activity lifecycles to control an app.<br>CO17: Analyze a design's ability to support multiple screen resolutions and natural languages.<br>CO18: Design dynamic UIs using fragments and the Android support library.<br>CO19: Analyze a design's ability to interact with other apps on the device.<br>CO20: Use layout hierarchies to produce reusable layouts . |
| 7. | 18B1CI314 | Python Programming Essentials | CO1. FamiliarityaboutconceptsofPythonProgramming.BroadentheknowledgeaboutVariables,expressionsandFunctions inPython.<br>CO2. BroadentheknowledgeaboutBranchingandIteration.Tohave handsonskillsonStringManipulation,GuessandCheck,Approximations,Bisection<br>CO3. To learn about Decomposition Abstractions, Tuples, Lists, DictionariesandIllustrativeprograms<br>CO4. Files,Modules,PackagesandTesting,Debuggi |

|  |  |  |  |
|---|---|---|---|
|  |  |  | ng,Exceptions,Assertions<br>CO5. UnderstandingandanalyzingObjectOrientedProgramming.<br>CO6. TohavehandsonskillsonIllustrativeprograms(examplesSortingandSearching,Regularexpressions)and GUI |
| 8. | 18B11CI313 | Database Management Systems | CO1. Explain the characteristics, architecture of database approach, its components, different data models and the examples of their usage.<br>CO2. For a given query write relational algebra expressions for that query and optimize the developed expressions.<br>CO3. For a given specification of the requirement, design the databases using E-R method and normalization.<br>CO4. Determine the functional dependency between two or more attributes, compute the closure of a set of attributes, evaluate a proposed decomposition<br>CO5. Give examples of the application of primary, secondary, and clustering indexes, explain the theory and application of internal and external hashing techniques.<br>CO6. Implement the isolation property, including locking, time stamping based on concurrency control and Serializability of scheduling.<br>CO7. Familiarize with the security in databases and gaining familiarity with other popular databases used in the industry |
| 9. | 18B11CI311 | Object Oriented System and Programming | CO1: To learn the concepts of Objects, Classes, Methods, Constructors and Destructors<br>CO2: To learn the designing of complex classes: Friend Functions and Static member functions, Inline functions, constant functions.<br>CO3: To learn Inheritance: Single Inheritance, Multiple Inheritance, Multi- level Inheritance, Hierarchical Inheritance and Hybrid Inheritance.<br>CO4: To learn the concept of Abstract classes and interfaces<br>CO5: To learn the concepts of Operator overloading and conversion function<br>CO6: To learn File Handling. Writing and reading data from the file, reading and writing the objects into the file.<br>CO7: To learn the Exception Handling: try --catch and finally block, making user- defined exceptions.<br>CO8: To learn the Unified Modeling Language (UML): Use Case Diagrams, State Diagrams, Sequence Diagrams, Communication Diagrams, and Activity Diagrams. |
| 10. | 18B11CI31 | Object Oriented | CO1: TolearntheconceptsofObjects,Classes,Metho |

|  |  |  |  |
|---|---|---|---|
|  |  | System and Programming | ds,ConstructorsandDestructors<br>CO2: Tolearnthedesigningofcomplexclasses:Friend FunctionsandStaticmember functions,Inlinefunctions,constantfunctions.<br>CO3: TolearnInheritance:SingleInheritance,MultipleInheritance,Multi-level Inheritance,HierarchicalInheritanceandHybridInheritance.<br>CO4: TolearntheconceptofAbstractclassesandinterfaces<br>CO5: TolearntheconceptsofOperatoroverloadingandconversionfunction<br>CO6: TolearnFileHandling.Writingandreadingdatafromthefile,readingand writingtheobjectsintothefile.<br>CO7: TolearntheExceptionHandling:try--catchandfinallyblock,makinguser-definedexceptions.<br>CO8: TolearntheUnifiedModelingLanguage(UML):UseCaseDiagrams,StateDiagrams,SequenceDiagrams,Communication Diagrams,andActivityDiagrams. |
| 11. | 18B17CI372 | IT Workshop (SciLab/MATLAB) Lab | CO1: WritingfundamentalprogramsinMatlab,creatingvariablesandmathematical functions<br>CO2: ProgrammingthefundamentalsconceptsofbasicPlottingconsistingofsimpleandmultiple data setsinone plot<br>CO3: Understandhowtoprogrammatrixoperations,arrayoperationsandhowtosolvethe systemoflinearequations<br>CO4: UnderstandhowtoprogramM-filescripts,M-filefunctions,Input–output Arguments<br>CO5: Programcontrolflowoperators,loops,flowstructuresanddebuggingM-files |
| 12. | 18B11CI371 | Object Oriented System and Programming Lab | CO1: TolearntheconceptsofObjects,Classes,Methods,ConstructorsandDestructors<br>CO2: Tolearnthedesigningofcomplexclasses:Friend FunctionsandStaticmember functions,Inlinefunctions,constantfunctions.<br>CO3: To learn Inheritance: Single Inheritance, Multiple Inheritance, Multi-level Inheritance,HierarchicalInheritanceandHybridInheritance.<br>CO4: To learntheconceptofAbstractclassesandinterfaces.<br>CO5: To learntheconceptsofOperatoroverloadingandconversionfunction.<br>CO6: TolearnFileHandling.Writingandreadingdataf |

|  |  |  |  |
|---|---|---|---|
|  |  |  | romthefile,readingandwriting theobjectsintothefile.<br>CO7: TolearntheExceptionHandling:try--catchandfinallyblock,makinguser-defined exceptions. |
| 13. | 18B17CI374 | Python Programming Lab | CO1: FamiliarityaboutconceptsofPythonProgramming.BroadentheknowledgeaboutVariables,expressionsandFunctions inPython.<br>CO2: BroadentheknowledgeaboutBranchingandIteration.Tohave handsonskillsonStringManipulation,GuessandCheck,Approximations,Bisection.<br>CO3: To learn about Decomposition Abstractions, Tuples, Lists, DictionariesandIllustrativeprograms.<br>CO4: Files,Modules,PackagesandTesting,Debugging,Exceptions,Assertions.<br>CO5: UnderstandingandanalyzingObjectOrientedProgramming.<br>CO6: TohavehandsonskillsonIllustrativeprograms(examplesSortingandSearching,Regularexpressions)and GUI |
| 14. | 18B17CI373 | Database Management Systems Lab | CO1: Designandimplementadatabaseschema<br>CO2: Designdifferentviewsoftablesfordifferentusersandtoapplyembeddedandnested queries<br>CO3: Understandtheuseofstructuredquerylanguage anditssyntax,transactions, databaserecoveryandtechniquesforqueryoptimization<br>CO4: Understand,analyzeandapplycommonSQLstatementsincludingDDL,DML,DCLstatementstoperformdifferentoperations<br>CO5: DevelopapplicationprogramsusingPL/SQL<br>CO6: DesignandimplementaprojectusingembeddedSQLandGUI |

**Semester: IV**

| SNo | Course Codes | Course Name | Course Outcomes |
|---|---|---|---|
| 1. | 10B11CI401 | Microprocessors and Controllers | CO1: Knowledge of standard 32-bit Intel Architectures.<br>CO2: Understanding of the Intel processors' seldom-used capabilities.<br>CO3: Increase in proficiency with using C/C++ and assembler language.<br>CO4: Learn to access service-functions provided in BIOS firmware.<br>CO5: Gaining practical experience in programming peripheral I/O devices.<br>CO6: Acquiring the background for understanding next-generation CPUs. |

|  |  |  |  |
|---|---|---|---|
|  |  |  | CO7: To learn microprocessor programming model at a level that enables writing assembly language programs for the processor meeting given specifications.<br>CO8: Learn concepts associated with interfacing a microprocessor to memory and to I/O devices.<br>CO9: Learn how to control components of a microprocessor based system through the use of interrupts. |
| 2. | 10B11CI411 | Fundamentals of Algorithms | CO1: To Strengthen higher level cognitive skills of analysis, creation and evaluation.<br>CO2: To Strengthen ability of data abstraction and problem solving using computers.<br>CO3: To Strengthen ability to express solutions to problems clearly and precisely.<br>CO4: To Strengthen ability to design and evaluate ADTs, non-linear temporary and persistent data structures and also related algorithms.<br>CO5: To Introduce students to some domain specific data structures and related algorithms in various domains. |
| 3. | 10B17CI407 | Microprocessors and Controllers Lab | CO1: You will increase your proficiency with using assembler language, MASM.<br>CO2: You will know how to access service-functions provided in BIOS firmware.<br>CO3: You will gain practical experience in programming peripheral I/O devices.<br>CO4: You will acquire the background for understanding next-generation CPUs.<br>CO5: You will learn a microprocessor programming model at a level that enables you to write assembly language programs for the processor meeting given specifications.<br>CO6: You will learn concepts associated with interfacing a microprocessor to memory and to I/O devices.<br>CO7: You will learn how to control components of a microprocessor based system through the use of interrupts. |
| 4. | 10B17CI471 | Algorithms Lab | CO1: Understand the running time using time library functions. Learn to prepare table for input size vs. running time. Learn to measure best run and worst run of the experiments.<br>CO2: Learn to program for sorting algorithms. Also, they will learn to implement Priority Queue and order statistics.<br>CO3: Students will learn to implement searching techniques through RB-Tree and Skiplist and hashing.<br>CO4: Students will learn to implement basic graph algorithms (BFS, DFS, Prims, Kruskal, Dijkstra) and apply those to explore graph properties.<br>CO5: Students will learn to implement algorithms for pattern matching.<br>CO6: Students will learn to implement Dynamic programming methodsfor problems like, Longest common subsequence, Matrix chain multiplication, Coin denomination, Knapsack and back tracking algorithm to |

