CHRIST
(DEEMED TO BE UNIVERSITY)
DELHI-NCR, INDIA

School of Science

Syllabus

Bachelor of Science

(Data Science & Artificial Intelligence - Honours)

2020-23

CHRIST(Deemed to be University)
Delhi NCR Campus
www.ncr.christuniversity.in

Semester 1

Course Code	Course Title	Course Type	Hrs/week	Credits	Marks
BDA121N	Professional English	AECC	3	3	100
BDA131N	Discrete Mathematics	Core	3	3	100
BDA132N	Descriptive Statistics and Probability	Core	4	4	100
BDA133N	Digital Computer Fundamentals	Core	3	3	100
BDA134N	Principles of Data Science	Core	4	4	100
BDA135N	Python Programming	Core	4	4	100
BDA151N	Descriptive Statistics Using Excel Lab	PC	2	1	50
BDA152N	Python Lab	PC	4	2	100
HOL111N	Holistic Education	SEC	1		
	TOTAL		**28**	**24**	**750**

Semester 2

Course Code	Course Title	Course Type	Hrs/week	Credits	Marks
BDA221N	Communicative English	AECC	3	3	100
BDA231N	Differential Calculus	Core	3	3	100
BDA232N	Random Variables and Probability Distributions	Core	4	4	100
BDA233N	Operating System	Core	3	3	100
BDA234N	Data Structures	Core	4	4	100
BDA251N	Data Structures Lab	PC	4	2	100
BDA252N	R Programming and Statistical Modelling Lab(No ESE)	PC	2+4	4	100
HOL211N	Holistic Education	SEC	1		
EVS 221N	Environmental Studies	AECC		2	
	TOTAL		**28**	**25**	**700**

Semester 3

Course Code	Course Title	Course Type	Hrs/week	Credits	Marks
BDA331N	Linear Algebra	Core	3	3	100
BDA332N	Statistical Inference	Core	4	4	100
BDA333N	Software Engineering	Core	3	3	100
BDA334N	Introduction to Machine Learning and Artificial Intelligence	Core	4	4	100
BDA335N	Object Oriented Programming Using Java	Core	4	4	100
BDA351N	Statistical Inference Lab	PC	2	1	50
BDA352N	Machine Learning and AI Lab	PC	4	2	100
BDA353N	Java Programming Lab	PC	4	2	100
HOL311N	Holistic Education	SEC	1		
	TOTAL		**29**	**23**	**750**

Semester 4

Course Code	Course Title	Course Type	Hrs/week	Credits	Marks
BDA431N	Operations Research	Core	3	3	100
BDA432N	Applied Regression	Core	4	4	100
BDA433N	Database Systems	Core	3	3	100
BDA434N	Data Analytics	Core	3	3	100
BDA435N	Web Technologies	Core	4	4	100
BDA451N	Database Systems Lab	PC	2	1	50
BDA452N	Data Analytics Lab	PC	4	2	100
BDA453N	Web Technologies Lab	PC	4	2	100
HOL411N	Holistic Education	SEC	1		
VAC411N	Value Added courses	SEC	2	2	
	TOTAL		**30**	**24**	**750**

Semester 5

Course Code	Course Title	Course Type	Hrs/week	Credits	Marks
BDA531N	Artificial Neural Networks and Deep learning	Core	4	4	100
BDA532N	Big data Programming using Hadoop and Spark	Core	4	4	100
Elective 1					
BDA541AN	Block Chain with AI	DSE	4	4	100
BDA541BN	IOT				
BDA541CN	Cyber Security				
BDA541DN	UI/UX Design				
BDA541EN	Simulation and Modelling				
BDA541FN	Digital Image Processing				
BDA541GN	Computer Networks and WSN				
Elective-2					
BDA542AN	Time Series and Forecasting	DSE	4	4	100
BDA542BN	Optimization Techniques				
BDA542CN	Stochastic Process				
BDA542DN	Multivariate Analysis				
BDA551N	Deep Learning Models Lab	PC	4	2	100
BDA552N	Big Data Programming with Hadoop and Spark Lab	PC	4	2	100
BDA581N	Mini Project		4	2	100
VAC511N	Value Added Courses	SEC	2	2	
	TOTAL		**30**	**24**	**700**

Semester 6

Course Code	Course Title	Course Type	Hrs/week	Credits	Marks
BDA671N	Cloud Analytics	Core	3+4	5	150
	Elective-3				
BDA672AN	Social Media Analytics and Recommender Systems	DSE	3+4	5	150
BDA672BN	Machine Learning Techniques				
BDA672CN	Data Warehousing And Mining				
BDA672DN	Web Analytics				
BDA681N	Major Project		16	8	300
IC631	Indian Constitution Law	SEC		1	Grade
	TOTAL		**30**	**19**	**600**

Semester 1

Professional English (BDA121N)

Total Teaching Hours for Semester:45 **Credits:03**
Maximum Marks: 100

Course Description and Objectives:

This course focuses on preparing students to communicate verbally and non-verbally in an effective manner. The aim is to introduce students to communication in a professional environment. It is instrumental in learners comprehending the role of technical english in communication.

Course Outcomes:

Upon completion of the course the student should be able to

CO1: Understand how to engage with texts from various countries, historical, cultural specificities and politics.
CO2: Understand and develop the ability to reflect upon and comment on texts with various themes.
CO3: Develop the ability to communicate both orally and in writing for various purposes.
CO4: Develop an analytical and critical bent of mind to compare and analyse the various literature they read, listen and discuss in class.

Unit - 1 **Teaching Hours:06**
BEAUTY

1.1. The Happy Prince by Oscar Wilde

1.2. Shakespeare Sonnet 18

Language

Common Errors- Subject-Verb Agreement- Punctuation- Tense Errors.

Unit - 2 **Teaching Hours:06**

TRAVEL

2.1. Why We Travel by Pico Iyer

2.2 What Solo Travel Has Taught Me about the World – and Myself by Shivya Nath Blog post

Language

Sentence Fragments- Dangling Modifiers- Faulty Parallelism.

Unit - 3 **Teaching Hours:06**

ENVIRONMENT

3.1. Thinking like a Mountain by Aldo Leopold

3.2. Short Text: On Cutting a Tree by Gieve Patel

Language

Note Making

Unit - 4 **Teaching Hours:06**

RELIGION

4.1. Violence in the name of God is Violence against God by Rev Dr Tveit
4.2. Leave this Chanting From Gitanjali by Rabindranath Tagore

Language

Paragraph writing

Unit - 5 **Teaching Hours:06**

CRIME

5.1. The Story of B24 by Sir Arthur Conan Doyle

5.2. Short Text: Aarushi Murder Case

Language

Newspaper report

Unit - 6 **Teaching Hours:06**

HEALTH

6.1. Long text: My Story by Nicole DeFreece

6.2. Short text: Why You Should Never Aim for Six Packs

Language

Essay Writing

Unit - 7 **Teaching Hours:06**

SPORTS

7.1. Long Text: Sir Ranjth Singh Essay by Sourav Ganguly

7.2. Short text: Casey at the Bat by Ernest Lawrence Thayer

Language

Paraphrasing and interpretation skills

Unit - 8 **Teaching Hours:03**

8.1 VISUAL TEXT

Visual text- Before the Flood

Essential Reading :

[1] Englogue – I : A textbook for First Year Undergraduate Students

Recommended Reading :

[1] Wren and Martin's English Grammar and Composition
[2] English Grammar and Composition by NK Narayan
[3] Master your English Grammar by I. Jayakaran

Discrete Mathematics (BDA131N)

Total Teaching Hours for Semester:45 **Credits:03**
Maximum Marks: 100

Course Description:

The purpose of this course is to understand and use (abstract) discrete structures that are backbones of computer science. In particular, this class is meant to introduce logic, proofs, sets, relations, functions and counting, basics of graph theory with an emphasis on applications in computer science.

Course Outcomes: After the completion of the course students will be able to

CO1: Understand the notion of Sets, mathematical proofs and relations functions. Students will be able to apply them in problem solving.
CO 2: Understand the basics of combinatorics- and be able to apply the methods from these subjects in problem solving.
CO 3: Write precise and accurate mathematical definitions of basics concepts in graph theory.

Unit 1 **Teaching hours: 9**

Set Theory and Counting Principles

Set Theory-Introduction- Combination of sets-Set Identities. Mathematical Induction-inclusion and exclusion- pigeon-hole principle- permutation- combination- summations. Introduction to recurrence relations and generating functions.

Unit 2 **Teaching hours: 9**

Relations and functions

Relations and Products- Functions as Relations- Relations on a Set-Properties of Relations: reflexive-irreflexive-symmetric-asymmetric-antisymmetric, transitive- inverse. One-to-One and onto functions-One to one correspondence-Inverse functions and compositions of functions-Graphs of functions-Floor-ceiling-greatest Integer functions.

Unit 3 **Teaching hours: 9**

Propositional and Predicate Logic

Propositional Logic, Applications of Propositional Logic, Propositional Equivalences, Predicates and Quantifiers.

Unit 4 **Teaching hours: 9**

Methods of Proof

Nested Quantifiers, Rules of Inference, Introduction to Proofs, Proof Methods and Strategy.

Unit 5 **Teaching hours: 9**

Graphs

Graphs – introduction – isomorphism – sub graphs-types of graphs-Results related to graphs – walks- paths - circuits – connectedness – components – Euler graphs – Hamiltonian paths and circuits.

Essential Reading:

[1] K. H. Rosen- Discrete Mathematics and its Applications- 7th ed.- McGraw – Hill- 2012.

[2] Floyd- Thomas L: Digital Computer Fundamentals- 11th Edition- Pearson International- 2015.

Recommended Reading

[1] R.P. Grimaldi and B.V. Ramana- Discrete and Combinatorial Mathematics- An applied introduction- 5th ed.- Pearson Education- 2007.

[2] R.P. Grimaldi- Discrete and Combinatorial Mathematics- Addison Wesley, 5th ed., 2004.

[3] D. S. Chandrasekharaiah- Discrete Mathematical Structures- 6th ed.- India: PRISM Book Pvt. Ltd.- 2019.

[4] J. P. Tremblay and R. Manohar- Discrete Mathematical Structures with Application to Computer Science- Reprint- India: Tata McGraw Hill Education- 2008.

