R 20 Regulations

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
(Established by Govt. of A.P., ACT No.30 of 2008)
ANANTHAPURAMU – 515 002 (A.P) INDIA

Comuper Science & Engineering (Data Science)

II B.TECH.

Semester-III

S.No.	Course Code	Course Name	Category	Hours per week			Credits
				L	T	P	
1.	20A54304	Discrete Mathematics & Graph Theory	BS	3	0	0	3
2.	20A04304T	Digital Electronics& Microprocessors	ES	3	0	0	3
3.	20A05301T	Advanced Data Structures & Algorithms	PC	3	0	0	3
4.	20A05303	Computer Organization	PC	3	0	0	3
5.	20A32301T	Advanced Python Programming for Data Science	PC	3	0	0	3
6.	20A04304P	Digital Electronics& Microprocessors Lab	ES	0	0	3	1.5
7.	20A05301P	Advanced Data Structures and Algorithms Lab	PC	0	0	3	1.5
8.	20A32301P	Advanced Python Programming for Data Science Lab	PC	0	0	3	1.5
9.	20A32302	**Skill Oriented Course – I** Working with Handoop	SC	1	0	2	2
10.	20A99201	**Mandatory noncredit course - II** Environmental Science	MC	3	0	0	0
						Total	**21.5**

Semester-IV

S.No.	Course Code	Course Name	Category	Hours per week			Credits
				L	T	P	
1.	20A54405	Statistical Methods for Data Science	BS	3	0	0	3
2.	20A05401T	Database Management Systems	PC	3	0	0	3
3.	20A05402T	Operating Systems	PC	3	0	0	3
4.	20A05403T	Software Engineering	PC	3	0	0	3
5.	20A52301 20A52302 20A52303	**Humanities Elective– I** Managerial Economics & Financial Analysis Organizational Behaviour Business Environment	HS	3	0	0	3
6.	20A05401P	Database Management Systems lab	PC	0	0	3	1.5
7.	20A05402P	Operating SystemsLab	PC	0	0	3	1.5
8.	20A05403P	Software Engineering Lab	PC	0	0	3	1.5
9.	20A32401	**Skill Oriented Course– II** Programmingwith R	SC	1	0	2	2
10.	20A99401	**Mandatory noncredit course – III** Design Thinking for Innovation	MC	2	1	0	0
11.	20A99301	NSS/NCC/NSO Activities	MC	0	0	2	0
						Total	**21.5**
Community Service Internship/Project(Mandatory) for 6 weeks duration during summer vacation							

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Note:

1. Eligible and interested students can register either for Honors or for a Minor in IV Semester as per the guidelines issued by the University
2. Students shall register for NCC/NSS/NSO activities and will be required to participate in an activity for two hours in a week during fourth semester.
3. Lateral entry students shall undergo a bridge course in Mathematics during third semester

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Course Code	Discrete Mathematics & Graph theory		L	T	P	C
20A54304	(Common to CSE, IT, CSE(DS), CSE (IoT), CSE (AI), CSE (AI & ML) and AI & DS)		3	0	0	3
Pre-requisite	Basic Mathematics	Semester	III			

Course Objectives:

Introduce the concepts of mathematical logic and gain knowledge in sets, relations and functions and Solve problems using counting techniques and combinatorics and to introduce generating functions and recurrence relations. Use Graph Theory for solving real world problems

Course Outcomes (CO):

After completion of the course, students will be able to

- Apply mathematical logic to solve problems.
- Understand the concepts and perform the operations related to sets, relations and functions.
- Gain the conceptual background needed and identify structures of algebraic nature.
- Apply basic counting techniques to solve combinatorial problems.
- Formulate problems and solve recurrence relations.
- Apply Graph Theory in solving computer science problems

UNIT - I	**Mathematical Logic**	8 Hrs

Introduction, Statements and Notation, Connectives, Well-formed formulas, Tautology, Duality law, Equivalence, Implication, Normal Forms, Functionally complete set of connectives, Inference Theory of Statement Calculus, Predicate Calculus, Inference theory of Predicate Calculus.

UNIT - II	**Set theory**	9 Hrs

Basic Concepts of Set Theory, Relations and Ordering, The Principle of Inclusion- Exclusion, Pigeon hole principle and its application,Functions composition of functions, Inverse Functions, Recursive Functions, Lattices and its properties. Algebraic structures: Algebraic systems-Examples and General Properties, Semi groups and Monoids, groups, sub groups, homomorphism, Isomorphism.