| | | | |
|---|---|---|---|
| | | | find a solution of the 3-SAT problem. |
| 5. | 18B11CI412 | Design & Analysis of Algorithms | CO1: For a given algorithms analyze worst-case running times of algorithms based on asymptotic analysis and justify the correctness of algorithms.<br>CO2: Describe the greedy paradigm and explain when an algorithmic design situation<br>calls for it. For a given problem develop the greedy algorithms.<br>CO3: Describe the divide-and-conquer paradigm and explain when an algorithmic design situation calls for it. Synthesize divide-and conquer algorithms. Derive and solve recurrence relation.<br>CO4: Describe the dynamic-programming paradigm and explain when an algorithmic design situation calls for it. For a given problems of dynamic programming<br>and develop the dynamic programming<br>algorithms, and analyze it to determine its computational complexity.<br>CO5: For a given model engineering problem model it using graph and write the corresponding algorithm to solve the problems.<br>CO6: Explain the ways to analyze randomized algorithms (expected running time, probability of error).<br>CO7: Explain what an approximation algorithm is. Compute the approximation factor of an approximation algorithm (PTAS and FPTAS). |
| 6. | 18B11CI415 | Object Oriented Programing | CO1: To learn the concepts of Objects, Classes, Methods, Constructors and Destructors .<br>CO2: To learn the designing of complex classes: Friend Functions and Static member functions, Inline functions, constant functions.<br>CO3: To learn Inheritance: Single Inheritance, Multiple Inheritance, Multi-level Inheritance, Hierarchical Inheritance and Hybrid Inheritance.<br>CO4: To learn the concept of Abstract classes and interfaces.<br>CO5: To learn the concepts of Operator overloading and conversion function .<br>CO6: To learn File Handling. Writing and reading data from the file, reading and writing the objects into the file.<br>CO7: To learn the Exception Handling: try --catch and finally block, making user-defined exceptions.<br>CO8: To learn the Unified Modeling Language (UML): Use Case Diagrams, State CO-8 Diagrams, Sequence Diagrams, Communication Diagrams, and Activity Diagrams. |
| 7. | 18B11CI411 | Operating Systems | CO1: An appreciation of the role of an operating system.<br>CO2: Create processes and threads.<br>CO3: Develop algorithms for process scheduling for a given specification of CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time.<br>CO4: For a given specification of memory organization |

| | | | |
|---|---|---|---|
| | | | develop the techniques for optimally allocating memory to processes by Increasing memory utilization and for improving the access time.<br>CO5: Design and implement file management system.<br>CO6: For a given I/O devices and OS (specify) develop the I/O management functions in OS as part of a uniform device abstraction by performing operations for synchronization between CPU and I/O controllers. |
| 8. | 18BI7CI471 | Operating System Lab | CO1: Be able to create sockets and analyze different (client/server) models.<br>CO2: Be able to create processes, threads, semaphores.<br>CO3: Be able to analyze different protocols.<br>CO4: Be able to learn how resources are being managed in Operating system.<br>CO5: Be able to manage system memory |
| 9. | 18BI7CI472 | Design And Analysis Algorithms Lab | CO1: Understand the running time using time library functions. Learn to prepare table for input size vs. running time. Learn to measure best run and worst run of the experiments.<br>CO2: Implement various types of design for an algorithms and compare the approaches.<br>CO3: Learn to implement network algorithms and their applications.<br>CO4: Implement approximate algorithms for real world problems.<br>CO5: Apply randomized solution for difficult real world problems. |
| 10. | 18B17CI474 | Web Tech Lab | CO1: Basic PHP Concepts, PHP Operators, PHP Function, PHP Variables and Super globals.<br>CO2: Conditional Statements, Looping Statements, Array, Cookies, PHP Form, PHP Session, File Upload, File Handling, User login and Registration.<br>CO3: Database Connectivity, MySQL, MySQL connect, create DB/Table, Instructions such as select, where, order By, update and delete etc., encryption methods.<br>CO4: Create and save an XML document at the server, which contains 10users information. Write a program which takes User Id as input and returns the user details by taking the user information from the XML document.<br>CO5: To get familiar with JavaScript, working with operators, Conditional Statements, looping statements, Alert Box, Confirm Box and Prompt Box, Functions, Array, event handler, regular expressions and modifiers, Cookie and form validations.<br>CO6 Validate the registration, user login, user profile and payment by credit card pages using JavaScript. |
| 11. | 18B11CI414 | Discrete Computational | CO1: Students will be able to express logical statements in terms of logical connectives, predicates and quantifiers. |

| | | | |
|---|---|---|---|
| | | Mathematics | CO2: Students will be able to apply various proving techniques such as direct, indirect proofs, mathematical induction, etc.<br>CO3: They will learn basic set operations along with relations & functions with their types and usage.<br>CO4: They will be familiar with graph & tree terminologies along with their various applications in computer science.<br>CO5: Students will be able to solve counting problems using permutation, combinations techniques.<br>CO6: They will learn about algebraic structures such as group, abelian group, rings, integral domain, fields, etc.<br>CO7: Students will be able to analyze and solve various algorithms using recurrence relation methods. |
| 12. | 18B11CI474 | Object Oriented Programing Lab | CO1: To learn the concepts of Objects, Classes, Methods, Constructors and Destructors<br>CO2: To learn the designing of complex classes: Friend Functions and Static member functions, Inline functions, constant functions.<br>CO3: To learn Inheritance: Single Inheritance, Multiple Inheritance, Multi-level Inheritance, Hierarchical Inheritance and Hybrid Inheritance.<br>CO4: To learn the concept of Abstract classes and interfaces.<br>CO5: To learn the concepts of Operator overloading and conversion function.<br>CO6: To learn File Handling. Writing and reading data from the file, reading and writing the objects into the file.<br>CO7: To learn the Exception Handling: try --catch and finally block, making user- defined exceptions.<br>CO8: To learn the Unified Modeling Language (UML): Use Case Diagrams, State Diagrams, Sequence Diagrams, Communication Diagrams, and Activity Diagrams. |
| 13. | 18B17CI473 | Data Simulation Lab | CO1: Student will learn simulation of real world problems using python, scipy and simpy.<br>CO2: Students will learn structural development of complex system in terms of process, resources and levels.<br>CO3: Student will learn to use random number generator.<br>CO4: Students will learn to monitor and tally simulation results.<br>CO5: Students will apply simulation and modelling techniques in many real examples.<br>CO6: Students will apply simulation and modelling techniques in a real life project. |
| 14. | 18B11CI413 | Modeling and Simulation Techniques | CO1: To learn the basic concepts, applications and terminology of computer simulation and modeling.<br>CO2: To learn statistical methods of estimation and testing and other relevant concepts.<br><br>CO3: To explain the working and applications of different types of simulation such as Monte Carlo, VS. Discrete Event. |

|  |  |  |  |
|---|---|---|---|
|  |  |  | CO4: You will learn how to model a system and the execution of simulation tools.<br>CO5: You will learn to analyze input data, its parameters, and the use of random number in a typical simulation study.<br>CO6: Student will learn different techniques for the Verification and Validation of a simulation study. |

**Semester: V**

| SNo | Course Codes | Course Name | Course Outcomes |
|---|---|---|---|
| 1. | 10B11CI511 | Operating Systems | CO1: An appreciation of the role of an operating system.<br>CO2: Understand the theory and logic behind the design and construction of operating systems.<br>CO3: Examine the algorithms used for various operations on operating systems.<br>CO4: Differentiate between various operating systems functionalities in terms of performance.<br>CO5: Know the problems in the design of operating system and study the probable solutions.<br>CO6: Become aware of the issues in the management of resources like processor, memory and input-output. |
| 2. | 10B17CI571 | Operating Systems Lab | CO1: Be able to create sockets and analyze different (client/server) models.<br>CO2: Be able to create processes, threads, semaphores.<br>CO3: Be able to analyze different protocols.<br>CO4: Be able to learn how resources are being managed in Operating system.<br>CO5: Be able to manage system memory |
| 3. | 10B17CI572 | Software Engineering Lab | CO1: Students will be capable to acquire the generic software development skill through various stages of software life cycle.<br>CO2: He will also be able to ensure the quality of software through software development with various protocol based environment. After completion of course student will be able to generate test cases for software testing.<br>CO3: Students will also be able to handle software development models through rational method.<br>CO4: Rational Rose Enterprise Edition software is used to serve the objectives.<br>CO5: The courses contains Basic Structural Modeling, Advance Structural Modeling, Basic Behavioral Modeling, Advance Behavioral Modeling, Architectural Modeling, UML Notation, UML Stranded Elements, Designing Test cases, Test Suits, Rational Unified Process etc. |
| 4. | 10B11CI512 | Software Engineering | CO1: Describe the relative advantages and disadvantages among several major process models (e.g., waterfall, |

| | | | |
|---|---|---|---|
| | | | iterative, and agile). [Familiarity]<br>CO2: Describe the different practices that are key components of various process models. [Familiarity]<br>CO3: Differentiate among the phases of software development.<br>CO4: Apply key elements and common methods for elicitation and analysis to produce a set of software requirements for a medium-sized software system. [Usage]<br>CO5: Use a common, non-formal method to model and specify the requirements for a medium-size software system. [Usage]<br>CO6: Translate into natural language a software requirements specification (e.g., a software component contract) written in a formal specification language. [Usage] |
| 5. | 10B1WCI515 | Software Testing and Debugging | CO1: You will broaden your knowledge of software engineering.<br>CO2: You will learn Software testing algorithms and programs.<br>CO3: You will increase your proficiency in JAVA Language.<br>CO4: You will know how strategies and tactics of effective and efficient testing.<br>CO5: You will gain practical experience in design, develop, and document static, white-box, black-box tests.<br>CO6: You will acquire the background for understanding Test Management and Software Development.<br>CO7: You will acquire the knowledge of higher order and object oriented testing.<br>CO8: You will learn a effective and efficient use of debugging techniques.<br>CO9: You will learn how to make use of Web testing and Automated software testing. |
| 6. | 10B1WCI575 | Software Testing and Debugging Lab | CO1: Have an ability to apply software testing knowledge and engineering methods.<br>CO2: Have an ability to design and conduct a software test process for a software testing project.<br>CO3: Have an ability to identify the needs of software test automation, and define and develop a test tool to support test automation.<br>CO4: Have an ability understand and identify various software testing problems, and solve these problems by designing and selecting software test models, criteria, strategies, and methods.<br>CO5: Have an ability to use various communication methods and skills to communicate with their teammates to conduct their practice-oriented software testing projects.<br>CO6: Have basic understanding and knowledge of contemporary issues in software testing, such as |

