



SATHYABAMA

**INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)**

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SCHOOL OF COMPUTING

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

1.2.1 New Course Introduced during 2023- 2024

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B.E Computer Science and Engineering with Specialization In Artificial Intelligence

S11BLH11	PROGRAMMING IN C	L	T	P	EL	Credits	Total Marks
		2	0	4	0	4	100

COURSE OBJECTIVES

- To understand the concepts of variables, operators, control structures and arrays.
- To gain knowledge on functions, structures and union in C.
- To explore the concepts of pointers and files to create real world applications using C.

UNIT 1 BITS AND BYTES IN COMPUTING**12 Hrs.**

Computers: Hardware – Software – Processor – Memory – I/O devices – Interface – Programming Languages – Evolution from COBOL, FORTRAN to C, Python – Need

Algorithms: Role in problem solving – Analysis – Design – Flowcharts: Role in problem solving – Symbols – Design – Pseudo code: Role in problem solving – Design – Program: Role in problem solving – Design Practice: Describe a simple real world problem in your domain of interest and describe it in the form of problem statement, input, output and provide its solution in terms of algorithm, flowchart, pseudo code and program.

UNIT 2 C: MATH BEHIND CODING**12 Hrs.**

C: Structure of program – Character set – Tokens – Keywords – Identifiers – Constants – Variables – Data types – Strings – Operators and its types – Functions – Header Files

Algorithmic Strategies: Iteration and Recursion – Efficiency – Role of time and space consumption while building an algorithm – Complexities

Practical:

- Describe a simple real world problem in your domain of interest and provide a computing and non-computing solution for the same. Calculate the time and space consumed in both solutions. Compare and contrast the pros and cons in both solutions.
- Write an algorithm, flowchart, pseudo code followed by a simple C code to do find the Factorial and Fibonacci series using both iteration and recursion.
- Input the number of days taken to cultivate both rice and wheat in turns in an agricultural land from the user. Write a C program to display the days as years, months and days using simple operators.
- You have a circular plot for building playground and a rectangular plot for building an apartment. Get the input from the user for both plots and write a C program to calculate the area and perimeter of both plots.

UNIT 3 C: MAGIC BEHIND INSTANT OUTPUTS**12 Hrs.**

Advanced Coding Concepts: Decision Making using branching statements and its types – Decision making using looping statements and its types – Switch statements – Break – Continue – Goto – Jump statements.

Case Study: Fun with Code -- Printing Alphabets / Flags of Countries / Flying Alphabet Screensaver. Practical:

- Describe a problem statement in your domain of interest whose solution involves repetition of same steps and provide code as solution involving for, while and do while loops.
- Describe a problem statement in your domain of interest whose solution involves decision making and provide code as solution involving if-else, nested if-else and ladder if-else.
- Develop a simple scientific calculator using Switch case statement.
- A Cartesian co-ordinate system has four quadrants. Write a C program to find the quadrant of the co-ordinate points given by the user using both if-else and nested if-else control structure.
- Given a rose flower to you, dismantle the petals of the flower from inside, if you notice - it follows

the sequence of Fibonacci. Now, try to arrange the word "PIZZA" in several ways without repeating and calculate number of ways it can be done using factorial concept. Write a C program to find both Fibonacci and factorial by getting the mentioned input.

1. Product of two large prime numbers is used as encryption key in encryption algorithms. Write a C program to display all the prime numbers between 1 to 100 and give the first two largest numbers as the output.

UNIT 4 STORING GROUP OF HOMOGENOUS ELEMENTS: ARRAYS 12 Hrs.

Diving into Arrays: Definition – Syntax – Types – Representation: Row and Column Order – Dynamic Arrays. Idea behind Functions: Declaration – Definition – Types – Calling – Arguments – Prototypes – Call by Value – Call by Reference – Pointers – Amalgamation of Pointers with Arrays and Strings.

Case Study: Fun with Code – Simple Game Development using Arrays and Functions. Practical:

- Describe a problem statement in your domain of interest where you need to work with group of same type of data. Provide a solution in terms of C program to store and manage the data effectively.
- You're playing UNO cards, suddenly a person is getting rev card. Write a C program to reverse the round by storing the number of players in array.
- Write a C program for Vehicle Regulation System where odd number ending vehicles can use the road on odd days and even number ending vehicles can use the road on even days using two separate arrays to store and display the odd and even numbers.
- Write a C program to do the following applications in array:
 - a. (i). Get set of positive and negative integers from user, replace positive integers by 0 in the array.
 - b. (ii). Reverse the floating point numbers stored in the array.
 - c. (iii). Return the smallest value and largest value position in the array.
 - d. (iv). Search the number '5' in array and replace it with '10'
- Write C program to do the following string handling applications.
 - a. (i). Get favourite actor and actress name, concatenate it and display
 - b. (ii). Display your name in uppercase, lowercase and as fname and lname.
 - c. (iii). Count the frequency of "the" in any sentence and delete it from sentence.
 - d. (iv). Check whether the given string is a palindrome or not.
- Write a C program for counting the total number of duplicate elements in an array, print all the unique elements in the same array as two different functions.
- Write a C program to sort the elements in an array in both ascending and descending order using two different functions.
- Write a C program to find the largest and smallest number in an array using recursion and to convert the output into a binary number.
- Write a C program to swap two numbers using two functions, one using pointers and the other one without using pointers.

UNIT 5 STORING GROUP OF HETEROGENOUS ELEMENTS: STRUCTURE 12 Hrs.

Outset of Structure and Union: Structure definition and declaration – Structures fusion with Arrays – Pointers – Functions – Union initiation, Definition and declaration – Memory allocation- Static and dynamic Working with Files: File handling functions – Read – Write – Other operations – Different file types Case Study: Report on using file functions to create score board for any game, importing it to program Practical:

- Describe a problem statement in your domain of interest where you need to work with group of different type of data. Provide a solution in terms of C program to store and manage the data

effectively.

- Write a C program to get the details of the student (roll no, name, date of birth, state, 10th percentage and 12th percentage) using structure. Calculate the age of the student and display the eligibility status for his admission.
 - a. Eligibility criteria: more than 60 percent in 10th and 12th, age $\geq$ 17, state==TN.
- Write a menu driven C program for library management system with ten entries:
 - a. (i). Add Book (ii). Add Author (iii). Add Category (iv). Book Cos (v). Display - Book by Author, Book by Category, Book under cost
- Write a C program to create an employee Union with employee details (id, name, salary) Accept the details of 'n' employees, rearrange the data in ascending order of employee name, id and salary as three different functions and display it.