[5] Liu and Mohapatra- "Elements of Discrete Mathematics"- McGraw Hill, 4th ed., 2017.

Descriptive Statistics and Probability (BDA132N)

Total Teaching Hours for Semester:60 **Credits:04**
Maximum Marks: 100

Course Description and Objectives: This course is designed to introduce the historical development of statistics- presentation of data- descriptive measures and fitting mathematical curves for the data. This course also introduces measurement of the relationship of quantitative and qualitative data and the concept of probability. This course will help the learner to

- To enable the students to understand and present the data.
- To enable the students to understand and apply the descriptive measures and probability for data analysis.
- Implement theoretical concepts of descriptive measures and probability.
- To study the study the relationship between variables

Course Outcomes:

Upon completion of the course the student should be able to

CO1: Demonstrate the history of statistics and present the data in various forms.
CO2: Infer the concept of correlation and regression for relating two or more related variables.
CO3: Demonstrate the probabilities for various events.

Unit 1 **Teaching Hours:12**

Organization and presentation of data
Origin and development of Statistics- Scope- limitation and misuse of statistics. Types of data: primary- secondary- quantitative and qualitative data. Types of Measurements: nominal- ordinal- discrete and continuous data. Presentation of data by tables: construction of frequency distributions for discrete and continuous data- graphical representation of a frequency distribution by histogram and frequency polygon- cumulative frequency distributions (inclusive and exclusive methods).

Unit 2 **Teaching Hours:12**

Descriptive Statistics
Measures of location or central tendency: Arithmetic mean- Median- Mode- Geometric mean- Harmonic mean. Partition values: Quartiles- Deciles and percentiles. Measures of dispersion: Mean deviation- Quartile deviation- Standard deviation- Coefficient of variation. Moments: measures of skewness- Kurtosis.

Unit 3 **Teaching hours:11**

Correlation and Regression
Correlation: Scatter plot- Karl Pearson coefficient of correlation- Spearman's rank correlation coefficient- multiple and partial correlations (for 3 variates only). Regression: Concept of errors- Principles of Least Square- Simple linear regression and its properties.

Unit 4 **Teaching hours:13**

Basics of Probability

Random experiment- sample point and sample space- event- algebra of events. Definition of Probability: classical- empirical and axiomatic approaches to probability- properties of probability. Theorems on probability- conditional probability and independent events- Laws of total probability- Baye's theorem and its applications.

Unit 5 **Teaching hours:12**

Association of Attributes

Relation between class frequencies- consistency of data- independence of attributes- criterion of independence- association of attributes: Yule's coefficient of association- Yule 'coefficient of colligation.

Essential Reading:

[1] Gupta S.C and Kapoor V.K- Fundamentals of Mathematical Statistics- 12th edition- Sultan Chand & Sons- New Delhi- 2017.

[2] Mukhopadhyay P- Mathematical Statistics- Books and Allied (P) Ltd- Kolkata, 3rd ed., 2018.

Recommended Reading:

[1] Walpole R.E- Myers R.H- and Myers S.L- *Probability and Statistics for Engineers and Scientists*-Pearson- New Delhi- 2017.

[2] Montgomery D.C and Runger G.C- *Applied Statistics and Probability for Engineers*- Wiley India- New Delhi-9th ed., 2016.

[3] Agarwal B.L- *Basic Statistics*- 6th Edition- New Age International Publication- 2015.

[4] Rohatgi V.K and Saleh E- An Introduction to Probability and Statistics- 3 rd edition- John Wiley & Sons Inc.- New Jersey- 2015.

Digital Computer Fundamentals (BCA133N)

Total Teaching Hours for Semester : 45 **Credits:03**
Maximum Marks: 100

Course Objectives/Course Description

This is an introductory course that provides the required knowledge about the digital fundamentals of computers. The course covers a few topics like number systems, logic gates, and flips flops. The course starts with an introduction to number systems and its applications in computers. The discussion about the working of devices like encoders and decoders, multiplexers, and demultiplexers are dealt with.

Course Outcomes:

Upon completion of the course the student should be able to

CO1: use math and boolean algebra in performing computations in various Number systems.
CO2: simplify boolean algebraic expressions.
CO3: design efficient combinational and sequential logic circuit

Unit 1 **Teaching Hours:10**

Introduction to Number System and Codes

Number systems-Decimal numbers - Binary numbers-Counting in binary- The weighted structure of binary numbers- Octal numbers- hexadecimal numbers and their mutual conversions -Binary arithmetic-Addition- subtraction- multiplication and division of binary numbers- 1‘s and 2‘s complement- signed numbers- arithmetic operations-addition-subtraction with signed numbers- 9‘s and 10‘s complement- BCD numbers- BCD addition-BCD subtraction- Gray code-Binary to Gray code conversion- Gray to Binary conversion-Weighted code-8421 code and Non weighted codes : ASCII and EBCDIC.

Unit 2 **Teaching Hours:8**

Boolean Algebra

Boolean operations and expressions, Laws and rules of boolean algebra, Demorgan‘s Theorem, Boolean expressions, Simplification of a Boolean expression.

Unit 3

Logic Gates **Teaching Hours:8**

AND gate, OR gate, NOT gate, NAND gate, NOR gate, X-OR gate, X-NOR gate, The universal property of NAND gate and NOR gate, Realization of basic gates. The boolean expression for logic circuits, Karnaugh map SOP with examples.

Unit-4 **Teaching Hours:10**

Combinational Logic

Basic Adders: Half adder, Full adder, 4-bit Parallel adders, Subtractor: Half subtractor, Full subtractor Implementation using logic gates, Decoders: 4-bit decoder, BCD to decimal decoder, Encoder: Decimal to BCD encoder, Multiplexer: 4 to 1 multiplexer, Demultiplexer: 1 to 4 demultiplexer.

Unit-5 **Teaching Hours:9**

Flip-flops

Latches: SR latch, Clocked flip-flops: SR flip-flop, D flip-flop, JK flip-flop, Positive edge-triggered flip flops, Timing diagrams, Master-slave JK flip-flop.

Self-Learning

Introduction to RAM- SRAM- DRAM- ROM- PROM- EPROM- EEPROM.

Essential Reading:

[1] Floyd- Thomas L: Digital Computer Fundamentals- 11th Edition- Pearson International- 2015.

Recommended Reading:

[1] Malvino, Paul Albert, Leach, Donald P,Gautam Saha: Digital Principles And Applications, TMH ,8th Edition, 2015.

[2] Bartee,Thomas C: Digital Computer Fundamentals, 6 Edition,TMH, 2010.

Principles of Data Science (BDA134N)

Total Teaching Hours for Semester: 60 **No of Lecture Hours/Week: 4**
Max Marks: 100 **Credits: 4**
Course Objectives

The Course enables Students to

- Provide a strong foundation for data science and application areas related to it.
- Understand the underlying core concepts and emerging technologies in data science.
- Learn the process of working with data on large scale.
- Explore the concepts of Data Processing.
- Learn basic concepts of Machine Learning.
- Prepare students for advanced courses in Data Science.

Course Outcomes

After Successful completion of the course, students will be able to

- Understand the fundamental concepts of data science.
- Evaluate the data analysis techniques for applications handling large data and Demonstrate the data science process.
- Understand concept of machine learning used in the data science process.
- Visualize and present the inference using various tools.
- Learn to think through the ethics surrounding privacy, data sharing.

Unit 1 Data Evolution **Hours: 12**

Data Evolution: Data to Data Science – Understanding data: Introduction – Type of Data, Data Evolution – Data Sources.

Preparing and gathering data and knowledge - Philosophies of data science - data all around us: the virtual wilderness - Data wrangling: from capture to domestication - Data science in a big data world - Benefits and uses of data science and big data - facets of data.

Unit 2 **Hours: 12**

Digital Data-An Imprint: Introduction to Big Data: - Evolution of Big Data - What is Big Data – Sources of Big Data. Characteristics of Big Data 6Vs – Big Data-Challenges of Conventional Systems- -– Data Processing Models – Limitation of Conventional Data Processing Approaches – Big Data. Big Data Exploration - The Big data Ecosystem and Data science.

Overview of the data science process - retrieving data - Cleansing, integrating, and transforming data.

Unit 3 **Hours: 12**

Machine learning – Modelling Process – Training model – Validating model – Predicting new observations –Supervised learning, Unsupervised learning, Semi-supervised learning. Exploratory data analysis.

Unit 4 **Hours: 12**

First steps in big data - Distributing data storage and processing with frameworks - Case study: Assessing risk when loaning money - Join the NoSQL movement - Introduction to NoSQL - Case Study. The rise of graph databases - Introducing connected data and graph databases.

Unit 5 **Hours: 12**

Ethics and Data Science- Doing Good Data Science, Data Ownership, The Five Cs, Implementing the Five Cs, Ethics and Security Training, Developing Guiding Principles, Building Ethics into a Data-Driven Culture, Regulation, Building Our Future, Case Study.

Text Books

1. Introducing Data Science, Davy Cielen, Arno D. B. Meysman and Mohamed Ali, Manning Publications, 2016.
2. Think Like a Data Scientist, Brian Godsey, Manning Publications, 2017.
3. Ethics and Data Science, Mike Loukides, Hilary Mason and D J Patil, O'Reilly, 1st edition, 2018.

Reference Books

1. Data Science from Scratch: First Principles with Python, Joel Grus, O'Reilly, 1st edition, 2015.
2. Doing Data Science, Straight Talk from the Frontline, Cathy O'Neil, Rachel Schutt,
   O' Reilly, 1st edition, 2013.
3. Mining of Massive Datasets, Jure Leskovec, Anand Rajaraman, Jeffrey David Ullman, Cambridge University Press, 2nd edition, 2014.
4. An Introduction to Statistical Learning: with Applications in R, Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, Springer, 1st edition, 2013.

Python Programming (BDA135N)

Total hours: 60 **Credits: 4**
Maximum Marks: 100

Course Description and Objectives:

This course covers the programming paradigms associated with python. It explores the programming language concepts like Data Types- Loops- Functions; Python Lists- Strings- Tuples- Dictionaries of python with help of built in modules. The objective of this course is to provide comprehensive knowledge of python programming paradigms.