UNIT - III	**Elementary Combinatorics**	8 Hrs

Basics of Counting, Combinations and Permutations, Enumeration of Combinations and Permutations, Enumerating Combinations and Permutations with Repetitions, Enumerating Permutations with Constrained Repetitions, Binomial Coefficients, The Binomial and Multinomial Theorems.

UNIT - IV	**Recurrence Relations**	9 Hrs

Generating Functions of Sequences, Calculating Coefficients of Generating Functions, Recurrence relations, Solving Recurrence Relations by Substitution and Generating functions, The Method of Characteristic roots, Solutions of Inhomogeneous Recurrence Relations.

UNIT - V	**Graphs**	9 Hrs

Basic Concepts, Isomorphism and Subgraphs, Trees and their Properties, Spanning Trees, Directed Trees, Binary Trees, Planar Graphs, Euler's Formula, Multigraphs and Euler Circuits, Hamiltonian Graphs, Chromatic Numbers, The Four Color Problem

Textbooks:

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1. Joe L. Mott, Abraham Kandel and Theodore P. Baker, Discrete Mathematics for Computer Scientists & Mathematicians, 2nd Edition, Pearson Education.
2. J.P. Tremblay and R. Manohar, Discrete Mathematical Structures with Applications to Computer Science, Tata McGraw Hill, 2002.

Reference Books:

1. Kenneth H. Rosen, Discrete Mathematics and its Applications with Combinatorics and Graph Theory, 7th Edition, McGraw Hill Education (India) Private Limited.
2. Graph Theory with Applications to Engineering and Computer Science byNarsinghDeo.

Online Learning Resources:

http://www.cs.yale.edu/homes/aspnes/classes/202/notes.pdf

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Comuper Science & Engineering (Data Science)

Course Code	DIGITAL ELECTRONICS & MICROPROCESSORS	L	T	P	C
20A04304T		3	0	0	3
Pre-requisite	Basic Electronics	Semester	III		

Course Objectives:

- To understand all the concepts of Logic Gates and Boolean Functions.
- To learn about Combinational Logic and Sequential Logic Circuits.
- To design logic circuits using Programmable Logic Devices.
- To understand basics of 8086 Microprocessor and 8051 Microcontroller.
- To understand architecture of 8086 Microprocessor and 8051 Microcontroller.
- To learn Assembly Language Programming of 8086 and 8051.

Course Outcomes (CO):

After Completion of this course, the student will be able to:

- Design any Logic circuit using basic concepts of Boolean Algebra.
- Design any Logic circuit using basic concepts of PLDs.
- Design and develop any application using 8086 Microprocessor.
- Design and develop any application using 8051 Microcontroller.

UNIT - I Number Systems & Code Conversion

Number Systems & Code conversion, Boolean Algebra & Logic Gates, Truth Tables, Universal Gates, Simplification of Boolean functions, SOP and POS methods – Simplification of Boolean functions using K-maps,Signed and Unsigned Binary Numbers.

UNIT - II Combinational Circuits

Combinational Logic Circuits: Adders &Subtractors, Multiplexers, Demultiplexers, Encoders, Decoders, Programmable Logic Devices.

UNIT - III Sequential Circuits

Sequential Logic Circuits: RS, Clocked RS, D, JK, Master Slave JK, T Flip-Flops, Shift Registers, Types of Shift Registers, Counters, Ripple Counter, Synchronous Counters, Asynchronous Counters, Up-Down Counter.

UNIT - IV Microprocessors - I

8085 microprocessor Review (brief details only), 8086 microprocessor, Functional Diagram, register organization 8086, Flag register of 8086 and its functions, Addressing modes of 8086, Pin diagram of 8086, Minimum mode & Maximum mode operation of 8086, Interrupts in 8086.

UNIT – V Microprocessors - II

Instruction set of 8086, Assembler directives, Procedures and Macros, Simple programs involving arithmetic, logical, branch instructions, Ascending, Descending and Block move programs, String Manipulation Instructions. Overview of 8051 microcontroller, Architecture, I/O ports and Memory organization, addressing modes and instruction set of 8051(Brief details only), Simple Programs.

