



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

Computer 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 Hadoop	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							



R 20 Regulations

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Computer Science & Engineering (Data Science)

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



R 20 Regulations

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ANANTHAPURAMU – 515 002 (A.P) INDIA

Computer Science & Engineering (Data Science)

Course Code	Discrete Mathematics & Graph theory (Common to CSE, IT, CSE(DS), CSE (IoT), CSE (AI), CSE (AI & ML) and AI & DS)	L	T	P	C
20A54304		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 <ul style="list-style-type: none"> • 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:					



R 20 Regulations

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ANANTHAPURAMU – 515 002 (A.P) INDIA

Computer Science & Engineering (Data Science)

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 by Narsingh Deo.

Online Learning Resources:

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



R 20 Regulations
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ANANTHAPURAMU – 515 002 (A.P) INDIA

Comuper Science & Engineering (Data Science)



R 20 Regulations

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ANANTHAPURAMU – 515 002 (A.P) INDIA

Computer Science & Engineering (Data Science)

Course Code	Advanced Data Structures & Algorithms (Common to CSE, IT, CSE(DS), CSE (IoT), CSE (AI), CSE (AI & ML) and AI & DS)	L	T	P	C
20A05301T		3	0	0	3
Pre-requisite	Data Structures	Semester		III	
Course Objectives:					
<ul style="list-style-type: none"> 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 <ul style="list-style-type: none"> 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:					



R 20 Regulations

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ANANTHAPURAMU – 515 002 (A.P) INDIA

Comuper Science & Engineering (Data Science)

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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>



R 20 Regulations

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ANANTHAPURAMU – 515 002 (A.P) INDIA

Computer 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:					
<ul style="list-style-type: none"> 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					
<ul style="list-style-type: none"> 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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ANANTHAPURAMU – 515 002 (A.P) INDIA

Comuper Science & Engineering (Data Science)

Textbooks:
1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, “Computer Organization”, 5 th Edition, McGraw Hill Education, 2013.
Reference Books:
1. M.Morris Mano, “Computer System Architecture”, 3 rd Edition, Pearson Education. 2. Themes and Variations, Alan Clements, “Computer Organization and Architecture”, CENGAGE Learning. 3. Smruti Ranjan Sarangi, “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/



R 20 Regulations

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ANANTHAPURAMU – 515 002 (A.P) INDIA

Computer 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					
<ul style="list-style-type: none"> • 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					



R 20 Regulations

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ANANTHAPURAMU – 515 002 (A.P) INDIA

Comuper Science & Engineering (Data Science)

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



R 20 Regulations

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ANANTHAPURAMU – 515 002 (A.P) INDIA

Computer 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:						
<ul style="list-style-type: none">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: <ul style="list-style-type: none">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:						
<ol style="list-style-type: none">Verification of Truth Table for AND, OR, NOT, NAND, NOR and EX-OR gates.Realisation of NOT, AND, OR, EX-OR gates with only NAND and only NOR gates.Karnaughmap Reduction and Logic Circuit Implementation.Verification of DeMorgan's Laws.Implementation of Half-Adder and Half-Subtractor.Implementation of Full-Adder and Full-Subtractor.Four Bit Binary AdderFour Bit Binary Subtractor using 1's and 2's Complement.						
MICROPROCESSORS (8086 Assembly Language Programming)						
<ol style="list-style-type: none">8 Bit Addition and Subtraction.16 Bit Addition.BCD Addition .BCD Subtraction.8 Bit Multiplication.8 Bit Division.Searching for an Element in an Array.Sorting in Ascending and Descending Orders.Finding Largest and Smallest Elements from an Array.Block Move						
Text Books:						
<ol style="list-style-type: none">M. Morris Mano, Michael D. Ciletti, Digital Design, Pearson Education, 5th Edition, 2013.Anil K. Maini, Digital Electronics: Principles, Devices and Applications, John Wiley & Sons, Ltd., 2007.						



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ANANTHAPURAMU – 515 002 (A.P) INDIA

Computer Science & Engineering (Data Science)

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>



R 20 Regulations

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ANANTHAPURAMU – 515 002 (A.P) INDIA

Computer Science & Engineering (Data Science)

Course Code	Advanced Data Structures and Algorithms Lab (Common to CSE, IT, CSE(DS), CSE (IoT), CSE (AI), CSE (AI & ML) and AI & DS)	L	T	P	C
20A05301P		0	0	3	1.5
Pre-requisite	Basics of Data Structures	Semester	III		
Course Objectives:					
<ul style="list-style-type: none">• 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					
<ul style="list-style-type: none">• 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:					
<ol style="list-style-type: none">1. Write a program to implement the following operations on Binary Search Tree: a) Insert b) Delete c) Search d) Display2. 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 algorithm8. Write a program to find minimum cost spanning tree using Kruskal's algorithm9. 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:					
<ol style="list-style-type: none">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. Necaie, "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					



R 20 Regulations

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ANANTHAPURAMU – 515 002 (A.P) INDIA

Computer 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:					
<ul style="list-style-type: none"> 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 <ul style="list-style-type: none"> Apply principles and techniques for optimizing the performance of Python numeric applications Implement parallel computing applications using Python Develop GPU accelerated Python applications 					
List of Experiments:					
W-1	<p>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.</p> <pre>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]]</pre> <ol style="list-style-type: none"> How many sites are there? How many birds were counted at the 7th site? How many birds were counted at the last site? What is the total number of birds counted across all sites? What is the average number of birds seen on a site? 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	<ol style="list-style-type: none"> Multiplication of two Matrices in Single line using Numpy in Python Transpose a matrix in Single line using Python Python program to print checkerboard pattern of nxn using numpy 				
W-3	Reading different types of data sets (.txt, .csv) from Web and disk and writing in file in specific disk location. Reading Excel data sheet				



R 20 Regulations

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Computer Science & Engineering (Data Science)

	Reading XML dataset
W-4	<ol style="list-style-type: none"> 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	<ol style="list-style-type: none"> 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 categorical variables 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 the admission of a student in an institute based on his or her GRE score, GPA obtained and rank of the student. Also check the model is fit or not. 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 continuous independent variable. Apply on above dataset.
W-9	Apply regression Model techniques to predict the data
W-10	<ol style="list-style-type: none"> 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	<p>Case Study: Data Science in Education</p> <p>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.</p> <p>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.</p>
References:	
<ol style="list-style-type: none"> 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	



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

Computer Science & Engineering (Data Science)

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:						
<ul style="list-style-type: none"> • 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:						
<ul style="list-style-type: none"> • 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:						
<ol style="list-style-type: none"> 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. 						



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

Computer Science & Engineering (Data Science)

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:						
<ul style="list-style-type: none"> 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):						
<p>At the end of the course, the student will be able to</p> <ul style="list-style-type: none"> 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	
<p>Multidisciplinary Nature Of Environmental Studies: – Definition, Scope and Importance – Need for Public Awareness.</p> <p>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</p>						
UNIT - II					12 Hrs	
<p>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:</p> <ol style="list-style-type: none"> Forest ecosystem. Grassland ecosystem Desert ecosystem Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) <p>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-spots 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.</p>						



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

Compuer Science & Engineering (Data Science)

UNIT - III	8 Hrs
<p>Environmental Pollution: Definition, Cause, effects and control measures of :</p> <ol style="list-style-type: none">a. Air Pollution.b. Water pollutionc. Soil pollutiond. Marine pollutione. Noise pollutionf. Thermal pollutiong. Nuclear hazards <p>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.</p>	
UNIT - IV	10 Hrs
<p>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.</p>	
UNIT - V	8 Hrs
<p>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.</p> <p>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..</p>	
<p>Textbooks:</p> <ol style="list-style-type: none">1. Text book of Environmental Studies for Undergraduate Courses ErachBharucha for University Grants Commission, Universities Press.2. Palaniswamy, “Environmental Studies”, Pearson education3. S.AzeemUnnisa, “Environmental Studies” Academic Publishing Company4. K.Raghavan Nambiar, “Text book of Environmental Studies for Undergraduate Courses as per UGC model syllabus”, Scitech Publications (India), Pvt. Ltd.	
<p>Reference Books:</p> <ol style="list-style-type: none">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 limited5. G.R.Chatwal, “A Text Book of Environmental Studies” Himalaya Publishing House6. Gilbert M. Masters and Wendell P. Ela, “Introduction to Environmental Engineering and Science, Prentice hall of India Private limited.	