Course Outcomes:

Upon completion of the course the student should be able to

CO1: To know the basics of algorithmic problem solving
CO2: To develop Python programs with conditionals and loops.
CO3: To use Python data structures - lists- tuples- dictionaries.
CO4: To do input/output with files in Python.

Unit 1

Teaching hours:10

Algorithm Problem Solving
Algorithms- building blocks of algorithms (statements- state- control flow- functions)- notation (pseudo code- flow chart- programming language)- algorithmic problem solving- simple strategies for developing algorithms (iteration- recursion).

Unit 2 **Teaching hours:10**

Introduction to Python
Python Introduction- Technical Strength of Python- Introduction to Python Interpreter and program execution- Using Comments- Literals- Constants- Python's Built-in Data types- Numbers (Integers- Floats- Complex Numbers- Real- Sets)- Strings (Slicing- Indexing- Concatenation- other operations on Strings)- Accepting input from Console- printing statements- Simple 'Python' programs.

Unit 3 **Teaching hours:13**

Operators- Expressions and Python Statements
Assignment statement- expressions- Arithmetic- Relational- Logical- Bitwise operators and their precedence- Conditional statements: if- if-else- if-elif-else; simple programs- Notion of iterative computation and control flow –range function- While Statement- For loop- break statement- Continue Statement- Pass statement- else- assert.

Unit 4 **Teaching hours:13**

Sequence Data Types
Lists: list operations- list slices- list methods- list loop- mutability- aliasing- cloning lists- list parameters-Slicing- Indexing- Concatenation- other operations on Sequence data type;
Tuples: tuple assignment- tuple as return value;

Dictionaries: operations and methods; advanced list processing – list comprehension;
Examples to include finding the maximum- minimum- mean; linear search on list/tuple of numbers- and counting the frequency of elements in a list using a dictionary

Unit 5 **Teaching hours:14**

File Processing
Concept of Files- File opening in various modes and closing of a file- Reading from a file- Writing onto a file- File functions-open()- close()- read()- readline()-readlines()-write()- writelines()-tell()-seek()- Command Line arguments.

Introduction to Packages
Introduction to NumPy – Ndim – Shape – Size – Dtype – Itemsize - Reshape - Introduction to Pandas, series objects, Data frame Objects, Panel Objects , various functions.

Essential Reading:
[1] Python Programming using problem solving Approach by Reema Thareja, Oxford University, Higher Education Oxford University Press; First edition (10 June 2017), ISBN-10: 0199480173.
[2] Y. Daniel Liang "Introduction to Programming using Python" Pearson

Recommended Reading:
[1] Robert Sedgewick, Kevin Wayne, Robert Dondero, "Introduction to Programming in Python" Pearson.
[2] Mrak Litz, "Learning Python", O' Reilly.

Descriptive Statistics using Excel (BDA151N)

Total hours: 30 **Credits: 1**
Maximum Marks: 50

Course Description and Objective:

The course is designed to provide a practical exposure to the students in Basic concepts of Excel and different way of representation and exploratory data analysis in excel.

Course Outcomes:

Upon completion of the course the student should

CO1: Perform calculations and apply excel functions.
CO2: Represent data using charts and diagrams
CO3: Perform exploratory data analysis using Data Analysis Pack(DAP)

List of Programs

1. Excel worksheets: add worksheet- rename- save and delete- record worksheet and various operations on worksheet, freezing panes and splitting window
2. Cell referencing, Linking, and conditional formatting
3. Apply Text to column, Data validation and checks using excel
4. Creating Pivot table and Pivot chart
5. Apply formulas like financial, look up, maths, statistics, engineering etc
6. Apply filter and advanced filter, sorting.
7. Diagrammatic representation and Graphical representation
8. Descriptive statistics using statistical functions and Data Analysis Pack (DAP)
9. Exercise on correlation, Correlation matrix, partial and multiple correlation coefficient.
10. Draw a scatter plot and fit trend line for a bivariate data set.

Python Lab (BDA152N)

Total hours: 60 **Credits: 2**
Maximum Marks: 100

Course Description and Objectives:

The course is designed to provide a practical exposure to python and its applications.

Course Outcomes:

Upon completion of the course the student should be able to

CO1: Understand and develop Computational Thinking concepts.
CO2: Describe python programs that appropriately utilize built-in functions and control flow statements
CO3: Represent compound data using Python lists- tuples- dictionaries
CO4: Be able to do input/output with files in Python.

List of Programs

1. Write a program to demonstrate basic data type in python.
2. Write a program to implement various operators in python.
3. Write a program to implement various conditional statements in python.
4. Write a program to implement various looping statements in python.
5. Write a program to implement various string operations.
6. Write a program to demonstrate list & related functions in python.
7. Write a program to demonstrate tuple & related functions in python.
8. Write a program to demonstrate Dictionary & related functions in python.
9. Write a program to read and write from a file, and copy a file
10. Write a program to implement numpy and pandas packages.
11. Apply scaling mechanism by considering the employee data (based on the given data set).
12. Demonstrate the normalization process and implement the same with customer data of bank.
13. Apply at least 3 sampling techniques to get the best data from the population.
14. Demonstrate the missing value imputations.
15. Demonstrate the usage of outlier detection.
16. Apply various data summarization techniques in student data.
17. Demonstrate the techniques to handle the imbalanced data sets.

Essential Reading:

[1] Python Programming using problem solving Approach by Reema Thareja- Oxford University- Higher Education Oxford University Press; First edition (10 June 2017)- ISBN-10: 0199480173.
[2] John M. Sewart- “Python for Scientist”- Cambridge Universities Press.

Recommended Reading:

[1] Robert Sedgewick- Kevin Wayne- Robert Dondero- “Introduction to Programming in Python” Pearson.
[2] Mrak Litz- “ Learning Python”-O’ Reilly.

Semester 2
Communicative English (BDA221N)

Total hours: 45 **Credits: 3**
Maximum Marks: 100

Course Description and Objectives:

This course will help the learner to help learners understand the relationship between the world around them and the text/literature and improve their communication skills for larger academic purposes and vocational purposes and teach them logical sequencing of content and process information..

Course Outcomes:

Upon completion of the course the student should

CO1: Understand how to engage with texts from various countries, historical, cultural specificities and politics.
CO2: Understand and develop the ability to reflect upon and comment on texts with various themes.
CO3: Develop the ability to communicate both orally and in writing for various purposes.
CO4: Develop an analytical and critical bent of mind to compare and analyse the various literature they read, listen and discuss in class.

Unit 1 **Teaching Hours:9**

FOOD
1.1. Long text: Witches' Loaves by O Henry
1.2. Short text: Portion size is the trick!!! by Ranjani Raman
Language
1.1.1. Presentation Skills
1.1.2. Listening skills

Unit 2 **Teaching Hours:7**

FASHION
2.1. Long text: In the Height of Fashion by Henry Lawson
2.2. Short text: Crazy for Fashion by Babatunde Aremu
Language
2.1.1. Report Writing
2.1.2. Listening skills

Unit 3 **Teaching Hours: 8**

MANAGEMENT
3.1. Long Text: The Amazing Dabbawalas of Mumbai by Shivani Pandita
3.2. Short Text: If by Rudyard Kupling

Language

3.1.1. Interview Skills and CV Writing

3.1.2. Listening skills

Unit 4 **Teaching Hours:9**

HISTORY

4.1. Long text: Whose Ambedkar is he anyway? by KanchaIlaiah

4.2. Short text: Dhauli by Jayanta Mahapatra

Language

4.1.1. Developing Arguments- Debating

4.1.2. Listening skills

Unit 5 **Teaching Hours:8**

WAR

5.1. Long text: An Occurrence at Owl Creek Bridge by Ambrose Bierce

5.2. Short text: Strange meeting by Wilfred Owen

Language

5.1.1. Letter Writing

5.1.2. Listening skills

Unit 6 **Teaching Hours:4**

VISUAL TEXT

6.1 BBC Documentary- Dabbawalas**.**

Essential Reading:

[1] Englogue – I : A textbook for First Year Undergraduate Students

[2] Shivani Pandita, *The story of Mumbai Dabbawalas,* BBC Documentary,2008.

Recommended Reading:

[1] I.Jayakaran, *Master your English Grammar*, 2M Publishing International,2004.

[2] Wren & Martin, *English and Grammar Composition*, Blackie ELT Books,2016.

[3] Rudyard Kipling, *Something of myself*, Macmillan and Co Limited ,1937

Differential Calculus (BDA231N)

Total hours: 45 **Credit: 3**

Maximum Marks: 100

Course Description and Objectives:

This course aims at enabling the students to know various concepts and principles of differential calculus and its applications. Sound knowledge of calculus is essential for the students of mathematics for the better perceptions of the subject and its development.

Course Outcomes:

Upon completion of the course the student should be able to

CO1: understand and use the notion of Derivative of the function of one variable.
CO2: demonstrate a working knowledge of vectors and vector functions.
CO3: determine partial derivatives of the functions of two or more variables.
CO4: illustrate the computational skills in finding the directional derivatives- Gradient vectors and differentials.

Unit 1 **Teaching Hours:9**

Functions of single variable

Definition of the limit of a function (ε-δ) form – Continuity- Uniform Continuity – Types of discontinuities – Properties of continuous functions on a closed interval – Differentiability.

Unit 2 **Teaching Hours:9**

Mean Value Theorems

Mean Value Theorems: Rolle's theorem – Lagrange's and Cauchy's First Mean Value Theorems – Taylor's theorem (Lagrange's form and Cauchy's forms of remainder) –Maclaurin's theorem and expansions - Indeterminate forms. Maxima and Minima.

Unit 3 **Teaching Hours:9**

Successive and Partial Differentiation

Successive differentiation – nth derivatives of functions – Leibnitz theorem and its applications – Partial differentiation –First and higher order derivatives – Differentiation of homogeneous Functions.

Unit 4 **Teaching Hours:9**

Functions of two variables

Partial derivatives- Total derivative- Lagrange's multipliers for two variables- Euler's theorem – Taylor's theorem for two variables - Maxima and Minima of functions of two variables.

Unit 5 **Teaching Hours:9**

Tangents and Normal- Curvature- Asymptotes- Singular points- Tracing of curves (Parametric representation of curves and tracing of parametric curves- Polar coordinates and tracing of curves in polar coordinates).