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY * WAKNAGHAT * IQAC

| | | | |
|---|---|---|---|
| | | | component-based software testing problems.<br>CO7: Have an ability to use software testing methods and modern software testing tools for their testing projects. |
| 7. | 10B22CI521 | Web Application Engineering | CO1: The student shall acquire the skill to design and develop web based applications with high usability, scalability and efficiency.<br>CO2: They shall be exposed to various technologies required to design web sites<br>CO3: They shall acquire the skill to choose the technology to use based on the requirements and functionality of the web site. |
| 8. | 10B28CI581 | Web Technology Lab | CO1: Basic PHP Concepts, PHP Operators, PHP Function, PHP Variables and Super globals.<br>CO2: Conditional Statements, Looping Statements, Array,<br>CO3: Cookies, PHP Form, PHP Session, File Upload, File Handling, User login and Registration.<br>CO4: Database Connectivity, MySQL, MySQL connect, create DB/Table, Instructions such as select, where, order By, update and delete etc., encryption methods.<br>CO5: Create and save an XML document at the server, which contains 10users information. Write a program which takes User Id as input and returns the user details by taking the user information from the XML document.<br>CO6: To get familiar with JavaScript, working with operators, Conditional Statements, looping statements, Alert Box, Confirm Box and Prompt Box, Functions, Array, event handler, regular expressions and modifiers, Cookie and form validations.<br>CO7: Validate the registration, user login, user profile and payment by credit card pages using JavaScript. |
| 9. | 18B1WCI535 | Python Programming | CO1Familiarity about concepts of Python Programming. Broaden the knowledge about Variables, expressions and Functions in Python.<br>CO2Broaden the knowledge about Branching and Iteration. To have hands on skillson String Manipulation, Guess and Check, Approximations, Bisection<br>CO3To learn about Decomposition Abstractions, Tuples, Lists, Dictionaries and Illustrative programs:<br>CO4Files, Modules, Packages and Testing, Debugging, Exceptions, Assertions:<br>CO5Understanding and analyzing Object Oriented Programming:<br>CO6To have hands on skills on Illustrative programs (examples Sorting and Searching, Regular expressions) and GUI |

|  |  |  |  |
|---|---|---|---|
| 10 | 18B1WCI533 | Principle of Programming Language | CO1: Tolearnmajorprogrammingparadigmsandtechniques involvedindesignandimplementationofmodernprogramminglanguages.Tolearnthestructureofacompiler andinterpretation.Tolearnsyntaxandsemanticofprogramminglanguage.<br>CO2: Tolearnthestructuredandobjectorientedprogramming paradigm.<br>CO3: To different programming paradigm to improving the clarity, quality, and developmenttime of a program (structured programming). To learn Haskell (an advanced purely-functionalprogrammingstyleandlambdacalculus(forvariablebindingand substitution).<br>CO4: Tolearntheconcurrencyinprogramminglanguages,ExceptionhandlingandScriptinglanguages |
| 11 | 18B1WCI573 | Principle of Programming Language Lab | CO1: Tolearnmajorprogrammingparadigmsandtechniques involvedindesignandimplementationofmodernprogramminglanguages.Tolearnthestructureofacompiler andinterpretation.Tolearnsyntaxandsemanticofprogramminglanguage.<br>CO2: Tolearnthestructuredandobject-orientedprogrammingparadigm.<br>CO3: To different programming paradigm to improving the clarity, quality, and developmenttime of a program (structured programming). To learn Haskell (an advanced purely-functionalprogrammingstyleandlambdacalculus(forvariablebindingand substitution).<br>CO4: Tolearntheconcurrencyinprogramminglanguages,ExceptionhandlingandScriptinglanguages |
| 12 | 18B1WCI534 | Java Programming | CO1: To learn the graphics and animation on the web pages, using Java Applets. To learn anddesign a full set of Event driven UI widgets and other components, including windows,menus,buttons,checkboxes,textfields,scrollbarsandscrollinglists,usingAbstract WindowingToolkit(AWT)&Swings<br>CO2: TolearnJavaDataBaseConnectivity(JDBC)soastoretrieveandmanipulatetheinformationonany relationaldatabasethroughJavaprograms.<br>CO3: TolearntheserversideprogrammingusingServletsand JSP.<br>CO4: TolearntheinvocationoftheremotemethodsinanapplicationusingRMI |
| 13 | 18B1WCI574 | Java Programming Lab | CO1: To learn the graphics and animation on the web |

| | | | |
|---|---|---|---|
| | | | pages, using Java Applets. To learn and design a full set of Event driven UI widgets and other components, including windows, menus, buttons, checkboxes, text fields, scrollbars and scrolling lists, using Abstract Windowing Toolkit (AWT) & Swings<br>CO2: To learn Java Data Base Connectivity (JDBC) so as to retrieve and manipulate the information on any relational database through Java programs.<br>CO3: To learn the server side programming using Servlets and JSP.<br>CO4: To learn the invocation of the remote methods in an application using RMI |
| 14 | 18B11CI514 | Computer Organization & Architecture | CO-1 To learn the basic concepts, terminology and evolution in computer organization and architecture.<br>CO-2 Understanding the computer architecture and computer arithmetic.<br>CO-3 Understanding of the computer memory and the issues related to memory.<br>CO-4 Understanding the concept of memory I/O, interrupt handling and DMA.<br>CO-5 Learn the organization of Processor and the concept of pipelining.<br>CO-6 Learning concepts of Parallel processing and related issues. |
| 15 | 18B17CI574 | Computer Organization & Architecture Lab | CO-1 Ability to understand basic structure of computer.<br>CO-2 Ability to perform arithmetic operations on computer.<br>CO-3 Ability to understand the memory concepts including Cache.<br>CO-4 Familiarity with CPU design. |
| 16 | 18B11CI515 | Computer Graphics | CO 1: Student will learn about the overview of computer graphic applications and graphics devices (Display Technologies, Raster Refresh (Raster-Scan), CRT, LCD displays, etc.).<br>CO 2: Student will learn about the scan conversion - lines, circles and Ellipses, filling, clipping and aliasing.<br>CO 3: Student will learn about the Two-Dimensional transformations and matrix representation of 2D Transformations (Translations, Rotation, Reflection, Scaling and Combined Transformation) and Window-to- Viewport transformations.<br>CO 4: Student will learn about the Three-Dimensional transformations and viewing in 3D Assessment<br>CO 5: Student will learn about the solid modelling: representing solids, regularized Boolean Set operations, primitive instancing, sweep representations, spatial-partitioning representations - Octree representation, B-Reps and Constructive Solid Geometry. |

|  |  |  |  |
|---|---|---|---|
|  |  |  | CO 6 Student will learn about the visible surface detection, illumination and shading |
| 17 | 18B17CI575 | Computer Graphics Lab | CO-1 Using OpenGL for Graphics.<br>CO-2 Programming User-Interface Issues Assessment.<br>CO-3 Concepts of 2D & 3D object representation.<br>CO-4 Implementation of various scan and clipping algorithms.<br>CO-5 2 D Modelling.<br>CO-6 Implementation of a project using learned models. |
| 18 | 18B11CI513 | Formal Language & Automata Theory | CO-1: Broaden knowledge of the fundamental mathematical and computational principles that are the foundation of computer science.<br>CO-2: Understand the concept of Deterministic Finite Automata and Non- Deterministic Finite Automata.<br>CO-3: Understand how to minimize the states, usage Moore and Mealy Machine.<br>CO-4: Understand how to use the context free grammars in languages and how to derive parse trees and solve ambiguity problems.<br>CO-5: Understand Normal forms for Context Free Grammar"s Chomsky and Greibach Normal Forms.<br>CO-6: Understand the Push Down Automaton algorithm Assessment<br>CO-7: Understand how the push down automata will accept arbitrary context free languages. To understand the properties of CFG To understand the determinism and parsing. To understand different parsing methodologies.<br>CO-8: Understand the basic concepts of Turing Machine, configuration of Turing Machine, computing with the Turing Machine.<br>CO-9: Understand multiple tapes, two way infinite tape concepts, the real computers random access memories working, concept of non-deterministic Turing machines.<br>CO-10: Understand the computational power of languages, numerical functions applied to Turing machines, numerical functions applied to Turing machines, various mathematical models applied to Turing machines, the concept of halting problem, undecidable problems about Turing machines and grammars, properties of recursive languages, concept of polynomial decidable. |
| 19 | 18B1WCI575 | Multimedia Lab | CO-1:To learn how to design and develop multimedia for real world e-learning.<br>CO-2: To learn how to implement multimedia e-leaning in Macromedia Flash.<br>CO-3: Students will learn to create multi-user multimedia applications.<br>CO-4: Students will learn to create a 3D multimedia application.<br>CO-5: Students will learn to write interactive programs on |

| | | | |
|---|---|---|---|
| | | | the Android.<br>CO-6: Students will learn to analyze and design's to interact with other apps on the device. |
| 20 | 18B1WCI532 | Data Compression | CO-1: To understand the statistical basis for and performance metrics for lossless compression.<br>CO-2: To understand the conceptual basis for commonly used lossless compression Techniques.<br>CO-3: To understand how to use and evaluate several readily available implementations of those techniques.<br>CO-4: To understand the structural basis for and performance metrics for commonly used lossy compression techniques.<br>CO-5: To understand the conceptual basis for commonly used lossy compression techniques.<br>CO-6: To implement graph theory in compression methodologies for images in MATLAB.<br>CO-7: To understand image compression techniques case studies. |
| 21 | 18B1WCI572 | Data Compression Lab | CO-1 To understand the statistical basis for and performance metrics for lossless compression.<br>CO-2 To understand the conceptual basis for commonly used lossless compression techniques<br>CO-3 To understand how to use and evaluate several readily available implementations of those techniques.<br>CO-4 To understand the structural basis for and performance metrics for commonly used lossy compression techniques.<br>CO-5 To understand the conceptual basis for commonly used lossy compression techniques<br>CO-6 To implement graph theory in compression methodologies for images in MATLAB.<br>CO-7 To understand image compression techniques" case studies. |
| 22 | 20B1WCI531 | Foundation for Data Science and visualization | CO-1: Understanding the basics of data science<br>CO-2 Using versatile and flexible languages (Python and R programming) for supporting data science.<br>CO-3 Using data processing for collecting and manipulating the data into the usable and desired form Usage<br>CO-4 Using data visualization to easily access the huge amount of data in visuals Usage<br>CO-5 Using statistics to collect and analyze the numerical data in a large amount and finding meaningful insights from i Usage<br>CO-6 Understanding linear algebra to represent, model, synthesize and summarize the complex data |
| 23 | 20B1WCI571 | Data Science and | CO-1 Understanding the basics of data science. |

