UG PROGRAM (4 Years Honors)
CBCS - 2020-21

B. Sc
DATA SCIENCE

Syllabus and Model Question Papers

TABLE OF CONTENTS

Note: BOS is to provide final soft copy in PDF and word formats and four copies of hard copies in bounded form to the office of Dean Academic affairs.

1. Resolutions of the Board of Studies

Meeting held on: 22.01.2021.Time:10 A.MAt: Adikavi Nannaya University, RJY

Agenda:

1. Adoption of revised-common program structure and revising/updating course - wise syllabi (in the prescribed format) as per the guidelines issued by APSCHE.

2. Adoption of regulations on scheme of examination and marks/grading system of the University UG programs.

3. Preparation of Model question papers in prescribed format.

4. List of equipment/software requirement for each lab/practical

5. Eligibility of student for joining the course

6. Eligibility of faculty for teaching the course

7. List of paper-setters/paper evaluators with phone, email-id in the prescribed format

Members present:

Dr.M.KamalaKumari - Chairman Dept of CSE, AKNU, RJY
Dr.P.Venkateswara Rao - Member, Dept of CSE, AKNU, RJY
Mrs.A.M.Sirisha   - Coordinator, Dept of CSE, AKNU, RJY
Mr.M. Simhadri   - Member, Lecturer, Aditya Degree College, Kakinada

Resolutions:

1. Resolved the revised-common program structure and revising/updating course- wise syllabi (in the prescribed format) as per the guidelines issued by APSCHE.

2. Resolved the regulations on scheme of examination and marks/grading system of the University UG programs.

3. Prepared the Model question papers in prescribed format.

4. Prepared the list of equipment/software requirement for each lab/practical

5. Given the eligibility of student for joining the course

6. Given the eligibility of faculty for teaching the course

7. Given the list of paper-setters/paper evaluators with phone, email-id in the prescribed format

2. DETAILS OF PAPER TITLES & CREDITS

Sem	Course no.	Course Name	Course type (T/L/P)	Hrs./Week: Science: 4+2	Credits: Science: 4+1	Max. Marks Cont/ Internal/Mid Assessment	Max. Marks Sem- end Exam
I	1	Introduction to Data Science and R Programming	T	4	4	25	75
		Introduction to Data Science and R Programming	L	2	1	-	50
II	2	Data Mining Concepts and Techniques	T	4	4	25	75
		Data Mining Concepts andTechniques	L	2	1	-	50
III	3	Python Programming For Data Analysis	T	4	4	25	75
		Python Programming For Data Analysis	L	2	1	-	50
IV	4	Big Data Analytics Using Spark	T	4	4	25	75
		Big Data Analytics Using Spark	L	2	1	-	50
	5	Data Visualization	T	4	4	25	75
		Data Visualization	L	2	1	-	50
V	6A	Data Analytics With Tableau	T	4	4	25	75
		Data Analytics With Tableau Lab	L	2	1	-	50
	7A	Ai Concepts and Techniques With Python	T	4	4	25	75
		AI Concepts and Techniques with Python Lab	L	2	1	-	50
		OR					
	6B	Supervised Ml With Python	T	4	4	25	75
		Supervised ML with Python Lab	L	2	1	-	50
	7B	Unsupervised Ml With Python	T	4	4	25	75
		Unsupervised ML with Python Lab	L	2	1	-	50
		OR					
	6C	NLP With Python	T	4	4	25	75
		NLP with Python Lab	L	2	1	-	50
	7C	Deep Learning Neural Networks With Python	T	4	4	25	75
		Deep Learning Neural Networks With Python Lab	L	2	1	-	50

Note : *Course type code: T: Theory, L: Lab, P: Problem solving.

Note 1: For Semester–V, for the domain subject DATA SCIENCE, any one of the three pairs of SECs shall be chosen as courses 6 and 7, i.e., 6A & 7A or 6B & 7B or 6C & 7C. The pair shall not be broken (ABC allotment is random, not on any priority basis).

Note 2: One of the main objectives of Skill Enhancement Courses (SEC) is to inculcate field skills related to the domain subject in students. The syllabus of SEC will be partially skill oriented. Hence, teachers shall also impart practical training to students on the field skills embedded in the syllabus citing related real field situations.

Note 3: To insert assessment methodology for Internship/ on the Job Training/Apprenticeship under the revised CBCS as per APSCHE Guidelines.

   ➢ **First internship (After 1st Year Examinations):** Community Service Project. To inculcate social responsibility and compassionate commitment among the students, the summer vacation in the intervening 1st and 2nd years of study shall be for Community Service Project (the detailed guidelines are enclosed).
   ➢ **Credit For Course: 04**

   ➢ **Second Internship (After 2nd Year Examinations):** Apprenticeship / Internship / on the job training / In-house Project / Off-site Project. To make the students employable, this shall be undertaken by the students in the intervening summer vacation between the 2nd and 3rd years (the detailed guidelines are enclosed).
   ➢ **Credit For Course: 04**

   ➢ **Third internship/Project work (6th Semester Period):**
   During the entire 6th Semester, the student shall undergo Apprenticeship / Internship / On the Job Training. This is to ensure that the students develop hands on technical skills which will be of great help in facing the world of work (the detailed guidelines are enclosed).
   ➢ **Credit For Course:12**

a. Proposed combination subjects: Computer Applications, Information Technology
b. Student eligibility for joining in the course: Any stream 10+2, Open Inter School, Any Diploma and its equivalent
c. Faculty eligibility for teaching the course: Post Graduation + 3 Year experience in the relevant field
d. List of Proposed Skill enhancement courses with syllabus, if any:
e. Any newly proposed Skill development/Life skill courses with draft syllabus and required resources
f. Required instruments/software/ computers for the course (Lab/Practical course-wise required i.e., for a batch of 15 students)