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

Computer Science & Engineering (Data Science)

Course Code	Statistical Methods for Data Science		L	T	P	C
20A54405	CSE (Data Science)		3	0	0	3
Pre-requisite		Semester	IV			
Course Objectives:						
This course aims at providing knowledge on basic concepts of Statistics, Estimation and testing of hypotheses for large and small samples.						
Course Outcomes (CO): Student will be able to						
<ul style="list-style-type: none"> • Understand the basic concepts of Statistics • Analyze data and draw conclusion about collection of data under study using Point estimation • Analyze data and draw conclusion about collection of data under study using Interval estimation • Analyzing the tests and types of errors for large samples • Apply testing of hypothesis for small samples. 						
UNIT - I	Basic Concepts		9 Hrs			
Population, sample, parameter and statistic; characteristics of a good estimator; Consistency – Invariance property of Consistent estimator, Sufficient condition for consistency; Unbiasedness; Sufficiency – Factorization Theorem – Minimal sufficiency; Efficiency – Most efficient estimator, likelihood equivalence, Uniformly minimum variance unbiased estimator, applications of Lehmann-Scheffe’s Theorem, Rao - Blackwell Theorem and applications						
UNIT - II	Point Estimation		8 Hrs			
Point Estimation- Estimator, Estimate, Methods of point estimation – Maximum likelihood method (the asymptotic properties of ML estimators are not included), Large sample properties of ML estimator(without proof)- applications , Method of moments, method of least squares, method of minimum chi-square and modified minimum chi-square-Asymptotic Maximum Likelihood Estimation and applications.						
UNIT - III	Interval Estimation		8 Hrs			
Confidence limits and confidence coefficient; Duality between acceptance region of a test and a confidence interval; Construction of confidence intervals for population proportion (small and large samples) and between two population proportions(large samples); Confidence intervals for mean and variance of a normal population; Difference between the mean and ratio of two normal populations.						
UNIT - IV	Testing of hypotheses		9 Hrs			
Types of errors, power of a test, most powerful tests; Neyman-Pearson Fundamental Lemma and its applications; Notion of Uniformly most powerful tests; Likelihood Ratio tests: Description and property of LR tests - Application to standard distributions.						
UNIT - V	Small sample tests		9 Hrs			
Student’s t-test, test for a population mean, equality of two population means, paired t-test, F-test for equality of two population variances,CRD,RBD,LSD; Chi-square test for goodness of fit and test for independence of attributes, χ^2 test for testing variance of a normal distribution Sign test, Signed rank test, Median test, Mann-Whitney test, Run test and One sample Kolmogorov – Smirnov test ,Kruskal – Wallis H test(Description, properties and applications only).						
Textbooks:						



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

Computer Science & Engineering (Data Science)

1. Manoj Kumar Srivastava and Namita Srivastava, Statistical Inference – Testing of Hypotheses, Prentice Hall of India, 2014.
2. Robert V Hogg, Elliot A Tannis and Dale L.Zimmerman, Probability and Statistical Inference, 9th edition, Pearson publishers, 2013.

Reference Books:

1. S.P.Gupta, Statistical Methods, 33rd Edition, Sultan Chand & Sons.
2. Miller and John E Freund, Probability and Statistics for Engineers, 5th Edition.

Online Learning Resources:

1. <https://www.statstutor.ac.uk/resources/uploaded/introduction3.pdf>
2. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2996198/>



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

Computer Science & Engineering (Data Science)

Course Code	DATABASE MANAGEMENT SYSTEMS (Common to CSE, IT, CSE(DS), CSE (IoT), CSE (AI), CSE (AI & ML) and AI & DS)		L	T	P	C
20A05401T			3	0	0	3
Pre-requisite	NIL	Semester	IV			
Course Objectives:						
<p>This course is designed to:</p> <ul style="list-style-type: none"> • Train in the fundamental concepts of database management systems, database modeling and design, SQL, PL/SQL and system implementation techniques. • Enable students to model ER diagrams for any customized application • Inducting appropriate strategies for optimization of queries. • Provide knowledge on concurrency techniques • Demonstrate the organization of Databases 						
Course Outcomes (CO):						
<p>After completion of the course, students will be able to</p> <ul style="list-style-type: none"> • Design a database for a real-world information system • Define transactions that preserve the integrity of the database • Generate tables for a database • Organize the data to prevent redundancy • Pose queries to retrieve the information from the database. 						
UNIT - I	Introduction, Introduction to Relational Model		9Hrs			
<p>Introduction: Database systems applications, Purpose of Database Systems, view of Data, Database Languages, Relational Databases, Database Design, Data Storage and Querying, Transaction Management, Database Architecture, Data Mining and Information Retrieval, Specialty Databases, Database users and Administrators, Introduction to Relational Model: Structure of Relational Databases, Database Schema, Keys, Schema Diagrams, Relational Query Languages, Relational Operations</p>						
UNIT - II	Introduction to SQL, Advanced SQL		9 Hrs			
<p>Introduction to SQL: Overview of the SQL Query Language, SQL Data Definition, Basic Structure of SQL Queries, Additional Basic Operations, Set Operations, Null Values, Aggregate Functions, Nested Sub-queries, Modification of the Database. Intermediate SQL: Joint Expressions, Views, Transactions, Integrity Constraints, SQL Data types and schemas, Authorization. Advanced SQL: Accessing SQL from a Programming Language, Functions and Procedures, Triggers, Recursive Queries, OLAP, Formal relational query languages.</p>						
UNIT - III	Database Design and the E-R Model, Relational Database Design		8Hrs			
<p>Database Design and the E-R Model: Overview of the Design Process, The Entity-Relationship Model, Constraints, Removing Redundant Attributes in Entity Sets, Entity-Relationship Diagrams, Reduction to Relational Schemas, Entity-Relationship Design Issues. Relational Database Design: Features of Good Relational Designs, Atomic Domains and First Normal Form, Decomposition Using Functional Dependencies, Functional-Dependency Theory, Algorithms for Decomposition, Decomposition Using Multivalued Dependencies, More Normal Forms.</p>						
UNIT - IV	Query Processing, Query optimization		8 Hrs			
<p>Query Processing: Overview, Measures of Query cost, Selection operation, sorting, Join Operation, other operations, Evaluation of Expressions. Query optimization: Overview, Transformation of Relational Expressions, Estimating statistics of Expression results, Choice of Evaluation Plans, Materialized views, Advanced Topics in Query Optimization.</p>						
UNIT - V	Transaction Management, Concurrency Control, Recovery System		10Hrs			
<p>Transaction Management: Transactions: Concept, A Simple Transactional Model, Storage Structures, Transaction Atomicity and Durability, Transaction Isolation, Serializability, Isolation and Atomicity, Transaction Isolation Levels, Implementation of Isolation Levels, Transactions as SQL Statements.</p>						



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

Computer Science & Engineering (Data Science)

Concurrency Control: Lock-based Protocols, Deadlock Handling, Multiple granularity, Timestamp-based Protocols, and Validation-based Protocols.
Recovery System: Failure Classification, Storage, Recovery and Atomicity, Recovery Algorithm, Buffer Management, Failure with Loss of Nonvolatile Storage, Early Lock Release and Logical Undo Operations.
Textbooks:
1. A.Silberschatz, H.F.Korth, S.Sudarshan, “Database System Concepts”,6/e, TMH 2019
Reference Books:
1. Database Management System, 6/e RamezElmasri, Shamkant B. Navathe, PEA
2. Database Principles Fundamentals of Design Implementation and Management, Carlos Coronel, Steven Morris, Peter Robb, Cengage Learning.
3.Database Management Systems, 3/e, Raghurama Krishnan, Johannes Gehrke,TMH
Online Learning Resources:
https://onlinecourses.nptel.ac.in/noc21_cs04/preview



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

Computer Science & Engineering (Data Science)

Course Code	OPERATING SYSTEMS		L	T	P	C
20A05402T	(Common to CSE, IT, CSE(DS), CSE (IoT), CSE (AI), CSE (AI & ML) and AI & DS)		3	0	0	3
Pre-requisite	Basics of CO and DBMS	Semester	IV			
Course Objectives:						
<p>The course is designed to</p> <ul style="list-style-type: none"> • Understand basic concepts and functions of operating systems • Understand the processes, threads and scheduling algorithms. • Provide good insight on various memory management techniques • Expose the students with different techniques of handling deadlocks • Explore the concept of file-system and its implementation issues • Familiarize with the basics of the Linux operating system • Implement various schemes for achieving system protection and security 						
Course Outcomes (CO):						
<p>After completion of the course, students will be able to</p> <ul style="list-style-type: none"> • Realize how applications interact with the operating system • Analyze the functioning of a kernel in an Operating system. • Summarize resource management in operating systems • Analyze various scheduling algorithms • Examine concurrency mechanism in Operating Systems • Apply memory management techniques in the design of operating systems • Understand the functionality of the file system • Compare and contrast memory management techniques. • Understand deadlock prevention and avoidance. • Perform administrative tasks on Linux based systems. 						
UNIT - I	Operating Systems Overview, System Structures		8Hrs			
<p>Operating Systems Overview: Introduction, Operating system functions, Operating systems operations, Computing environments, Open-Source Operating Systems System Structures: Operating System Services, User and Operating-System Interface, systems calls, Types of System Calls, system programs, Operating system Design and Implementation, Operating system structure, Operating system debugging, System Boot.</p>						
UNIT - II	Process Concept, Multithreaded Programming, Process Scheduling, Inter-process Communication		10Hrs			
<p>Process Concept: Process scheduling, Operations on processes, Inter-process communication, Communication in client server systems. Multithreaded Programming: Multithreading models, Thread libraries, Threading issues, Examples. Process Scheduling: Basic concepts, Scheduling criteria, Scheduling algorithms, Multiple processor scheduling, Thread scheduling, Examples. Inter-process Communication: Race conditions, Critical Regions, Mutual exclusion with busy waiting, Sleep and wakeup, Semaphores, Mutexes, Monitors, Message passing, Barriers, Classical IPC Problems - Dining philosophers problem, Readers and writers problem.</p>						
UNIT - III	Memory-Management Strategies, Virtual Memory Management		Lecture 8Hrs			
<p>Memory-Management Strategies: Introduction, Swapping, Contiguous memory allocation, Paging, Segmentation, Examples. Virtual Memory Management: Introduction, Demand paging, Copy on-write, Page replacement, Frame allocation, Thrashing, Memory-mapped files, Kernel memory allocation, Examples.</p>						
UNIT - IV	Deadlocks, File Systems		Lecture 9Hrs			



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

Computer Science & Engineering (Data Science)

Deadlocks: Resources, Conditions for resource deadlocks, Ostrich algorithm, Deadlock detection And recovery, Deadlock avoidance, Deadlock prevention.