Essential Reading:

[1] G.B. Thomas- M. D. Weir and J. Hass- *Thomas Calculus*- 14th ed.- Pearson Education India- 2018

Recommended Reading:

[1] F. Ayres and E. Mendelson- *Schaum's Outline of Calculus*- 10th ed. USA: Mc. Graw Hill.- 2015.
[2] J. Stewart- *Single Variable Essential Calculus: Early Transcendentals*- 2nd ed.: Belmont- USA: Brooks/Cole Cengage Learning.- 2013.
[3] M. Spivak- *Calculus*- 4th ed.- Cambridge University Press- 2008.
[4] T.M. Apostol- *Calculus*- *Vol-II*- Wiley India Pvt. Ltd.- 2011.linear

Random Variables and Probability Distributions (BDA232N)

Total hours: 60 **Credits: 4**
Maximum Marks: 100

Course Description and Objectives:

This course is designed to teach the basic concepts of random variables and its generation functions. It also gives a brief idea about standard probability distributions and how they are applied in real time situations. The course will enable the students to understand the properties and applications of various probability functions.

Course Outcomes:

Upon completion of this course the students will be able to

CO1: Demonstrate the random variables and its functions
CO2: Infer the expectations for random variable functions and generating functions.
CO3: Demonstrate various discrete and continuous distributions and their usage

Unit 1 **Teaching Hours:12**

Random variables

Definition- Discrete and continuous random variables- Probability Mass function and Probability density function- Distribution function and its properties. Two dimension random variables: Discrete and continuous type- Joint Density function- Marginal and conditional Probability Mass function and Probability Density function- independence of variables with illustration.

Unit 2 **Teaching Hours:12**

Mathematical Expectation and Generating functions

Expectation of single and bivariate random variables and its properties. Moments and Cumulants- moment generating function- cumulant generating function and characteristic function. Uniqueness and inversion theorems (without proof) along with applications- Conditional expectations.

Unit 3 **Teaching Hours:12**

Discrete Probability distributions

Discrete distributions: Binomial- Poisson- geometric- negative binomial- Hypergeometric distributions along with their properties- limiting/approximation cases and applications.

Unit 4 **Teaching Hours:12**

Continuous Probability distributions

Continuous distributions: Uniform- normal- exponential- Cauchy- beta and gamma distributions along with their properties- limiting/approximation cases and applications.

Unit 5 **Teaching Hours:12**

Limiting Theorems

Chebyshev's inequality- Week Law of Large numbers- Strong Law of Large numbers and their applications- Central Limit Theorem for i.i.d variates and its application- De-Moivre Laplace theorem.

Essential Reading:

[1] Sheldon Ross- *A First Course in Probability*- 9th edition- Pearson Education- US-10th ed., 2019.

[2] Gupta S.C and Kapoor V.K- *Fundamentals of Mathematical Statistics*- Sultan Chand & Sons- New Delhi- 2017

Recommended Reading:

[1] Mukhopadhyay P- *Mathematical Statistics*- Books and Allied (P) Ltd- Kolkata-3rd ed., 2018.

[2] Rohatgi V.K and Saleh E- *An Introduction to Probability and Statistics*- 3rd edition- John Wiley & Sons Inc.- New Jersey-3rd ed., 2015.

[3] Montgomery D.C and Runger G.C- Applied Statistics and Probability for Engineers- Wiley India- New Delhi-9th ed., 2016.

[4] Mood A.M- Graybill F.A and Boes D.C- *Introduction to the Theory of Statistics*- McGraw Hill- New Delhi-3rd ed., 2017.

Operating System (BDA233N)

Total Teaching Hours for Semester :45 **Credits: 3**
Maximum Marks: 100

Course Description and Objectives:

This course is an introduction to the concepts behind modern computer operating systems. Topics will include what an operating system does (and doesn't) do- system calls and interfaces- processes- resource scheduling and management (of the CPU- memory- etc.)- Virtual memory. To acquire the fundamental knowledge of the operating system architecture and its components.

Course Outcomes:

Upon completion of the course the student should be able to

CO1: Understand the basic working process of an operating system.
CO2: Understand the importance of process and scheduling.
CO3: Understand the issues in synchronization and memory management.

Unit 1 **Teaching hours:9**

Introduction
Categories of Operating Systems- Computer-System Organization- Computer-System Architecture- Operating-System Structure- Operating-System Operations.

System Structures
Operating-System Services- User Operating-System Interface- System Calls- Types of System Calls- System Programs.

Process Management
Process Concept- Process Scheduling- Operations on Processes: process creation and termination - zombie and orphan process- Cooperating Processes- Inter-process Communication- Process related commands.

Unit 2 **Teaching hours:9**

Scheduling and Synchronization
CPU Scheduling- Basic Concepts- Scheduling Criteria- Scheduling Algorithms- Thread Scheduling- Multiple-Processor Scheduling - The Critical-Section Problem - Peterson's Solution - Synchronization Hardware - Semaphores - Classic problems of Synchronization - Multithreading models - threading issues.

Unit 3 **Teaching hours:10**

Memory Management Strategies and Deadlocks
System Model- Deadlock Characterization- Methods for handling Deadlocks -Deadlock Prevention- Deadlock avoidance- Deadlock detection- Recovery from Deadlocks - Swapping- Contiguous Memory allocation- Paging- Structure of the Page Table- Segmentation.

Unit 4 **Teaching hours:9**

Virtual Memory Management

Demand Paging- Copy-on-Write- Page Replacement- page replacement algorithms- Allocation of frames- Thrashing.

File System

File Concept- Access Methods- Directory and Disk Structure- File System Mounting- File Sharing- Protection.

Unit 5 **Teaching hours:8**

Implementing File Systems

File System Structure- File System Implementation- Directory Implementation- allocation Methods- Free-space Management.

Secondary Storage Structure

Disk Structure- Disk Attachment- Disk Scheduling- Disk Management and Swap-Space Management. Case study.

Essential Reading:

[1] Silberschatz- P.B. Galvin and G. Gagne- Operating System Concepts.9th Edition- New Delhi: Wiley India- 2011.

Recommended Reading:

[1] Stalling William- Operating Systems: Internals and Design Principles. 7th Edition - Prentice Hall-2011.

Data Structures (BDA234N)

Total hours: 60 **Credits: 4**
Maximum Marks: 100

Course Description and Objectives:

This course will introduce the concepts of Abstract data type (ADTs), linear data structures which includes lists, stacks, and queues. The course covers various sorting, searching and hashing algorithms and applications of linear data structures.

Course Outcomes:

Upon completion of the course the student should

CO1: Understand the need for Data Structures when building applications.
CO2: Design and develop algorithms using relevant data structure operations.
CO3: Appreciate the need for an optimized algorithm.

Unit 1 **Teaching Hours:11**

Introduction
Introduction to data structures - Algorithms - Analysing algorithms - Complexity of algorithms- Growth of functions - Asymptotic Notations - Performance measurements - Arrays and Structures: Abstract Data Type- Dynamically Allocated Arrays- Structures- Unions- Polynomial Representation and Additions.

Unit 2 **Teaching Hours:12**

Linear Data Structures – List
Linear Lists: Abstract Data Types (ADTs) – List ADT – array-based implementation linked list implementation — singly linked lists- circularly linked lists- doubly-linked lists – applications of lists –Polynomial Manipulation – All operations.(Insertion, Deletion, Merge, Traversal)

Unit 3 **Teaching Hours:12**

Linear Data Structures – Stacks, Queues
Stack ADT – Operations – Applications – Evaluating arithmetic expressions-Conversion of Infix to postfix expression – Queue ADT – Operations – Circular Queue- Priority Queue – deQueue – applications of queues.

Unit 4 **Teaching Hours:11**

Searching, Sorting and Hashing Techniques
Searching- Linear Search – Binary Search. Sorting – Bubble sort – Selection sort – Insertion sort – Shell sort – Radix sort. Hashing- Hash Functions – Separate Chaining- Open Addressing – Rehashing – Extendible Hashing.

Unit 5 **Teaching Hours:14**

Non-Linear Data Structures – Trees

Tree ADT – tree traversals – Binary Tree ADT – expression trees – applications of trees binary search tree ADT –Threaded Binary Trees- AVL Trees – B-Tree -B+ Tree – Heap– Applications of heap.

Non-Linear Data Structures -Graphs

Definition – Representation of Graph – Types of graph – Breadth-first traversal –Depth-first traversal – Topological Sort – Bi-connectivity – Cut vertex – Euler circuits-Applications of graphs.

Essential Reading:

[1] Rance D. Necaise. "Data Structures and Algorithms Using Python" Hamilton Printing Company-2011.
[2] Thomas H. Coreman- Charles E. Leiserson and Ronald L. Rivest- "Introduction to Algorithms"- Printice Hall of India, 2001.

Recommended Reading:

[1] Aho- Hopcraft- Ullman- "The Design and Analysis of Computer Algorithms" Pearson Education- 2008.
[2] Horowitz- Sahni- Rajasekaran- Fundamentals of Computer Algorithms-Silicon Pr- 2nd Edition- November 2012.

Data Structures Lab (BDA251N)

Total Teaching Hours/Semester: 60 **Credits: 2**

Max Marks: 100

Course Description and Objective

The course is designed to provide a practical exposure to data structures and its applications.

Course Outcomes

Upon completing this course the student will be able to

CO1: acquire the knowledge to build the logic and develop solution for a problem statement.

List of Programs:

1. Implement creation, insertion, deletion, update in an array.
2. Implement concatenation of arrays , find the length of the arrays.
3. Implementation of Single Linked List performing the following operations
   (i)Creation (ii) insertion (iii) deletion (iv) traversal
4. Array implementation of Stacks.
5. Array Implementation of queues.
6. Implementation of Stack using Linked list.
7. Implementation of Queue using Linked list.
8. Implementation of linear search.
9. Implementation of Binary Search.
10. Implementation of Insertion sorting.
11. Implementation of selection sorting.
12. Implementation of merge sort.
13. Implementation of Sorting Algorithm - Separate chaining and Open Addressing Hashing Technique
14. Implementation of Binary Search Tree
    a. Create a binary search tree.
    b. Traverse the above binary search tree recursively in pre-order, post-order and in- order
    c. Count the number of nodes in the binary search tree. LIST
15. Write Python programs to create a tree and implement the following graph traversal algorithms
    a. Depth first search. b. Breadth first search.c

R programming and Statistical Modelling Lab (BDA252N)

Total Teaching Hours/Semester: 30+60 **Credits: 4**

Max Marks: 100

Course Description: This course is used to provide an introduction to R, statistical language and environment. The course also covers the basics of R for statistical computation, exploratory analysis, and modeling.