Complex Practice Problems

- Design a C program by creating your own header file for any function of your choice and display the output by calling the header file.
- Create TIC-TAC-TOE game using C Language.
- Given a situation, you are going to ATM to withdraw money. Write a C program, get the money requested from the user as input and display the number of possible bank notes for the requested money. Note: Give input as number ending in 0's or 5's.
- Develop a C program for managing Car Rental process with various modules for registration as new user, login, get id proof, keep track of cars available and cars given for rental.
- Create SUDOKU game using C Language.

Max. 60 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1** - Interpret the difference between components of problem solving such as algorithm, flowchart, pseudo code and source code.
- CO2** - Build simple solutions for any given problem statement using various components of problem solving techniques and measure its efficiency in terms of time and space.
- CO3** - Examine the roots and foundation of C programming's key concepts like Data types, Operators. **CO4** - Design applications using different core concepts such as Arrays and Functions in C language. **CO5** - Formulate real time solutions through programs using Structure and Union in C language.
- CO6** - Develop various applications for solving real time societal problems.

TEXT / REFERENCE BOOKS

1. Yashavant Kanetkar, "Let us C", BPB Publications, Fourteenth Edition, 2019.
2. R.G.Dromey, "How to Solve it by Computer", Pearson Education, 2008..
3. Balagurusamy, "Programming in ANSI C", McGraw Hill Publications, Eighth Edition, 2019.
4. Greg Perry, Dean Miller "C Programming Absolute Beginner's Guide", Third Edition, 2013.

SCSB1231	DATA AND INFORMATION SCIENCE	L	T	P	EL	Credits	Total Marks
		3	0	0	0	3	100

COURSE OBJECTIVES

- Learn how to process raw data into formats necessary for analysis
- Conquer in-depth knowledge of data science concepts through motivating real-world case studies.
- Understand the methods and principles of data handling and big data.

UNIT 1 DATA ACQUISITION

9 Hrs.

Data Acquisition–Sources of acquiring the data - Internal systems and External systems- Web APIs, Data preprocessing- Exploratory Data Analysis (EDA)- Basic tools (plots, graphs and summary statistics) of EDA -Open Data Sources, Data APIs, Web Scrapping -Relational Database access (queries) to process/access data.

UNIT 2 DATA PREPROCESSING AND PREPARATION

9 Hrs.

Data Munging, Wrangling - Data Visualization Basics -Plyr packages - Cast/Melt. Tableau: Creating Visualizations in Tableau- Data hierarchies, filters, groups, sets, calculated fields-Map based visualizations-Build interactive dashboards-Data Stories.

UNIT 3 DATA QUALITY AND TRANSFORMATION

9 Hrs.

Data imputation -Data Transformation (minmax, log transform, z-score transform etc.,). - Binning, Classing and Standardization. - Outlier/Noise& Anomalies.

UNIT 4 HANDLING TEXT DATA

9 Hrs.

Bag-of-words- Regular Expressions - Sentence Splitting and Tokenization - Punctuations and Stop words, Incorrect spellings - Properties of words and Word cloud - Lemmatization and Term-Document TxD computation -Sentiment Analysis (Case Study).

UNIT 5 PRINCIPLES OF BIG DATA

9 Hrs.

Introduction to Big Data - Challenges of processing Big Data (Volume, Velocity and Variety perspective)
- Use Cases.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course the student will be able to **CO1** -

Explore the fundamental concepts of Data science. **CO2** -

Identify and execute the basic data format.

CO3 - Understand basics of Data Preprocessing and Data Visualization.

CO4 - Improve the Data quality through various transformations.

CO5 - Implement the methods of handling text data.

CO6 - Analyze and understand the basics of Big Data.

TEXT / REFERENCE BOOKS

1. Data Science at the Command Line, Jeroen Janssens, O'Reilly, 2015, ISBN 978-1-491-94785-2.
2. Python for Data Analysis, Wes McKinney, O'Reilly, 2018, ISBN-13: 978-1-491-95766.
3. Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk from The Frontline. O'Reilly. 2014.
4. Avrim Blum, John Hopcroft and Ravindran Kannan. Foundations of Data Science.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks:100****Exam Duration: 3 Hrs.****PART A :** 10 questions of 2 marks each; No choice**20 Marks****PART B :** 2 questions from each unit of internal choice; each carrying 16 marks**80 Marks**

S11BLH21	PROGRAMMING IN PYTHON	L	T	P	EL	Credits	Total Marks
		3	0	2	1	4	100

COURSE OBJECTIVES

- To learn about data structures lists, tuples, and dictionaries in Python.
- To build packages with Python modules for reusability and handle user/custom exceptions.
- To create real world GUI applications, establish Database connectivity and Networking.

UNIT 1 INTRODUCTION TO PYTHON

12 Hrs.

History of Python- Introduction to the IDLE interpreter (shell) - Data Types - Built-in function – Conditional statements - Iterative statements- Input/output functions - Python Database Communication - data analysis and visualization using python.

Practical:

- Implement built-in functions and trace the type of data items.
- Implement concepts of Conditional and Iterative Statements.
- Use the built-in csv module to read and write from a CSV file in Python.
- Perform data analysis and visualization on a given dataset using Python libraries like pandas, numpy, matplotlib and display charts, graphs, and plots.

UNIT 2 OBJECT ORIENTED CONCEPTS

12 Hrs.

Class – Objects – Constructors – Polymorphism – Encapsulation -Inheritance -Data Abstraction- Method Overloading-Method Overriding-Database Access-Data Hiding-Import Class.

Practical:

- Execute concepts on Polymorphism, Encapsulation.
- Implement Data Abstraction and Inheritance.
- Differentiate Method Overloading and Overriding.
- Create a class called "Person" with attributes "name" and "age." Make the "age" attribute private and implement a getter method to access it.
- Create a module called "math_operations.py" with a class called "Calculator." Import the "Calculator" class into another script and use its methods to perform mathematical operations.

UNIT 3 FILES AND EXCEPTIONS HANDLING, MODULES, PACKAGES

12 Hrs.

File Operations –Iterators - Exception handling - Regular Expressions- Functions and modules-Import Statement Introduction to PIP-Installing Packages via PIP-Using Python Packages.