File Systems: Files, Directories, File system implementation, management and optimization.

Secondary-Storage Structure: Overview of disk structure, and attachment, Disk scheduling, RAID structure, Stable storage implementation.

UNIT - V	System Protection, System Security	Lecture 8Hrs
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System Protection: Goals of protection, Principles and domain of protection, Access matrix, Access control, Revocation of access rights.

System Security: Introduction, Program threats, System and network threats, Cryptography as a security, User authentication, implementing security defenses, firewalling to protect systems and networks, Computer security classification.

Case Studies: Linux, Microsoft Windows.

Textbooks:

1. Silberschatz A, Galvin P B, and Gagne G, Operating System Concepts, 9th edition, Wiley, 2016.
2. Tanenbaum A S, Modern Operating Systems, 3rd edition, Pearson Education, 2008.
(Topics: Inter-process Communication and File systems.)

Reference Books:

1. Tanenbaum A S, Woodhull A S, Operating Systems Design and Implementation, 3rd edition, PHI, 2006.
2. Dhamdhare D M, Operating Systems A Concept Based Approach, 3rd edition, Tata McGraw-Hill, 2012.
3. Stallings W, Operating Systems -Internals and Design Principles, 6th edition, Pearson Education, 2009
4. Nutt G, Operating Systems, 3rd edition, Pearson Education, 2004

Online Learning Resources:

<https://nptel.ac.in/courses/106/106/106106144/>
<http://peterindia.net/OperatingSystems.html>



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

Computer Science & Engineering (Data Science)

Course Code	Software Engineering	L	T	P	C
20A05403T	(Common to CSE, IT, CSE(DS), CSE (IoT))	3	0	0	3
Pre-requisite	Semester	IV			
Course Objectives:					
<ul style="list-style-type: none"> To learn the basic concepts of software engineering and life cycle models To explore the issues in software requirements specification and enable to write SRS documents for software development problems To elucidate the basic concepts of software design and enable to carry out procedural and object oriented design of software development problems To understand the basic concepts of black box and white box software testing and enable to design test cases for unit, integration, and system testing To reveal the basic concepts in software project management 					
Course Outcomes (CO):					
After completion of the course, students will be able to					
<ul style="list-style-type: none"> Obtain basic software life cycle activity skills. Design software requirements specifications for given problems. Implement structure, object oriented analysis and design for given problems. Design test cases for given problems. Apply quality management concepts at the application level. 					
UNIT - I	Basic concepts in software engineering and software project management	8Hrs			
Basic concepts: abstraction versus decomposition, evolution of software engineering techniques, Software development life cycle (SDLC) models: Iterative waterfall model, Prototype model, Evolutionary model, Spiral model, RAD model, Agile models, software project management: project planning, project estimation, COCOMO, Halstead's Software Science, project scheduling, staffing, Organization and team structure, risk management, configuration management.					
UNIT - II	Requirements analysis and specification	8Hrs			
The nature of software, The Unique nature of Webapps, Software Myths, Requirements gathering and analysis, software requirements specification, Traceability, Characteristics of a Good SRS Document, IEEE 830 guidelines, representing complex requirements using decision tables and decision trees, overview of formal system development techniques, axiomatic specification, algebraic specification.					
UNIT - III	Software Design	9Hrs			
Good Software Design, Cohesion and coupling, Control Hierarchy: Layering, Control Abstraction, Depth and width, Fan-out, Fan-in, Software design approaches, object oriented vs. function oriented design. Overview of SA/SD methodology, structured analysis, Data flow diagram, Extending DFD technique to real life systems, Basic Object oriented concepts, UML Diagrams, Structured design, Detailed design, Design review, Characteristics of a good user interface, User Guidance and Online Help, Mode-based vs Mode-less Interface, Types of user interfaces, Component-based GUI development, User interface design methodology: GUI design methodology.					
UNIT - IV	Coding and Testing	9Hrs			
Coding standards and guidelines, code review, software documentation, Testing, Black Box Testing, White Box Testing, debugging, integration testing, Program Analysis Tools, system testing, performance testing, regression testing, Testing Object Oriented Programs.					
UNIT - V	Software quality, reliability, and other issues	9Hrs			
Software reliability, Statistical testing, Software quality and management, ISO 9000, SEI capability maturity model (CMM), Personal software process (PSP), Six sigma, Software quality metrics, CASE and its scope, CASE environment, CASE support in software life cycle, Characteristics of software maintenance, Software reverse engineering, Software maintenance processes model, Estimation maintenance cost. Basic issues in any reuse program, Reuse approach, Reuse at organization level.					
Textbooks:					



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

Computer Science & Engineering (Data Science)

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| <ol style="list-style-type: none">1. Rajib Mall, “Fundamentals of Software Engineering”, 5th Edition, PHI, 2018.2. Pressman R, “Software Engineering- Practioner Approach”, McGraw Hill. |
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Reference Books:

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| <ol style="list-style-type: none">1. Somerville, “Software Engineering”, Pearson 2.2. Richard Fairley, “Software Engineering Concepts”, Tata McGraw Hill.3. JalotePankaj, “An integrated approach to Software Engineering”, Narosa |
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Online Learning Resources:

<p>https://nptel.ac.in/courses/106/105/106105182/ http://peterindia.net/SoftwareDevelopment.html</p>
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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

Computer Science & Engineering (Data Science)

Course Code	MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS		L	T	P	C
20A52301	(Common to All branches of Engineering)		3	0	0	3
Pre-requisite	NIL	Semester	III			
Course Objectives:						
<ul style="list-style-type: none"> To inculcate the basic knowledge of micro economics and financial accounting To make the students learn how demand is estimated for different products, input-output relationship for optimizing production and cost To Know the Various types of market structure and pricing methods and strategy To give an overview on investment appraisal methods to promote the students to learn how to plan long-term investment decisions. To provide fundamental skills on accounting and to explain the process of preparing financial statements 						
Course Outcomes (CO):						
<ul style="list-style-type: none"> Define the concepts related to Managerial Economics, financial accounting and management. Understand the fundamentals of Economics viz., Demand, Production, cost, revenue and markets Apply the Concept of Production cost and revenues for effective Business decision Analyze how to invest their capital and maximize returns Evaluate the capital budgeting techniques Develop the accounting statements and evaluate the financial performance of business entity. 						
UNIT - I	Managerial Economics					
Introduction – Nature, meaning, significance, functions, and advantages. Demand-Concept, Function, Law of Demand - Demand Elasticity- Types – Measurement. Demand Forecasting- Factors governing Forecasting, Methods. Managerial Economics and Financial Accounting and Management.						
UNIT - II	Production and Cost Analysis					
Introduction – Nature, meaning, significance, functions and advantages. Production Function– Least-cost combination– Short run and Long run Production Function- Isoquants and Isocosts, MRTS - Cobb-Douglas Production Function - Laws of Returns - Internal and External Economies of scale. Cost & Break-Even Analysis - Cost concepts and Cost behavior- Break-Even Analysis (BEA) - Determination of Break-Even Point (Simple Problems)-Managerial significance and limitations of Break-Even Analysis.						
UNIT - III	Business Organizations and Markets					
Introduction – Nature, meaning, significance, functions and advantages. Forms of Business Organizations- Sole Proprietary - Partnership - Joint Stock Companies - Public Sector Enterprises. Types of Markets - Perfect and Imperfect Competition - Features of Perfect Competition Monopoly- Monopolistic Competition–Oligopoly-Price-Output Determination - Pricing Methods and Strategies						
UNIT - IV	Capital Budgeting					
Introduction – Nature, meaning, significance, functions and advantages. Types of Working Capital, Components, Sources of Short-term and Long-term Capital, Estimating Working capital requirements. Capital Budgeting– Features, Proposals, Methods and Evaluation. Projects – Pay Back Method, Accounting Rate of Return (ARR) Net Present Value (NPV) Internal Rate Return (IRR) Method (sample problems)						
UNIT - V	Financial Accounting and Analysis					
Introduction – Nature, meaning, significance, functions and advantages. Concepts and Conventions- Double-Entry Book Keeping, Journal, Ledger, Trial Balance- Final Accounts (Trading Account, Profit						



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

Computer Science & Engineering (Data Science)

and Loss Account and Balance Sheet with simple adjustments). *Financial Analysis* - Analysis and Interpretation of Liquidity Ratios, Activity Ratios, and Capital structure Ratios and Profitability.

Textbooks:

1. Varshney&Maheswari: Managerial Economics, Sultan Chand, 2013.
2. Aryasri: Business Economics and Financial Analysis, 4/e, MGH, 2019

Reference Books:

1. Ahuja HI Managerial economics Schand,3/e,2013
2. S.A. Siddiqui and A.S. Siddiqui: Managerial Economics and Financial Analysis, New Age International, 2013.
3. Joseph G. Nellis and David Parker: Principles of Business Economics, Pearson, 2/e, New Delhi.
4. Domnick Salvatore: Managerial Economics in a Global Economy, Cengage, 2013.