|  |  |  |  |
|---|---|---|---|
|  |  | Visualization Lab | CO-2 Using versatile and flexible languages (Python and R programming) for supporting data science.<br>CO-3 Using data processing for collecting and manipulating the data into a usable and desired form.<br>CO-4 Using statistics to collect and analyze the numerical data in a large amount and finding meaningful insights from i.<br>CO-5 Understanding linear algebra to represent, model, synthesize and summarize the complex data.<br>CO-6 Using data visualization to easily access the huge amount of data in visuals. |
| 24 | 20B1WCI532 | Cloud Computing: Concepts, Technology & Architecture | CO-1 To learn the basic concepts, applications, and terminology of cloud computing.<br>CO-2 To learn basic concepts of infrastructure management and load balancing.<br>CO-3 To learn basic concepts of cloud security and metrics for evaluation.<br>CO-4 To understand cloud computing and its role in new distributed computing implementation. |
| 25 | 20B1WCI572 | Cloud Computing: Concepts, Technology & Architecture Lab | CO1 To learn the basic concepts, applications, and terminology of cloud computing.<br>CO2 To learn basic concepts of infrastructure management and load balancing.<br>CO3 To learn basic concepts of cloud security and metrics for evaluation.<br>CO4 To understand cloud computing and its role in new distributed computing implementation. |

**Semester: VI**

| SNo | Course Codes | Course Name | Course Outcomes |
|---|---|---|---|
| 1. | 10B11CI611 | Computer Networks | CO1: To learn the basic concepts and terminology in computer networks.<br>CO2: To learn about the layered models in computer networks and different types of network topologies and protocols.<br>CO3: To learn about the data link layer and MAC layer protocols and related issues.<br>CO4: To learn concepts associated with subnetting and routing mechanisms. Understand network industry standards such as: Routing Protocols, Address Resolution and Reverse Address Resolution Protocols, IP Addresses and Subnetting, MAC Addressing.<br>CO5: To learn about the transport layer protocols and related issues.<br>CO6: You will learn about the session, presentation and application layers protocols.<br>CO7: Further, to learn about the some advanced topics in networks such as Cryptographic algorithms, Network |

| | | | |
|---|---|---|---|
| | | | security and management, and concepts of wireless networks. |
| 2. | 10B11CI612 | Compiler Design | CO1: To understand the basic concept of compilation particular, lexical analyzer, syntax and semantic analysis, code generation and optimization phases of compilation.<br>CO2: Ability to create lexical rules and grammars for a programming language.<br>CO3: Ability to use flex or similar tools to create a lexical analyzer and Yacc/Biscon tools to create a parser.<br>CO4: Ability to implement a various parser such as a bottom-up SLR parser without using any compiler-generation tools.<br>CO5: Ability to implement a various intermediate code generation techniques without using any compiler generation tools.<br>CO6: Ability to implement various code optimizing techniques without using any compiler-generation tools<br>CO7: Ability to implement semantic rules into a parser that performs attribution while parsing<br>CO8: Ability to design a compiler for a concise programming language. |
| 3. | 10B11CI613 | Computer Organisation and Architecture | CO1: To learn the basic concepts, terminology and evolution in computer organization and architecture.<br>CO2: Understanding the computer architecture and computer arithmetic.<br>CO3: Understanding of the computer memory and the issues related to memory.<br>CO4: Understanding the concept of memory I/O, interrupt handling and DMA.<br>CO5: Learn the organization of Processor and the concept of pipelining.<br>CO6: Learning concepts of Parallel processing and related issues. |
| 4. | 10B11CI673 | Computer Organization & Architecture Lab | CO-1 Ability to understand basic structure of computer.<br>CO-2 Ability to perform arithmetic operations on computer.<br>CO-3 Ability to understand the memory concepts including Cache.<br>CO-4 Familiarity with CPU design. |
| 5. | 11B1WCI611 | Computer Graphics | CO1: Student will learn about the overview of computer graphic applications and graphics devices (Display Technologies, Raster Refresh (Raster-Scan), CRT, LCD displays, etc.)<br>CO2: Student will learn about the scan conversion - lines, circles and Ellipses, filling, clipping and aliasing.<br>CO3: Student will learn about the Two-Dimensional transformations and matrix representation of 2D Transformations (Translations, Rotation, Reflection, Scaling and Combined Transformation) and Window-to-Viewport transformations. |

| | | | |
|---|---|---|---|
| | | | CO4: Student will learn about the Three-Dimensional transformations and viewing in 3D.<br>CO5: Student will learn about the solid modelling: representing solids, regularized Boolean Set operations, primitive instancing, sweep representations, spatial-partitioning representations - Octree representation, B-Reps and Constructive Solid Geometry. |
| 6. | 10B17CI671 | Computer Networks Lab | CO1: To understand the working concepts of Networking and inter – networking Devices.<br>CO2: To understand the concepts of different shortest path algorithms.<br>CO3: To understand different error detection and correction techniques/algorithms.<br>CO4: To understand Flow control techniques/algorithms.<br>CO5: To understand the concepts of client – server interaction using connection oriented and connectionless protocols.<br>CO6: To understand the proficiency in Traffic Shaping Algorithms.<br>CO7: You shall be exposed to working of encryption and decryption algorithms. |
| 7. | 10B17CI672 | Compiler Design Lab | CO1: Gain an in-depth understanding of the principles underlying the design.<br>CO2: Construction of compilers.<br>CO3: Functioning of Compiler writing tools.<br>CO4: Building various parsing techniques. |
| 8. | 10B17CI673 | System and Network Programming Lab | CO1: Student will be able to create sockets and analyze different (client/server) models.<br>CO2: Student will be able to create processes, threads, semaphores and Bluetooth programming.<br>CO3 Student will be able to analyze different protocols. |
| 9. | 11B1WCI671 | Computer Graphics Lab | CO1: Using OpenGL for Graphics.<br>CO2: Programming User-Interface Issues.<br>CO3: Concepts of 2D & 3D object representation.<br>CO4: Implementation of various scan and clipping algorithms.<br>CO5: 2 D Modelling. |
| 10 | 18B1WCI634 | Machine Learning | CO1: To learn the basic concepts and terminology in machine learning.<br>CO2: To learn about the definition of learning systems, their goals and applications in machine learning.<br>CO3: To understand concepts associated with classification and experimental evaluation of classification algorithms.<br>CO4: To learn concepts associated with decision trees and experimental evaluation of classification algorithms.<br>CO5: To learn about instance-based learning, clustering |

|  |  |  |  |
|---|---|---|---|
|  |  |  | and unsupervised learning. |
| 11 | 19B1WCI631 | Digital Forensics | CO1: Introduction to Cyber Crime and Ethical Hacking.<br>CO2: Introduction to Digital Forensics and Digital Evidences.<br>CO3: Computer Security Incident Response Methodology.<br>CO4: Forensic Duplication and Disk Analysis, and Investigation Data Analysis.<br>CO5: Network Forensics Incidents, Using Routers as Response Tools.<br>CO6: Forensic Investigation Report and Forensic Tools. |
| 12 | 18B1WCI635 | Data Mining & Data Warehousing | CO1: To describe the concept of Data warehouse & its attributes.<br>CO2: To study different data warehouse models, architectures and implementation.<br>CO3: To understand the basic concept of data mining and its functionality.<br>CO4: To understand the concept of classification techniques and its implementation.<br>CO5: To understand the concept of association rules, different techniques and implementation details.<br>CO6: To understand the concept of cluster analysis, anomaly detection and its usage and implementation details. |
| 13 | 19B1WCI632 | Information Security | CO1: Understand the need for security.<br>CO2: Analysis of security algorithms.<br>CO3: Demonstrate familiarity with major security algorithms and data structure.<br>CO4: Apply important security algorithmic design paradigms and methods of analysis. |
| 14 | 19BIWCI637 | Statistics And Exploratory Data Analytics | CO1: Analyze the concept of statistics and exploratory data analysis.<br>CO2: Graphical and modeling techniques for exploring data.<br>CO3: Implement data transformation, dimensionality reduction.<br>CO4: Apply data clustering and visualized exploratory data through various plots and graphs. |

| | | | |
|---|---|---|---|
| 15 | 19BIWCI635 | Architecting Distributed Cloud Applications | CO1: Introduction to cloud computing and distributed cloud applications.<br>CO2: Network Communication in distributed cloud applications.<br>CO3: Message Communication in distributed cloud applications.<br>CO4: Versioning, upgrading, and configuration of distributed cloud applications. |
| 16 | 18B11CI611 | Computer Networks | CO1: To learn the basic concepts and terminology in computer networks.<br>CO2: To learn about the layered models in computer networks and different types of network topologies and protocols.<br>CO3: To learn about the data link layer and MAC layer protocols and related issues.<br>CO4: To learn concepts associated with subnetting and routing mechanisms. Understand network industry standards such as: Routing Protocols, Address Resolution and Reverse Address Resolution Protocols, IP Addresses and Subnetting, MAC Addressing.<br>CO5: To learn about the transport layer protocols and related issues.<br>CO6: You will learn about the session, presentation and application layers protocols.<br>CO7: Further, to learn about the some advanced topics in networks such as Cryptographic algorithms, Network security and management, and concepts of wireless networks. |
| 17 | 18B17CI671 | Computer Networks Lab | CO1: To understand the working concepts of Networking and inter – networking Devices.<br>CO2: To understand the concepts of different shortest path algorithms.<br>CO3: To understand different error detection and correction techniques/algorithms.<br>CO4: To understand Flow control techniques/ algorithms.<br>CO5: To understand the concepts of client – server interaction using connection oriented and connectionless protocols.<br>CO6: To understand the proficiency in Traffic Shaping Algorithms.<br>CO7: You shall be exposed to working of encryption and decryption algorithms. |
| 18 | 18B11CI612 | Compiler Design | CO1: To understand the basic concept of compilation particular, lexical analyzer, syntax and semantic analysis, code generation and optimization phases of compilation.<br>CO2: Ability to create lexical rules and grammars for a programming language.<br>CO3: Ability to use flex or similar tools to create a lexical analyzer and Yacc/Biscon tools to create a parser.<br>CO4: Ability to implement a various parser such as a bottom-up SLR parser without using any compiler- |