Practical:

- Create a text file called "numbers.txt" and write the numbers from 1 to 10 in words, each on a separate line.
- Implement a custom iterator that generates a sequence of Fibonacci numbers and print the first 10 numbers.
- Create a try-except block to catch a File Not Found Error and print a message when a file is not found.
- Write a Python program that handles a Zero Division Error and prints a custom error message to the console.
- Create a module called "greetings.py" with a function called "hello" that prints "Hello, World!" Import the module into another script and use the "hello" function.
- Install the "numpy" package using PIP. Import the package and create a NumPy array with random values.

UNIT 4 GUI PROGRAMMING**12 Hrs.**

GUI Programming in Python - Introduction to GUI library - Layout management - Events and bindings - Fonts – Colors - Canvas - Widgets (frame, label, button, check box, entry, list box, message, radio button, text, spin box).

Practical:

- Design a GUI form with a vertical box layout that includes labels and entry fields for user registration information.
- Create a GUI window with a grid layout that contains buttons representing a 3x3 game board.
- Create a canvas in your GUI program and draw simple shapes such as rectangles, circles, and lines.
- Create a GUI form program that includes various widgets and implement event handling Concepts also add Create a drop-down menu that allows users to select different font styles for text display.

UNIT 5 DATABASE AND NETWORK**12 Hrs.**

Database (using NoSQL): Connector Module –Cursor – Statements - Exceptions in database. Network connectivity: Socket module - Client – Server –Email – URL Access.

Practical:

- Connect to the NoSQL database using a Python connector module, such as "pymongo" for MongoDB or "cassandra-driver" for Cassandra.
- Use a cursor to iterate over the records in a collection/table and print specific fields/attributes.
- Implement error handling for specific scenarios, such as duplicate key violation or record not found, in the NoSQL database.
- Implement either a TCP/IP or UDP client-server application using the socket module for sending and receiving messages.
- Write a program using the smtplib module to send an email from a specified email address to another recipient.

Max. 60 Hrs.**COURSE OUTCOMES**

On Completion of the course, student will able to

- C01** - Describe the Numbers, Math functions, Strings, List, Tuples and Dictionaries in Python.
- C02** - Do the decision making and write functions in Python.
- C03** - Explain how to design GUI Applications in Python and evaluate different database operations.
- C04** - Design and develop Client Server network applications using Python.
- C05** - Ability to design real life situational problems and think creatively about solutions of them.
- C06** - Apply the best features of mathematics, engineering and natural sciences to program real life problems.

TEXT / REFERENCE BOOKS

1. Y. Daniel Liang, "Introduction to Programming Using Python", Pearson,2013.
2. Python Notes for Professionals by Stack Overflow Documentation (<https://books.goalkicker.com/PythonBook/>)
3. Dr. Charles R. Severance, "Python for Everybody- Exploring Data Using Python 3", 2016.
4. Paul Gries, Jennifer Campbell, Jason Montojo, "Practical Programming: An Introduction to Computer Science using Python 3", Pragmatic Bookshelf, 2nd Edition,2014.

S731BLH22	DATA STRUCTURES & ALGORITHMS	L	T	P	EL	Credits	Total Marks
		3	0	2	0	4	100

COURSE OBJECTIVES

- To impart the basic concepts of data structures and algorithms.
- To be familiar with writing recursive methods
- To implement operations on Linked List, Stack and Queues.
- To implement traversal operations of trees and graphs.
- To understand concepts about various algorithm design techniques, searching and sorting techniques.

UNIT 1 INTRODUCTION TO ALGORITHMS**12 Hrs.**

Introduction to Data vs Information - Data Structures - Classification – Abstraction - Abstract data types (ADT) - Array - characteristics - Storage Representations. Array Order Reversal- Recursion- Array operations, Algorithm- complexity – Time and Space trade off.

Practical Exercise:

1. Python program to find the sum of all elements of an array
2. Python program to find a series in an array consisting of characters
3. Python program to find the occurrence of a particular number in an array
4. Python program to find the largest element in an array
5. Python program for array rotation

UNIT 2 LINKED LIS**12 Hrs.**

Array Vs Linked List – Singly linked list - Representation of a linked list in memory - Operations on a singly linked list - Merging two singly linked lists into one list - Reversing a singly linked list – Polynomial Manipulation using List - Advantages and disadvantages of singly linked list - Circular linked list - Doubly linked list - Circular Doubly Linked List.

Practical Exercise:

1. Program to implement operations on a Singly linked list.
2. Program to implement operations on a doubly linked list

UNIT 3 STACKS & QUEUE**12 Hrs.**

Introduction – Array Representation of a Stack – Linked List Representation of a Stack - Stack Operations - Algorithm for Stack Operations - Stack Applications: Tower of Hanoi - Infix to postfix Transformation - Evaluating Arithmetic Expressions. Queue – Introduction – Array Representation of Queue – Linked List Representation of Queue - Queue Operations - Algorithm for Queue Operations -. Queue Applications: Priority Queue.

Practical Exercise:

1. Program to implement a Stack using an array and Linked list.
2. Program to implement Queue using an array and Linked list.
3. Program to implement Circular Queue.

UNIT 4 TREES AND GRAPHS**12 Hrs.**

Preliminaries of Tree ADT - Binary Trees - The Search Tree ADT–Binary Search Trees - AVL Trees - Tree Traversals - B-Trees - Heap Tree – Preliminaries of Graph ADT - Representation of Graph – Graph Traversal - BFS – DFS – Applications of Graph – Shortest - Path Algorithms – Dijkstra's Algorithm

Minimum Spanning Tree – Prims Algorithm Practical**Exercise:**

1. Program to convert an infix expression to postfix expression.
2. Program to implement BFS and DFS
3. Program to implement N Queens problem.
4. Program to implement Binary Tree Traversal
5. Program to implement Travelling Salesman Problem

UNIT 5 ALGORITHM DESIGN TECHNIQUES & SEARCHING AND SORTING TECHNIQUES**12 Hrs.**

Divide and Conquer Strategy – Greedy Algorithm – Dynamic Programming – Backtracking Strategy - List Searches using Linear Search - Binary Search - Fibonacci Search - Sorting Techniques - Insertion sort - Heap sort - Bubble sort - Quick sort - Merge sort - Analysis of sorting techniques.