Online Learning Resources:

<https://www.slideshare.net/123ps/managerial-economics-ppt>
<https://www.slideshare.net/rossanz/production-and-cost-45827016>
<https://www.slideshare.net/darkyla/business-organizations-19917607>
<https://www.slideshare.net/balarajbl/market-and-classification-of-market>
<https://www.slideshare.net/ruchi101/capital-budgeting-ppt-59565396>
<https://www.slideshare.net/ashu1983/financial-accounting>



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

Computer Science & Engineering (Data Science)

Course Code	ORGANISATIONAL BEHAVIOUR (Common to All branches of Engineering)		L	T	P	C
20A52302			3	0	0	3
Pre-requisite	NIL	Semester	III			
Course Objectives:						
<ul style="list-style-type: none"> To enable student's comprehension of organizational behavior To offer knowledge to students on self-motivation, leadership and management To facilitate them to become powerful leaders To Impart knowledge about group dynamics To make them understand the importance of change and development 						
Course Outcomes (CO):						
<ul style="list-style-type: none"> Define the Organizational Behaviour, its nature and scope. Understand the nature and concept of Organizational behaviour Apply theories of motivation to analyse the performance problems Analyse the different theories of leadership Evaluate group dynamics Develop as powerful leader 						
UNIT - I	Introduction to Organizational Behavior					
Meaning, definition, nature, scope and functions - Organizing Process – Making organizing effective -Understanding Individual Behaviour –Attitude -Perception - Learning – Personality.						
UNIT - II	Motivation and Leading					
Theories of Motivation- Maslow's Hierarchy of Needs - Herzberg's Two Factor Theory - Vroom's theory of expectancy – Mc Clelland's theory of needs–Mc Gregor's theory X and theory Y– Adam's equity theory – Locke's goal setting theory– Alderfer's ERG theory .						
UNIT - III	Organizational Culture					
Introduction – Meaning, scope, definition, Nature - Organizational Climate - Leadership - Traits Theory–Managerial Grid - Transactional Vs Transformational Leadership - Qualities of good Leader - Conflict Management -Evaluating Leader- Women and Corporate leadership.						
UNIT - IV	Group Dynamics					
Introduction – Meaning, scope, definition, Nature- Types of groups - Determinants of group behavior - Group process – Group Development - Group norms - Group cohesiveness - Small Groups - Group decision making - Team building - Conflict in the organization– Conflict resolution						
UNIT - V	Organizational Change and Development					
Introduction –Nature, Meaning, scope, definition and functions- Organizational Culture - Changing the Culture – Change Management – Work Stress Management - Organizational management – Managerial implications of organization's change and development						
Textbooks:						
1. Luthans, Fred, Organisational Behaviour, McGraw-Hill, 12 Th edition 2011 2. P Subba Ran, Organisational Behaviour, Himalya Publishing House 2017						
Reference Books:						
<ul style="list-style-type: none"> McShane, Organizational Behaviour, TMH 2009 Nelson, Organisational Behaviour, Thomson, 2009. Robbins, P. Stephen, Timothy A. Judge, Organisational Behaviour, Pearson 2009. Aswathappa, Organisational Behaviour, Himalaya, 2009 						
Online Learning Resources:						
httphttps://www.slideshare.net/Knight1040/organizational-culture-9608857s://www.slideshare.net/AbhayRajpoot3/motivation-165556714 https://www.slideshare.net/harshrastogi1/group-dynamics-159412405 https://www.slideshare.net/vanyasingla1/organizational-change-development-26565951						



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)



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

Compuer Science & Engineering (Data Science)

Course Code	Business Environment (Common to All branches of Engineering)		L	T	P	C
20A52303			3	0	0	3
Pre-requisite	NIL	Semester	III			
Course Objectives:						
<ul style="list-style-type: none"> • To make the student to understand about the business environment • To enable them in knowing the importance of fiscal and monetary policy • To facilitate them in understanding the export policy of the country • To Impart knowledge about the functioning and role of WTO • To Encourage the student in knowing the structure of stock markets 						
Course Outcomes (CO):						
<ul style="list-style-type: none"> • Define Business Environment and its Importance. • Understand various types of business environment. • Apply the knowledge of Money markets in future investment • Analyse India's Trade Policy • Evaluate fiscal and monetary policy • Develop a personal synthesis and approach for identifying business opportunities 						
UNIT - I	Overview of Business Environment					
Introduction – meaning Nature, Scope, significance, functions and advantages. Types-Internal & External, Micro and Macro. Competitive structure of industries -Environmental analysis- advantages & limitations of environmental analysis& Characteristics of business.						
UNIT - II	Fiscal & Monetary Policy					
Introduction – Nature, meaning, significance, functions and advantages. Public Revenues - Public Expenditure - Evaluation of recent fiscal policy of GOI. Highlights of Budget- Monetary Policy - Demand and Supply of Money –RBI -Objectives of monetary and credit policy - Recent trends- Role of Finance Commission.						
UNIT - III	India's Trade Policy					
Introduction – Nature, meaning, significance, functions and advantages. Magnitude and direction of Indian International Trade - Bilateral and Multilateral Trade Agreements - EXIM policy and role of EXIM bank -Balance of Payments– Structure & Major components - Causes for Disequilibrium in Balance of Payments - Correction measures.						
UNIT - IV	World Trade Organization					
Introduction – Nature, significance, functions and advantages. Organization and Structure - Role and functions of WTO in promoting world trade - GATT -Agreements in the Uruguay Round –TRIPS, TRIMS - Disputes Settlement Mechanism - Dumping and Anti-dumping Measures.						
UNIT - V	Money Markets and Capital Markets					
Introduction – Nature, meaning, significance, functions and advantages. Features and components of Indian financial systems - Objectives, features and structure of money markets and capital markets - Reforms and recent development – SEBI – Stock Exchanges - Investor protection and role of SEBI, Introduction to international finance.						
Textbooks:						
1. Francis Cherunilam (2009), International Business: Text and Cases, Prentice Hall of India. 2. K. Aswathappa, Essentials of Business Environment: Texts and Cases & Exercises 13th Revised Edition.HPH2016						
Reference Books:						



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)

- 1.K. V. Sivayya, V. B. M Das (2009), Indian Industrial Economy, Sultan Chand Publishers, New Delhi, India.
2. Sundaram, Black (2009), International Business Environment Text and Cases, Prentice Hall of India, New Delhi, India.
3. Chari. S. N (2009), International Business, Wiley India.
- 4.E. Bhattacharya (2009), International Business, Excel Publications, New Delhi.

Online Learning Resources:

<https://www.slideshare.net/ShompaDhali/business-environment-53111245>
<https://www.slideshare.net/rbalsells/fiscal-policy-ppt>
<https://www.slideshare.net/aguness/monetary-policy-presentationppt>
<https://www.slideshare.net/DaudRizwan/monetary-policy-of-india-69561982>
<https://www.slideshare.net/ShikhaGupta31/indias-trade-policyppt>
<https://www.slideshare.net/viking2690/wto-ppt-60260883>
<https://www.slideshare.net/prateeknepal3/ppt-mo>



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

Computer Science & Engineering (Data Science)

Course Code	Database Management Systems Lab	L	T	P	C
20A05401P	(Common to CSE, IT, CSE(DS), CSE (IoT), CSE (AI), CSE (AI & ML) and AI & DS)	0	0	3	1.5
Pre-requisite		Semester IV			

Course Objectives:

- To implement the basic knowledge of SQL queries and relational algebra.
- To construct database models for different database applications.
- To apply normalization techniques for refining of databases.
- To practice various triggers, procedures, and cursors using PL/SQL.
- To design and implementation of a database for an organization

Course Outcomes (CO):

After completion of the course, students will be able to

- Design database for any real world problem
- Implement PL/SQL programs
- Define SQL queries
- Decide the constraints
- Investigate for data inconsistency

List of Experiments:

Week-1: CREATION OF TABLES

1. Create a table called Employee with the following structure.

Name	Type
Empno	Number
Ename	Varchar2(20)
Job	Varchar2(20)
Mgr	Number
Sal	Number

- a. Add a column commission with domain to the Employee table.
- b. Insert any five records into the table.
- c. Update the column details of job
- d. Rename the column of Employ table using alter command.
- e. Delete the employee whose empno is 19.

2. Create department table with the following structure.

Name	Type
Deptno	Number
Deptname	Varchar2(20)
location	Varchar2(20)

- a. Add column designation to the department table.
- b. Insert values into thetable.
- c. List the records of emp table grouped bydeptno.
- d. Update the record where deptno is 9.
- e. Delete any column data from thetable

3. Create a table called Customertable

Name	Type
-------------	-------------



Computer Science & Engineering (Data Science)

Cust name	Varchar2(20)
Cust street	Varchar2(20)
Cust city	Varchar2(20)

- a. Insert records into the table.
- b. Add salary column to the table.
- c. Alter the table column domain.
- d. Drop salary column of the customer table.
- e. Delete the rows of customer table whose cust_city is 'hyd'.
- f. Create a table called branch table.

Name	Type
Branch name	Varchar2(20)
Branch city	Varchar2(20)
asserts	Number

4. Increase the size of data type for asserts to the branch.
 - a. Add and drop a column to the branch table.
 - b. Insert values to the table.
 - c. Update the branch name column
 - d. Delete any two columns from the table
5. Create a table called sailor table

Name	Type
Sid	Number
Sname	Varchar2(20)
rating	Varchar2(20)

- a. Add column age to the sailor table.
 - b. Insert values into the sailor table.
 - c. Delete the row with rating > 8.
 - d. Update the column details of sailor.
 - e. Insert null values into the table.
6. Create a table called reserves table

Name	Type
Boat id	Integer
sid	Integer
day	Integer

- a. Insert values into the reservestable.
- b. Add column time to the reservestable.
- c. Alter the column day data type to date.
- d. Drop the column time in the table.
- e. Delete the row of the table with some condition.