Course Objective: To enable students to understand and develop programs in R environment.

Course Outcome:

CO1: Demonstrate data handling in R.

CO2: Perform exploratory data analysis using R.

CO3: Perform statistical modelling using R.

Unit-1 **Teaching Hours:10**

Introduction to R- Installation of R- Getting Started with R interface- Entering Input-Evaluation. R objects- Numbers- Attributes- Creating Vectors-Mixing Objects Explicit Coercion- Matrices-Lists- Missing Values-Data Frames- Names- Reading and Writing Data into R- Introduction to read.table().

Unit-2 **Teaching Hours:10**

Managing Data Frames with dplyr package- Data Frames- dplyr package- dplyr grammar-Installing dplyr- functions –select-filter-arrange-rename-mutate-group by. Control Structures-Functions and Debugging- If-else- for loops-Nested for loops-while loops- repeat Loops-next break.

Unit-3 **Teaching Hours:10**

Statistical Modelling using R: Diagrammatic and graphical representation. Exploratory data analysis-generating random numbers-fitting of discrete and continuous distributions.

List of Programs:

1. Creating vectors and performing operations on vectors.
2. Creating Matrices and performing operations on matrix.
3. Usage of select-filter-arrange-rename-mutate-group by functions.
4. Programming using control statements.
5. Diagrammatic and graphical representation.

6. Doing exploratory data analysis.

7. Correlation and Regression analysis

8. Generate random numbers from discrete distributions.

9. Generate random numbers from continuous distributions.

10-13. Fitting of discrete probability distribution.

14-15. Fitting of continuous probability distribution.

Essential References

1. W.N.Venables, D.M.Smith, An Introduction to R, R Core Team, 2018.

2. Maria Dolores Ugarte, Ana F. Militino, Alan T. Arnhold. Probability and Statistics with R -2nd Edition-CRC Press, 2016.

Recommended References

1. John Verzani, simple R - Using R for Introductory Statistics-2nd Edition CRC Press- Taylor & Francis Group - 2018.

2. Bharti Motwani-Data Analytics with R- 1st Edition – Wiley-2019.

Semester 3

Linear Algebra (BDA331N)

Total Teaching Hours/Semester: 45 **Credits: 3**

Max Marks: 100

Course Description and Objectives:
Linear algebra is one of the basic core disciplines in mathematics, and is central to many subjects in pure and applied mathematics. It also has direct applications in Data Science and Artificial Intelligence.

Course Outcomes:

Upon completion of the course the student should able to

CO1: Use properties of matrices- especially invertibility and matrix algebra.

CO2: Understand concepts of vector space, linear dependence and independence.

CO3: Be familiar with linear transformations and their corresponding matrices and understand the Rank and nullity concepts.

Unit 1 **Teaching Hours:9**

Matrices and System of linear equations

Matrix- Operation on matrices- Transposes and Powers of Matrices- Zero-One Matrices: Diagonal Matrix- Inverse of Matrix- System of Linear equations and Matrices - System of Homogeneous and non-homogeneous equations - Cayley Hamilton Theorem - Eigenvalues - Eigenvectors - and diagonalization.

Unit 2 **Teaching Hours:9**

Vector Spaces
Vector space-Examples and Properties- Subspaces-criterion for a subset to be a subspace- linear span of a set- linear combination- linear independent and dependent subsets- Basis and dimensions- Standard properties- Examples illustrating concepts and results.

Unit 3 **Teaching Hours:9**

Linear Transformations
Linear transformations- properties - matrix of a linear transformation- change of basis - range and kernel- rank and nullity- Rank-Nullity theorem.

Unit 4 **Teaching Hours:9**

Norms and Inner Product Spaces

Introduction - Inequalities on Linear Spaces - Norms on Linear Spaces - Inner products- Orthogonality - Unitary and Orthogonal Matrices - norms for matrices.

Unit 5 **Teaching Hours:9**

Linear Algebra Application to Data Science

Linear Algebra in Machine Learning - Loss functions - Regularization-covariance Matrix-Support Vector Machine Classification. Linear Algebra in dimensionality Reduction - Principal Component Analysis (PCA) - Singular Value Decomposition (SVD).

Essential Reading:

[1] M.P. Deisenroth, A. Aldo Faisal and C.H. Ong- Mathematics for Machine Learning 1st ed. Cambridge University Press, 2020.

[2] V. Krishnamurthy- V. P. Mainra- and J. L. Arora- An introduction to linear algebra. New Delhi-India: Affiliated East East-West Press Pvt Ltd.- 2003.

Reference books:

[1] David C. Lay- Linear Algebra and its Applications- 5th ed.-Indian Reprint- Pearson Education Asia- 2018.

[2] K.P.Murthy, Machine Learning- a Probabilistic Perspective, MIT Press, 2012.

[3] S. H. Friedberg- A. Insel- and L. Spence- Linear algebra- 4th ed.- Pearson- 2015.

[4] Gilbert Strang- Linear Algebra and its Applications- 4th ed.- Thomson Brooks/Cole- 2007.

Statistical Inference (BDA332N)

Total Teaching Hours/Semester: 60 **Credits: 4**

Max Marks: 100

Course Description:

This course is designed to introduce the concepts of theory of estimation and testing of hypothesis. This paper also deals with the concept of parametric tests for large and small samples. It also provides knowledge about non-parametric tests and its applications.

Course Outcomes:

Upon completion of this course students will be able to

CO1: Demonstrate the concepts of point and interval estimation of unknown parameters and their significance using large and small samples.

CO2: Apply the idea of sampling distributions of difference statistics in testing of hypotheses.

CO3: Infer the concept of nonparametric tests for single sample and two samples.

Unit 1 **Teaching Hours:10**

Introduction

Concept of Population- Sample- Sample Space- Parameter and Statistic- Parameter Space- Sampling distribution of a statistic- Standard error. Derivation of Standard Error of sample mean- variance- proportion and difference between variances. Concept of Order Statistics.

Unit 2 **Teaching Hours:13**

Theory of estimation

Point Estimation: Concept of Estimator and Estimate- properties of Point estimator – Unbiasedness- Consistency- efficiency- relative efficiency- Minimum variance unbiased estimators- sufficiency- Crammer Rao Inequality (Statement only)- Rao Blackwell Theorem (Statement only)- Neyman Factorization Theorem (Statement only). Methods of Estimation: Maximum likelihood- least squares and minimum variance. Concept of Interval Estimation.

Unit 3 **Teaching Hours:13**

Tests of Significance I

Concept of Statistical hypotheses- Type I and Type II error- Critical Region and power of the test. Neyman-Pearson lemma (Statement only). Large sample tests: Tests for single mean- equality of two means- single variance and equality of two variance for normal population- Tests of proportions.

Unit 4 **Teaching Hours:12**

Tests of Significance I

Sampling distributions of Chi-square- t and F statistics: derivation of Mean- variance- M.G.F and properties. Small sample tests: Tests for single mean- equality of two means- single variance and equality of two variance- Tests of proportions based on t and F statistics. Chi-square tests for independence of attributes and goodness of fit.

Unit 5 **Teaching Hours:12**

Nonparametric Tests

Concept of Nonparametric tests- Run test for randomness- Sign test and Wilcoxon Signed Rank Test for one and paired samples. Run test- Median test and Mann-Whitney-Wilcoxon tests for two samples.

Essential Reading:

[1] Rohatgi V.K- Statistical Inference- Dover Publication- New York- 2013.

[2] Gupta S.C and Kapoor V.K- *Fundamentals of Mathematical Statistics*-12th ed. Sultan Chand & Sons- New Delhi- 2017.

Recommended Reading:

[1] Walpole R.E- Myers R.H and Myers S.L- Probability and Statistics for Engineers and Scientists- 9th edition- Pearson- New Delhi- 2017.

[2] John V- Using R for Introductory Statistics- 2nd edition- CRC Press- Boca Raton- 2014.

[3] Rajagopalan M and Dhanavanthan P- Statistical Inference- PHI Learning (P) Ltd- New Delhi- 2012.

[4] Rohatgi V.K an Saleh E- An Introduction to Probability and Statistics- 3rd edition- John Wiley & Sons Inc- New Jersey- 2015.

Software Engineering (BDA333N)

Total Teaching Hours/Semester: 45 **Credits: 3**

Max Marks: 100

Course Objectives and Description:

This course is an introduction to software development process and design. It includes the descriptions about stages of software development, various process models, software engineering principles and scrum and Agile methodologies.

Course Outcomes:

Upon completion of the course the student should able to

CO1: Understand the importance of the stages in the software life cycle.

CO2: Become proficient in maintaining, estimation and testing software.

CO3: Formulate project management principles for the software development.

CO4: Develop understanding of Agile methodologies, Capable of producing different scrum artifacts.

Unit 1 **Teaching Hours:9**

Software Process

Introduction –S/W Engineering Paradigm – life cycle models (water fall, incremental, spiral, WINWIN spiral, evolutionary, prototyping, object oriented) - system engineering – computer based system – verification – validation – life cycle process – development process –system engineering hierarchy

Unit 2 **Teaching Hours: 9**

Software Requirement Specifications (SRS) and Engineering Process:

Elicitation - Analysis- Documentation- Review and Management of User Needs- Feasibility Study- Information Modelling- Data Flow Diagrams- Entity Relationship Diagrams- Decision Tables- SRS Document- Software Quality Frameworks- SEI-CMM Model**.**

Unit 3 **Teaching Hours: 9**

Software Testing and Maintenance

A Strategic approach to testing- Test strategies for conventional software- Test strategies for Object Oriented software - Validation testing - White-box testing - Basis path testing, control structure testing - Black-box testing- Object oriented testing methods.