Practical Exercise:

1. Program to sort the elements using insertion sort.
2. Program to sort the elements using quick sort.
3. Program to sort the elements using merge sort.
4. Program to find an element using Linear and Binary Search.

Max. 60 Hrs.**COURSE OUTCOMES**

On completion of the course, student will be able to

- CO1** - Understand the concept of recursive algorithms.
- CO2** - Demonstrate the different types of data structures.
- CO3** - Able to understand the operations on linear data structures.
- CO4** - Summarize searching and sorting techniques.
- CO5** - Choose appropriate data structure as applied to specified problem definition.
- CO6** - Understand and implement the various algorithm design techniques.

TEXT / REFERENCE BOOKS

1. Jean-Paul Tremblay, Paul G. Sorenson, 'An Introduction to Data Structures with Application', TMH, 2017.
2. Richard F. Gilberg, Forouzan, "Data Structures", Cengage, 2004, 2nd Edition.
3. Larry R. Nyhoff, ADTs, Data Structures, and Problem Solving with C++, Prentice Hall Editin, 2004.
4. Thomas H. Cormen, Charles E. Leiserson, "Introduction to Algorithms", 3rd Edition, 2010.

B.E Computer Science and Engineering With Specialization In Data Science

SCSB1232	EXPLORATORY DATA ANALYSIS	L	T	P	EL	Credits	Total Marks
		3	0	0	0	3	100

COURSE OBJECTIVES

- To focus on the significance of data and software tools.
- To emphasize the relationship between variables and gain knowledge about univariate data analysis.
- To explore multivariate data analysis and visualize the data.

UNIT 1 INTRODUCTION**9 Hrs.**

EDA fundamentals – Understanding data science – Significance of EDA – Making sense of data - Comparing EDA with classical and Bayesian analysis – Software tools for EDA – Visual Aids for EDA- Data transformation techniques-merging database, reshaping and pivoting, Transformation techniques.

UNIT 2 THE EXPLORATORY PERSPECTIVE**9 Hrs.**

Introduction: Overview – Sources of Data – Process for Making Sense of Data - Describing Data: Observations and Variables – Types of Variables – Central Tendency – Distribution of the Data – Confidence Intervals – Hypothesis Tests - Distributions of Single Variables.
 Displaying Data: The Stem and Leaf – Summarizing Data – Resistant Statistics and Number Summaries - The Box and Whisker -Understanding Data: Skewness – Outliers – Gaps and Multiple Peaks.

UNIT 3 RELATIONSHIPS BETWEEN VARIABLES**9 Hrs.**

Preparing Data Tables: Cleaning - Displaying Relationships =The Scatter Plot –Summarizing Relationships – Fitting A Line – Smoothing the Data – Median and Hinge Traces –Examining Residuals – Understanding Relationships: Outliers – Nonlinear Monotonic Relationships.

UNIT 4 REEXPRESSION AND UNIVARIATE ANALYSIS**9 Hrs.**

Choosing Re-expressions: Nonlinear Monotonic Functions – Nonmonotonic Functions. Introduction to Single variable: Distribution Variables – Numerical Summaries of Level and Spread -Scaling and Standardizing – Inequality - Univariate data: measures of center and spread, transformations.

UNIT 5 MULTIVARIATE ANALYSIS AND VISUALIZATION**9 Hrs.**

Introducing a Third Variable – Causal Explanations – Three-Variable Contingency Tables and Beyond - Bivariate Analysis – Multivariate Analysis – Casual Analysis.
 Basics of Matplotlib, Plotting with Pandas and Seaborn, Other Python Visualization Tools.

Max. 45 Hrs.**COURSE OUTCOMES**

On completion of the course, student will be able to:

- CO1** - Understand about the significance of exploratory data analysis.
- CO2** - Analyze the data statistically.
- CO3** - Summarize data and understanding their relationship.
- CO4** - Perform univariate data exploration and analysis.
- CO5** - Apply multivariate data exploration and analysis.
- CO6** - Perform data exploration and visualization techniques.

TEXT / REFERENCE BOOKS

1. Glenn J. Myatt, Wayne P. Johnson – Making Sense Of Data | A Practical Guide To Exploratory Data Analysis And Data Mining, Second Edition, 2014.
2. Frederick Hartwig, Brian E. Dearing , Exploratory Data Analysis, 1979.
3. Suresh Kumar Mukhiya, Usman Ahmed, Hands-On Exploratory Data Analysis with Python, Packt Publishing, 2020.
4. Jake Vander Plas, “Python Data Science Handbook: Essential Tools for Working with Data”, First Edition, O Reilly, 2017.
5. Catherine Marsh, Jane Elliott, Exploring Data: An Introduction to Data Analysis for Social Scientists, Wiley Publications, 2nd Edition, 2008.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max.Marks:100****Exam Duration: 3 Hrs.****PART A :** 10 questions of 2 marks each –No choice**20 Marks****PART B :** 2 questions from each unit of internal choice; each carrying 16 marks**80 Marks**

B.E Computer Science and Engineering With Specialization In Internet of Things

S11BLH31	INTRODUCTION TO IOT	L	T	P	EL	Credits	Total Marks
		3	0	0	0	3	100

COURSE OBJECTIVES

- To understand the concepts of Internet of Things To identify the various elements of an IoT System.
- To understand the various means of communication from Node / Gateway to Cloud Platforms.
- To transfer data from IoT devices to various cloud providers.
- To make students aware of various domain specific applications and challenges while implementing IoT solutions.

UNIT 1 INTRODUCTION TO IoT**9 Hrs.**

Introduction to IoT, Current technological trends and future prospects- Evolution of IoT - IoT Devices - IoT Devices vs. Computers - Trends in the Adoption of IoT - Societal Benefits of IoT -, Business Scope, Relation with embedded system - IoT Reference Architecture physical-logical design of IOT-From M2M to IoT, Software define Network.

UNIT 2 ELEMENTS OF IoT**9 Hrs.**

Application Sensors & Actuators - Edge Networking (WSN) Gateways - IoT Communication Model WPAN & LPWA, Overview of IoT supported Hardware platforms such as: Raspberry pi, ARM Cortex Processors, Arduino and Intel Galileo boards, Wearable Development Boards .