Week-2: QUERIES USING DDL AND DML

1.
 - a. Create a user and grant all permissions to the user.
 - b. Insert the any three records in the employee table and use rollback. Check the result.
 - c. Add primary key constraint and not null constraint to the employee table.
 - d. Insert null values to the employee table and verify the result.
2.
 - a. Create a user and grant all permissions to the user.



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

Computer Science & Engineering (Data Science)

- b. Insert values in the department table and use commit.
- c. Add constraints like unique and not null to the department table.
- d. Insert repeated values and null values into the table.
3. a. Create a user and grant all permissions to the user.
- b. Insert values into the table and use commit.
- c. Delete any three records in the department table and use rollback.
- d. Add constraint primary key and foreign key to the table.
4. a. Create a user and grant all permissions to the user.
- b. Insert records in the sailor table and use commit.
- c. Add save point after insertion of records and verify save point.
- d. Add constraints not null and primary key to the sailor table.
5. a. Create a user and grant all permissions to the user.
- b. Use revoke command to remove user permissions.
- c. Change password of the user created.
- d. Add constraint foreign key and not null.
6. a. Create a user and grant all permissions to the user.
- b. Update the table reserves and use save point and rollback.
- c. Add constraint primary key, foreign key and not null to the reserves table
- d. Delete constraint not null to the table column

Week-3: QUERIES USING AGGREGATE FUNCTIONS

1. a. By using the group by clause, display the enames who belongs to deptno 10 along with average salary.
- b. Display lowest paid employee details under each department.
- c. Display number of employees working in each department and their department number.
- d. Using built in functions, display number of employees working in each department and their department name from dept table. Insert deptname to dept table and insert deptname for each row, do the required thing specified above.
- e. List all employees which start with either B or C.
- f. Display only these ename of employees where the maximum salary is greater than or equal to 5000.
2. a. Calculate the average salary for each different job.
- b. Show the average salary of each job excluding manager.
- c. Show the average salary for all departments employing more than three people.
- d. Display employees who earn more than the lowest salary in department 30
- e. Show that value returned by sign (n) function.
- f. How many days between day of birth to current date
3. a. Show that two substring as single string.
- b. List all employee names, salary and 15% rise in salary.
- c. Display lowest paid emp details under each manager
- d. Display the average monthly salary bill for each deptno.
- e. Show the average salary for all departments employing more than two people.
- f. By using the group by clause, display the eid who belongs to deptno 05 along with average salary.
4. a. Count the number of employees in department 20
- b. Find the minimum salary earned by clerk.
- c. Find minimum, maximum, average salary of all employees.
- d. List the minimum and maximum salaries for each job type.
- e. List the employee names in descending order.
- f. List the employee id, names in ascending order by emp id.
5. a. Find the sids, names of sailors who have reserved all boats called "INTERLAKE"
Find the age of youngest sailor who is eligible to vote for each rating level with at least two such sailors.



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

Computer Science & Engineering (Data Science)

- b. Find the sname , bid and reservation date for eachreservation.
- c. Find the ages of sailors whose name begin and end with B and has at least 3characters.
- d. List in alphabetic order all sailors who have reserved redboat.
- e. Find the age of youngest sailor for each ratinglevel.
6. a. List the Vendors who have delivered products within 6 months from orderdate.
b. Display the Vendor details who have supplied both Assembled and Subparts.
c. Display the Sub parts by grouping the Vendor type (Local or NonLocal).
d. Display the Vendor details in ascendingorder.
e. Display the Sub part which costs more than any of the Assembledparts.
f. Display the second maximum cost Assembledpart

Week-4: PROGRAMS ON PL/SQL

1. a. Write a PL/SQL program to swaptwonumbers.
b. Write a PL/SQL program to find the largest of threenumbers.
2. a. Write a PL/SQL program to find the total and average of 6 subjects and display thegrade.
b. Write a PL/SQL program to find the sum of digits in a givennumber.
3. a. Write a PL/SQL program to display the number in reverseorder.
b. Writea PL/SQLprogramtocheckwhetherthegivennumberisprimeornot.
4. a. Write a PL/SQL program to find the factorial of a givennumber.
b. Write a PL/SQL code block to calculate the area of a circle for a value of radius varying from 3 to 7. Store the radius and the corresponding values of calculated area in an empty table named areas, consisting of two columns radius andarea.
5. a. Write a PL/SQL program to accept a string and remove the vowels from the string. (When 'hello' passed to the program it should display 'Hll' removing e and o from the worldHello).
b. Write a PL/SQL program to accept a number and a divisor. Make sure the divisor is less than or equal to 10. Else display an error message. Otherwise Display the remainderin words.

Week-5: PROCEDURES AND FUNCTIONS

1. Write a function to accept employee number as parameter and return Basic +HRA together as single column.
2. Accept year as parameter and write a Function to return the total net salary spent for a givenyear.
3. Create a function to find the factorial of a given number and hence findNCR.
4. Write a PL/SQL block o pint prime Fibonacci series using localfunctions.
5. Create a procedure to find the lucky number of a given birthdate.
6. Create function to the reverse of givennumber

Week-6: TRIGGERS

1. Create a row level trigger for the customers table that would fire for INSERT or UPDATE or DELETE operations performed on the CUSTOMERS table. This trigger will display the salary difference between the old values and newvalues:

CUSTOMERS table:

ID	NAME	AGE	ADDRESS	SALARY
1	Alive	24	Khammam	2000
2	Bob	27	Kadappa	3000
3	Catri	25	Guntur	4000
4	Dena	28	Hyderabad	5000
5	Eeshwar	27	Kurnool	6000
6	Farooq	28	Nellore	7000



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

Computer Science & Engineering (Data Science)

2. Creation of insert trigger, delete trigger, update trigger practice triggers using the passenger database.
Passenger(Passport_ id INTEGER PRIMARY KEY, Name VARCHAR (50)
NotNull, Age Integer Not Null, Sex Char, Address VARCHAR (50)
NotNull);
 - a. Write a Insert Trigger to check the Passport_id is exactly six digits or not.
 - b. Write a trigger on passenger to display messages '1 Record is inserted', '1 record is deleted', '1 record is updated' when insertion, deletion and updation are done on passenger respectively.
3. Insert row in employee table using Triggers. Every trigger is created with name any trigger have same name must be replaced by new name. These triggers can raised before insert, update or delete rows on data base. The main difference between a trigger and a stored procedure is that the former is attached to a table and is only fired when an INSERT, UPDATE or DELETE occurs.
4. Convert employee name into uppercase whenever an employee record is inserted or updated. Trigger to fire before the insert or update.
5. Trigger before deleting a record from emp table. Trigger will insert the row to be deleted into table called delete _emp and also record user who has deleted the record and date and time of delete.
6. Create a transparent audit system for a table CUST_MSTR. The system must keep track of the records that are being deleted or updated

Week-7: PROCEDURES

1. Create the procedure for palindrome of given number.
2. Create the procedure for GCD: Program should load two registers with two Numbers and then apply the logic for GCD of two numbers. GCD of two numbers is performed by dividing the greater number by the smaller number till the remainder is zero. If it is zero, the divisor is the GCD if not the remainder and the divisors of the previous division are the new set of two numbers. The process is repeated by dividing greater of the two numbers by the smaller number till the remainder is zero and GCD is found.
3. Write the PL/SQL programs to create the procedure for factorial of given number.
4. Write the PL/SQL programs to create the procedure to find sum of N natural number.
5. Write the PL/SQL programs to create the procedure to find Fibonacci series.
6. Write the PL/SQL programs to create the procedure to check the given number is perfect or not

Week-8: CURSORS

1. Write a PL/SQL block that will display the name, dept no, salary of first highest paid employees.
2. Update the balance stock in the item master table each time a transaction takes place in the item transaction table. The change in item master table depends on the item id is already present in the item master then update operation is performed to decrease the balance stock by the quantity specified in the item transaction in case the item id is not present in the item master table then the record is inserted in the item master table.
3. Write a PL/SQL block that will display the employee details along with salary using cursors.
4. To write a Cursor to display the list of employees who are working as a Manager or Analyst.
5. To write a Cursor to find employee with given job and dept no.
6. Write a PL/SQL block using implicit cursor that will display message, the salaries of all the employees in the 'employee' table are updated. If none of the employee's salary are updated we get a message 'None of the salaries were updated'. Else we get a message like for example, 'Salaries for 1000 employees are updated' if there are 1000 rows in 'employee' table

Week-9: CASE STUDY: BOOK PUBLISHING COMPANY



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

Compuer Science & Engineering (Data Science)

A publishing company produces scientific books on various subjects. The books are written by authors who specialize in one particular subject. The company employs editors who, not necessarily being specialists in a particular area, each take sole responsibility for editing one or more publications.

A publication covers essentially one of the specialist subjects and is normally written by a single author. When writing a particular book, each author works with on editor, but may submit another work for publication to be supervised by other editors. To improve their competitiveness, the company tries to employ a variety of authors, more than one author being a specialist in a particular subject for the above case study, do thefollowing:

1. Analyze the datarequired.
2. Normalize theattributes.

Create the logical data model using E-R diagrams

Week-10: CASE STUDY GENERAL HOSPITAL

A General Hospital consists of a number of specialized wards (such as Maternity, Pediatric, Oncology, etc.). Each ward hosts a number of patients, who were admitted on the recommendation of their own GP and confirmed by a consultant employed by the Hospital. On admission, the personal details of every patient are recorded. A separate register is to be held to store the information of the tests undertaken and the results of a prescribed treatment. A number of tests may be conducted for each patient. Each patient is assigned to one leading consultant but may be examined by another doctor, if required. Doctors are specialists in some branch of medicine and may be leading consultants for a number of patients, not necessarily from the same ward. For the above case study, do the following.