| | | | |
|---|---|---|---|
| | | | generation tools.<br>CO5: Ability to implement a various intermediate code generation techniques without using any compiler generation tools.<br>CO6: Ability to implement various code optimizing techniques without using any compiler-generation tools<br>CO7: Ability to implement semantic rules into a parser that performs attribution while parsing<br>CO8: Ability to design a compiler for a concise programming language. |
| 19 | 18B17CI672 | Compiler Design Lab | CO1: Gain an in-depth understanding of the principles underlying the design.<br>CO2: Construction of compilers.<br>CO3: Functioning of Compiler writing tools.<br>CO4: Building various parsing techniques. |
| 20 | 18B1WCI674 | Machine Learning Lab | CO1: To implement classification algorithms in python.<br>CO2: To implement Clustering algorithms in python.<br>CO3: To implement Genetic Algorithms in Python.<br>CO4: Top compare different algorithms based on some common factors. |
| 21 | 19B1WCI671 | Digital Forensics Lab | CO1: Introduction to Cyber Crime and Ethical Hacking.<br>CO2: Introduction to Digital Forensics and Digital Evidences.<br>CO3: Computer Security Incident Response Methodology.<br>CO4: Forensic Duplication and Disk Analysis, and Investigation Data Analysis.<br>CO5: Network Forensics Incidents, Using Routers as Response Tools.<br>CO6: Forensic Investigation Report and Forensic Tools. |
| 22 | 18B1WCI675 | Data Mining & Data Warehousing Lab | CO1: Practical exposure on implementation of well-known data mining tasks.<br>CO2: Exposure to real life data sets for analysis and prediction.<br>CO3: Learning performance evaluation of data mining algorithms in a supervised and an unsupervised setting.<br>CO4: Handling a small data mining project for a given practical domain.<br>CO5: Develop and apply machine learning tools and techniques. |
| 23 | 19B1WCI672 | Information Security Lab | CO1: Understand the basic security services e.g. Authentication, Access Control, Confidentiality, and Integrity.<br>CO2: Learn standard symmetric encryption algorithms.<br>CO3: Learn architecture for public and private key cryptography.<br>CO4: Learn the methods of digital signature and encryption.<br>CO5: Learn key management and how key exchange protocols work.<br>CO6: Learn futuristic cryptographic techniques like Elliptic |

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY
IQAC
WAKNAGHAT

|  |  |  |  |
|---|---|---|---|
|  |  |  | Curve and quantum cryptography. |
| 24 | 19B1WCI677 | Statistics And Exploratory Data Analytics Lab | CO1: Understand the basics of MATLAB syntax/python libraries.<br>CO2: Exploring dataset and visualizing data on different charts.<br>CO3: Perform the basic operations of data pre-processing and dimensionality reduction.<br>CO4: Design and analyze clustering techniques.<br>CO5: Understanding of curve fitting toolbox.<br>CO6: Implementation of dendrogram and treemaps |
| 25 | 19B1WCI675 | Architecting Distributed Cloud Applications Lab | CO1: Introduction to cloud computing and distributed cloud applications.<br>CO2: Network Communication in distributed cloud applications.<br>CO3: Message Communication in distributed cloud applications.<br>CO4: Versioning, upgrading, and configuration of distributed cloud applications. |
| 26 | 18B19CI691 | Minor Project | CO1: Identify an open ended problem in area of mechanical engineering which requires further investigation.<br>CO2: Identify the methods and materials required for the project work.<br>CO3: Manage the work with team members.<br>CO4: Formulate and implement innovative ideas for social and environmental benefits.<br>CO5: Analyze the results to come out with concrete solutions. 6. Write technical report of the project apart from developing a presentation. |

**Semester: VII**

| SNo | Course Codes | Course Name | Course Outcomes |
|---|---|---|---|
| 1 | 20B1WCI732 | From Graph to Knowledge Graph | CO1: Learn graph representations.<br>CO2: Utilize fundamentals to build knowledge graphs.<br>CO3: Understand the algorithms and techniques for crawling web sites, structured data extraction, and information extraction from unstructured text.<br>CO4: Understand how to apply the tools and infrastructure to build and query knowledge graphs. |
| 2 | 20B1WCI772 | From Graph to Knowledge Graph Lab | CO1: Build a knowledge graph from documents.<br>CO2: Building a knowledge graph from a text.<br>CO3: Build a Small Knowledge Graph.<br>CO4: Understand the Graph Databases.<br>CO5: Familiarity with graph computing Frameworks.<br>CO6: Able to Visualization of graphs |
| 3 | 13B1WCI731 | Arm Based | CO1: Describe the architecture of a typical embedded |

|  |  |  |  |
|---|---|---|---|
|  |  | Embedded System Design | RISC processor (e.g. ARM Cortex-M3).<br>CO2: Develop an understanding of the instruction set and addressing modes.<br>CO3: Exercise a range of typical microcontroller peripherals (e.g. GPIO, USART, ADC, etc...).<br>CO4: Use a typical toolchain to implement and test simple embedded microcontroller applications in C and assembly language.<br>CO5: Evaluate the requirements for embedded Real Time Operating Systems (RTOS).<br>CO6: Understand the structure of a RTOS (e.g.eLinux) |
| 4 | 19B1WCI734 | Object Oriented Technologies Using Java | CO1: Understanding the features and concepts of Object-Oriented Programming using Java.<br>CO2: Defining classes, objects, constructors, methods in Java.<br>CO3: Inheritance, Interfaces, and Polymorphism.<br>CO4: Packages, Exception Handling, and Multithreading. |
| 5 | 19B1WCI774 | Object Oriented Technologies Using Java Lab | CO1: Understanding the features and concepts of Object-Oriented Programming using Java.<br>CO2: Defining classes, objects, constructors, methods in Java.<br>CO3: Inheritance, Interfaces, and Polymorphism.<br>CO4: Packages, Exception Handling, and multithreading. |
| 6 | 18B1WCI734 | Cryptography& network security | CO-1 Understand the basic security services e.g.Authentication, Access Control, Confidentiality, Integrity, and Non repudiation).<br>CO-2 Learn standard symmetric encryption algorithms<br>CO-3 Learn the architecture for public and private key cryptography and how public key infrastructure (PKI) supports network security.<br>CO-4 Learn the methods of digital signature and encryption<br>CO-5 Learn key management and how key exchange protocols work.<br>CO-6 Learn futuristic cryptographic techniques like Eliptic Curve and quantum cryptography. |
| 7 | 18B1WCI742 | Artificial Intelligence | CO-1 Determine the characteristics of a given problem that an intelligent system must solve.<br>CO-2 Apply Bayes rule to determine the probability of a hypothesis given evidence.<br>CO-3 Identify examples of knowledge representations for reasoning under uncertainty.<br>CO-4 List the differences among the three main styles of learning: supervised, reinforcement, and unsupervised.<br>CO-5 Identify examples of classification tasks, including the available input features and output to be predicted. |
| 8 | 18B1WCI732 | Social and Information Network Analysis | CO-1. Understand what constitutes a social network<br>CO-2. Represent networks in graph-theoretic language<br>CO-3. Design effective and reliable network research projects |

|  |  |  |  |
|---|---|---|---|
|  |  |  | CO-4. Configure network and attribute data for standard software packages<br>CO-5. Comprehend the reasons for using, and principles of, permutation tests<br>CO-6. Apply centrality measures appropriatelyy |
| 9 | 18B1WCI772 | Artificial Intelligence Lab | CO-1 Determine the characteristics of a given problem that an intelligent system must solve.<br>CO-2 Apply Bayes' rule to determine the probability of a hypothesis given evidence.<br>CO-3 Identify examples of knowledge representations for reasoning under uncertainty.<br>CO-4 List the differences among the three main styles of learning: supervised, reinforcement, and unsupervised.<br>CO-5 Identify examples of classification tasks, including the available input features and output to be predicted. |
| 10 | 20B17CI771 | Advanced Software Systems Lab | CO-1 Knowledge and Understanding of the lists, exception handling, dictionaries, and NumPy arrays in python.<br>CO-2 Knowledge and Understanding of scatter plots and inferring the information from scatter plots.<br>CO-3 Understanding and implementing Probability functions.<br>CO-4 Understanding and generating Area Under a Curve (AUC) for the given discrete or continuous functions and generating PDF curves.<br>CO-5 Understanding to import CSV datasets. Applying statistical functions on the dataset and classifying dataset. Building machine learning models.<br>CO-6 Understanding and implementing data wrangling, Advanced graphs and 3-D graphs. |
| 11 | 10M11CI112 | Advanced Computer Networks | CO1: Understand the main abstract concepts related to the layered communication architecture Cognitive skills (thinking and analysis).<br>CO2: Analyze and implement some of the most advanced routing and congestion control algorithms.<br>CO3: Evaluate the performances of computer networks (through mathematical modeling and simulation) Communication skills (personal and academic).<br>CO4: Understand basics and principles of new generation of computer networks (VPN, wireless networks, mobile networks...).<br>CO5: Practical and subject specific skills (Transferable Skills). |
| 12 | 10M11CI114 | High Performance Computer Architecture | CO1: To evaluate and analyze cost and performance of multi-processor systems.<br>CO2: To develop and simulate assembly language programs on pipelined and serial architecture.<br>CO3: To develop, implement, and demonstrate the |