Sem. No.	Lab/Practical Name	Names of Instruments/Software/ computers required with specifications	Brand Name	Qty Required
1	BASICS OF R LAB	Intel desktop PC(80GB HDD,2GB DDR), Windows OS, R Studio with supporting utilities		15
2	DATA MINIG USING R PROGRAMMING LAB	Intel desktop PC(80GB HDD,2GB DDR), Windows OS, R Studio with supporting utilities		15
3	PYTHON PROGRAMMING LAB	Intel desktop PC(80GB HDD,2GB DDR), Windows OS, Python 3.6 and related packages		15
4	SPARK PROGRAMMING LAB	Intel desktop PC(80GB HDD,2GB DDR), Windows OS,JDK,Python,Hadoop and Apache SPARK		15
5	DATA VISUALIZATION LAB USING TABLEAU	Intel desktop PC(80GB HDD,2GB DDR), Windows OS,MS Office,TABLEAU Desktop		15

g. List of Suitable levels of positions eligible in the Govt/Pvt organizations

Suitable levels of positions for these graduates either in industry/govt organization like., technical assistants/ scientists/ school teachers., clearly define them, with reliable justification

S.No	Position	Company/ Govt organization	Remarks	Additional skills required, if any
01	Data Analyst	Banking Sector, Ministries, Technology Sector, PSU Companies, Defence field, IT and Communication sector, and Engineering and Industrial segments in India		
02	Data Scientists	Research Analysts/Associates posts		

h. List of Govt. organizations / Pvt companies for employment opportunities or internships or projects

S.No	Company/ Govt organization	Position type	Level of Position			
1	AMAZON	Data Scientist , Data Analyst				
2	HCL	Data Scientist , Data Analyst				
3	GOOGLE	Data Scientist , Data Analyst				
4	INTEL	Data Scientist , Data Analyst				
5	YAHOO	Data Scientist , Data Analyst				
6	ITC	Data Scientist , Data Analyst				

i. Any specific instructions to the teacher /paper setters/Exam-Chief Superintendent

3. Program objectives, outcomes, co-curricular and assessment methods

B.Sc	Data Science

1. **Aim and objectives of UG program in Subject**: Data Science

The Objectives of this Program describes what students are expected to know and be able to do by the time of graduation. The Computer Science Department's Bachelor of Science program must enable students to attain, by the time of graduation:

- An ability to identify, formulate and develop solutions to computational challenges.
- An ability to design, implement and evaluate a computational system to meet desired needs within realistic constraints.
- An ability to function effectively on teams to accomplish shared computing design, evaluation, or implementation goals.
- An understanding of professional, ethical, legal, security, and social issues and responsibilities for the computing profession.
- An ability to communicate and engage effectively with diverse stakeholders.
- An ability to analyze impacts of computing on individuals, organizations, and society.
- Recognition of the need for and ability to engage in continuing professional development.
- An ability to use appropriate techniques, skills, and tools necessary for computing practice.
- Effectively utilizing their knowledge of computing principles and mathematical theory to develop sustainable solutions to current and future computing problems.
- Developing and implementing solution based systems and/or processes that address issues and/or improve existing systems within in a computing based industry.

2. Learning outcomes of Subject Computer Science:

- Students will be able to communicate in written and oral forms in such a way as to demonstrate their ability to present information clearly, logically, and critically.
- Students will be able to apply mathematical and computing theoretical concepts in solution of common computing applications, such as computing the order of an algorithm.
- Students will be able to complete successfully be able to program small-to-mid- size programs on their own. Sufficient programming skills will require use of good practice, e.g., good variable names, good use of computational units, appropriate commenting strategies.
- Students will be able to use appropriately system design notations and apply system design engineering process in order to design, plan, and implement software systems
- In a self-selected area of depth in Computing, students will demonstrate a depth of knowledge appropriate to graduate study and/or lifelong learning in that area. Students should be able to read for understanding materials in that area beyond those assigned in coursework.
- Students will be prepared for a career in an information technology oriented business or industry, or for graduate study in computer science or other scientific or technical fields.
- Use systems development, word-processing, spreadsheet, and presentation software to solve basic information systems problems

3. Recommended Co-Curricular methods : (Co-curricular Activities should not promote copying from text book or from others' work and shall encourage self/independent and group learning)

4. Recommended Assessment Methods :
   A. Measurable:
      1. Assignments on:
      2. Student seminars (Individual presentation of papers) on topics relating to:
      3. Quiz Programmes on:
      4. Individual Field Studies/projects:
      5. Group discussion on:

5. Recommended Continuous Assessment methods:
   - Assignments, Mid Examinations, Semester End Examinations, Practicals-   Internal and Theory are conducted continuously, 2-Mid examinations per semester.

4. Details of course-wise Syllabus

B. Sc	Semester: I	Credits:4
Course: 1	**INTRODUCTION TO DATA SCIENCE AND R PROGRAMMING**	**Hrs/Wk: 4**

Aim and objectives of Course :

Data Science is a fast-growing interdisciplinary field, focusing on the analysis of data to extract knowledge and insight. This course will introduce students to the collection. Preparation, analysis, modelling and visualization of data, covering both conceptual and practical issues. Examples and case studies from diverse fields will be presented, and hands- on use of statistical and data manipulation software will be included.

Learning outcomes of Course:
- Recognize the various discipline that contribute to a successful data science effort.
- Understand the processes of data science identifying the problem to be solved, data collection, preparation, modeling, evaluation and visualization.
- Be aware of the challenges that arise in Data Sciences.
- Be able to identify the application of the type of algorithm based on the type of the problem.
- Be comfortable using commercial and open source tools such as the R/Python language and its associated libraries for data analytics and Visualization.

UNIT I:
Defining Data Science and Big data, Benefits and Uses, facets of Data, Data Science Process. History and Overview of R, Getting Started with R, R Nuts and Bolts

UNIT II:
The Data Science Process: Overview of the Data Science Process-Setting the research goal, Retrieving Data, Data Preparation, Exploration, Modeling, data Presentation and Automation. Getting Data in and out of R, Using reader package, Interfaces to the outside world.

UNIT III:
Machine Learning: Understanding why data scientists use machine learning-What is machine learning and why we should care about, Applications of machine learning in data science, Where it is used in data science, The modeling process, Types of Machine Learning-Supervised and Unsupervised.

UNIT IV:
Handling large Data on a Single Computer: The problems we face when handling large data, General Techniques for handling large volumes of data, Generating programming tips for dealing with large datasets. Case study- Predicting malicious URLs(This can be implemented in R).

UNIT V:
Sub setting R objects, Vectorised Operations, Managing Data Frames with the dplyr, Control structures, functions, Scoping rules of R, Coding Standards in R, Loop Functions, Debugging, Simulation

TEXT BOOKS:
1. DavyCielen, Arno.D.B.Maysman, Mohamed Ali, "Introducing Data Science" ManningPublications, 2016.
2. Roger D. Peng, "R Programming for DataScience" Lean Publishing, 2015.