1. Analyze the datarequired.
2. Normalize theattributes.

Create the logical data model using E-R diagrams

Week-11: CASE STUDY: CAR RENTAL COMPANY

A database is to be designed for a car rental company. The information required includes a description of cars, subcontractors (i.e. garages), company expenditures, company revenues and customers. Cars are to be described by such data as: make, model, year of production, engine size, fuel type, number of passengers, registration number, purchase price, purchase date, rent price and insurance details. It is the company policy not to keep any car for a period exceeding one year. All major repairs and maintenance are done by subcontractors (i.e. franchised garages), with whom CRC has long-term agreements. Therefore the data about garages to be kept in the database includes garage names, addresses, range of services and the like. Some garages require payments immediately after a repair has been made; with others CRC has made arrangements for credit facilities. Company expenditures are to be registered for all outgoings connected with purchases, repairs, maintenance, insurance etc. Similarly the cash inflow coming from all sources: Car hire, car sales, insurance claims must be kept of file. CRC maintains a reasonably stable client base. For this privileged category of customers special creditcard facilities are provided. These customers may also book in advance a particular car. These reservations can be made for any period of time up to one month. Casual customers must pay a deposit for an estimated time of rental, unless they wish to pay by credit card. All major credit cards are accepted. Personal details such as name, address, telephone number, driving license, number about each customer are kept in the database. For the above case study, do thefollowing:

1. Analyze the datarequired.
2. Normalize theattributes.

Create the logical data model using E-R diagrams

Week-12: CASE STUDY: STUDENT PROGRESS MONITORING SYSTEM



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

Compuer Science & Engineering (Data Science)

A database is to be designed for a college to monitor students' progress throughout their course of study. The students are reading for a degree (such as BA, BA (Hons.) M.Sc., etc) within the framework of the modular system. The college provides a number of modules, each being characterized by its code, title, credit value, module leader, teaching staff and the department they come from. A module is coordinated by a module leader who shares teaching duties with one or more lecturers. A lecturer may teach (and be a module leader for) more than one module. Students are free to choose any module they wish but the following rules must be observed: Some modules require pre- requisites modules and some degree programs have compulsory modules. The database is also to contain some information about students including their numbers, names, addresses, degrees they read for, and their past performance i.e. modules taken and examination results. For the above case study, do the following:

1. Analyze the data required.
2. Normalize the attributes.
3. Create the logical data model i.e., ER diagrams.
4. Comprehend the data given in the case study by creating respective tables with primary keys and foreign keys wherever required.
5. Insert values into the tables created (Be vigilant about Master- Slave tables).
6. Display the Students who have taken M.Sc course
7. Display the Module code and Number of Modules taught by each Lecturer.
8. Retrieve the Lecturer names who are not Module Leaders.
9. Display the Department name which offers 'English' module.
10. Retrieve the Prerequisite Courses offered by every Department (with Department names).
11. Present the Lecturer ID and Name who teaches 'Mathematics'.
12. Discover the number of years a Module is taught.
13. List out all the Faculties who work for 'Statistics' Department.
14. List out the number of Modules taught by each Module Leader.
15. List out the number of Modules taught by a particular Lecturer.
16. Create a view which contains the fields of both Department and Module tables. (Hint- The fields like Module code, title, credit, Department code and its name).
17. Update the credits of all the prerequisite courses to 5. Delete the Module 'History' from the Module table.

References:

1. Ramez Elmasri, Shamkant, B. Navathe, "Database Systems", Pearson Education, 6th Edition, 2013.
2. Peter Rob, Carles Coronel, "Database System Concepts", Cengage Learning, 7th Edition, 2008.

Online Learning Resources/Virtual Labs:

<http://www.scoopworld.in>

<http://vlabs.iitb.ac.in/vlabs-dev/labs/dblab/index.php>



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

Computer Science & Engineering (Data Science)

Course Code	OPERATING SYSTEMS LAB		L	T	P	C
20A05402P	(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 CO and DBMS	Semester	IV			
Course Objectives:						
<ul style="list-style-type: none">To familiarize students with the architecture of OS.To provide necessary skills for developing and debugging CPU Scheduling algorithms.To elucidate the process management and scheduling and memory management.To explain the working of an OS as a resource manager, file system manager, process manager, memory manager, and page replacement tool.To provide insights into system calls, file systems and deadlock handling.						
Course Outcomes (CO):						
After completion of the course, students will be able to <ul style="list-style-type: none">Trace different CPU Scheduling algorithms (L2).Implement Bankers Algorithms to Avoid and prevent the Dead Lock (L3).Evaluate Page replacement algorithms (L5).Illustrate the file organization techniques (L4).Illustrate shared memory process (L4).Design new scheduling algorithms (L6)						
List of Experiments:						
<ol style="list-style-type: none">Practicing of Basic UNIX Commands.Write programs using the following UNIX operating system calls Fork, exec, getpid, exit, wait, close, stat, opendir and readdirSimulate UNIX commands like cp, ls, grep, etc.,Simulate the following CPU scheduling algorithms a) Round Robin b) SJF c) FCFS d) PriorityImplement a dynamic priority scheduling algorithm.Assume that there are five jobs with different weights ranging from 1 to 5. Implement round robin algorithm with time slice equivalent to weight.Implement priority scheduling algorithm. While executing, no process should wait for more than 10 seconds. If the waiting time is more than 10 seconds that process has to be executed for at least 1 second before waiting again.Control the number of ports opened by the operating system with a) Semaphore b) Monitors.Simulate how parent and child processes use shared memory and address space.Simulate sleeping barber problem.Simulate dining philosopher's problem.Simulate producer-consumer problem using threads.Implement the following memory allocation methods for fixed partition a) First fit b) Worst fit c) Best fitSimulate the following page replacement algorithms a) FIFO b) LRU c) LFU etc.,Simulate Paging Technique of memory managementSimulate Bankers Algorithm for Dead Lock avoidance and preventionSimulate the following file allocation strategies a) Sequential b) Indexed c) LinkedSimulate all File Organization Techniques a) Single level directory b) Two level c) Hierarchical d) DAG						



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

Computer Science & Engineering (Data Science)

References:

1. “Operating System Concepts”, Abraham Silberchatz, Peter B. Galvin, Greg Gagne, Eighth Edition, John Wiley.
2. “Operating Systems: Internals and Design Principles”, Stallings, Sixth Edition–2009, Pearson Education
3. “Modern Operating Systems”, Andrew S Tanenbaum, Second Edition, PHI.
4. “Operating Systems”, S.Haldar, A.A.Aravind, Pearson Education.
5. “Principles of Operating Systems”, B.L.Stuart, Cengage learning, India Edition.2013-2014
6. “Operating Systems”, A.S.Godbole, Second Edition, TMH.
7. “An Introduction to Operating Systems”, P.C.P. Bhatt, PHI.

Online Learning Resources/Virtual Labs:

<https://www.cse.iitb.ac.in/~mythili/os/>
<http://peterindia.net/OperatingSystems.html>
<https://www.vlab.co.in>



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

Computer Science & Engineering (Data Science)

Course Code	SOFTWARE ENGINEERING LAB (Common to CSE, IT, CSE(DS), CSE (IoT))		L	T	P	C
20A05403P			0	0	3	1.5
Pre-requisite	Semester		IV			
Course Objectives:						
<ul style="list-style-type: none"> • To learn and implement the fundamental concepts of Software Engineering. • To explore functional and non-functional requirements through SRS. • To practice the various design diagrams through the appropriate tool. • To learn to implement various software testing strategies. 						
Course Outcomes (CO):						
After completion of the course, students will be able to <ul style="list-style-type: none"> • Acquaint with historical and modern software methodologies • Understand the phases of software projects and practice the activities of each phase • Practice clean coding • Take part in project management • Adopt skills such as distributed version control, unit testing, integration testing, build management, and deployment 						
List of Experiments:						
<ol style="list-style-type: none"> 1 Draw the Work Breakdown Structure for the system to be automated 2 Schedule all the activities and sub-activities Using the PERT/CPM charts 3 Define use cases and represent them in use-case document for all the stakeholders of the system to be automated 4 Identify and analyze all the possible risks and its risk mitigation plan for the system to be automated 5 Diagnose any risk using Ishikawa Diagram (Can be called as Fish Bone Diagram or Cause& Effect Diagram) 6 Define Complete Project plan for the system to be automated using Microsoft Project Tool 7 Define the Features, Vision, Business objectives, Business rules and stakeholders in the vision document 8 Define the functional and non-functional requirements of the system to be automated by using Use cases and document in SRS document 9 Define the following traceability matrices : <ol style="list-style-type: none"> 1. Use case Vs. Features 2. Functional requirements Vs. Usecases 10 Estimate the effort using the following methods for the system to be automated: <ol style="list-style-type: none"> 1. Function point metric 2. Usecase point metric 11 Develop a tool which can be used for quantification of all the non-functional requirements 12 Write C/C++/Java/Python program for classifying the various types of coupling. 13 Write a C/C++/Java/Python program for classifying the various types of cohesion. 14 Write a C/C++/Java/Python program for object oriented metrics for design proposed by Chidamber and Kremer. (Popularly called CK metrics) 15 Convert the DFD into appropriate architecture styles. 16 Draw a complete class diagram and object diagrams using Rational tools 17 Define the design activities along with necessary artifacts using Design Document. 18 Reverse Engineer any object-oriented code to an appropriate class and object diagrams. 19 Test a piece of code that executes a specific functionality in the code to be tested and asserts a certain behavior or state using Junit. 20 Test the percentage of code to be tested by unit test using any code coverage tools 21 Define appropriate metrics for at least 3 quality attributes for any software application of your interest. 22 Define a complete call graph for any C/C++ code. (Note: The student may use any tool that generates call graph for source code) 						