|  |  |  |  |
|---|---|---|---|
|  |  |  | learning through a project that meet stated specifications.<br>CO4: To understand and be able to explain different parallel architectures, interconnections and various memory organization in modern high-performance architectures. |
| 13 | 12B1WCI734 | C# and VB.NET | CO1: Learn about MS.NET framework developed by Microsoft.<br>CO2: You will be able to using XML in C#.NET specifically ADO.NET and SQL server<br>CO3: Be able to understand use of  C# basics, Objects and Types, Inheritance<br>CO4: To develop, implement and creating Applications with C#.<br>CO5: To develop, implement, and demonstrate Component Services, Threading, Remoting, Windows services, web<br>CO6: To understand and be able to explain Security in the .NET framework and Deployment in the .NET.<br>CO7: To develop Assemblies and Deployment in .NET, Mobile Application Development. |
| 14 | 15B1WCI731 | Mobile Computing | CO1: To acquire solid knowledge on mobile networks and mobile computing.<br>CO2: To develop applications that are mobile-device specific and demonstrate current practice in mobile computing contexts.<br>CO3: To understand the concepts of Adhoc and wireless sensor networks, and Mobile IP.<br>CO4: To be able to analyze the performance of different handoff, roaming, and location update algorithms for cellular networks.<br>CO5: To develop applications that are mobile-device specific and demonstrate current practice in mobile computing contexts. |
| 15 | 10B1WCI733 | Graph Algorithms and Applications | CO1: To present a rigorous introduction to the fundamentals of Graph Theory and Graph algorithms.<br>CO:2  To enable the students to model various applications from Computer Science and Engineering using Graphs,<br>CO:3  To introduce the techniques to store, manipulate and answer queries about a graph using a computer. |
| 16 | 10M11CI113 | Advanced Database Systems | CO1:To understand the basic Transaction Management in Databases.<br>CO2: To understand the concepts of Query processing and Query Optimization.<br>CO3: To know the important aspects of Single and Multilevel dynamic Indexing.<br>CO4: To understand the Data warehouse and Data mining.<br>CO5: To learn about how to find out the best query evaluation Plan.<br>CO6: To learn Query Optimization Techniques. |

|  |  |  |  |
|---|---|---|---|
|  |  |  | CO7: To understand how to apply appropriate known concurrency control techniques, recovery mechanism and query evaluation plan for a given scenario. |
| 17 | 12B1WCI733 | Advance JAVA | CO1: To learn the basic concepts of Internet Programming, using Java Applets<br>CO2: To create a full set of UI widgets using Abstract Windowing Toolkit (AWT) & Swings<br>CO3: Able to perform event handling on AWT and Swing components.<br>CO4: Learn to access database through Java programs, using Java Data Base Connectivity (JDBC)<br>CO5: To develop reusable software component, using Java Bean.<br>CO6: Understanding the multi-tier architecture of web-based enterprise applications using Enterprise JavaBeans (EJB). |
| 18 | 10B1WCI735 | Network Security and Cryptography Techniques (OE) | CO1: Understand the basic security services e.g.Authentication, Access Control, Confidentiality, Integrity, and Non repudiation).<br>CO2: Learn standard symmetric encryption algorithms<br>CO3: Learn the architecture for public and private key cryptography and how public key infrastructure (PKI) supports network security.<br>CO4: Learn the methods of digital signature and encryption<br>CO5: Learn key management and how key exchange protocols work.<br>CO6: Learn futuristic cryptographic techniques like Eliptic Curve and quantum cryptography. |
| 19 | 10M11CI111 | Advanced Data Structures | CO1: Analyze the asymptotic performance of algorithms.<br>CO2: Write rigorous correction proofs of algorithms.<br>CO3: Demonstrate a familiarity with major algorithms and data structure.<br>CO4: Apply important algorithmic design paradigms and method of analysis. |
| 20 | 13B1WCI731 | ARM based Embedded System Design | CO1: To learn the basic concepts of Computer Architecture.<br>CO2: To learn ARM Software Development Tools and ARM Architecture Fundamentals.<br>CO3: Understanding ARM Assembly Language Programming Basics.<br>CO4: To learn Programming Techniques for ARM. |
| 21 | 11B1WC1832 | Information Retrieval and Data Mining | CO1: To describe the concept of Data warehouse & its attributes<br>CO2:To study different data warehouse models, architectures and implementation<br>CO3:To understand the basic concept of data mining and its functionality<br>CO4:To understand the concept of classification techniques and its implementation |

| | | | |
|---|---|---|---|
| | | | CO5:To understand the concept of association rules, different techniques and implementation details<br>CO6:To understand the concept of cluster analysis, anomaly detection and its usage and implementation details |
| 22 | 10B1WC1731 | Artificial Intelligence | CO1:Demonstrate fundamental understanding of artificial intelligence (AI) and expert systems.<br>CO2:Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning.<br>CO3: Demonstrate proficiency in applying scientific method to models ofmachine learning.<br>CO4: Discuss the awareness of ANN and different optimizations techniques<br>CO5:Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning.<br>CO6:Demonstrate proficiency in applying scientific method to models of machine learning.<br>CO7:Discuss the basics of ANN and different optimizations techniques. |
| 23 | 10B1WC1737 | Image Processing | CO1: To understand how digital images are represented, manipulated, encoded and processed, with emphasis on algorithm design, implementation and performance evaluation.<br>CO2: Emphasis will be to develop engineering skills and intuitive understanding of the tools used in Image Processing.<br>CO3: The students would be encouraged to design and develop the image processing algorithms/tools to real life problems. |
| 24 | 18B1WCI731 | Python Programming | CO1: Familiarity about concepts of Python Programming. Broaden the knowledge about Variables, expressions and Functions in Python.<br>CO2: Broaden the knowledge about Branching and Iteration. To have<br>hands on skills on String Manipulation, Guess and Check, Approximations, Bisection<br>CO3: To learn about Decomposition Abstractions, Tuples, Lists,<br>CO4: Dictionaries and Illustrative programs:<br>Files, Modules, Packages and Testing, Debugging, Exceptions, Assertions:<br>CO5: Understanding and analyzing Object Oriented Programming:<br>CO6: To have hands on skills on Illustrative programs(examples Sorting and Searching, Regular expressions) and GUI |
| 25 | 10B19CI791 | Project Part I | CO1: To Plan/design and code, dependable software/hardware. |

|  |  |  |  |
|---|---|---|---|
|  |  |  | CO2: To act as catalyst in transferring the Computer Science and Engineering and Information Technology knowledge to field usage for the socio-economic development of the society. |
| 26 | 10B1WCI731 | Artificial Intelligence | CO1: Demonstrate fundamental understanding of artificial intelligence (AI) and expert systems.<br>CO2: Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning.<br>CO3: Demonstrate proficiency in applying scientific method to models of machine learning.<br>CO4: Discuss the awareness of ANN and different optimizations techniques<br>CO5: Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning.<br>CO6:Demonstrate proficiency in applying scientific method to models of machine learning.<br>CO7:Discuss the basics of ANN and different optimizations techniques. |
| 27. | 18B1WCI731 | Python Programming | CO1: Familiarity about concepts of Python Programming. Broaden the knowledge about Variables, expressions and Functions in Python.<br>CO2: Broaden the knowledge about Branching and Iteration. To have hands on skills on String Manipulation, Guess and Check, Approximations, Bisection<br>CO3: To learn about Decomposition, Abstractions, Tuples, Lists, Dictionaries and Illustrative programs: Files, Modules, Packages and Testing, Debugging, Exceptions, Assertions:<br>CO4: Understanding and analyzing Object Oriented Programming:<br>CO5: To have hands on skills on Illustrative programs(examples Sorting and Searching, Regular expressions) and GUI |
| 28. | 11B1WCI731 | Software Agents | CO1: Student shall deepen the generic skills to design and implement software agents, software agent's tools, architectures for a broad-based set of user-computer and automating systems in various domains.<br>CO2: Student will explore, study, evaluate, present several agent tools.<br>CO3: Teaching in this course is designed to engage the students in active and experiential learning by taking a problem solving and design oriented approach with special emphasis on real world applications. |
| 29. | 18B1WCI733 | Computational Techniques and Algorithms | CO1: Solve systems of linear equations using multiple methods, including Gaussian elimination and matrix inversion. Algorithms for vector and matrix operations. |

| | | | |
|---|---|---|---|
| | | | PositiveDefinite Systems, Cholesky Decomposition Decomposition, Sensitivity and round-off errors Least Squares Problem, OR Decomposition SVD and QR algorithm<br>CO2: Determine Eigen values and eigenvectors and solve Eigen value problems Iterative algorithms and Convergence |
| 30. | 10B19CI792 | Project Part- 1 | CO-1 To Plan/design and code, dependable software/hardware.<br>CO-2 To act as catalyst in transferring the Computer Science and Engineering and Information Technology knowledge to field usage for the socio-economic development of the society. |
| 31. | 18B1WCI733 | Advanced Algorithms | CO-1 Analyze the asymptotic performance of algorithms.<br>CO-2Write rigorous correction proof s of algorithms.<br>CO-3Demonstrate a familiarity with major algorithms and data structure.<br>CO-4Apply important algorithmic design paradigms and method of analysis. |
| 32. | 18B1WCI773 | Advanced Algorithms Lab | CO-1 Analyze the asymptotic performance of algorithms.<br>CO-2Write rigorous correction proof s of algorithms.<br>CO-3Demonstrate a familiarity with major algorithms and data structure.<br>CO-4 Apply important algorithmic design paradigms and method of analysis. |
| 33. | 19B1WCI731 | Computational Data Analysis | CO-1 To learn the basic concepts and terminology in statistics used in machine learning.<br>CO-2 To understand the concepts associated with the classification andexperimental evaluation of classification algorithms.<br>CO-3 To learn about clustering and unsupervised learning.<br>CO-4 To learn about various techniques for selecting relevant features selection.<br>CO-5 To learn about various techniques for enhancing the performance of basic machine learning algorithms. |
| 34. | 19B1WCI771 | Computational Data Analysis lab | CO1 To learn and implement the basic concepts and terminology in statistics used in machine learning.<br>CO2 To implement classification and clustering algorithms in python.<br>CO3 To implement feature selection methods in Python.<br>CO4 To compare different algorithms based on some common factors. |
| 35. | 18B1WCI774 | Cryptography& network security Lab | CO-1 Implement the cipher techniques.<br>CO-2 Apply the mathematical foundation required for various cryptographic algorithms.<br>CO-3 Develop the various security algorithms<br>CO-4 Design the signature scheme by applying Digital Signature Standard.<br>CO-5 Use different open source tools for network security and analysis. |