Text Books:

1.M. Morris Mano, Michael D. Ciletti, Digital Design, Pearson Education, 5th Edition, 2013
2. Anil K. Maini, Digital Electronics: Principles, Devices and Applications, John Wiley & Sons, Ltd., 2007.
3. N. Senthil Kumar, M. Saravanan, S. Jeevanathan, Microprocessor and Microcontrollers,Oxford Publishers, 2010.
4. Advanced microprocessors and peripherals-A.K Ray and K.M.Bhurchandani, TMH, 2nd edition, 2006.

Reference Books:

1. Thomas L. Floyd, Digital Fundamentals – A Systems Approach, Pearson, 2013.
2. Charles H. Roth, Fundamentals of Logic Design, Cengage Learning, 5th, Edition, 2004.
3. D.V.Hall, Microprocessors and Interfacing. TMGH, 2nd edition, 2006.
4. Kenneth.J.Ayala, The 8051 microcontroller, 3rd edition, Cengage Learning,2010.

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Comuper Science & Engineering (Data Science)

Course Code	Advanced Data Structures & Algorithms	L	T	P	C
20A05301T	(Common to CSE, IT, CSE(DS), CSE (IoT), CSE (AI), CSE (AI & ML) and AI & DS)	3	0	0	3
Pre-requisite	Data Structures	Semester	III		

Course Objectives:

- Learn asymptotic notations, and analyze the performance of different algorithms.
- Understand and implement various data structures.
- Learn and implement greedy, divide and conquer, dynamic programming and backtracking algorithms using relevant data structures.
- Understand non-deterministic algorithms, polynomial and non-polynomial problems.

Course Outcomes (CO):

After completion of the course, students will be able to

- Analyze the complexity of algorithms and apply asymptotic notations.
- Apply non-linear data structures and their operations.
- Understand and apply greedy, divide and conquer algorithms.
- Develop dynamic programming algorithms for various real-time applications.
- Illustrate Backtracking algorithms for various applications.

UNIT - I	**Introduction to Algorithms**	9 Hrs

Introduction to Algorithms:
Algorithms, Pseudocode for expressing algorithms, Performance Analysis-Space complexity, Time complexity, Asymptotic Notation- Big oh, Omega, Theta notation and Little oh notation, Polynomial Vs Exponential Algorithms, Average, Best and Worst Case Complexities, Analysing Recursive Programs.

UNIT - II	**Trees Part-I**	8 Hrs

Trees Part-I
Binary Search Trees: Definition and Operations, AVL Trees: Definition and Operations, Applications.
B Trees: Definition and Operations.

UNIT - III	**Trees Part-II**	8 Hrs

Trees Part-II
Red-Black Trees, Splay Trees, Applications.
Hash Tables: Introduction, Hash Structure, Hash functions, Linear Open Addressing, Chaining and Applications.

UNIT - IV	**Divide and conquer, Greedy method**	9 Hrs

Divide and conquer: General method, applications-Binary search, Finding Maximum and minimum, Quick sort, Merge sort, Strassen's matrix multiplication.
Greedy method: General method, applications-Job sequencing with deadlines, knapsack problem, Minimum cost spanning trees, Single source shortest path problem.

UNIT - V	**Dynamic Programming & Backtracking**	9 Hrs

Dynamic Programming: General method, applications- 0/1 knapsack problem, All pairs shortest path problem, Travelling salesperson problem, Reliability design.
Backtracking: General method, applications-n-queen problem, sum of subsets problem, graph coloring, Hamiltonian cycles.
Introduction to NP-Hard and NP-Complete problems: Basic Concepts.

Textbooks:

1. Data Structures and algorithms: Concepts, Techniques and Applications, G A V Pai.
2. Fundamentals of Computer Algorithms, Ellis Horowitz, Sartaj Sahni and Rajasekharam, Galgotia publications Pvt. Ltd.