Need for Maintenance- Categories of Maintenance: Preventive, Corrective and Perfective Maintenance - Cost of Maintenance- Software ReEngineering - Reverse Engineering - An

Overview of CASE Tools - Estimation of Various Parameters such as Cost - Efforts - Schedule/Duration - Constructive Cost Models (COCOMO).

Unit 4 **Teaching Hours: 9**

Overview of SCRUM and Sprint in Agile

Overview of SCRUM - Key Aspects of SCRUM – Product Owner, Planning Poker, the Team, The Sprint, Scrum Master, Manager in Scrum and Product Backlog - Scrum Pre-Planning meeting – Roadmap – Estimation - Backlog - Scrum Pre-Planning Meeting - Sprint Planning meeting - A typical Sprint Calendar - Defining DONE - Getting to DONE – Definition of Ready - Good and BAD Ways.

Sprint: Daily Scrum Meeting - Updating Sprint Backlog - Burndown Chart – TaskBoard - Sprint Review - Sprint Retrospective

Unit 5 **Teaching Hours: 9**

Scrum and Metrics

Principles of Agile metrics – Reflections: – Reflection of each iteration - Business value Delivered – Velocity – BurnDown - Code Coverage – Pairing - Defects Carried Over. Release Planning and Estimation in Scrum: Velocity – Based on historical Data - How to plan a release in Scrum - Scrum dis-advantages

Essential Reading:

[1] Roger S. Pressman- Software engineering- A Practitioner's Approach, McGraw Hill International Edition, 9th Edition 2020.

[2] Essential Scrum: A Practical Guide to the Most Popular Agile Process (Addison Wesley Signature Series (Cohn).

Recommended Reading:

[1] The Scrum Essential Scrum: A Practical Guide to the Most Popular Agile Process (Addison-Wesley Signature Series (Cohn).

[2] Ian Sommerville-Software engineering, Pearson education Asia-10th Edition 2016.

Introduction to Machine Learning and Artificial Intelligence (BDA334N)

Total Teaching Hours/Semester: 60 **Credits: 4**

Max Marks: 100

Course Description and Objectives:

The main objective of this course is to provide fundamental knowledge of Machine Learning Algorithms and Artificial Intelligence. On successful completion of the course- students will acquire fundamental knowledge of Machine Learning Algorithms such as Supervised- Unsupervised- Ensemble learning along with AI strategies.

Course Outcomes:

Upon completion of the course the student should able to

CO1: Describe Machine Learning fundamentals and various models of Machine Learning.

CO2: Demonstrate various ML techniques of Supervised and Unsupervised learning algorithms.

CO3: Applicability of various techniques of Artificial Intelligence Strategies.

CO4: Demonstrate the Usage of Ensemble models and the importance of Adaboost.

Unit 1

Machine Learning Basics **Teaching Hours: 12**

Machine Learning- AI- ML and Data Science Context- Training and Testing- Algorithm and Model-ML importance and techniques-Various Application areas of ML- Inferential and Descriptive models with example implementations-performance tuning techniques in the model fit.

Unit 2 **Teaching Hours:12**

Supervised Learning

Supervised Learning approach- Characteristics of Supervised learning-K.fold cross validation-Classification Techniques: KNN- Naive Bayes- Support Vector Machine and Logistic Regression-Regression Techniques: Simple Linear Regression- Multiple Linear Regression- Lasso- Ridge and Elastic Net Regression- Types.

Unit 3 **Teaching Hours:12**

Unsupervised Learning

Unsupervised Learning approach- characteristics of unsupervised learning- Apriori Algorithm-Association Rule generation- Dimensionality Reduction with Principal Component Analysis-Various Clustering Methods-K-means- Hierarchical Regularization and Penalization techniques.

Unit 4 **Teaching Hours:12**

AI Strategies

Searching- Breadth First search- Depth First search- A*- AO* algorithms- Neural Network introduction- ANN models- Implementation of ANN with various hidden layers- Implementation of ANN with multiple hidden layer, Perceptron and Single and Multiple output classes, back propagation algorithm and flowchart.

Unit 5 **Teaching Hours:12**

Ensemble Learning

Decision Tree Models- Bagging and Bootstrapping Models- Random Forest Implementation- Adaboost –Weighted Average-Gradient Boosting Machines and Implementations.

Essential Reading:

[1] Machine Learning For Absolute Beginners: A Plain English Introduction (2nd Edition)

Recommended Reading:

[1] Mueller John Paul -Machine Learning (in Python and R) For Dummies- Wiley India Pvt. Ltd

(1st Edition)

[2] Fundamentals of Machine Learning for Predictive Data Analytics

[3] Machine Learning: The Art and Science of Algorithms that Make Sense of Data (1st Edition)

[4] E. Rich and K. Knight- Artificial Intelligence- 3rd Edition. New York: TMH- 2019.

Object Oriented Programming Using Java (BDA335N)

Total Teaching Hours/Semester: 60 **Credits: 4**

Max Marks: 100

Course Description and Objectives

This course teaches students how to develop java applications. Course gives an overview of the difference between C++ and Java. Students will be developing and testing java applications as a practical course work. The course introduces the concept of UI design in java using SWING .

Course Outcomes:

Upon completion of the course the student should able to

CO1: Demonstrate their ability to understand the concepts of Object-oriented programming and will model the real-world applications using Object Oriented Programming concepts.

CO2: Apply the concept of Multithreading in concurrent programming.

CO3: Able to design GUI applications using SWING and Event Handling.

Unit-1 **Teaching Hours:12**

Java Basics

Java Fundamentals - History and philosophy of Java - Java's contribution to the Internet - Importance of bytecode - e Java buzzwords – The foundational principles of object ¬oriented programming - JDK - Create- compile- and run a simple Java program - Java keywords - identifiers in java - the java class libraries.

Introducing data types and operators

Importance of data types – Java's primitive types - literals - a closer look at variables – scope and life time of variables – Operators - type conversion in assignments - casting incompatible types - operator precedence -expressions.

Program control statements

Input characters from the keyboard - if statement - switch statement - for loop - the while loop - the do-while loop – break – continue - nested loops.

Unit-2 **Teaching Hours:12**

Arrays and Classes

Arrays: One dimensional arrays - multidimensional arrays - irregular arrays - alternative array declaration syntax - assigning array references - using the length member- the for each style for loop – command line arguments.

Classes: Class fundamentals - how objects are created - reference variables and assignment - methods returning a value - using parameters - constructors - parameterized constructors - the new operator revisited - garbage collection - the this keyword - controlling access to class members - method overloading -overloading constructors - understanding static - introducing nested and inner classes.

Unit-3 **Teaching Hours:12**

Inheritance- Packages and Interface

Inheritance: Inheritance basic - member access and inheritance - constructors and inheritance - using super to call superclass constructors - using super to access superclass members - creating a multilevel hierarchy - superclass references and subclass objects - method overriding - using abstract classes -using final - the object class.

Packages and Interfaces: Packages - packages and member access - understanding protected members -importing packages - Interfaces - implementing interfaces - using interface references - variables in interfaces - interfaces can be extended - default interface methods - use static methods in an interface.

Unit 4 **Teaching Hours:12**

Exception Handling and Using I/O

Exception Handling: The exception hierarchy - exception handling fundamentals - the consequences of an uncaught exception - using multiple catch statements - catching subclass exceptions - try blocks can be nested - throwing an exception - using finally -using throws - java's built-in exceptions - creating exception subclasses.

Using I/O: Java's I/O is built upon streams - byte streams and character streams - the byte stream classes - the character stream classes - the predefined streams-using the byte streams - reading and writing files using byte streams - reading and writing binary data- using java's character-based streams - file I/O using character streams.

Unit-5 **Teaching Hours:12**

Multi-Threaded Programming , Generics and Swings

Multithreaded programming: Multithreading fundamentals - the thread class and runnable interface - creating a thread - creating multiple threads - determining when a thread ends -thread priorities - synchronization – thread communication using NOTIFY()- WAIT() and NOTIFYALL() -suspending- resuming- and stopping threads.

Generics: Generics fundamentals – generics example- generics work only with reference types – generic class with two type parameters –general form of a generic class-bounded types –using wildcard arguments - generic methods – generic constructors – generic interfaces

The origins and design philosophy of swing - components and containers- layout managers - swing event handling – Event classes and listener interfaces -use of JButton -work with JTextField - create a JCheckBox - work with JList-JDBC

Self-Study

Advanced SWING components

Essential Reading:

[1] Schildt Herbert- Java: The Complete Reference- Tata McGraw- Hill- 10th Edition-2017

[2] Dr.Rao-Nageswara -Core Java-An Integrated Approach -New Edition Kongent Solutions Inc-2009.

Recommended Reading:

[1] Java ™ A Beginner's Guide- Herbert Schildt- McGraw-Hill Education- 8th Edition- 2017

Statistical Inference Lab (BDA351N)

Total Teaching Hours/Semester: 30 **Credits: 1**

Max Marks: 50

Course Description and Objectives:

This course is designed to give a practical exposure for testing of hypothesis by analysing various data sets using R programming.

Course Outcomes:

Upon completion of this course- students will be able to

CO1: Perform the parametric and nonparametric tests for small and large samples using R programming.

List of Programs:

1. Test for mean and equality of two means when variance is known under normality conditions.
2. Test for single mean when variance is unknown under normality conditions.
3. Test for equality of two means when variance is unknown under normality conditions.
4. Test for single proportion
5. Test for equality of two proportions.
6. Test for variance and equality of variances under normality conditions.
7. Test for independence of attributes using Chi-Square test.
8. Test for goodness fit using Chi-Square test.
9. Test for one sample using Run test and sign test.
10. Test for paired samples using Wilcoxon Signed Rank test
11. Test for two samples using Run test and Median test
12. Test for two samples using Mann-Whitney-Wilcoxon test.

Machine Learning and AI Lab(BDA352N)

Total Teaching Hours/Semester: 60 **Credits: 2**

Max Marks: 100

Course Description and Objectives:

This course teaches students how to implement various Machine Learning Algorithms.
The usage of Supervised and Unsupervised Learning algorithms in the real time scenarios.
The AI based strategies and their implementation with the help of algorithms.

Course Outcomes:

Upon completion of the course the student should be able to

CO1: Demonstrate the usage of Supervised Learning Models.