UNIT 3 COMMUNICATION AND CONNECTIVE TECHNOLOGIES**9 Hrs.**

IoT Communication Model - Wireless medium access issues - MAC protocol survey -Survey routing protocols, Sensor deployment & Node discovery, Data aggregation & dissemination. Communication technologies, Long-range Wireless Protocols : LoRa WAN, Ingenu, Satellite Communications, Short- range Wireless Protocols : ANT+, WiFi, ZigBee, WHART, EnOcean, Z-Wave, NFC communication technologies : Zigbee Wifi - Zwave.

UNIT 4 IoT AND CLOUD**9 Hrs.**

Interoperability in IoT - Introduction to Arduino Programming - Integration of Sensors and Actuators with Arduino - Cloud computing in IoT, IoT in cloud architecture, Logging on to cloud,- cloud based IoT platforms - IBM Watson, Google cloud.

UNIT 5 DOMAIN SPECIFIC APPLICATIONS OF IoT**9 Hrs.**

Home automation, Industry applications, Surveillance applications, Other IoT applications - Introduction to different IoT tools, Developing applications through IoT tools, Developing sensor based application through embedded system platform case studies : Soil moisture monitoring, Weather monitoring, Air quality Monitoring, Movement Detection.

Max. 45 Hrs.**COURSE OUTCOMES**

On completion of the course, student will be able to

CO1 - Understand general concepts of Internet of Things (IoT).

CO2 - Recognize various devices, sensors and applications.

CO3 - Apply design concept to IoT solutions.

CO4 - Analyze various M2M and IoT architectures.

CO5 - Evaluate design issues in IoT applications.

CO6 - Create IoT solutions using sensors, actuators and Devices.

TEXT / REFERENCE BOOKS

1. Boswarthick, Omar Elloumi., The Internet of Things: Applications and Protocols, Wiley publications., 2012.
2. Dieter Uckelmann, Mark Harrison, Florian Michahelles., Architecting the Internet of Things, Springer publications.2011.
3. Marco Schwatz Internet of Things with Arduino Cookbook, Packt Publications.2016 .
4. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Kamouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1st Edition, Academic Press, 2014.
5. Vijay Madisetti, Arshdeep Bahga, "Internet of Things : A Hands on Approach", published by Vijay Madisetti 2014.

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks : 100****Exam Duration : 3 Hrs.****PART A : 10 Questions of 2 marks each-No choice****20****Marks PART B : 2 Questions from each unit with internal choice, each carrying 16 marks****80****Marks**

SCSB1251	ARTIFICIAL INTELLIGENCE SEARCH METHODS AND REASONING					Credits	Total Marks
		L	T	P	EL		
1. Stuart J. Russell, Peter Norvig, "Artificial Intelligence a Modern Approach". 3rd Edition, Pearson Education, 2009.		3	0	0	0	3	100
2. Elaine Rich, Kevin Knight, "Artificial Intelligence", 3rd Edition, Tata McGraw Hill, 2009.							
3. M. Tim Jones, "Artificial Intelligence: A Systems Approach (Computer Science)", Jones and Bartlett Publishers, Inc., 1st Edition, 2008.							

COURSE OBJECTIVES

- David L. Poole and Alan K. Mackworth, Artificial Intelligence: Foundations of Computational Agents, 2nd Edition, 2010.
- Ertel, Wolfgang, Introduction to Artificial Intelligence, 1st Edition, 2017.

- To understand the various characteristics of intelligent agents.
- To learn the different search strategies in AI.
- To understand the knowledge in solving AI problems in AI.
- To learn the concepts of learning and communication
- To know about the various applications of AI.

UNIT 1 BASIC SCIENCE BEHIND AI**9 Hrs.**

Intelligence – Memory – Computation – Learning – AI's Foundation and History – Intelligent Agents: Features – Behavior in the environment – Rationality – Nature and its Structure – Case Study: AI Programming Languages History: LISP – Prolog – Python.

UNIT 2 SEARCHING TOWARDS SOLUTION**9 Hrs.**

Searching Strategies: Informed Search: BFS – DFS – Depth Bounded DFS – Uninformed Search: Heuristic Functions – Hill Climbing Search – Best First Search – Local Maxima – Solution Space Search – Adversarial Search – Constraint Satisfaction Problem – Case Study: N-Queens Problem.

UNIT 3 KNOWLEDGE: ROLE AND REPRESENTATION**9 Hrs.**

Knowledge – Definition and Management – Types: Declarative and Procedural Knowledge – Knowledge Engineering behind Logical Agents: Propositional Logic – First Order Logic – Inference: Forward and Backward Chaining – Ontological Engineering – Case Study: Ontology based knowledge representation.

UNIT 4 APPROACHES BEHIND PLANNING AND REASONING**9 Hrs.**

Algorithm for Planning as State Space Search – Analysis of Planning Approach – Reasoning: Bayes Rule – Bayesian Network and its approximation – Hidden Markov Model – Kalman Filters – Decision Networks – Case Study: Wumpus World Problem.

UNIT 5 DECODING AND LEARNING INTELLIGENCE**9 Hrs.**

Learning Algorithms: Classification and Regression with Linear Model – Non-Parametric Models – Ensemble Learning – Explanation Based Learning – Learning with Hidden Variables – AI Real Time Applications – Case Study: Nature Inspired Computation.

Max. 45 Hrs.**COURSE OUTCOMES**

On completion of the course the student will be able to

- CO1 -** An ability to identify, analyze the search algorithm for the AI problems.
- CO2 -** Represent a problem using first order logic.
- CO3 -** Provide the knowledge-based agent to solve the problem.
- CO4 -** Understand the Informed search strategies.
- CO5 -** Apply the Bayes rule to solve the problem for societal concern.
- CO6 -** Design user centric applications that use AI concepts.

TEXT / REFERENCE BOOKS

B.E CSE - AI & ML

REGULATIONS 2023

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max.Marks:100****PART A:****PART B:**

10 questions of 2 marks each –No choice

2 questions from each unit of internal choice; each carrying 16 marks

Exam Duration: 3 Hrs.**20 Marks****80 Marks**

B.E Computer Science and Engineering With Specialization In Artificial Intelligence and Robotics

SMEB1104	ENGINEERING GRAPHICS USING CAD	L	T	P	EL	Credits	Total Marks
		1	0	4	0	3	100

COURSE OBJECTIVES

- To know the basics of Engineering Graphics and make the student to possess the efficient drafting skill.
- To make the students to understand the importance of sectioning and concept of development.
- To learn about the orthographic and pictorial projections.
- Identify engineering graphics. Draw objects like points, lines, planes, and solids in perspective & orthographic projections

UNIT 1 DRAWING STANDARDS AND CONSTRUCTION OF BASIC SHAPES 9 Hrs.