Reference Books:

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1. Classic Data Structures by D. Samanta, 2005, PHI 2. Design and Analysis of Computer Algorithms by Aho, Hopcraft, Ullman 1998, PEA. 3. Introduction to the Design and Analysis of Algorithms by Goodman, Hedetniemi, TMG.
Online Learning Resources:
https://www.tutorialspoint.com/advanced_data_structures/index.asp http://peterindia.net/Algorithms.html

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Comuper Science & Engineering (Data Science)

Course Code	Computer Organization		L	T	P	C
20A05303	(Common to CSE, IT, CSE(DS), CSE (IoT), CSE (AI), CSE (AI & ML) and AI & DS)		3	0	0	3
Pre-requisite	Digital Electronics	Semester	III			

Course Objectives:

- To learn the fundamentals of computer organization and its relevance to classical and modern problems of computer design
- To understand the structure and behavior of various functional modules of a computer.
- To learn the techniques that computers use to communicate with I/O devices
- To acquire the concept of pipelining and exploitation of processing speed.
- To learn the basic characteristics of multiprocessors

Course Outcomes (CO):

After completion of the course, students will be able to

- Understand computer architecture concepts related to the design of modern processors, memories and I/Os
- Identify the hardware requirements for cache memory and virtual memory
- Design algorithms to exploit pipelining and multiprocessors
- Understand the importance and trade-offs of different types of memories.
- Identify pipeline hazards and possible solutions to those hazards

UNIT - I	**Basic Structure of Computer, Machine Instructions and Programs**	8Hrs

Basic Structure of Computer: Computer Types, Functional Units, Basic operational Concepts, Bus Structure, Software, Performance, Multiprocessors and Multicomputer.
Machine Instructions and Programs: Numbers, Arithmetic Operations and Programs, Instructions and Instruction Sequencing, Addressing Modes, Basic Input/output Operations, Stacks and Queues, Subroutines, Additional Instructions.

UNIT - II	**Arithmetic, Basic Processing Unit**	9Hrs

Arithmetic: Addition and Subtraction of Signed Numbers, Design of Fast Adders, Multiplication of Positive Numbers, Signed-operand Multiplication, Fast Multiplication, Integer Division, Floating-Point Numbers and Operations.
Basic Processing Unit: Fundamental Concepts, Execution of a Complete Instruction, Multiple-Bus Organization, Hardwired Control, and Multi programmed Control.

UNIT - III	**The Memory System**	8Hrs

The Memory System: Basic Concepts, Semiconductor RAM Memories, Read-Only Memories, Speed, Size and Cost, Cache Memories, Performance Considerations, Virtual Memories, Memory Management Requirements, Secondary Storage.

UNIT - IV	**Input/Output Organization**	8Hrs

Input/Output Organization: Accessing I/O Devices, Interrupts, Processor Examples, Direct Memory Access, Buses, Interface Circuits, Standard I/O Interfaces.

UNIT - V	**Pipelining, Large Computer Systems**	9 Hrs

Pipelining: Basic Concepts, Data Hazards, Instruction Hazards, Influence on Instruction Sets.
Large Computer Systems: Forms of Parallel Processing, Array Processors, The Structure of General-Purpose multiprocessors, Interconnection Networks.

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Textbooks:
1. Carl Hamacher, ZvonkoVranesic, SafwatZaky, "Computer Organization", 5th Edition, McGraw Hill Education, 2013.
Reference Books:
1. M.Morris Mano, "Computer System Architecture", 3rd Edition, Pearson Education. 2. Themes and Variations, Alan Clements, "Computer Organization and Architecture", CENGAGE Learning. 3. SmrutiRanjanSarangi, "Computer Organization and Architecture", McGraw Hill Education. 4. John P.Hayes, "Computer Architecture and Organization", McGraw Hill Education
Online Learning Resources:
https://nptel.ac.in/courses/106/103/106103068/

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Comuper Science & Engineering (Data Science)

Course Code	**Advanced Python Programming for Data Science**	**L**	**T**	**P**	**C**
20A32301T		**3**	**0**	**0**	**3**
Pre-requisite	Basics of Python Programming	**Semester**	**III**		

Course Objectives:

The main objective of this course is to help students learn, understand, and practice dataanalytics using python, which include the study of modern computingbig data technologies and scaling up machine learning techniques focusing on industryapplications. Mainly the course objectives are conceptualization and summarization of data

Course Outcomes (CO):

After completion of the course, students will be able to

- Write relatively advanced, well structured, computer programs in Python
- Gain familiarity with principles and techniques for optimizing the performance of numeric applications
- Understand parallel computing and how parallel applications can be written in Python
- Experiment with developing GPU accelerated Python applications
- Learn the fundamentals of the most widely used Python packages; including NumPy, Pandas and Matplotlib
- Apply programming concepts in Data Analysis and Data Visualization projects

UNIT - I	**The Role of Python in Data Science**	9 Hrs

Introduction- Creating the Data Science Pipeline, Understanding Python's Role in Data Science, Learning to Use Python Fast, Setting Up Python for Data Science, Reviewing Basic Python