REFERENCE BOOKS:
1. Nina Zumel, John Mount, "Practical Data Science with R", Manning Publications, 2014.
2. Tony Ojeda, Sean Patrick Murphy, Benjamin Bengfort, AbhijitDasgupta, "Practical Data Science Cookbook", Packt Publishing Ltd., 2014.

B. Sc	Semester: I	Credits:1
Course: 1	Introduction To Data Science and R Programming Lab	Hrs/Wk: 2

Details of Lab/Practical/Experiments/Tutorials syllabus:

1. Installing R and R studio
2. Basic operations in r
3. Getting data into R, Basic data manipulation, Loading Data into R
4. Basic plotting
5. Loops and functions
6. Create Vectors, Lists, Arrays, Matrices, Data frames and operations on them.
7. Demonstrate the visualization and graphics using visualization packages.
8. Implement Loop functions with lapply(), sapply(), tapply(), apply(), mapply().
9. Explore data using Single Variables: Unimodal, Bimodal, Histograms, Density Plots, Barcharts
10. Explore data using two Variables: Line plots, Scatter Plots, smoothing cures, Bar charts
11. Explore and implement commands using dplyr package
12. Generate random numbers and set seed

RECOMMENDED TEXT BOOKS:
1. Mark Gardener, "Beginning R - The Statistical Programming Language", John Wiley & Sons, Inc., 2012.
2. W. N. Venables, D. M. Smith and the R Core Team, "An Introduction to R", 2013. Recommended Reference books:
3. The art of R Programming: A tour of Statistical Software design. Norman Matloff. KindleEdition
4. The book of R : The first course in Programming and Statistics by Tilman M. Davies.

Recommended Co-curricular activities: (Co-curricular Activities should not promote copying from text book or from others' work and shall encourage self/independent and grouplearning)

    A. Measurable:
       1. Assignments on:
       2. Student seminars (Individual presentation of papers) on topics relating to:
       3. Quiz Programmes on:
       4. Individual Field Studies/projects:
       5. Group discussion on:
       6. Group/Team Projects on:
    B.   General
       1. Collection of news reports and maintaining a record of paper-cuttings relating to topics covered in syllabus
       2. Group Discussions on:
       3. Watching TV discussions and preparing summary points recording personal observations etc., under guidance from the Lecturers
       4. Any similar activities with imaginative thinking.
       5. Recommended Continuous Assessment methods:

MODEL QUESTION PAPER (Sem-end. Exam)
UG DEGREE EXAMINATIONS
SEMESTER: I
Course 1: INTRODUCTION TO DATA SCIENCE AND RPROGRAMMING

Time: 3Hrs   **Max.Marks:75**

SECTION-A

Answer any FIVE of the following   **5 x 5=25M**

1. What is data science, and Big data, How data science and Big data are related. What is the application of data science.3

2. Explain Read R package

3. What are the applications of machine learning in data science.

4. What are the different challenges that w face when handling large data.

5. What is meant by data frame in 'R'. Explain dplyr package.

6. What are the different types of big data.

7. What are the four steps in modeling process in machine earning.

8. What is meant by debugging.

SECTION-B

Answer ALL of the following.   **5X10=50M**

9. a)Explain different phases of facets of data.

(or)

b)What is R. Describe basic commends in R with Examples (Vectors, matrices, lists, data frames etc.)

10. a)Explaining detail the steps involved in data science process.

(or)

b)What are the different ways of leading data into R. with examples.

11. a)What are the different types of machine learning processes. Explain detail.

(or)

b)List out the importance of machine learning and gives examples in our day to day life.

12. a)What are the different techniques for handling large volumes of data.

(or)

b)Explain any case study that deals with large data sets.

13. a)Explain Vectorised operations, control structures, functions and loop functions in R.

(or)

b)Explain and give examples of exploring data using single variable and two variables.

B. Sc	Semester: II	Credits:4
Course: 2	DATA MINING CONCEPTS AND TECHNIQUES	Hrs/Wk: 4

Aim and objectives of Course:
- To understand Data mining techniques and algorithms.
- Comprehend the data mining environments and application.

Learning outcomes of Course:
Students who complete this course will be able to
- Compare various conceptions of data mining as evidenced in both research and application.
- Evaluate mathematical methods underlying the effective application of data mining.
- Should be able to apply the type of techniques based on the problems considered

UNIT I:
An idea on Data Warehouse, Data mining-KDD versus data mining, Stages of the Data Mining Process-Task primitives., Data Mining Techniques – Data mining knowledge representation.

UNIT II
Data mining query languages- Integration of Data Mining System with a Data Warehouse-Issues, Data pre-processing – Data Cleaning, Data transformation – Feature selection – Dimensionality reduction

UNIT III
Concept Description: Characterization and comparison What is Concept Description,Data Generalization by Attribute-Oriented Induction(AOI), AOI for Data Characterization, Efficient Implementation of AOI.
Mining Frequent Patterns, Associations and Correlations: Basic Concepts, FrequentItemset Mining Methods: Apriori method, generating Association Rules, Improvingthe Efficiency of Apriori, Pattern-Growth Approach for mining Frequent Item sets.

UNIT-IV
Classification Basic Concepts: Basic Concepts, Decision Tree Induction: Decision TreeInduction Algorithm, Attribute Selection Measures, Tree Pruning. Bayes Classification Methods.

UNIT-V
Classification by Back Propagation: Multi_Layer Feed Forward Neural Network. Support **Vector Machines:** Cases when the data are linearly separable and linearlyinseparable.
Cluster Analysis: Cluster Analysis, Partitioning Methods, Hierarchal methods, Density based methods-DBSCAN.

TEXT BOOKS:
1. Jiawei Han, MichelineKamber, Jian Pei."Data Mining: Concepts and Techniques", 3rd Edition,Morgan Kaufmann Publishers, 2011.
2. AdelchiAzzalini, Bruno Scapa, "Data Analysis and Data mining" , 2ndEdiiton, Oxford Univeristy Press Inc., 2012.