Drawing standards: BIS – Lettering - Two systems of dimensioning - Drawing tools. Construction of the basic shapes: Points – Lines – Circle –Circular arc - Polygons – Ellipse – Parabola - Hyperbola – Spline Curves. Introduction to CAD packages: Setting up a new drawing template - Drawing Commands - Modifying Commands - Formatting commands - Dimensioning styles – Texts - Basic Function keys - Shortcuts. Features and applications of CAD.

UNIT 2 PROJECTION OF POINTS AND LINES 9 Hrs.

Projections - Types of projections –projection of points – Change of position method - Sketching the orthographic projection of points lying in four quadrants using a CAD package - Orthographic projection of lines (First angle projection only) - Sketching the orthographic projection of lines using a CAD package (Projection of lines parallel to one plane and inclined to another).

UNIT 3 ORTHOGRAPHIC PROJECTION OF SOLIDS 9 Hrs.

Types of solids – Orthographic projection of simple solids like prisms, pyramids, cylinder and cone (Change of position method) – Sketching of the front view and top view of solids in simple vertical position or the inclined position (inclined to one plane and perpendicular to another plane) using a CAD package.

UNIT 4 SECTION OF SOLIDS 9 Hrs.

Types of sectional views - Hatching - Section plane perpendicular to one plane and parallel to other plane– Sketching of the front view, top view and true shape of the solids with cutting plane parallel to one plane or inclined to one plane and perpendicular to another using a CAD package.

UNIT 5 DEVELOPMENT OF SURFACES AND ORTHOGRAPHIC PROJECTION 9 Hrs.

Need for development of surfaces - Types of development of surfaces - Development of pentagonal and hexagonal prisms - Development of cylinders - Development of pentagonal and hexagonal pyramids - Development of cones - Sketching of the development drawings of surfaces of solids in simple vertical position with or without sectioning using a CAD package.

Orthographic Projection- Drawing front view, top view and side view of objects from the given pictorial views using CAD package.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1** - Identify the national standards related to the Engineering drawing based on BIS and construct conic sections and polygons.
- CO2** - Draw the projections of points, lines.
- CO3** - Draw projection of solid objects like prisms, cylinders, pyramids and cones used in various engineering objects.
- CO4** - Draw orthographic section of solids and improve the visualization skill to develop New products.
- CO5** - Draw the development of surfaces and its applications in manufacturing industry.
- CO6** - Draw the 2D and 3D surfaces of engineering components using modeling software.

TEXT / REFERENCE BOOKS

1. Venugopal, K. and Prabhu Raja, V., Engineering Drawing and Graphics + AutoCAD, New Age International, 2021.
2. Trymbaka Murthy, S., Computer Aided Engineering Drawing, I.K. International Publishing House, 2017.
3. SP 46: Engineering Drawing Practice for schools and colleges, Bureau of Indian Standards.
4. AutoCAD – 2D CAD Reference Guide
5. Luzzader, Warren J., Duff John M., Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Prentice Hall of India Pvt. Ltd., 2016.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

PART A : 10 Questions of 2 marks each-No choice

20 Marks

PART B : 2 Questions from each unit with internal choice, each carrying 16 marks

80 Marks

SMRB1102	FUNDAMENTALS OF ROBOTICS	L	T	P	EL	Credits	Total Marks
		3	0	0	0	3	100

COURSE OBJECTIVES

- To understand the concepts of robotics and automation.
- To learn the basic configurations and performance of robot.
- To familiarize with the sensors, drive system, and control systems of a robot.
- To design a robot work cell for an industrial application.
- To understand the various applications of robots, justification, implementation and safety of robot.
- To write programming for various robotic application.

UNIT1 BASICS OF ROBOTICS**9 Hrs.**

Introduction - Anatomy of Robot - Laws of robotics - Links and Joints of robot - Robot wrist - Configurations of robot - work volume - Spatial resolution - Precision of Movement: Resolution, Accuracy and Repeatability, Speed of Response and Load Carrying Capacity-Drive Systems of Robot - Control system of Robot - Types of robot control - Robot motions Rotary to rotary motion, Rotary to linear motion, Harmonics drives.

UNIT 2 ROBOT SENSORS AND END EFFECTORS**9 Hrs.**

Robotic sensors and actuators - Robot actuation and feedback components - Power transmission system – Robot joint control design - Robot End effectors Types of End effectors - Requirements and challenges of end effectors- Mechanical gripper- types of gripper mechanism - gripper force analysis – other types of gripper - special purpose grippers - Tools – Degrees of Freedom - Selection and design of Grippers.

UNIT 3 ROBOT KINEMATICS**9 Hrs.**

Robot kinematics: Introduction - Position representation - 2 DOF Arm in 2D - 3 DOF Arm in 2D - 4 DOF Arm in 3D - rigid motion & homogeneous transformation forward & inverse kinematics - trajectory planning - Wrist Orientation - Manipulator path control - Robot Dynamics: Robot Arm dynamics - configuration of a robot controller.

UNIT 4 WORK CELL DESIGN AND MACHINE VISION SYSTEM**9 Hrs.**

Robot work cell design - Work cell types – Work cell Control - Factors to be considered for work cell design - Interlocks - Machine vision: - Sensing and Digitizing - Imaging Devices - Lighting Techniques - AD Converter - Image Processing - Data reduction - Segmentation - Thresholding - Region Growing- Edge Detection - Feature extraction - Object recognition - Applications Inspection - Identification - Visual servicing and navigation - Training the vision.