UNIT - II	**Conditioning and Working with Real Data**	10 Hrs

Uploading, Streaming, and Sampling Data, Accessing Data in Structured Flat-File Form, Sending Data in Unstructured File Form, Managing Data from Relational Databases, Interacting with Data from NoSQL Databases, Accessing Data from the Web,NumPy and pandas, Validating Your Data, Manipulating Categorical Variables, Dealing with Dates in Your Data, Slicing and Dicing: Filtering and Selecting Data, Aggregating Data at Any Level

UNIT - III	**Shaping and Performing Action on Data**	09 Hrs

Working with HTML Pages, Working with Raw Text, Using the Bag of Words Model and Beyond, Working with Graph Data, Contextualizing Problems and Data, Considering the Art of Feature Creation, Performing Operations on Arrays

UNIT - IV	**MatPlotLib and Visualization of Data**	09 Hrs

Starting with a Graph, Setting the Axis, Ticks, Grids, Defining the Line Appearance, Using Labels, Annotations, and Legends, Choosing the Right Graph, Creating Advanced Scatterplots, Plotting Time Series, Plotting Geographical Data, Visualizing Graphs

UNIT - V	**Wrangling Data**	09 Hrs

Playing with Scikit-learn, Performing the Hashing Trick, Considering Timing and Performance, Running in Parallel, Counting for Categorical Data, Understanding Correlation, Modifying Data Distributions, Reducing Dimensionality, Clustering, Detecting Outliers in Data

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Textbooks:	
1.	Python for Data Science for Dummies, 2ed, Luca Massaron John Paul Mueller, by ISBN: 978-1-118-84418-2
Reference Books:	
1.	Introduction to Parallel Computing, Ananth Grama, Anshul Gupta, George Karypis, Vipin Kumar, Pearson; 2 edition (January 26, 2003), ISBN 978-0201648652
2.	Big Data: Principles and best practices of scalable realtime data systems, 1st Edition, Nathan Marz, James Warren, ISBN 978-1617290343

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Comuper Science & Engineering (Data Science)

Course Code	DIGITAL ELECTRONICS & MICROPROCESSORS LAB		L	T	P	C
20a04304P			0	0	3	1.5
Pre-requisite	Basic Electronics Engineering	**Semester**	**III**			

Course Objectives:

- To understand all the concepts of Logic Gates and Boolean Functions.
- To learn about Combinational Logic and Sequential Logic Circuits.
- To design logic circuits using Programmable Logic Devices.
- To understand basics of 8086 Microprocessor and 8051 Microcontroller.
- To understand architecture of 8086 Microprocessor and 8051 Microcontroller.
- To learn Assembly Language Programming of 8086 and 8051.

Course Outcomes (CO):

After Completion of this course, the student will be able to:

- Design any Logic circuit using basic concepts of Boolean Algebra.
- Design any Logic circuit using basic concepts of PLDs.
- Design and develop any application using 8086 Microprocessor.
- Design and develop any application using 8051 Microcontroller.

List of Experiments:

Note: Minimum of 12 (6+6) experiments shall be conducted from both the sections given below:

DIGITAL ELECTRONICS:

1. Verification of Truth Table for AND, OR, NOT, NAND, NOR and EX-OR gates.
2. Realisation of NOT, AND, OR, EX-OR gates with only NAND and only NOR gates.
3. Karnaughmap Reduction and Logic Circuit Implementation.
4. Verification of DeMorgan's Laws.
5. Implementation of Half-Adder and Half-Subtractor.
6. Implementation of Full-Adder and Full-Subtractor.
7. Four Bit Binary Adder
8. Four Bit Binary Subtractor using 1's and 2's Complement.

MICROPROCESSORS (8086 Assembly Language Programming)

1. 8 Bit Addition and Subtraction.
2. 16 Bit Addition.
3. BCD Addition .
4. BCD Subtraction.
5. 8 Bit Multiplication.
6. 8 Bit Division.
7. Searching for an Element in an Array.
8. Sorting in Ascending and Descending Orders.
9. Finding Largest and Smallest Elements from an Array.
10. Block Move

Text Books:

1.M. Morris Mano, Michael D. Ciletti, Digital Design, Pearson Education, 5th Edition, 2013.
2. Anil K. Maini, Digital Electronics: Principles, Devices and Applications, John Wiley & Sons, Ltd., 2007.