REFERENCES BOOKS:
1. Alex Berson and Stephen J. Smith, "Data Warehousing, Data Mining & OLAP", 10th Edition, TataMcGraw Hill Edition , 2007.
2. G.K. Gupta, "Introduction to Data Mining with Case Studies", 1st Edition, Easter Economy Edition, PHI, 2006.

Student Activities:
1. Students should be able to implement Data Mining algorithms provided the relevant data
2. Given the data, students can visualize all statistical measures
3. Differentiate the types of mining problems and identify what type of algorithms are to be implemented.

Continuous assessment:
Let the students be tested in the following questions from each unit
1. What is Data Mining and KDD? Where Data Mining fits in KDD Process
2. Describe all Preprocessing methods
3. Explain Data Description and AOI Algorithm
4. Explain Classification and Write any Decision tree induction algorithm
5. Explain the concept of clustering and write any algorithm to form clusters.

B. Sc	Semester: II	Credits:1
Course: 2	DATA MINING CONCEPTS AND TECHNIQUES LAB	Hrs/Wk: 2

1. Get and Clean data using swirl exercises.(Use 'swirl' package, library and install that topicfrom swirl).
2. Visualize all Statistical measures(Mean ,Mode, Median, Range, Inter Quartile Range etc., using Histograms, Boxplots and Scatter Plots).
3. Create a data frame with the following structure.

EMP ID	EMP NAME	SALARY	START DATE
1	Satish	5000	01-11-2013
2	Vani	7500	05-06-2011
3	Ramesh	10000	21-09-1999
4	Praveen	9500	13-09-2005
5	Pallavi	4500	23-10-2000

a. Extract two column names using column name.
b. Extract the first two rows and then all columns.
c. Extract 3rd and 5th row with 2nd and 4th column.

4. Create a data frame with 10 observations and 3 variables and add new rows and columns to it using 'rbind' and 'cbind' function.

5. Create a function to discretize a numeric variable into 3 quantiles and label them as low, medium, and high. Apply it on each attribute of any dataset to create a new data frame. 'discrete' with Categorical variables and the class label.

6. Create a simple scatter plot using any dataset using 'dplyr' library. Use the same data to indicate distribution densities using box whiskers.

7. Write R Programs to implement k-means clustering, k-medoids clustering and density based clustering on any datasets.

8. Write a R Program to implement decision trees using 'reading Skills' dataset.

9. Implement decision trees using any dataset using package party and 'rpart'.

10. Train SVM Model by taking any dataset.

MODEL QUESTION PAPER (Sem-end. Exam)
UG DEGREE EXAMINATIONS
SEMESTER: II
Course 2: DATA MINING CONCEPTS AND TECHNIQUES

Time: 3Hrs   Max.Marks:75

SECTION-A

Answer any FIVE of the following   5 x 5=25M

1. What is Data mining explain the architecture of Data mining.
2. Discuss issues to be considered during data integration of Data mining system with a ware house.
3. Explain Apriori method.
4. State Bayes theorem and explain Bayesian belief network.
5. Define support and confidence in association rule mining.
6. Discuss reasons to perform data pre-processing.
7. Describe data characterisation.
8. What is SVM? Explain linearly separable data.

SECTION-B

Answer ALL the following Questiopns.   5X10=50M

9. a).What is Data mining functionality ?Explain different types of Data mining functionalities with examples.

(OR)

b). Discuss in detail about the steps in knowledge discovery in data bases. Explaindifferent techniques in Data mining.

10. a). Describe the process of data cleaning and data transformation In pre processing

(OR)

b). Explain various data reduction and dimensionality reduction in the pre processing stepof Data mining.

11. a). Discuss concept description and generalised by AOI for data characterisation.

(OR)

b). Explain Frequent item set mining methods by frequent pattern mining algorithm.

12. a). Explain the algorithm for construction a decision tree from training samples.

(OR)

b). Explain Basian theorem.

13. a). Discuss Multifeed forward neural networks.

(OR)

b). What is cluster? Explain how we form clusters through K-means.

B. Sc	Semester: III	Credits:4
Course: 3	**PYTHON PROGRAMMING FOR DATA ANALYSIS**	Hrs/Wk: 4

Aim and objectives of Course:
- To be able to Program in Python
- To know and understand the data Analysis phases
- To know the usage of all libraries

Learning outcomes of Course:
- Understands and learn all basic concepts of
- PythonProgram Data Analysis methods in Python
- Get used with Python Programming environments

UNIT I:
What is Data Analysis? Differences between Data Analysis and Analytics, What is Python, Why Python for Data Analysis? What is Library, Essential Python Libraries. Python Language basics, I Python and Jupyter Notebook. Python Language Basics.

UNIT II:
Built-in Data Structures, Functions, Files and Operating System. **NumPy Basics:** Arrays and Vectorized Computation, The Numpynd array, Universal Functions, Array-Oriented Programming with Arrays, File Input and Output with Arrays, Linear Algebra, Pseudorandom Number Generation.

UNIT III:
Getting Started with Pandas: Introduction to Pandas Data Structures, Essential Functionality, Summarizing and Computing Descriptive Statistics
Data Loading, Storage and File Formats: Reading and Writing Data in Text Format, Binary Data Formats, Interacting with Web APIs, Interacting with Databases.

UNIT IV:
Data Cleaning and Preparation: Handling Missing Data, Data Transformation, String Manipulation.
Data Wrangling: Join, Combine and Reshape: Hierarchical Indexing, Combining and Merging Datasets, Reshaping and Pivoting.

UNIT V:
Introduction to Modeling Libraries in Python: Interfacing between pandas and Model code, Creating model descriptions with Patsy, Introduction to stats models.
Plotting and Visualization: A brief matplotlib API Primer, Plotting with Pandas and Seaborn, Other Python visualization tools.