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)

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1. Software Engineering? A Practitioner's Approach, Roger S. Pressman, 1996, MGH.
2. Software Engineering by Ian Sommerville, Pearson Edu, 5th edition, 1999
3. An Integrated Approach to software engineering by Pankaj Jalote , 1991 Narosa

Online Learning Resources/Virtual Labs:

<http://vlabs.iitkgp.ac.in/se/>



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

Computer Science & Engineering (Data Science)

Course Code	Programming with R		L	T	P	C
20A32401			1	0	2	2
Pre-requisite	Fundamental Programming	Semester	IV			
Course Objectives:						
<ul style="list-style-type: none"> • How to manipulate data within R and to create simple graphs and charts used in introductory statistics. • The given data using different distribution functions in R. • The hypothesis testing and calculate confidence intervals; perform linear regression models for data analysis. • The relevance and importance of the theory in solving practical problems in the real world. 						
Course Outcomes (CO):						
<p>After completion of the course, students will be able to</p> <ul style="list-style-type: none"> • Install and use R for simple programming tasks. • Extend the functionality of R by using add-on packages • Extract data from files and other sources and perform various data manipulation tasks on them. • Explore statistical functions in R. • Use R Graphics and Tables to visualize results of various statistical operations on data. • Apply the knowledge of R gained to data Analytics for real-life applications. 						
List of Experiments:						
1: INTRODUCTION TO COMPUTING						
<ol style="list-style-type: none"> a. Installation of R b. The basics of R syntax, workspace c. Matrices and lists d. Subsetting e. System-defined functions; the help system f. Errors and warnings; coherence of the workspace 						
2: GETTING USED TO R: DESCRIBING DATA						
<ol style="list-style-type: none"> a. Viewing and manipulating Data b. Plotting data c. Reading the data from console, file (.csv) local disk and web d. Working with larger datasets 						
3: SHAPE OF DATA AND DESCRIBING RELATIONSHIPS						
<ol style="list-style-type: none"> a. Tables, charts and plots. b. Univariate data, measures of central tendency, frequency distributions, variation, and Shape. c. Multivariate data, relationships between a categorical and a continuous variable, d. Relationship between two continuous variables – covariance, correlation coefficients, comparing multiple correlations. e. Visualization methods – categorical and continuous variables, two categorical variables, two continuous variables. 						



Compuer Science & Engineering (Data Science)

4: PROBABILITY DISTRIBUTIONS

- a. Sampling from distributions – Binomial distribution, normal distribution
- b. tTest, zTest, Chi Square test
- c. Density functions
- d. Data Visualization using ggplot – Box plot, histograms, scatter plotter, line chart, bar chart, heat maps

5: EXPLORATORY DATA ANALYSIS Demonstrate the range, summary, mean, variance, median, standard deviation, histogram, box plot, scatter plot using population dataset.

6: TESTING HYPOTHESES

- a. Null hypothesis significance testing
- b. Testing the mean of one sample
- c. Testing two means

7: PREDICTING CONTINUOUS VARIABLES

- a. Linear models
- b. Simple linear regression
- c. Multiple regression
- d. Bias-variance trade-off – cross-validation

8: CORRELATION

- a. How to calculate the correlation between two variables.
- b. How to make scatter plots.
- c. Use the scatter plot to investigate the relationship between two variables

9: TESTS OF HYPOTHESES

- a. Perform tests of hypotheses about the mean when the variance is known.
- b. Compute the p-value.
- c. Explore the connection between the critical region, the test statistic, and the p-value

10: ESTIMATING A LINEAR RELATIONSHIP Demonstration on a Statistical Model for a Linear Relationship

- b. Least Squares Estimates
- c. The R Function lm
- d. Scrutinizing the Residuals

11: APPLY-TYPE FUNCTIONS

- a. Defining user defined classes and operations, models and methods in R
- b. Customizing the user's environment
- c. Conditional statements
- d. Loops and iterations

12: STATISTICAL FUNCTIONS IN R



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

Computer Science & Engineering (Data Science)

- a. Demonstrate Statistical functions in R
- b. Statistical inference, contingency tables, chi-square goodness of fit, regression, generalized linear models, advanced modeling methods.

References:

1. SandipRakshit, “Statistics with R Programming”, McGraw Hill Education, 2018.
2. Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, “An Introduction to Statistical Learning: with Applications in R”, Springer Texts in Statistics, 2017.
3. Joseph Schmuller, “Statistical Analysis with R for Dummies”, Wiley, 2017.
4. K G Srinivasa, G M Siddesh, ChetanShetty, Sowmya B J, “Statistical Programming in R”, Oxford Higher Education, 2017.

Online Learning Resources/Virtual Labs:

1. www.oikostat.ch
2. <https://learningstatisticswithr.com/>
3. <https://www.coursera.org/learn/probability-intro#syllabus>
4. <https://www.isibang.ac.in/~athreya/psweur/>



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

Computer Science & Engineering (Data Science)

Course Code	Design Thinking for Innovation (Common to All branches of Engineering)		L	T	P	C
20A99401			2	1	0	0
Pre-requisite	NIL	Semester	IV			
Course Objectives:						
The objective of this course is to familiarize students with design thinking process as a tool for breakthrough innovation. It aims to equip students with design thinking skills and ignite the minds to create innovative ideas, develop solutions for real-time problems.						
Course Outcomes (CO):						
<ul style="list-style-type: none"> ● Define the concepts related to design thinking. ● Explain the fundamentals of Design Thinking and innovation ● Apply the design thinking techniques for solving problems in various sectors. ● Analyse to work in a multidisciplinary environment ● Evaluate the value of creativity ● Formulate specific problem statements of real time issues 						
UNIT - I	Introduction to Design Thinking					10 Hrs
Introduction to elements and principles of Design, basics of design-dot, line, shape, form as fundamental design components. Principles of design. Introduction to design thinking, history of Design Thinking, New materials in Industry.						
UNIT - II	Design Thinking Process					10 Hrs
Design thinking process (empathize, analyze, idea & prototype), implementing the process in driving inventions, design thinking in social innovations. Tools of design thinking - person, costumer, journey map, brain storming, product development						
Activity: Every student presents their idea in three minutes, Every student can present design process in the form of flow diagram or flow chart etc. Every student should explain about product development.						
UNIT - III	Innovation					8 Hrs
Art of innovation, Difference between innovation and creativity, role of creativity and innovation in organizations. Creativity to Innovation. Teams for innovation, Measuring the impact and value of creativity.						
Activity: Debate on innovation and creativity, Flow and planning from idea to innovation, Debate on value-based innovation.						
UNIT - IV	Product Design					8 Hrs
Problem formation, introduction to product design, Product strategies, Product value, Product planning, product specifications. Innovation towards product design Case studies.						
Activity: Importance of modelling, how to set specifications, Explaining their own product design.						
UNIT - V	Design Thinking in Business Processes					10 Hrs
Design Thinking applied in Business & Strategic Innovation, Design Thinking principles that redefine business – Business challenges: Growth, Predictability, Change, Maintaining Relevance, Extreme competition, Standardization. Design thinking to meet corporate needs. Design thinking for Startups. Defining and testing Business Models and Business Cases. Developing & testing prototypes.						
Activity: How to market our own product, About maintenance, Reliability and plan for startup.						
Textbooks:						
<ol style="list-style-type: none"> 1. Change by design, Tim Brown, Harper Bollins (2009) 2. Design Thinking for Strategic Innovation, Idris Mootee, 2013, John Wiley & Sons. 						



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

Computer Science & Engineering (Data Science)

Reference Books:

1. Design Thinking in the Classroom by David Lee, Ulysses press
2. Design the Future, by Shrrutin N Shetty, Norton Press
3. Universal principles of design- William lidwell, kritinaholden, Jill butter.
4. The era of open innovation – chesbrough.H

Online Learning Resources:

<https://nptel.ac.in/courses/110/106/110106124/>
<https://nptel.ac.in/courses/109/104/109104109/>
https://swayam.gov.in/nd1_noc19_mg60/preview



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

Computer Science & Engineering (Data Science)

COMMUNITY SERVICE PROJECT

.....Experiential learning through community engagement

Introduction

- Community Service Project is an experiential learning strategy that integrates meaningful community service with instruction, participation, learning and community development
- Community Service Project involves students in community development and service activities and applies the experience to personal and academic development.
- Community Service Project is meant to link the community with the college for mutual benefit. The community will be benefited with the focused contribution of the college students for the village/ local development. The college finds an opportunity to develop social sensibility and responsibility among students and also emerge as a socially responsible institution.

Objective

Community Service Project should be an integral part of the curriculum, as an alternative to the 2 months of Summer Internships / Apprenticeships / On the Job Training, whenever there is an exigency when students cannot pursue their summer internships. The specific objectives are;

- To sensitize the students to the living conditions of the people who are around them,
- To help students to realize the stark realities of the society.
- To bring about an attitudinal change in the students and help them to develop societal consciousness, sensibility, responsibility and accountability
- To make students aware of their inner strength and help them to find new /out of box solutions to the social problems.
- To make students socially responsible citizens who are sensitive to the needs of the disadvantaged sections.
- To help students to initiate developmental activities in the community in coordination with public and government authorities.
- To develop a holistic life perspective among the students by making them study culture, traditions, habits, lifestyles, resource utilization, wastages and its management, social problems, public administration system and the roles and responsibilities of different persons across different social systems.