CO2: Apply the concepts Artificial Intelligence.

CO3: Demonstrate the Usage of Unsupervised and Reinforcement Learning Models.

List of Programs:

1. Demonstrate the descriptions observed from the given data set.
2. Implement K-Nearest Neighbour implementation.
3. Demonstrate the implementation of Naive bayes technique.
4. Apply the linear and multiple regression and justify the results.
5. Apply the logistic regression and justify the results.
6. Implement K-Means clustering algorithm.
7. Implement hierarchical clustering algorithm.
8. Demonstrate the usage of BFS search strategy in AI.
9. Demonstrate the usage of DFS search strategy in AI.
10. Apply the A* algorithm on a data set and justify the results.
11. Apply AO* algorithm on a data set and justify the results.
12. Implement the principal component analysis
13. Implement the decision tree algorithm.
14. Demonstrate the usage of Random Forest and justify results.

Java Programming Lab (BDA353N)

Total Teaching Hours/Semester: 60 **Credits: 2**

Max Marks: 100

Course Description and Objectives:

This course teaches students how to develop java applications. Course gives an overview of difference between C++ and Java. Students will be developing and testing java application as a practical course work. The course introduces the concept of UI design in java using SWING.

Course Outcomes:

Upon the completion of this course students will be able to

CO1: Demonstrate their ability to understand the concepts of Object-oriented programming and will model the real-world applications using Object Oriented programming concepts.

CO2: Apply the concept of Multithreading in concurrent programming.

CO3: Able to design GUI applications using SWING and Event Handling.

List of programs:

1. To implement different entry controlled and exit controlled looping statements
2. To Implement nesting of switch statement
3. To Implement single and multi-dimensional arrays
4. To implement constructor overloading and method overloading
5. To implement static keyword
6. To Implement multilevel inheritance
7. To implement super and this keyword
8. To implement abstract and final keyword
9. To implement the concept packages
10. To implement the concept of interfaces
11. To Implement exception handling and custom exceptions
12. To implement Byte oriented stream classes
13. To implement character oriented stream classes
14. To Implement multithreading
15. To implement generic classes
16. To implement mouse and keyboard events

17. To implement different layout managers

18. To design a customer registration form using advanced swing components

Semester 4

Operations Research (BDA431N)

Total Teaching Hours/Semester: 45 **Credits:3**

Max Marks: 100

Course Description and Objectives:

Operations research deals with the problems on optimization or decision making that are affected by certain constraints / restrictions in the environment. This course aims at teaching solution techniques of solving linear programming models, simple queuing model, and two-person zero sum games and Network models.

Course Outcomes:

Upon completion of the course the student should be able to

CO1: Develop a deep understanding of the Operations Research and its applications.

CO2: Understand different solving techniques and how to develop mathematical models for future prediction.

CO3: Ability to develop competitive strategies with use of Operations Research.

CO4: Solving the Industrial and real-world problems.

Unit 1 **Teaching Hours:9**

Introduction

Development of operation Research- definition of operation Research- Scientific Methods of operation research- Necessity of operation research- Scope of operation research- operation research and decision making- Models in OR- Character stick of a good model- Advantage and limitation of a model- type of Mathematical Models- Advantages and Limitation of operation Research.

Unit 2 **Teaching Hours:9**

Linear Programming

Application of Linear Programming method- Area of application of linear programming- Advantages and limitations of linear programing- Graphical Method of solution- Theory of simplex method- slack variable- surplus variable- artificial variable techniques.

Unit 3 **Teaching Hours:9**

Cost Analysis

Introduction to the model- assumptions of transportation model- North west corner method (NWCM) - Least cost Method (LCM) - Vogel Approximation Method (VAM)- Assignment problem- Hungarian Method- travelling salesman problem.

Unit 4 **Teaching Hours:9**

Game Theory

Introduction of Game theory- saddle point- pure strategy and mixed strategy- reduce game by dominance- mixed strategy.

Unit 5 **Teaching Hours:9**

Decision Analysis

Application of queuing models- assumptions of queuing models- classification of queuing models- Model I Single- channel passion arrival- Birth and death model- what is simulation- when to use simulation- advantages and limitations of simulation technique- application of simulations.

Essential Reading:

[1] Prem Kumar Gupta & D.S. Hira. Operations Research 7th edition - S.Chand & Company Pvt. Ltd, 2014.
[2] Kanti Swarup, P.K. Gupta and Man Mohan- Operations Research- Sultan Chand and Sons, 2014.

Recommended Reading:

[1] H.A Taha- Operations Research: An introduction 10th edition Pearson Prentice Hall, 2020.
[2] Wayne L. Winston-Operations Research 4th edition, Thomson Learning-2004.
[3] R. Panneer Seevam- Operations Research 2nd edition PHI Learning- 2009.

Applied Regression (BDA432N)

Total Teaching Hours/Semester: 60 **Credits: 4**

Max Marks: 100

Course Description and Objectives:

This course aims to provide the grounding knowledge about the regression model building of simple and multiple regression.

Course Outcomes:

Upon completion of the course the student should be able to

CO1: Develop a deeper understanding of the linear regression model.

CO2: Understand the forward- backward and stepwise methods for selecting the variables.

CO3: Understand the importance of multicollinearity in regression modelling.

CO4: Ability to use and understand generalizations of the linear model to binary and count data.

Unit 1 **Teaching Hours:12**

Simple Linear Regression
Introduction to regression analysis: Modelling a response- overview and applications of regression analysis- major steps in regression analysis. Simple linear regression (Two variables): assumptions- estimation and properties of regression coefficients- significance and confidence intervals of regression coefficients- measuring the quality of the fit.

Unit 2 **Teaching Hours:12**

Multiple Linear Regression
Multiple linear regression model: assumptions- ordinary least square estimation of regression coefficients- interpretation and properties of regression coefficient- significance and confidence intervals of regression coefficients.

Unit 3 **Teaching Hours:12**

Criteria for Model Selection
Mean Square error criteria- R2 and R 2 criteria for model selection; Need of the transformation of variables; Box-Cox transformation; Forward- Backward and Stepwise procedures.

Unit 4 **Teaching Hours:12**

Residual Analysis
Residual analysis- Departures from underlying assumptions- Effect of outliers- Collinearity- Non-constant variance and serial correlation- Departures from normality- Diagnostics and remedies.

Unit 5 **Teaching Hours:12**

Nonlinear Regression
Introduction to nonlinear regression- Least squares in the nonlinear case and estimation of parameters- Models for binary response variables- estimation and diagnosis methods for logistic and Poisson regressions. Prediction and residual analysis.

Essential Reading:

[1] D.C Montgomery- E.A Peck and G.G Vining- Introduction to Linear Regression Analysis- 5th ed. John Wiley and Sons-Inc.NY- 2012.

[2] S. Chatterjee and A. Hadi- Regression Analysis by Example- 5th ed. - John Wiley and Sons-Inc- 2012.

Recommended Reading:

[1] Iain Pardoe- Applied Regression Modeling- 3rd ed. John Wiley and Sons- Inc- 2020.

[2] P. McCullagh- J.A. Nelder- Generalized Linear Models- 2nd ed. Chapman & Hall- 1989.

Database Systems (BDA433N)

Total Teaching Hours/Semester: 45 **Credits: 3**

Max Marks: 100

Course Description and Objectives:
To learn the fundamentals of data models and to conceptualize and depict a database system using ER diagram, NoSQL, to implement the design of the tables in DBMS, to construct queries to get optimized outputs.

Course Outcomes:
Upon completion of the course the student should be able to
CO1: Apply the fundamental concepts of databases and Entity-Relationship (E-R) model.
CO2: Implement NoSQL
CO3: Compare and contrast different file organization concepts for data storage in Relational databases. Apply the transaction management principles on relational databases.

Unit 1 **Teaching Hours:9**

Introduction & DBMS Architecture
Introduction- Data- Database- Database management system- Characteristics of the database approach-Role of Database administrators- Role of Database Designers-End Users-Advantages and limitations of Using a DBMS and When not to use a DBMS.

DBMS Architecture – Data Models – Categories of Data models-Schemas-Instance and Database states- DBMS Architecture and Data Independence – The Three schema architecture- Data Independence- DBMS language and interface-Classifications of Database Management Systems.

Unit 2 **Teaching Hours:9**

Data Modelling Using Entity-Relationship Model
Using high level conceptual Data models for Database Design- Example Database Applications. Entity types- Entity Sets- Attributes and Keys. Relationships- Relationship types- Roles and Structural constraints. Weak Entity Types and Drawing E- R Diagrams.

Unit 3 **Teaching Hours:9**

Database Design
Functional dependencies and Normalization for Relational Databases - Normalization on concepts- first, second, third normal forms-BCNF.

Unit 4 **Teaching Hours:9**

Transaction Processing Concepts and Concurrency Control
Transaction and System concepts – Desirable properties of Transactions – Schedules and Recoverability. Lock-Based Protocols – Locks-Granting of Locks and Two- phase locking protocol.

Unit 5 **Teaching Hours:9**

Database Connectivity and NoSQL

Introduction and implementation of database connectivity - Introduction to NoSQL - Advantages and disadvantages-Types

Essential Reading:

[1] Elmasri Ramez and Navathe Shamkant B, Fundamentals of Database Systems, Addison-Wesley, 6th Edition, 2010

Recommended Reading:

[1] Silberschatz, Korth, Sudarshan, Database System Concepts, 5 Edition, McGraw Hill, 2006.
[2] O`neil Patricand, O`neil Elizabeth, Database Principles, Programming and Performance, 2nd Edition, Margon Kaufmann Publishers Inc, 2008.
[3] Raghu Ramakrishnan, “Database Management System”, Tata McGraw-Hill Publishing Company, 2003.

Data Analytics (BDA434N)

Total Teaching Hours/Semester: 45 **Credits:3**

Max Marks: 100

Course Description and Objectives:

The main objective of this course is to provide fundamental knowledge on analytics with R programming. On successful completion of the course- students will acquire fundamental knowledge of various techniques of analysis of the data along with mining and Business Analytics.

Course Outcomes:

Upon completion of the course the student should be able to

CO1: describe Data Analytics fundamentals and Business Intelligence.

CO2: demonstrate the usage of data warehousing- mining and visualization importance in analytics.