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY
IQAC
WAKNAGHAT

|  |  |  |  |
|---|---|---|---|
|  |  |  | CO-6 Demonstrate the intrusion detection system |
| 36. | 18B1WCI736 | Storage Networks | CO-1 Basics of Storage networks.<br>CO-2 Design and Implement the RAID Levels.<br>CO-3 Discussing algorithms related to storage networks.<br>CO-4 Designing the SAN, NAS, CAS, and DAS based storage networks.<br>CO-5 Concepts of Data Deduplication, and File Systems.<br>CO-6Discussion of advanced topics of Distributed storage networks, protocols, and architecture. |
| 37. | 19B1WCI736 | Information Auditing & Risk Management | CO-1To learn to explain why it is important to design interactive products that are usable, define key terms used in interaction design.<br>CO-2To learn to explain key theories used in the design of interactive products and to explain the importance of iteration, evaluation, and prototyping in interaction design.<br>CO-3To gather data in the context of developing a simple interactive product using suitable techniques.<br>CO-4To produce a low-fidelity prototype for an interactive product based upon a simple list of interaction design principles and to evaluate an interactive product using suitable techniques.<br>CO-5To communicate effectively to peers and specialists about requirements, design, and evaluation activities relating to interactive products.<br>CO-6To define a suitable program of user involvement that treats users ethically and fairly. |
| 38. | 19B1WCI737 | Optimization Methods in Business Analytics | CO-1 Comprehension of the design of the optimized algorithm.<br>CO-2 Demonstrate familiarity with major algorithms.<br>CO-3 Analyze the different types of algorithms.<br>CO-4 Apply algorithms for simulating the decision. |
| 39. | 18B1WCI840 | Computer Vision | CO1 Implement fundamental image processing techniques required for computer vision.<br>CO-2 Perform shape analysis and implement boundary tracking techniques.<br>CO-3 Apply chain codes and other region descriptors.<br>CO-4 Apply Hough Transform for line, circle, and ellipse detections.<br>CO-5Apply 3D vision techniques, implement motion-related techniques, and Develop applications using computer vision techniques. |
| 40. | 19B1WCI738 | Introduction to Deep Learning | CO-1 Linear regression: mean squared error, analytical solution.<br>CO-2 Logistic regression: model, cross-entropy loss, class probability estimation.<br>CO-3 Gradient descent for linear models. Derivatives of MSE and cross entropy loss functions.<br>CO-4 The problem of overfitting.<br>CO-5 Regularization for linear models. |

|  |  |  |  |
|---|---|---|---|
| 41. | 19B1WC1734 | Object-Oriented Technologies using Java | CO1 Understanding the features and concepts of Object-Oriented Programming using Java.<br>CO2 Defining classes, objects, constructors, methods in Java.<br>CO3 Inheritance, Interfaces, and Polymorphism.<br>CO4 Packages, Exception Handling, and Multithreading |
| 42. | 19B1WC1774 | Object-Oriented Technologies using Java Lab | CO1 Understanding the features and concepts of Object-Oriented Programming using Java.<br>CO2 Defining classes, objects, constructors, methods in Java.<br>CO3 Inheritance, Interfaces, and Polymorphism.<br>CO4 Packages, Exception Handling, and Multithreading. |
| 43. | 19B1WC1740 | Introduction to Statistical learning | CO-1Understanding statistical learning and, analyzing regression and classification.<br>CO-2 Analyzing resampling, model selection and regularization.<br>CO-3 Analyzing non-linear and tree based regression.<br>CO-4 Analyzing Support Vector Machines and unsupervised learning |
| 44. | 18B19CI791 | MAJOR PROJECT-I | CO 1: To Plan/design and code, dependable software/hardware.<br>CO 2: To act as catalyst in transferring the Computer Science and Engineering and Information Technology knowledge to field usage for the socio-economic development of the society. |

**Semester: VIII**

| SNo | Course Codes | Course Name | Course Outcomes |
|---|---|---|---|
| 1. | 10B19CI891 | Project Part 2 | CO-1 To Plan/design and code, dependable software/hardware.<br>CO-2 To act as catalyst in transferring the Computer Science and Engineering and Information Technology knowledge to field usage for the socio-economic development of the society. |
| 2. | 10M11CI211 | Advanced Algorithms | CO1: Analyze the asymptotic performance of algorithms.<br>CO2: Write rigorous correction proof s of algorithms.<br>CO3: Demonstrate a familiarity with major algorithms and data structure.<br>CO4: Apply important algorithmic design paradigms and method of analysis. |

| | | | |
|---|---|---|---|
| 3. | 10M11CI212 | Advanced Operating Systems | CO1: Able to implement a simple distributed application using a message based protocol.<br>CO2: To model connection-oriented and connectionless communication in a 2 tier Client Server architecture.<br>CO3: Able to distinguish the five main failure types in a Distributed System and specify algorithms for achieving fault tolerance and error recovery within such a system.<br>CO4: Implement a remote object based system to demonstrate parameter passing and code migration in a Distributed System.<br>CO5: To learn to achieve synchronisation among a group of processes in a distributed system.<br>CO6: To understand algorithms for determining global state, electing a co-ordinator for a group of communicating processes and implementing mutual exclusion in a Distributed System.<br>CO7: To be able to differentiate between client centric and data centric consistency models and describe protocols for implementing consistency models and updating replicas in a Distributed System. |
| 4. | 10M11CI213 | Advanced Software Engg | CO1: Review and understand the software Process.<br>CO2: Emphasise improvement in software Quality.<br>CO3: Review and understand various software architecture blueprints.<br>CO4: Practice software reuse and adopt common design patterns.<br>CO5: Understand component based software development.<br>CO6: Understand test driven software development the agile way.<br>CO7: Study software metrics and cost estimation techniques<br>CO8: Learn Professional software development tools and techniques. |
| 5. | 11B1WCI834 | Parallel Processing | CO-1: Describe different parallel processing architectures based on relationships between processing elements, instruction sequence, memory and interconnected network.<br>CO-2: Identify algorithms, which require parallelization as part of system design or performance enhancement.<br>CO-3. Classify shared and distributed memory parallel systems according to their properties and usage models<br>CO-4: Design and develop parallel algorithms for shared and distributed memory models.<br>CO-5: Evaluate the performance of parallel algorithms designed based on shared and distributed memory models as well as against serial based algorithm designs. |

| | | | |
|---|---|---|---|
| 6. | 11B1WCI835 | Storage Networks | CO-1: Understand various components and protocols used for creating storage networks.<br>CO-2: Learn about various technologies existing for storage networks.<br>CO-3: Explore Storage virtualization.<br>CO-4 Analyse techniques for management of storage networks.<br>About Data Centers and Distributed Storage Networks. |
| 7. | 11B1WCI836 | Network Management(OE) | CO1: Become familiar with the Network Management Standards.<br>CO2: Understand the SNMP protocols.<br>CO3: Understand how large-scale Network Management Systems operate.<br>CO4: Understand how large-scale Network Management Systems are configured.<br>CO5: Advanced network Management Tools and Systems.<br>CO6: Web Based Network Management Systems. |
| 8. | 12B1WCI831 | Cloud Computing | CO1: To learn the basic concepts, applications and terminology of cloud computing.<br>CO2: To understand different enabling technologies for Cloud computing environment.<br>CO3: To design Cloud computing data-center for effective utilization of available resources.<br>CO4: To study different managers related to Cloud computing services.<br>CO5: To understand different case studies of Cloud computing and its advance topics. |
| 9. | 13B1WCI731 | ARM Based Embedded System Design | CO1: To learn the basic concepts of Computer Architecture.<br>CO2: To learn ARM Software Development Tools and ARM Architecture Fundamentals.<br>CO3: Understanding ARM Assembly Language Programming Basics.<br>CO4: To learn Programming Techniques for ARM. |
| | 13B1WCI831 | Service Oriented Architecture | CO-1: To gain understanding of the basic principles of service orientation.<br>CO-2: To learn service oriented analysis techniques.<br>CO-3: Learn technology underlying the service design. |
| 10. | 14M1WCI431 | Parallel Programming Techniques | CO-1: Describe different parallel processing architectures based on relationships between processing elements, instruction sequence, memory and interconnected network.<br>CO-2: Identify algorithms, which require parallelization as part of system design or performance enhancement.<br>CO-3: Classify shared and distributed memory parallel systems according to their properties and usage models.<br>CO-4: Design and develop parallel algorithms for shared and distributed memory models.<br>CO-5: Evaluate the performance of parallel algorithms |

| | | | |
|---|---|---|---|
| | | | designed based on shared and distributed memory models as well as against serial based algorithm designs. |
| 11. | 15B1WCI831 | Wireless Sensor Networks-Protocols and Applications(OE) | CO-1 Architect sensor networks for various application setups.<br>CO-2 Explore the design space and conduct trade-off analysis between performance and resources.<br>CO-3 Assess coverage and conduct node deployment planning.<br>CO-3 Devise appropriate data dissemination protocols and model links cost.<br>CO-4 Determine suitable medium access protocols and radio hardware.<br>CO-5 Prototype sensor networks using commercial components.<br>CO-6 Provision quality of service, fault-tolerance, security and other dependability requirements while coping with resource constraints.<br>CO-7 Evaluate the performance of sensor networks and identify bottlenecks.<br>CO-8 Explore Security', routing Protocol and information Fusion in WSN. |
| 12. | 15B1WCI832 | Internet of Things Architecture | CO-1: Understand the basics of IoT, The various IoT protocols and applications of various IoT technologies.<br>CO-2: Learn the basics of Contiki OS and standardized protocols for IPv6 Low power networking.<br>CO-3 Understand the IEEE 802.15.4 standard and 6 LoWPAN technology.<br>CO-4 Understand the RPL protocol and to understand the various routing Issues in IoT.<br>CO-5 Analyse the security issues, data collection and distributed computing. |
| 13. | 15B1WCI833 | Big Data Analytics | CO-1 Understand the need for Big Data Analytics.<br>CO-2 Master the concepts of large scale file systems and map reduce framework.<br>CO-3 Master the concepts of mining data streams.<br>CO-4 Master the concepts of Link analysis and frequent item sets discovery from Big data.<br>CO-5 Master the concepts of clustering for streams and parallelism. |