TEXT BOOKS:
1. Wes McKinney "Python for Data Analysis" O'reilly Publications Second edition
2. Charles R Suverance "Python for Everybody" Exploring data using Python 3

REFERENCE BOOKS:
3. John Zelle Michael Smith Python Programming, second edition 2010

Co-curricular Activities

Take up any application which involves the python coding.Example Case studies/Simulators:

(https://knightlab.northwestern.edu/2014/06/05/five-mini-programming-projects-for-the-

python-beginner/)

1. Dice Rolling Simulator

2. Guess the number

3. Text based adventure game

4. Hangman

Continuous assessment:

Let the students be tested in the following questions from each unit

1. What is Data Analysis. List out the differences between data analysis and data analytics

2. What is Python? Explain Python basics

3. Explain NumPy Basics

4. What is Data Loading. Explain Pandas Data Structures

5. What is Data Cleaning. Explain different phases in it

6. Explain Plotting and Visualization in Python

B. Sc	Semester: III	Credits:1
Course: 3	PYTHON PROGRAMMING LAB	Hrs/Wk: 2

PYTHON PROGRAMMING LAB

1. Use matplotlib and plot an inline in Jupyter.

2. Implement commands of Python Language basics

3. Create Tuples, Lists and illustrate slicing conventions.

4. Create built-in sequence functions.

5. Clean the elements and transform them by using List, Set and Dict Comprehensions.

6. Create a functional pattern to modify the strings in a high level.

7. Write a Python Program to cast a string to a floating-point number but fails with Value Error on improper inputs using Errors and Exception handling.

8. Create an n array object and use operations on it.

9. Use arithmetic operations on Numpy Arrays

10. Using Numpy array perform Indexing and Slicing Boolean Indexing, FancyIndexing operations

11. Create an image plot from a two-dimensional array of function values.

12. Implement some basic array statistical methods (sum, mean, std, var, min,max, argmin, argmax, cumsum andcumprod) and sorting with sort method.

13. Implement numpy.random functions.

14. Plot the first 100 values on the values obtained from random walks.

15. Create a data frame using pandas and retrieve the rows and columns in it byperforming some indexing options and transpose it.

16. Implement the methods of descriptive and summary statistics

17. Load and write the data from and to different file formats including WebAPIs.

18. Implement the data Cleaning and Filtering methods(Use NA handlingmethods, fillna function arguments)

19. Transform the data using function or mapping

20. Rearrange the data using unstack method of hierarchical Indexing

21. Implement the methods that summarize the statistics by levels.

22. Use different Join types with how argument and merge data with keys and multiple keys.

MODEL QUESTION PAPER (Sem-end. Exam)
UG DEGREE EXAMINATIONS
SEMESTER: III
Course 3: PYTHON PROGRAMMING FOR DATA ANALYSIS

<u>Time: 3Hrs</u>   **Max.Marks:75**

SECTION-A
Answer any FIVE of the following   **5 x 5=25M**

1) What is Data analysis and Data analytics, What are the differences between them.

2) Explain different built in data structures in python

3) How pandas are used in Python.

4) Explain Reshaping and pivoting.

5) What is Pandas.

6) Explain Universal functions

7) Explain interactive with data base concepts.

8) Explain different python visualization tools.

SECTION-B
Answer ALL the following Questions.   **5X10=50M**

9) a) Why python is used for data analysis, What is meant by library and explain at least six python libraries.

(OR)

b) What are python and Jupiter note book. Why they are used.

10) a) What is meant by numpy. Why and how numpy is used in python. Explain with in an

example.

1)**(OR)**

b) Write a programme to generate a pseudo random number in python and write a programme find out the number of elements in an array.

11) a) Explain predictive and descriptive statistics. Explain with formulas.

(OR)

b) Explain how the data is loaded, stored in different file formats in python.

12) a) What are the different data cleaning and preparation methods. Explain.

(OR)

b) Write python program on hierarchical indexing and joint and combining data.

13) a) How to create model description in python. Explain with a programme.

(OR)

b) Matplotlib is used for plotting and visualization in python using that package explain with example.

B Sc	Semester: IV	Credits: 4
Course: 4	**BIG DATA ANALYTICS USING SPARK**	Hrs/Wk: 4

Aim and objectives of Course:
- To Understand the Complete Architecture of Spark
- To know the differences between Hadoop and Spark
- To know the concepts of Spark Programming

Learning outcomes of Course:
- Students will get well knowledge of what is
- Big DataKnowledge in Spark Eco System
- Mapping of Data Analytics techniques in Spark
- Application of Spark Programming to Analytics problems

UNIT I:
Introduction to Big Data: What is Big Data-Characteristics, Data in the Warehouse and Data in Hadoop, Why is Big Data Important- When to consider Big Data Solution, Applications.
Introduction to Hadoop: Hadoop- definition, Application development in Hadoop. The building blocks of Hadoop, Name Node, Data Node, Secondary Name Node, Job Tracker and Task Tracker.

UNIT II:
Introduction to Spark: What is Apache Spark, Why Spark when Hadoop is there, Spark Features, , Spark components, Spark program flow, Spark Eco System. Differences between implementation of programs in Hadoop and Spark Programming environments.

UNIT III:
Spark Fundamentals- Using spark in action VM, Using Spark Shell and writing first spark program, Basic RDD actions and transformations.
Spark SQL-Working with Data Frames, Using SQL Commands, Saving and loading Data Frame.

UNIT IV:
Streaming in Spark- Writing spark streaming applications, Using external data sources, structured streaming.
Spark MLlib-Introduction to Machine Learning. Definition of Machine Learning, Machine Learning with Spark.

UNIT V:
Graph Representation in MapReduce: Graph Processing with Spark, Spark GraphX, GraphX features, Graph Examples, Graph algorithms-Shortest Path Algorithm.

TEXT BOOKS:
1. Understanding Big Data Analytics for Enterprise Class Hadoop and Streaming Data by Dirk deRoos, Chris Eaton, George Lapis, Paul Zikopoulos, Tom Deutsch, 1st Edition, TMH,2012.
2. Spark in Action PetarZecevic, markoBonaci Manning Publications-2016.
3. Learning Spark"Holden KarauA. Konwinskietc.,"O'reilly Publications.

REFERENCE BOOKS:
1. Hadoop in Action by Chuck Lam, MANNING Publishers.
2. Hadoop: The Definitive Guide by Tom White, 3rd Edition, O'reilly
3. Mining of massive datasets, AnandRajaraman, Jeffrey D Ullman, Wiley Publications.