CO3: applicability of various exploratory data analysis techniques and various algorithms such as Association rule analysis and Time Series analytics.

CO4: applicability of various algorithms such as Factor Analysis- Classifications and Clustering.

Unit 1 **Teaching Hours: 09**

Wholeness of the data

Analytics- important of analytics - Business Intelligence- Pattern Recognition- Data Processing Chain- Business Intelligence Concepts and Applications- BI for Better Decisions- BI Tools- BI Skills- BI Applications- Data Analytics Life Cycle- R- Features of R.

Unit 2 **Teaching Hours: 09**

Sources of Analytics

Data warehousing Architecture- Data Sources- ETL process- Data warehouse Best practices- gathering and selecting the data- data cleansing and preparation- data mining best practices- Types of charts- tips for data visualization.

Unit 3 **Teaching Hours: 09**

Exploratory data Analysis

Descriptive Analytics- Prescriptive analytics and Predictive Analytics- Feature Selection- Feature Scaling and Normalization techniques- Confusion Matrix- Area Under Curve- Receiver operating characteristic Curve- Statistical methods for Evaluation- Correlation and Regression.

Unit 4 **Teaching Hours: 09**

Analytics related to rules and Patterns

Business Applications of Association Rules- Association Rule generation and analysis- Text analytics- Text processing- Term document matrix- Web content mining and Web analytics- Time series analysis and ARIMA model.

Unit 5 **Teaching Hours: 09**

Inference of Various Algorithms

Factor Analysis and observations- Hypothesis testing and inference- document clustering- Cluster analysis- decision trees and Random forest- Naive bayes.

Essential Reading:

[1] Data Analytics made Accessible Dr. Anil Maheshwari- November 2015.

[2] Data Science and Big Data Analytics: Discovering- Analyzing- Visualizing and Presenting Data-EMC Education Services- Wiley- January 2015.

Recommended Reading:

[1] Developing Analytic Talent: Becoming a Data Scientist- Wiley- 2014.

Web Technologies (BDA435N)

Total Teaching Hours/Semester: 60 **Credits: 4**

Max Marks: 100

Course Description and Objectives:

This subject will provide basic understanding of WWW- Web Development- Client side and Server-side technologies to develop and deploy Websites on Internet using HTML- Cascading Style Sheet- PHP and JavaScript

Course Outcomes:

Upon completion of the course the student should able to

CO1: Understand the concepts of Internet basics to design- implement and maintain a typical web page

CO2: Develop and incorporate dynamic capabilities in Web pages using DOM and JavaScript.

CO3: Learn the importance of server-side scripts for web Interactivity and Web Hosting

Unit-1 **Teaching Hours:12**

Web Essentials And Html5

Clients- Servers- and Communication. The Internet - Basic Internet Protocols -The World Wide Web - HTTP request message - response message - Web Clients - Web Servers – Markup Languages - Introduction to HTML- HTML Syntax- New input element and attribute- New Structure elements - SVG: SVG in HTML - SVG Shapes - SVG Text- Canvas.

Unit-2 **Teaching Hours:12**

CSS

CSS - Introduction to Cascading Style Sheets – Features – Core Syntax – colour and background – Text and font- list and tables – CSS selectors – Cascading and Inheritance.CSS Grouping/Nesting , Dimension , Display, Positioning, Navigation bar, Image gallery and image opacity. CSS 3.0 - CSS Border, Shadows, background - 3D transform - 3D transform - Gradient- multiple column - filters- web fonts.

Unit-3 **Teaching Hours:12**

Client-Side Programming

Introduction to JavaScript - Functions, Objects - Arrays - Built - in Objects - JavaScript Debuggers - JS Document Object Model (DOM) -Introduction to the DOM - DOM HTML- DOM CSS - Modifying Element Style - DOM Event Handling - Form validation: validating radio buttons - checkboxes- select menus - Text areas - JS Browser Object Model (BOM) - JS Cookies -JS Windows- JS Location - JS Popups- JS Time.

Unit-4 **Teaching Hours:12**

Server-Side Programming-1

Introduction to PHP - Basic Programming Concepts of PHP: Variables – Data types - Constants - Scope of Variables - Type of Variables - Type Casting – Operators - Operators Precedence –

References – Arrays - Control Structures: Branching -If statement - Switch statement - Looping: for Loop - while Loop - do while Loop - for each Loop. Functions: User Defined Functions – Built-in Function- - Functions for Variables - Script Controlling Functions - Array Functions - Date and Time Functions - Mathematical Functions -String Functions- PHP Server Variables;

Unit-5 **Teaching Hours:12**

Server-Side Programming-2 and PHP and MySQL

Working with form - File handling - session and cookies using PHP.

Basic commands with PHP examples - Connection to server - creating database - selecting a database - listing database – listing table names - creating a table- -inserting data - altering tables – queries -deleting database -deleting data and tables -PHP myadmin and database bugs.

Essential Reading:

[1] Programming the World Wide Web- Robert W. Sebesta- Pearson Education- Fourth edition- 2014.
[2] Developing Web application - Ralph Moseley press 2011.

Recommended Reading:

[1] Web Technologies-A Computer Science Perspective- Jeffrey C.Jackson- Pearson Education- 2008.
[2] Internet & World Wide Web - How To Program- H.M.Deitel- P.J. Deitel - et.al - Pearson Education- Fifth Edition- 2012.
[3] Web Technology- Rajkamal- Tata McGraw-Hill- 2001.
[4] Web Technologies Uttam K Roy- Oxford University Press- 2011.

Database Systems Lab(BDA451N)

Total Teaching Hours/Semester: 30 **Credits:1**

Max Marks: 50

Course Description and Objectives:

- To learn and understand Database Programming Paradigms.
- To learn and understand NoSQL.
- To learn Relational Database (Open source) such as MongoDB/ Oracle/MySQL.

Course Outcomes:

Upon completion of the course the student should

CO1: Understanding of Database Programming Languages.

CO2: Master the basics of database languages and construct queries using SQL, PLSQL, NoSQL.

CO3: Understand how analytics and big data affect various functions now and in the future.

List of Programs:

1. Draw E-R diagram and convert entities and relationships to a relation table for a given scenario. a. Two assignments shall be carried out i.e. consider two different scenarios (eg. bank, college).
2. Design a database schema for the two different scenarios
3. Study of Databases using MySQL
4. Design and Develop MySQL DDL statements which demonstrate the use of SQL objects such as Table, View, Index, Sequence.
5. Write MySQL queries using logical operations and operators.
6. Design at least 10 MySQL queries for suitable database applications using MySQL DML statements: Insert, Select, Update, Delete with operators, functions, and set operators.
7. Design at least 10 MySQL queries for suitable database application using DML statements: all types of Join, Sub-Query
8. Write a PL/SQL block to implement some commands.
9. Write a PL/SQL block to calculate the grade of minimum 10 students.
10. Write a PL/SQL block to implement trigger.

Data Analytics Lab (BDA452N)

Total Teaching Hours/Semester: 60 **Credits:2**

Max Marks: 100

Course Description and Objectives:

This course teaches students how to implement various Analytics Based Algorithms.
The usage of Descriptive and Predictive Learning algorithms in the real time scenarios.
The Web based data extraction and techniques of scaling and normalizations can be learned.

Course Outcomes:

Upon completion of the course the student should able to
CO1: demonstrate the usage of Descriptive and Inferential Models.
CO2: apply the concepts of Data cleaning and visualization techniques.
CO3: demonstrate the Usage of document clustering and time series models.

List of Programs:

1. Implement the descriptive analytics with R.

2. Implement inferential analytics with R.

3. Demonstrate the loading of .csv excel and text files with R.

4. Demonstrate the usage of various charts with R in the visualization.

5. Apply some data cleaning techniques on the given data set with R.

6. Demonstrate the importance of the Confusion Matrix.

7. Demonstrate the AUC-ROC curve usage in the analytics.

8. Apply the correlation technique and comment on P value.

9. Demonstrate the usage of document clustering with R.

10. Apply time series analysis on weather data.

11. Implement ARIMA model with R.

12. Describe the association rules generation with R.

13. Demonstrate the usage of R to extract web based data.

14. Demonstrate the scaling techniques with R.

15. Apply various normalization techniques in the data set with R.

Web Technologies Lab(BDA453N)

Total Teaching Hours/Semester: 60 **Credits:2**

Max Marks: 100

Course Description and Objectives:

This subject will provide basic understanding of WWW- Web Development- Client side and Server-side technologies to develop and deploy Websites on Internet using HTML- Cascading Style Sheet- PHP and JavaScript

Course Outcomes:

Upon completion of the course the student should be able
CO1: To implement HTML programming concepts.
CO2: To implement CSS concepts
CO3: Develop and incorporate dynamic capabilities in Web pages using DOM and JavaScript.
CO4: To implement server-side scripts for web Interactivity and Web Hosting

List of Programs:

1. Write an HTML code to display your education details in a tabular format.

2. Write an HTML code to display your CV on a web page.

3. Design a web page using CSS (Cascading Style Sheets) which includes the following:

   A. Use different font- styles: In the style definition you define how each selector should work (font- color etc.). Then- in the body of your pages- you refer to these selectors to activate the styles.

   B. Set a background image for both the page and single elements on the page.

   C. Control the repetition of the image with the background-repeat property.

4. Write an HTML code to create a Home page having three links: About Us- Our Services and Contact Us. Create separate web pages

5. Write an HTML code to create a login form. On submitting the form- the user should get navigated to a profile page.

6. Write an HTML code to create a Registration Form. On submitting the form- the user should be asked to login with this new credentials.

7. Write an HTML code to illustrate the usage of the following:

- Ordered List
- Unordered List
- Definition List

8. Write an HTML code to create a frameset having header- navigation and content sections.

9. Write an HTML code to demonstrate the usage of inline CSS

10. Write an HTML code to demonstrate the usage of internal CSS

11. Write an HTML code to demonstrate the usage of external CSS.

12. Write a Java script to prompt for the user's name and display it on the screen.

13. Design HTML form for keeping student records and validate it using Javascript

14. Write an HTML program to design an entry form of student details and send it to store at database server like SQL- Oracle or MS

15. To design the scientific calculator and make event for each button using javascript