| | | | |
|---|---|---|---|
| 14. | 17B1WCI811 | Mobile and Distributed Computing | CO-1: Introduce enabling technologies of pervasive computing.<br>Co-2 Acquire solid knowledge on mobile networks and mobile computing.<br>CO-3: Develop applications that are mobile-device specific and demonstrate current practice in mobile computing contexts.<br>CO-4: Understand the concepts of Ashco and wireless sensor networks.<br>CO-5: Understand the concepts of Mobile IP.<br>CO-6: To be able to analyse the performance of different handoff, roaming, and location update algorithms for cellular networks.<br>CO-7: Awareness of professional and ethical issues, in particular those relating to security and privacy of user data and user behaviour.<br>CO-8 Describe the possible future of mobile computing technologies and applications. |
| 15. | 17B1WCI812 | Computer Games | CO-1: Discuss games and game design. It includes the history and philosophy of games, the game production process.<br>CO-2: Discuss introduction to the electronic game design and development careers.<br>CO-3: Discover what the components of games are, and what parts of games are influenced by their design.<br>CO-4: Learn several ways to approach the design of a game, and processes and best practices for prototyping, play testing and balancing a game after it has been designed. |
| 16. | 17B1WCI814 | Design and Analysis of Real-World Algorithms | CO-1: To acquire knowledge of Machine learning algorithms.<br>CO-2: To gain knowledge on the notions Cryptographic algorithms.<br>CO-3: To have hands on Network Algorithms and their applications in problem solving.<br>CO-4: To have hands on skills to evaluate Compression algorithms and their applications and implementations in day to day problem solving.<br>CO-5: To evaluate different kinds of Geometry and graphics algorithms and their applications and implementations in simulations.<br>CO-6: To gain understanding of Algorithms for Big Data : representation and algorithms. |
| 17. | 18B1WCCI842 | R Programming and Application | CO1: To identify the usages of available R packages and associated Open Source software to meet different scientific objectives.<br>CO2: To understand how to programming in R, reading data into R, accessing R packages.<br>CO3: Able to write R functions, debugging, profiling R code, and organizing and commenting R code.<br>CO4: To design and write efficient programs using R to |

| | | | |
|---|---|---|---|
| | | | perform routine and specialized data manipulation/management and analysis tasks.<br>CO5: To do data analysis using R for real life applications. |
| 18. | 18B1WCI831 | Deep Learning | CO1: Variability models (deformation model, stochastic model).<br>CO2: Properties of CNN representations: invertibility, stability, invariance.<br>CO3: Covariance/invariance: capsules and related models.<br>CO4: Other tasks: localization, regression.<br>CO5: Dynamical systems: RNNs.<br>CO6: Autoencoders (standard, denoising, contractive, etc etc)<br>CO7: Maximum Entropy Distributions.<br>CO8: Non-convex optimization for deep networks.<br>CO9: Stochastic Optimization. |
| 19. | 18B1WCI832 | Machine Learning Algo | CO1: To learn the basic concepts and terminology in machine learning.<br>CO2: To learn about the definition of learning systems, their goals and applications in machine learning.<br>CO3: To understand concepts associated with classification and experimental evaluation of classification algorithms.<br>CO4: To learn concepts associated with decision trees and experimental evaluation of classification algorithms.<br>CO5: To learn about instance-based learning, clustering and unsupervised learning. |
| 20. | 18B1WCI836 | Block Chain Technologies | CO1: Explain how bitcoin works, from when a transaction is created to when it is considered part of the blockchain.<br>CO2: Thoroughly explain private and public keys as well as addresses and how exactly they are constructed and used.<br>CO3: Expose students to the different kinds of forking and explain the Bitcoin's network mechanisms for maintaining and upgrading.<br>CO4: Decompose a blockchain system's fundamental components, how they fit together and examine a modular blockchain system in more detail.<br>CO5: Detailed understanding of naïve Attacks and Trustless Networks of block chain.<br>CO6: Provide a thorough understanding of smart contracts, their technical capabilities, practical applications, limitations and security constraints they operate within.<br>CO7: Explain to students both fundamental and implied differences between Ethereum and Bitcoin protocol by covering historical, conceptual and architectural |

| | | | |
|---|---|---|---|
| | | | distinctions. |
| 21. | 18B1WCI838 | Secure Web Application Development | CO1: Veracode offers multiple analysis techniques for identifying vulnerabilities.<br>CO2: Web Application Discovery and Monitoring tools perform scans to discover and inventory all external web applications, even the apps that organizations didn't know were still running.<br>CO3: Static Application Security Testing (SAST) scans applications from the "inside out", reviewing static code for common vulnerabilities such as cross-site scripting and SQL injection.<br>CO4: Dynamic Application Security Testing (DAST) searches for flaws in software already in production and does not require access to source code.<br>CO5: Manual penetration testing enables development teams to find vulnerabilities such as authorization issues and business logic flaws that can only be discovered with the help of a skilled penetration tester. |
| 22. | 18B1WCI839 | Natural Language Processing Tech | CO1: Understand Natural Language Processing (Understanding).<br>CO2: Probabilistic model of defining language and techniques.(Application)<br>CO3: ApplyingHidden Markov modeland SpeechRecognition.(Application)<br>CO4: Application of context free grammar and language parsing.(Application) Implement probabilistic and language parsing.(Application)<br>CO5: Differentiation of semantic and discourse in terms of NLP.(Analyse) |
| 23. | 18BIWCI832 | Social and Information Network Analysis | CO-1. Understand what constitutes a social network.<br>CO-2. Represent networks in graph-theoretic language.<br>CO-3. Design effective and reliable network research projects.<br>CO-4. Configure network and attribute data for standard software packages.<br>CO-5. Comprehend the reasons for using, and principles of, permutation tests.<br>CO-6. Apply centrality measures appropriately. |
| 24. | 19BIWCI831 | Ethics and Information Technology | CO-1 Demonstrate knowledge of current models of information and computer ethics.<br>CO-2 Apply ethical theories to interpret personal and group behavior when using a variety of information technology tools.<br>CO-3 Evaluate the nature of ethical choices made by self and others when serving various roles that expose social and multicultural differences.<br>CO-4 Construct written arguments in a variety of formats on the evolving nature of ethical norms relating to new technologies. |

| | | | |
|---|---|---|---|
| 25. | 19BIWCI832 | Probabilistic Graphical Models | CO-1 Learn introductory concepts in probabilistic graphical models.<br>CO-2 Able to model problems using graphical models.<br>CO-3 Able to model problems using design inference algorithms.<br>CO-4 Analyse the structure of the graphical model from data. |
| 26. | 19BIWCI833 | Information Modelling | CO-1 Understand the basics of information modelling application and their usages in different areas.<br>CO-2 To be familiar with the basics of various modelling techniques.<br>CO-3 Ability to apply modelling techniques on real-life scenarios to solve them easily.<br>CO-4 Ability to apply information modelling with Linked data. |
| 27. | 19BIWCI835 | Cloud Computing Security | CO-1 To understand the use of cloud computing.<br>CO-2 A different technique to secure the cloud.<br>CO-3 Different types of attacks on the cloud.<br>CO-4 Identify the known threats, risks, vulnerabilities. |
| 28. | 19BIWCI837 | Reinforcement Learning | CO-1 Understanding the basic concepts of Reinforcement Learning.<br>CO-2 Understanding Probability Primer Techniques in detail.<br>CO-3 Learning & implementing various methods & techniques such as TD methods, Monte Carlo, Markov Decision Process, etc.<br>CO-4 Learning & understanding policy gradients along with its advantages and disadvantages. |
| 29. | 19BIWCI839 | Foundations of Blockchain | CO-1 Explain how bitcoin works, from when a transaction is created to when it is considered part of the blockchain.<br>CO-2 Thoroughly explain private and public keys as well as addresses and how exactly they are constructed and used.<br>CO-3 Expose students to the different kinds of forking and explain the Bitcoin's network mechanisms for maintaining and upgrading.<br>CO-4 Decompose a blockchain system's fundamental components, how they fit together and examine a modular blockchain system in more detail.<br>CO-5 Detailed understanding of naïve Attacks and Trustless Networks of block chain.<br>CO-6 Provide a thorough understanding of smart contracts, their technical capabilities, practical applications, limitations and security constraints they operate within.<br>CO-7 Explain to students both fundamental and implied differences between Ethereum and Bitcoin protocol by covering historical, conceptual and architectural distinctions. |

|  |  |  |  |
|---|---|---|---|
| 30. | 20B1WCI772 | From Graph to Knowledge Graph Lab | CO-1 Build a knowledge graph from documents.<br>CO-2 Building a knowledge graph from a text.<br>CO-3 Build a Small Knowledge Graph.<br>CO-4 Understand the Graph Databases.<br>CO-5 Familiarity with graph computing Frameworks.<br>CO-6 Able to Visualization of graphs. |
| 31. | 20BIWCI732 | From Graph to Knowledge Graph | CO-1 Learn graph representations.<br>CO-2 Utilize fundamentals to build knowledge graphs.<br>CO-3 Understand the algorithms and techniques for crawling web sites, structured data extraction, and information extraction from unstructured text.<br>CO-4 Understand how to apply the tools and infrastructure to build and query knowledge graphs. |
| 32. | 18B19CI891 | MAJOR PROJECT-II | CO 1: To Plan/design and code, dependable software/hardware.<br>CO 2: To act as catalyst in transferring the Computer Science and Engineering and Information Technology knowledge to field usage for the socio-economic development of the society. |