Student Activities:

Take any dataset and do the following machine learning steps.(https://www.guru99.com/pyspark-tutorial.html)

1. Use basic Operations with PySpark(Spark with Python)

2. Data Pre-processing

3. Build a data processing pipeline

4. Build the classifier

5. Train and evaluate the model

6. Tune the hyper parameter

Continuous assessment:

Let the students be tested in the following questions from each unit

7. What is Big Data? Explain the characteristics of it

8. What is Spark? What are the advantages of it over Hadoop

9. Explain Spark SQL

10. Explain Spark Streaming

11. Explain Shortest Path Algorithm.

B Sc	Semester: IV	Credits: 1
Course: 4	**BIG DATA ANALYTICS USING SPARK PROGRAMMING LAB**	Hrs/Wk: 2

SPARK PROGRAMMING LAB

1. Using Python Implement the following Programs

   a) Write Program to implement arithmetic operations

   b) Write Program to find the biggest of two numbers

   c) Write a program to find the matrix multiplication

2. Install Hadoop

3. Install Spark on top of Hadoop

4. Create and Implement the transformations in RDDs

5. Create a data frame from an existing RDD using Spark Session

6. Execute a Word Count example in Spark Shell by creating RDDs.

7. Implement Spark SQL Queries in Python.

8. Write a Program to implement maximum temperature give the recordings of one year.

9. Write a Program to implement the Pie estimation

10. Write a User Defined Function to convert a given text to Uppercase.

MODEL QUESTION PAPER (Sem-end. Exam)
UG DEGREE EXAMINATIONS
SEMESTER: IV
Course 4: BIG DATA ANALYTICS USING SPARK

Time: 3Hrs   **Max.Marks:75**

SECTION-A
Answer any FIVE of the following   **5 x 5=25M**

1) What is big data. What are its characteristics?

2) Why we have to used spark when hadoop is there?

3) What are the data structures in spark . explain the concept of RDD is spark?

4) Write the applications of spark streaming

5) Explain the features of spark graphics?

6) What is meant by hadoop define.

7) What are the differences between data frames and data sets in spark?

8) Explain the concept of machine learning?

SECTION-B
Answer ALL the following Questions.   **5X10=50M**

9) a) What are the differences between the data in hadoop and in warehouse
                                   (OR)
    b) Explain the building blocks of hadoop

10) a) Explain the components of spark and program flow in spark?

                                   (OR)
    b) Explain difference between implementation of programs in hadoop and spark

     programming environment?

11) a) Explain RDD transmission and actions
                                   (OR)

    b) With spark SQL commends explain how to save and load data in data frame
12) a) Explain different extend datasources

                                   (OR)

    b) How to implement machine learning concept in spark?

13) a) Explain graphs processing with spark using map reduce

                                   (OR)

    b) Explain shortest path algorithm

B. Sc	Semester: IV	Credits: 4
Course: 5	DATA VISUALIZATION	Hrs/Wk: 4

Aim and objectives of Course:
- To know the importance of data Visualization in the world of Data Analytics and Prediction
- To know the important libraries in Tableau
- To get equipped with Tableau Tool

Learning outcomes of Course:
- Students should be able to visualize data through seven stages of data analysis process
- Should be able to do explanatory and hybrid types of data visualization
- Should be able to understand various stages of visualizing data

UNIT I:
Creating Visual Analytics with tableau desktop, connecting to your data-How to Connect to your data, What are generated Values? Knowing when to use a direct connection, Joining tables with tableau, blending different data sources in a single worksheet.

UNIT II:
Building your first Visualization- How Me works- Chart types, Text Tables, Maps, bar chart, Line charts, Area Fill charts and Pie charts, scatter plot, Bullet graph, Gantt charts, Sorting data in tableau, Enhancing Views with filters, sets groups and hierarchies.

UNIT III:
Creating calculations to enhance your data- What is aggregation, what are calculated values and table calculations, Using the calculation dialog box to create, Building formulas using table calculations, Using table calculation functions

UNIT IV:
Using maps to improve insights-Create a Standard Map View, Plotting your own locations on a map, Replace Tableau's standard maps, Shaping data to enable Point-to-Point mapping.

UNIT V:
Developing an Adhoc analysis environment- generating new data with forecasts, providing self evidence adhoc analysis with parameters, Editing views in tableau Server.

TEXT BOOKS:
1. Tableau your data-Daniel G. Murray and the Inter works BI team, Wiley Publications
2. Tableau Data Visualizaton Cookbook, AshutoshNandeshwar, PACKT publishing.
3. Storytelling with Data: A Data Visualization Guide for Business Professionals by Cole NussbaumerKnaflic (2014)
4. ggplot2: Elegant Graphics for Data Analysis by Hadley Wickham (2009)

REFERENCE BOOKS:
5. Designing Data Visualizations: Representing Informational Relationships by Noah Iliinsky, Julie Steele (2011)
6. Alexandru C. Telea – "Data Visualization principles and practice" Second Edition, CRC Publications
7. Joshua N. Milligin–" Learning Tableau -2019" – Third Edition- Packt publications

Student Activity
Create a sample super store data set and visualize the following requirements

General Requirements
1. Dashboard size is 1250px wide by 750px tall.
2. Prefer using containers
3. The dashboard has a total of 5 containers (no more, no less)
4. The Filter Pane
5. Each filter has some padding

Charts Pane Requirement
1. All 3 charts must be in one vertical container
2. Do proper formatting
3. Each chart has some padding between them and other objects
4. Each chart has a grey border, slightly darker than the Pane background color.
5. The Pane under the Title has a border

Business Requirements
1. Show four filters- Category, Sub-Category, Region, and Segment. These filters should have only relevant values.
2. The dashboard should have the title "Executive sales"
3. The first chart should have the title "YTS KPIs" and should show the following-
   Total Discount
   Overall Profit
   Total Quantity and
   Total Sales
4. The second graph should have the title as "Sales" and should show monthly sales per year. Make sure it is an area chart with proper formatting.
5. The third graph should the title as "Profit" and should show monthly profit per year. Make sure it is an area chart with proper formatting.

Continuous assessment:
Let the students be tested in the following questions from each unit
10.   What are generated values? Join tables using Tableau
11.   Create any visualization charts using Chart types, Text Tables, Maps, bar chart, Line charts, Area Fill charts and Pie charts, scatter plot etc.,
12.   What is aggregation, what are calculated values and table calculations?
13.   Using Standard Map View, Plot your own locations on a map
14.   Develop an Adhoc analysis environment.