UNIT 5 ROBOT PROGRAMMING METHODS**9 Hrs.**

Robot programming Methods - Methods of Defining Position - Motion Interpolation - Commands - Branching - Robot Languages Classification of robot language - Computer control and robot software - Val system and Languages - Application of robots - Process Applications - Material Loading and Unloading - Material handling - spot and continuous arc welding & spray painting -Robots for Assembly and Inspection

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course the student will be able to

- CO1** - Understand the basics of robotics and to choose the appropriate type of drive and sensor system
- CO2** - To select the appropriate type of tools and grippers for various applications
- CO3** - To design a robotic arm and to bring a controlled movement in the end effectors
- CO4** - Understand the concept of Computer vision system and to develop a machine vision system for inspection
- CO5** - Ability to design robot work cell and develop robots for real life situational problems and think creatively for solutions
- CO6** - Ability to write various robot programs for various applications

TEXT / REFERENCE BOOKS

1. Mikell P. Groover, Mitchel Weiss, Roger N. Nagel, Nicholas G. Odrey , Ashish Dutta, Industrial Robotics - Technology, Programming and Applications McGraw Hill (SIE) | 2nd Edition 2012
2. John J. Craig, Introduction to Robotics: Mechanics and Control, third edition, Pearson Prentice Hall 2004
3. Harry H. Poole, Fundamentals of Robotics Engineering Van Nostrand Reinhold, Springer 2012
4. Frank L. Lewis, Darren M.Dawson, Chaouki T.Abdallah, Robot Manipulator Control Theory and Practice Second Edition, Revised and Expanded 2004
5. R.D.Klafter, T.A.Chimielewski and M.Negin, Robotic Engineering–An Integrated Approach, Prentice Hall of India, New Delhi, 1994.
6. Ashitava Ghoshal, Robotics-Fundamental Concepts and Analysis ‘, Oxford University Press, Sixth impression, 2010.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

PART A : 10 Questions of 2 marks each-No choice

20 Marks

PART B : 2 Questions from each unit with internal choice, each carrying 16 marks

80 Marks

B.E Computer Science and Engineering With Specialization In BlockChain Technology

SCSB1261	INTRODUCTION TO BLOCKCHAIN TECHNOLOGY	L	T	P	EL	Credits	Total Marks
		3	0	0	0	3	100

COURSE OBJECTIVE

- To understand the history, types and applications of Blockchain
- To acquire knowledge about cryptography and consensus algorithms.
- Deploy projects using Web3j and design blockchain based applications.

UNIT 1 INTRODUCTION TO BLOCKCHAIN**9 Hrs.**

Distributed DBMS – Limitations of Distributed DBMS, Introduction to Block chain – History, Definition, Distributed Ledger, Blockchain Categories – Public, Private, Consortium, Blockchain Network and Nodes, Peer-to-Peer Network, Mining Mechanism, Generic elements of Blockchain, Features and Types of Blockchain.

UNIT 2 BLOCKCHAIN ARCHITECTURE**9 Hrs.**

Operation of Bitcoin Blockchain, Blockchain Architecture – Block, Hash, Distributer P2P, Structure of Blockchain- Consensus mechanism: Proof of Work (PoW), Proof of Stake (PoS), Byzantine Fault Tolerance (BFT), Proof of Authority (PoA) and Proof of Elapsed Time (PoET).

UNIT 3 BLOCKCHAIN-BASED FUTURES SYSTEM**9 Hrs.**

Project presentation- Futures smart contract: Blockchain oracles- Web3j: Setting up the Web3J- Installing web3j- Wallet creation, Java client: The wrapper generator- Initializing web3j- Setting up Ethereum accounts- Deploying the contract.

UNIT 4 BLOCKCHAINS IN BUSINESS AND CREATING ICO**9 Hrs.**

Public versus private and permissioned versus permission less blockchains- Privacy and anonymity in Ethereum- Why are privacy and anonymity important? - The Ethereum Enterprise Alliance- Blockchain -as-a-Service- Initial Coin Offering (ICO): Project setup for ICO implementation- Token contracts- Token sale contracts-Contract security and testing the code.

UNIT 5 DISTRIBUTED STORAGE IPFS AND SWARM**9 Hrs.**

Ethereum Virtual Machine- Swarm and IPFS: Installing IPFS, Hosting our frontend: Serving your frontend using IFPS, Serving your frontend using Swarm, IPFS file uploader project: Project setup the web page.

Max. 45 Hrs.**COURSE OUTCOME**

On completion of the course, student will be able to

- CO1** - Contentedly discuss and describe the history, types and applications of Blockchain.
- CO2** - Gains familiarity with cryptography and Consensus algorithms.
- CO3** - Create and deploy projects using Web3j.
- CO4** - Implement an ICO on Ethereum.
- CO5** - Design block chain based application with Swarm and IPFS.
- CO6** - Create and deploy projects using distributed storage.

TEXT / REFERENCE BOOKS

1. Imran Bashir, "Mastering Blockchain: Distributed Ledger Technology, decentralization, and smart contracts explained", 2nd Edition, Packt Publishing Ltd, March 2018.
2. Bellaj Badr, Richard Horrocks, Xun (Brian) Wu, "Blockchain By Example: A developer's guide to creating decentralized applications using Bitcoin, Ethereum, and Hyperledger", Packt Publishing Limited, 2018.
3. Andreas M. Antonopoulos , "Mastering Bitcoin: Unlocking Digital Cryptocurrencies", O'Reilly Media Inc, 2015.
4. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, "Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction", Princeton University Press, 2016.

E BOOKS

1. <https://www.velmie.com/practical-blockchain-study>.

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks : 100****Exam Duration : 3 Hrs.****PART A : 10 Questions of 2 marks each-No choice****20 Marks****PART B : 2 Questions from each unit with internal choice, each carrying 16 marks****80 Marks**

B.E Computer Science and Engineering With Specialization In Cyber Security

SCSB1271	INTRODUCTION TO CYBER SECURITY	L	T	P	EL	Credits	Total Marks
		3	0	0	0	3	100

COURSE OBJECTIVES

- Understand the key concepts and principles of cybersecurity.
- To Identify common threats, attacks, and vulnerabilities in computer systems.
- Understand basics of cryptographic algorithms.
- Demonstrate knowledge of cryptographic techniques and their applications.
- Understand legal and ethical issues related to cybersecurity.

UNIT 1 INTRODUCTION TO CYBERSECURITY**9 Hrs.**

Definition and scope of cybersecurity, Cybersecurity goals and objectives, Security principles: confidentiality, integrity, availability, Threats, Attacks, and Vulnerabilities-Overview of common cybersecurity threats and attack vectors, Malware, phishing, and other attack techniques, Identifying and assessing vulnerabilities in systems and networks

UNIT 2 NETWORK SECURITY**9 Hrs.**

Network security concepts and protocols - Firewall -Intrusion Detection System (IDS) and Intrusion Prevention System (IPS)-TCP/IP-Virtual Private Network (VPN)- Internet Protocol Security (IPsec)- Secure Sockets Layer/Transport Layer Security (SSL/TLS)- Internet Protocol Security (IPsec)

UNIT 3 CRYPTOGRAPHY AND DATA PROTECTION**9 Hrs.**

Basics of cryptography: encryption, decryption, hashing, Symmetric and asymmetric encryption algorithms- Advanced Encryption Standard (AES)- Data Encryption Standard (DES)- Blowfish, RSA (Rivest-Shamir-Adleman)- Diffie-Hellman (DH)- Digital Signature Algorithm (DSA)- PGP (Pretty Good Privacy), ElGamal.