Implementation of Community Service Project

- Every student should put in a 6 weeks for the Community Service Project during the summer vacation.
- Each class/section should be assigned with a mentor.
- Specific Departments could concentrate on their major areas of concern. For example, Dept. of Computer Science can take up activities related to Computer Literacy to different sections of people like - youth, women, house-wives, etc
- A log book has to be maintained by each of the student, where the activities undertaken/involved to be recorded.
- The logbook has to be countersigned by the concerned mentor/faculty incharge.
- Evaluation to be done based on the active participation of the student and grade could be awarded by the mentor/faculty member.



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

Computer Science & Engineering (Data Science)

- The final evaluation to be reflected in the grade memo of the student.
- The Community Service Project should be different from the regular programmes of NSS/NCC/Green Corps/Red Ribbon Club, etc.
- Minor project report should be submitted by each student. An internal Viva shall also be conducted by a committee constituted by the principal of the college.
- Award of marks shall be made as per the guidelines of Internship/apprentice/ on the job training

Procedure

- A group of students or even a single student could be assigned for a particular habitation or village or municipal ward, as far as possible, in the near vicinity of their place of stay, so as to enable them to commute from their residence and return back by evening or so.
- The Community Service Project is a twofold one –
 - First, the student/s could conduct a survey of the habitation, if necessary, in terms of their own domain or subject area. Or it can even be a general survey, incorporating all the different areas. A common survey format could be designed. This should not be viewed as a duplication of work by the Village or Ward volunteers, rather, it could be another primary source of data.
 - Secondly, the student/s could take up a social activity, concerning their domain or subject area. The different areas, could be like –
 - Agriculture
 - Health
 - Marketing and Cooperation
 - Animal Husbandry
 - Horticulture
 - Fisheries
 - Sericulture
 - Revenue and Survey
 - Natural Disaster Management
 - Irrigation
 - Law & Order
 - Excise and Prohibition
 - Mines and Geology
 - Energy
 - Internet
 - Free Electricity
 - Drinking Water

EXPECTED OUTCOMES

BENEFITS OF COMMUNITY SERVICE PROJECT TO STUDENTS

Learning Outcomes

- Positive impact on students' academic learning
- Improves students' ability to apply what they have learned in "the real world"



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

Computer Science & Engineering (Data Science)

- Positive impact on academic outcomes such as demonstrated complexity of understanding, problem analysis, problem-solving, critical thinking, and cognitive development
- Improved ability to understand complexity and ambiguity

Personal Outcomes

- Greater sense of personal efficacy, personal identity, spiritual growth, and moral development
- Greater interpersonal development, particularly the ability to work well with others, and build leadership and communication skills

Social Outcomes

- Reduced stereotypes and greater inter-cultural understanding
- Improved social responsibility and citizenship skills
- Greater involvement in community service after graduation

Career Development

- Connections with professionals and community members for learning and career opportunities
- Greater academic learning, leadership skills, and personal efficacy can lead to greater opportunity

Relationship with the Institution

- Stronger relationships with faculty
- Greater satisfaction with college
- Improved graduation rates

BENEFITS OF COMMUNITY SERVICE PROJECT TO FACULTY MEMBERS

- Satisfaction with the quality of student learning
- New avenues for research and publication via new relationships between faculty and community
- Providing networking opportunities with engaged faculty in other disciplines or institutions
- A stronger commitment to one's research

BENEFITS OF COMMUNITY SERVICE PROJECT TO COLLEGES AND UNIVERSITIES

- Improved institutional commitment
- Improved student retention
- Enhanced community relations

BENEFITS OF COMMUNITY SERVICE PROJECT TO COMMUNITY

- Satisfaction with student participation
- Valuable human resources needed to achieve community goals
- New energy, enthusiasm and perspectives applied to community work
- Enhanced community-university relations.

SUGGESTIVE LIST OF PROGRAMMES UNDER COMMUNITY SERVICE PROJECT

The following the recommended list of projects for Engineering students. The lists are not exhaustive and open for additions, deletions and modifications. Colleges are expected to focus on specific local issues for this kind of projects. The students are expected to carry out these projects with involvement, commitment, responsibility and accountability. The mentors of a group of students should take the



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

Compuer Science & Engineering (Data Science)

responsibility of motivating, facilitating, and guiding the students. They have to interact with local leadership and people and appraise the objectives and benefits of this kind of projects. The project reports shall be placed in the college website for reference. Systematic, Factual, methodical and honest reporting shall be ensured.

For Engineering Students

1. Water facilities and drinking water availability
2. Health and hygiene
3. Stress levels and coping mechanisms
4. Health intervention programmes
5. Horticulture
6. Herbal plants
7. Botanical survey
8. Zoological survey
9. Marine products
10. Aqua culture
11. Inland fisheries
12. Animals and species
13. Nutrition
14. Traditional health care methods
15. Food habits
16. Air pollution
17. Water pollution
18. Plantation
19. Soil protection
20. Renewable energy
21. Plant diseases
22. Yoga awareness and practice
23. Health care awareness programmes and their impact
24. Use of chemicals on fruits and vegetables
25. Organic farming
26. Crop rotation
27. Flouy culture
28. Access to safe drinking water
29. Geographical survey
30. Geological survey
31. Sericulture
32. Study of species
33. Food adulteration
34. Incidence of Diabetes and other chronic diseases
35. Human genetics
36. Blood groups and blood levels
37. Internet Usage in Villages
38. Android Phone usage by different people
39. Utilisation of free electricity to farmers and related issues



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

Computer Science & Engineering (Data Science)

40. Gender ration in schooling lvel- observation.

Complimenting the community service project the students may be involved to take up some awareness campaigns on social issues/special groups. The suggested list of programmes are;

Programmes for School Children

1. Reading Skill Programme (Reading Competition)
2. Preparation of Study Materials for the next class.
3. Personality / Leadership Development
4. Career Guidance for X class students
5. Screening Documentary and other educational films
6. Awareness Programme on Good Touch and Bad Touch (Sexual abuse)
7. Awareness Programme on Socially relevant themes.

Programmes for Women Empowerment

1. Government Guidelines and Policy Guidelines
2. Womens' Rights
3. Domestic Violence
4. Prevention and Control of Cancer
5. Promotion of Social Entrepreneurship

General Camps

1. General Medical camps
2. Eye Camps
3. Dental Camps
4. Importance of protected drinking water
5. ODF awareness camp
6. Swatch Bharath
7. AIDS awareness camp
8. Anti Plastic Awareness
9. Programmes on Environment
10. Health and Hygiene
11. Hand wash programmes
12. Commemoration and Celebration of important days

Programmes for Youth Empowerment

1. Leadership
2. Anti-alcoholism and Drug addiction
3. Anti-tobacco
4. Awareness on Competitive Examinations
5. Personality Development

Common Programmes

1. Awareness on RTI
2. Health intervention programmes
3. Yoga
4. Tree plantation
5. Programmes in consonance with the Govt. Departments like –
 - i. Agriculture



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

Computer Science & Engineering (Data Science)

- ii. Health
- iii. Marketing and Cooperation
- iv. Animal Husbandry
- v. Horticulture
- vi. Fisheries
- vii. Sericulture
- viii. Revenue and Survey
- ix. Natural Disaster Management
- x. Irrigation
- xi. Law & Order
- xii. Excise and Prohibition
- xiii. Mines and Geology
- xiv. Energy

Role of Students:

- Students may not have the expertise to conduct all the programmes on their own. The students then can play a facilitator role.
- For conducting special camps like Health related, they will be coordinating with the Governmental agencies.
- As and when required the College faculty themselves act as Resource Persons.
- Students can work in close association with Non-Governmental Organizations like Lions Club, Rotary Club, etc or with any NGO actively working in that habitation.
- And also with the Governmental Departments. If the programme is rolled out, the District Administration could be roped in for the successful deployment of the programme.
- An in-house training and induction programme could be arranged for the faculty and participating students, to expose them to the methodology of Service Learning.

Timeline for the Community Service Project Activity

Duration: 8 weeks

1. Preliminary Survey (One Week)

- A preliminary survey including the socio-economic conditions of the allotted habitation to be conducted.
- A survey form based on the type of habitation to be prepared before visiting the habitation with the help of social sciences faculty. (However, a template could be designed for different habitations, rural/urban.
- The Governmental agencies, like revenue administration, corporation and municipal authorities and village secretariats could be aligned for the survey.

2. Community Awareness Campaigns (One Week)

- Based on the survey and the specific requirements of the habitation, different awareness campaigns and programmes to be conducted, spread over two weeks of time. The list of activities suggested could be taken into consideration.

3. Community Immersion Programme (Three Weeks)



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

Computer Science & Engineering (Data Science)

Along with the Community Awareness Programmes, the student batch can also work with any one of the below listed governmental agencies and work in tandem with them. This community involvement programme will involve the students in exposing themselves to the experiential learning about the community and its dynamics. Programmes could be in consonance with the Govt. Departments.

4. Community Exit Report (One Week)

- During the last week of the Community Service Project, a detailed report of the outcome of the 8 weeks work to be drafted and a copy shall be submitted to the local administration. This report will be a basis for the next batch of students visiting that particular habitation. The same report submitted to the teacher-mentor will be evaluated by the mentor and suitable marks are awarded for onward submission to the University.

Throughout the Community Service Project, a daily log-book need to be maintained by the students batch, which should be countersigned by the governmental agency representative and the teacher-mentor, who is required to periodically visit the students and guide them.