B. Sc	Semester: IV	Credits: 1
Course: 5	**DATA VISUALIZATION LAB**	Hrs/Wk: 2

DATA VISUALIZATION LAB USING TABLEAU

1. Connect to data Sources

2. Create Univariate Charts

3. Create Bivariate and Multivariate charts

4. Create Maps

5. Calculate user-defined fields

6. Create a workbook data extract

7. Save a workbook on a Tableau server and web

8. Export images, data.

(Answer any five of the following)   5x5=25M

MODEL QUESTION PAPER (Sem-end. Exam)
UG DEGREE EXAMINATIONS
SEMESTER: IV
Course 5: DATA VISIUALISATION

<u>Time: 3Hrs</u>   <u>Max.Marks:75</u>

SECTION-A

Answer any FIVE of the following   **5 x 5=25M**

1. Explain creating visual analytics with tableau desktop.

2. Discuss bar chart ,line chart, area fill and pie chart with examples.

3. What are calculated values and table calculations.

4. Explain how do you plot your own locations on a map.

5. How views are edited in tableau server.

6. What are generated values? Discuss

7. What is the usage of Gantt charts ? Explain with examples

8. Discuss table calculation functions

SECTION-B

Answer ALL the following Questions.   **5X10=50M**

9. a) Explain how to blend different data sources in a single work sheet

(OR)

b) Discuss how different tables are joined with tableau.

10. a) Discuss how to work with filters to enhance views

(OR)

b) What are different set groups and hierarchies in visualization.

11. a) What is aggregation explain how dialogue box is created using calculations.

(OR)

b) Discuss how formulas are build using table calculations

12. a) Discuss how to create a standard map view with an example

(OR)

13. b) Explain how data shaping is done to enable point to point mapping13.How self evidence ad-hoc analyses is provided with parameters.

(OR)

b) Explain methods or generating new data with fore cast.

B. Sc	Semester – V(Skill Enhancement Course- Elective)	Credits:4
Course :6A	Data Analytics with Tableau	Hrs/Wk:4

Learning Outcomes

Students at the successful completion of the course will be able to:
1. Understand Big Data and its usage
2. Identify various Data Quality and Preprocessing methods
3. Learn different Clustering techniques and Frequent Pattern Mining
4. Understand Regression, Classification and additional Predictive Methods

Syllabus: *(Total Hours: 90 including Teaching, Lab and internal exams, etc.)*

UNIT I:
Introduction to Data Analytics: Big Data and Data Science, Big Data Architectures, A Short Taxonomy of Data Analytics, Examples of Data Use, History on Methodologies for Data Analytics. Descriptive Statistics: Scale Types, Descriptive Univariate Analysis, Descriptive Bivariate Analysis.

UNIT II:
Descriptive Multivariate Analysis: Multivariate Frequencies, Multivariate Data Visualization, Multivariate Statistics, Infographics and Word Clouds Data Quality and Preprocessing: Data Quality, converting to a Different Scale Type, Converting to a Different Scale, Data Transformation, Dimensionality Reduction.

UNIT III:
Clustering: Distance Measures, Clustering Validation, Clustering Techniques.
Frequent Pattern Mining: Frequent Itemsets, Association Rules, Behind Support and Confidence, Other Types of Pattern.

UNIT IV:
Regression: Predictive Performance Estimation, Finding the Parameters of the Model, Technique and Model Selection.
Classification: Binary Classification, Predictive Performance Measures for Classification, Distance-based Learning Algorithms, Probabilistic Classification Algorithms.

UNIT V:
Additional Predictive Methods: Search-based Algorithms, Optimization-based Algorithms.
Advanced Predictive Topics: Ensemble Learning, Algorithm Bias, Non-binary Classification Tasks, Advanced Data Preparation Techniques for Prediction.

TEXT BOOKS:
1. "A General Introduction to Data Analytics" by João Mendes Moreira, André C. P. L. F. de Carvalho, TomášHorváth, 2019 Edition, Wiley Publications.
2. "Data Analytics: Principles, Tools and Practices" by Dr. Gaurav Aroraa, ChitraLele, Dr. Munish Jindal, 2022 Edition, pbp publications
3. "Data Analytics" by Anil Maheshwari, First Edition, McGraw Hill Education

B. Sc	Semester – V (Skill Enhancement Course-Elective)	Credits:1
Course: 6A	**Data Analytics With Tableau Lab**	Hrs/Wk:2

OBJECTIVES:
- To implement Map Reduce programs for processing big data
- To realize storage of big data using H base, Mongo DB
- To analyze big data using linear models
- To Analyse big data using machine learning techniques such as SVM / Decision tree classification and clustering

LIST OF EXPERIMENTS

Hadoop

1. Install, configure and run Hadoop and HDFS

2. Implement word count / frequency programs using MapReduce

3. Implement an MR program that processes a weather dataset

R

1. Implement Linear and logistic Regression

2. Implement SVM / Decision tree classification techniques

3. Implement clustering techniques

4. Visualize data using any plotting framework

5. Implement an application that stores big data in Hbase / MongoDB / Pig using Hadoop / R.

TEXT BOOKS:

1. "A General Introduction to Data Analytics" by João Mendes Moreira, André C. P. L. F. de Carvalho, TomášHorváth, 2019 Edition, Wiley Publications.

2. "Data Analytics: Principles, Tools and Practices" by Dr. Gaurav Aroraa, ChitraLele, Dr. Munish Jindal, 2022 Edition, pbp publications.

3. "Data Analytics" by Anil Maheshwari, First Edition, McGraw Hill Education

MODEL QUESTION PAPER (Sem-end. Exam)

B. Sc DEGREE EXAMINATION
SEMESTER –V (Skill Enhancement Course-Elective)
Course 6A: **Data Analytics with Tableau**

Time:3Hrs   Max.Marks:75

Section – A

Answer any FIVE of the following.   5x5=25M

1. Write about natural taxonomy that exists in data analytics.
2. What are the multivariate frequencies?
3. Write about Clustering Validation.
4. Explain about simple linear regression model.
5. Write about Random Forests.
6. Write about Two Quantitative Attributes with an example.
7. Write about missing values in the data set.
8. Explain about Eclat

SECTION-B

Answers ALL the following Questions.   5X10=50M

9. a) Explain about The CRISP-DM Methodology.

(OR)

b) Explain about Univariate Data Visualization.

10. a) Explain about Multivariate Data Visualization.