UNIT 4 WEB SECURITY**9 Hrs.**

Common web security vulnerabilities (e.g., Cross-Site Scripting, SQL injection), Web application security best practices, Securing web servers and web applications. Access Control and Authentication- Principles of access Control-Authentication methods (e.g., passwords, biometrics).

UNIT 5 ETHICAL AND LEGAL ISSUES IN CYBERSECURITY**9 Hrs.**

Ethical principles and professional codes of conduct, Laws, regulations, and privacy issues in cybersecurity, Cybersecurity ethics in the workplace.

Max. 45 Hrs.**COURSE OUTCOMES**

On completion of the course, student will be able to

CO1 - Understands the importance fundamentals of cyber threat intelligence and its importance in cybersecurity.

CO2 - Understands to develop skills to collect, analyze, and interpret threat intelligence data.

CO3 - Understands basics of cryptographic algorithms.

CO4 - Understands various types of malware and their characteristics.

CO5 - Explain the fundamentals of cryptography and its role in securing data

CO6 - Understand legal and ethical issues related to cybersecurity.

TEXT / REFERENCE BOOKS

1. Raef Meeuwisse." Cybersecurity For Beginners"Lulu,2015
2. Mayank Bhusan/Rajkumar Singh Rathore/Aatif Jamshed, "Fundamentals of Cyber Security", BPB, 2020

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 Hrs.****PART A:** 10 questions of 2 marks each – No choice**20 Marks****PART B:** 2 questions from each unit of internal choice; each carrying 16 marks**80 Marks**

SCSB1262	BLOCKCHAIN AND CRYPTOCURRENCY	L	T	P	EL	Credits	Total Marks
		3	0	0	0	3	100

COURSE OBJECTIVES

- To Impart strong technical understanding of Blockchain technologies.
- To introduce the concept and the basics of Ethereum that helps developers publish distributed applications.
- To learn various aspects of working and use of BitCoin.
- To give the knowledge to transfer of money for medium of exchange .
- To provide knowledge on SECURITY AND PRIVACY of Block chain technologies.
- To applied the various applications of block chain technologies.

UNIT 1 INTRODUCTION OF BLOCKCHAIN**9 Hrs.**

Peer-to-Peer(P2P) Networking, Blockchain Architecture, Design and Integration, key Participants in the block chaining, Blocks in Blockchain, Types of Block chain, the Logical Components of Blockchain, Core Components of Blockchain Architecture, Smart contracts and their applications.

UNIT 2 ETHEREUM BASICS**9 Hrs.**

Ethereum and Smart Contracts, The Turing Completeness of Smart Contract Languages and verification challenges, using smart contracts to enforce legal contracts, comparing Bitcoin scripting vs. Ethereum Smart Contracts, writing smart contracts using Solidity & JavaScript

UNIT 3 INTRODUCTION OF BITCOIN**9 Hrs.**

Bitcoin features, Blockchain and Bitcoin, Bitcoin Security, Bitcoin Transaction, Transaction Lifecycle, Consensus Protocol, Role of Bitcoin Crimes, Dark Side of Bitcoin Crimes, Open Challenges to Bitcoin Crimes.

UNIT 4 FUNDAMENTALS OF CRYPTOCURRENCIES**9 Hrs.**

Nodes, P2P, Ledger, Gossip Protocol, Consensus Methods, Messages, Account Balance, Genesis Block and New Coins, how a Crypto currency Works, crypto currency Exchange, Smart Contracts, E- Governance.

UNIT 5 SECURITY AND PRIVACY ISSUES OF BLOCKCHAIN TECHNOLOGY**9 Hrs.**

Introduction, Blockchain Aspects for Consideration, Security of block chain, Privacy of blockchains, Security Issues of Blockchain Technology, Privacy Issues of Blockchain Technology, Types of Attack, Security Enhancement to Blockchain Systems, Applications of Blockchain in Health care, Finance.

Max. 45 Hrs.**COURSE OUTCOMES**

On completion of the course, student will be able to

CO1 - Understand the concepts of Blockchain technologies.

CO2 - Implement Ethereum block chain contract.

CO3 - Illustrate the concepts of Bitcoin and their usage. **CO4** -

Understand basic principles of Cryptocurrencies. **CO5** - Apply

security features in blockchain technologies. **CO6** - Use smart

contract in real world applications.

TEXT / REFERENCE BOOKS

1. Tapscott, Don, Tapscott, Alex, "Blockchain Revolution How the Technology Behind Bitcoin and Other Cryptocurrencies Is Changing the World".
2. MerunasGrincalaitis, "Mastering Ethereum: Implement Advanced Blockchain Applications using Ethereum-supported Tools, Services, and Protocols", Packt Publishing.
3. Raj, Pethuru Saini, KavitaSurianarayanan, Chellammal, "Blockchain Technology and Applications".
4. Melanie Swan, "Blockchain Blueprint for a New Economy".
5. Shiho Kim, Ganesh Chandra Deka, "Advanced Applications of Blockchain Technology".
6. Rajneesh Gupta, "Hands-On Cybersecurity with Blockchain Implement DDoS protection, PKI- based identity, 2FA, and DNS security using Blockchain".
7. Martin Quest, "Cryptocurrency Master Everything You Need to Know About Cryptocurrency and Bitcoin Trading, Mining, Investing, Ethereum, ICOs, and the Blockchain".
8. Narayanan, Bonneau, Felten, Miller and Goldfeder, "Bitcoin and Cryptocurrency Technologies A Comprehensive Introduction", Princeton University Press.
9. Josh Thompson, 'Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming', Create Space Independent Publishing Platform, 2017.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 Hrs.****PART A:** 10 questions of 2 marks each – No choice**20 Marks****PART B:** 2 questions from each unit of internal choice; each carrying 16 marks**80 Marks**