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3. N. Senthil Kumar, M. Saravanan, S. Jeevanathan, Microprocessor and Microcontrollers,Oxford Publishers, 2010.
4. Advanced microprocessors and peripherals-A.K ray and K.M.Bhurchandani, TMH, 2nd edition, 2006.

Reference Books:

1. Thomas L. Floyd, Digital Fundamentals – A Systems Approach, Pearson, 2013.
2. Charles H. Roth, Fundamentals of Logic Design, Cengage Learning, 5th, Edition, 2004.
3. D.V.Hall, Microprocessors and Interfacing. TMGH, 2nd edition, 2006.
4. Kenneth. J. Ayala, The 8051 microcontroller, 3rd edition, Cengage Learning, 2010.

Online learning Resources/Virtual labs

https://www.vlab.co.in

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Course Code	Advanced Data Structures and Algorithms Lab		L	T	P	C
20A05301P	(Common to CSE, IT, CSE(DS), CSE (IoT), CSE (AI), CSE (AI & ML) and AI & DS)		0	0	3	1.5
Pre-requisite	Basics of Data Structures	Semester	III			

Course Objectives:

- Learn data structures for various applications.
- Implement different operations of data structures by optimizing the performance.
- Develop applications using Greedy, Divide and Conquer, dynamic programming.
- Implement applications for backtracking algorithms using relevant data structures.

Course Outcomes (CO):

After completion of the course, students will be able to

- Understand and apply data structure operations.
- Understand and apply non-linear data structure operations.
- Apply Greedy, divide and conquer algorithms.
- Develop dynamic programming algorithms for various real-time applications.
- Illustrate and apply backtracking algorithms, further able to understand non-deterministic algorithms.

List of Experiments:

1. Write a program to implement the following operations on Binary Search Tree:
a) Insert b) Delete c) Search d) Display
2. Write a program to perform a Binary Search for a given set of integer values.
3. Write a program to implement Splay trees.
4. Write a program to implement Merge sort for the given list of integer values.
5. Write a program to implement Quicksort for the given list of integer values.
6. Write a program to find the solution for the knapsack problem using the greedy method.
7. Write a program to find minimum cost spanning tree using Prim's algorithm
8. Write a program to find minimum cost spanning tree using Kruskal's algorithm
9. Write a program to find a single source shortest path for a given graph.
10. Write a program to find the solution for job sequencing with deadlines problems.
11. Write a program to find the solution for a 0-1 knapsack problem using dynamic programming.
12. Write a program to solve Sum of subsets problem for a given set of distinct numbers using backtracking.
13. Implement N Queen's problem using Back Tracking.

References:

1. Y Daniel Liang, "Introduction to Programming using Python", Pearson.
2. Benjamin Baka, David Julian, "Python Data Structures and Algorithms", Packt Publishers,2017.
3. Rance D. Necaise, "Data Structures and Algorithms using Python", Wiley Student Edition.

Online Learning Resources/Virtual Labs:

http://cse01-iiith.vlabs.ac.in/
http://peterindia.net/Algorithms.html

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Comuper Science & Engineering (Data Science)

Course Code	**Advanced Python Programming for Data Science Lab**		**L**	**T**	**P**	**C**
20A32301P			**0**	**0**	**3**	**1.5**
Pre-requisite		**Semester**	**III**			

Course Objectives:

- Understand the python Programming Language libraries.
- Exposure on Solving of data science problems.
- Understand The classification and Regression Model.

Course Outcomes (CO):

After completion of the course, students will be able to

- Apply principles and techniques for optimizing the performance of Python numeric applications
- Implementparallel computing applications using Python
- Develop GPU accelerated Python applications

List of Experiments:

W-1	The number of birds banded at a series of sampling sites has been counted by your field crew and entered into the following list. The first item in each sublist is an alphanumeric code for the site and the second value is the number of birds banded. Cut and paste the list into your assignment and then answer the following questions by printing them to the screen. data = [['A1', 28], ['A2', 32], ['A3', 1], ['A4', 0], ['A5', 10], ['A6', 22], ['A7', 30], ['A8', 19], ['B1', 145], ['B2', 27], ['B3', 36], ['B4', 25], ['B5', 9], ['B6', 38], ['B7', 21], ['B8', 12], ['C1', 122], ['C2', 87], ['C3', 36], ['C4', 3], ['D1', 0], ['D2', 5], ['D3', 55], ['D4', 62], ['D5', 98], ['D6', 32]] 1. How many sites are there? 2. How many birds were counted at the 7th site? 3. How many birds were counted at the last site? 4. What is the total number of birds counted across all sites? 5. What is the average number of birds seen on a site? 6. What is the total number of birds counted on sites with codes beginning with C? (don't just identify this site by eye, in the real world there could be hundreds or thousands of sites)
W-2	1. Multiplication of two Matrices in Single line using Numpy in Python 2. Transpose a matrix in Single line using Python 3. Python program to print checkerboard pattern of nxn using numpy
W-3	Reading different types of data sets (.txt, .csv) fromWeb and disk and writing in file in specific disk location. Reading Excel data sheet

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	Reading XML dataset
W-4	1. Find the data distributions using box and scatter plot. 2. Find the outliers using plot. 3. Plot the histogram, bar chart and pie chart on sample data
W-5	1. Find the correlation matrix. 2. Plot the correlation plot on dataset and visualize giving an overview of relationships among data on iris data. 3. Analysis of covariance: variance (ANOVA), if data have categoricalvariables on iris data.
W-6	Import a data from web storage. Name the dataset and now do LogisticRegression to find out relation between variables that are affecting theadmission of a student in a institute based on his or her GRE score,GPA obtained and rank of the student. Also check the model is fit ornot. Require (foreign), require (MASS).
w-7	Decision Tree Classification, attribute selection measures, and how to build and optimize Decision Tree Classifier using Python Scikit-learn
W-8	Apply multiple regressions, if data have a continuousindependent variable. Apply on above dataset.
W-9	Apply regression Model techniques to predict the data
W-10	1. Install relevant package for classification. 2. Choose classifier for classification problem. 3. Evaluate the performance of classifier.
W-11	Clustering algorithms for unsupervised classification. Plot the cluster data using python with Matplotlib visualizations.
W-12	**Case Study: Data Science in Education** Data Science has also changed the way in which students interact with teachers and evaluate their performance. Instructors can use data science to analyse the feedback received from the students and use it to improve their teaching. Use Predictive modeling Data Science that can predict the drop-out rate of students based on their performance and inform the instructors to take necessary precautions.
References:	
1. https://www.w3schools.com/datascience/ 2. https://data-flair.training/blogs/data-science-tutorials-home/ 3. https://www.javatpoint.com/data-science 4. https://www.tutorialspoint.com/python_data_science/index.htm 5. https://intellipaat.com/blog/tutorial/data-science-tutorial/	
Online learning Resources/Virtual labs	
https://www.vlab.co.in	

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Course Code	Working with Hadoop		L	T	P	C
20A32302			1	0	2	2
Pre-requisite	NIL	Semester	III			

Course Objectives:

This skill course is **designed to provide knowledge and skills to become a successful Hadoop Developer**. In depth knowledge of concepts such as Hadoop Distributed File System, Hadoop Cluster – Single and multi-node, Hadoop 2.0, Map–Reduce etc.

Course Outcomes (CO):

After the completion of the course, the students will be able to analyse and work upon voluminous data on Hadoop platform of any organization from various perspectives and will be able to develop reports and trends may be seen and decisions with regards to business activities running in organizations may be taken.

List of Experiments:

Suggested topics learning:

- Basic Linux Commands, understanding how to connect to remote Linux server using putty kind of tool; Understanding VMware player setup and configuring Cloudera Bundle using player; Basic HDFS commands. HDFS commands in detail; Hadoop File System navigation and manipulation using commands.
- MapReduce Job submission to Hadoop Cluster from command line; WordCount MapReduce Job Development using eclipse IDE, packing and testing
- Using pig grunt shell; practicing pig commands from grunt shell. Writing pig scripts and running them. Processing different datasets using pig.

Tentative List of Experiments:

- Installation of Single Node Hadoop Cluster on Ubuntu 14.04.;
- Installation of Single Node Hadoop Cluster on Ubuntu.
- Hadoop Programming: Word Count MapReduce Program Using Eclipse.
- Implementing Matrix Multiplication Using One Map-Reduce Step. Implementing Relational Algorithm on Pig.
- Implementing database operations on Hive.
- Implementing Bloom Filter using Map-Reduce. Implementing Frequent Item set algorithm using Map-Reduce.
- Implementing Clustering algorithm using Map-Reduce.
- Implementing Page Rank algorithm using Map-Reduce.

References:

1. Mayank Bhushan , “Big Data and Hadoop – learn by Example”, BPB publication 2018.
2. Tom White “Hadoop: The Definitive Guide” Third Edit on, O’reily Media, 2012.
3. Seema Acharya, Subhashini Chellappan, "Big Data Analytics" Wiley 2015.

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Course Code	ENVIRONMENTAL SCIENCE (Common to All Branches of Engineering)		L	T	P	C
20A99201			3	0	0	0
Pre-requisite	NIL	Semester	III			

Course Objectives:

- To make the students to get awareness on environment
- To understand the importance of protecting natural resources, ecosystems for future generations and pollution causes due to the day to day activities of human life
- To save earth from the inventions by the engineers.

Course Outcomes (CO):

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

- Grasp multidisciplinary nature of environmental studies and various renewable and nonrenewable resources.
- Understand flow and bio-geo- chemical cycles and ecological pyramids.
- Understand various causes of pollution and solid waste management and related preventive measures.
- About the rainwater harvesting, watershed management, ozone layer depletion and waste land reclamation.
- Casus of population explosion, value education and welfare programmes.

UNIT - I **8 Hrs**

Multidisciplinary Nature Of Environmental Studies: – Definition, Scope and Importance – Need for Public Awareness.

Natural Resources : Renewable and non-renewable resources – Natural resources and associated problems – Forest resources – Use and over – exploitation, deforestation, case studies – Timber extraction – Mining, dams and other effects on forest and tribal people – Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. – Energy resources

UNIT - II **12 Hrs**

Ecosystems: Concept of an ecosystem. – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the following ecosystem:

a. Forest ecosystem.
b. Grassland ecosystem
c. Desert ecosystem
d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Biodiversity And Its Conservation : Introduction 0 Definition: genetic, species and ecosystem diversity – Bio-geographical classification of India – Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-sports of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

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UNIT - III		**8 Hrs**

Environmental Pollution: Definition, Cause, effects and control measures of :

a. Air Pollution.
b. Water pollution
c. Soil pollution
d. Marine pollution
e. Noise pollution
f. Thermal pollution
g. Nuclear hazards

Solid Waste Management: Causes**,** effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone and landslides.

UNIT - IV		**10 Hrs**

Social Issues and the Environment: From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rain water harvesting, watershed management – Resettlement and rehabilitation of people; its problems and concerns. Case studies – Environmental ethics: Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies – Wasteland reclamation. – Consumerism and waste products. – Environment Protection Act. – Air (Prevention and Control of Pollution) Act. – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Issues involved in enforcement of environmental legislation – Public awareness.

UNIT - V		**8 Hrs**

Human Population And The Environment: Population growth, variation among nations. Population explosion – Family Welfare Programmes. – Environment and human health – Human Rights – Value Education – HIV/AIDS – Women and Child Welfare – Role of information Technology in Environment and human health – Case studies.

Field Work: Visit to a local area to document environmental assets River/forest grassland/hill/mountain – Visit to a local polluted site-Urban/Rural/Industrial/Agricultural Study of common plants, insects, and birds – river, hill slopes, etc..

Textbooks:

1. Text book of Environmental Studies for Undergraduate Courses ErachBharucha for University Grants Commission, Universities Press.
2. Palaniswamy, “Environmental Studies”, Pearson education
3. S.AzeemUnnisa, “Environmental Studies” Academic Publishing Company
4. K.Raghavan Nambiar, “Text book of Environmental Studies for Undergraduate Courses as per UGC model syllabus”, Scitech Publications (India), Pvt. Ltd.

Reference Books:

1. Deeksha Dave and E.Sai Baba Reddy, “Textbook of Environmental Science”, Cengage Publications.
2. M.Anji Reddy, “Text book of Environmental Sciences and Technology”, BS Publication.
3. J.P.Sharma, Comprehensive Environmental studies, Laxmi publications.
4. J. Glynn Henry and Gary W. Heinke, “Environmental Sciences and Engineering”, Prentice hall of India Private limited
5. G.R.Chatwal, “A Text Book of Environmental Studies” Himalaya Publishing House
6. Gilbert M. Masters and Wendell P. Ela, “Introduction to Environmental Engineering and Science, Prentice hall of India Private limited.