(OR)

b) Explain about Converting data in a scale to another scale of the same type.

11. a) Finite about Distance Measures for Non-conventional Attributes.

(OR)

b) Explain about Apriori – a Join-based Method.

12. a) Explain about Predictive Performance Measures for Regression.

(OR)

b) Explain about binary classification.

13. a) Explain about back propagation in MLP.

(OR)

b) Explain about Algorithm Bias.

B. Sc	Semester – V (Skill Enhancement Course- Elective)	Credits:4
Course:7A	AI Concepts and Techniques with Python	Hrs/Wk:4

Aim and objectives of Course :
* This course provides an introduction to the fundamentals of artificial intelligence. Demonstrates fundamental understanding of the history of artificial intelligence (AI) and its foundations.
* Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning.
* Demonstrates awareness and a fundamental understanding of various applications of AI techniques in intelligent Agents.

Learning outcomes of Course:
* List the objectives and functions of modern Artificial Intelligence.
* Categorize an AI problem based on its characteristics and its constraints.
* Understand and implement search algorithms.
* Learn how to analyze the complexity of a given problem and come with suitable optimizations.
* Demonstrate practical experience by implementing and experimenting with the learnt algorithms.

Syllabus: (Total Hours: 90 including Teaching, Lab and internal exams, etc.)

UNIT I:
Problems and Search: What is Artificial Intelligence, The AI Problems, and Underlying Assumption, what is an AI Technique.
Problems, Problems Spaces, and Search: Defining the problem as a state space search, production systems, problems characteristics, issues in the design of search programs.

UNIT II:
Heuristic Search Techniques: Generate-and-test, Hill Climbing, Best-First Search, Problem Reduction, Constraint Satisfaction, Means-Ends Analysis

UNIT III:
Knowledge Representation Issues: Representations and Mapping, Approaches to Knowledge Representation, The frame problem. Using Predicate Logic: Representing simple facts in logic, Representing Isa relationships, predicates, Resolution

UNIT IV:
Representing Knowledge using Rules: Procedural Vs Declarative knowledge, Logic Programming, Forward Vs Backward Reasoning, Matching, Control Knowledge

UNIT V:
Symbolic Reasoning under Uncertainty: Introduction to Non-monotonic Reasoning, Logics for Non-monotonic Reasoning, Implementation issues, Augmenting a Problem solver, implementation: DFS, BFS.
Statistical Reasoning: Probability and Bayes Theorem, Certainty Factors and Rule-Based Systems, Bayesian Networks, Dempster-Shafer Theory.

TEXT BOOK:
1. Artificial Intelligence, Second Edition, Elaine Rich, Kevin Knight, Tata McGraw-Hill Edition.

REFERENCES BOOK:
1. Russell, S., &Norvig, P. Artificial intelligence: a modern approach. Third Edition. Pearson new International edition. 2014.

B. Sc	**Semester – V (Skill Enhancement Course-Elective)**	**Credits:1**
Course: 7A	**AI Concepts and Techniques with Python Lab**	**Hrs/Wk:2**

Details of Lab/Practical/Experiments/Tutorials syllabus:

1. Write a Program to Implement Breadth First Search using Python.

2. Write a Program to Implement Depth First Search using Python.

3. Write a Program to Implement Tic-Tac-Toe game using Python.

4. Write a Program to implement 8-Puzzle problem using Python.

5. Write a Program to Implement Water-Jug problem using Python.

6. Write a Program to Implement Travelling Salesman problem using Python.

7. Write a Program to Implement Towers of Hanoi problem using Python.

8. Write a Program to implement 8-Queens problem using Python.

MODEL QUESTION PAPER (Sem-end. Exam)

B. Sc DEGREE EXAMINATION
SEMESTER –V (Skill Enhancement Course-Elective)
Course 7A: **AI Concepts and Techniques with Python**

<u>Time:3Hrs</u>   <u>Max.Marks:75</u>

SECTION-A

Answer any FIVE of the following   **5x5=25M**

1. What is AI Technique?

2. Define State space search

3. Explain Generate and test

4. What is heuristic search technique?

5. What is resolution?

6. Explain Uncertainty implementation issues

7. Explain Bayes Theorem

8. Define Dempster-Shafer Theory.

SECTION-B

Answers ALL the Following Questions.   **5X10=50M**

9. a) Define Artificial Intelligence. Applications and characteristics of AI.
                                   (OR)
    b) Explain the state space representation of Water – Jug problem.

10. a) Define Heuristic search? What are the advantages of Heuristic search?
                                   (OR)
    b) Describe the Hill climbing.

11. a) What is predicate logic? Explain the predicate logic representation with reference to
       suitable example.
                                   (OR)
    b) Describe the approaches to Knowledge Representation and explain the Issues in
       Knowledge Representation

12. a) Explain Procedural Vs Declarative knowledge
                                   (OR)
    b) Explain the Issues in Knowledge Representation. Write notes on control
        knowledge.

13. a) Show how to implement Non-monotonic reasoning using JTMS in medical
       diagnosis. Consider rules such as "If you have a runny nose, assume you have a
       cold unless it is Allergy season."
                                   (OR)
    b) Explain logics for Non-monotonic reasoning and discuss the implementation
       issues.

B. Sc	Semester – V (Skill Enhancement Course- Elective)	Credits:4
Course:6B	**Supervised ML with Python**	Hrs/Wk:4

Aim and objectives of Course:
- The purpose of this course is to serve as an introduction to Supervised machine learning with Python.
- We will explore several classifications, regression algorithms and see how they can help us perform a variety of Supervised machine learning tasks.

Learning outcomes of Course:
- Able to understand introduction to machine learning concepts.
- Able to Loading datasets, build models and model persistence.
- Understand Feature extraction from data sets.
- Able to do Regression & Classification.
- Able to compare SVM with other classifiers.

Syllabus: *(Total Hours: 90 including Teaching, Lab and internal exams, etc.)*

UNIT I:
Machine Learning Basics: What is machine learning? Key terminology, Key tasks of machine learning, How to choose right algorithm, steps in developing a machine learning, why python? Getting started with Numpy library
Classifying with k-Nearest Neighbors: The k-Nearest Neighbors classification algorithm, Parsing and importing data from a text file, Creating scatter plots with Matplotlib, Normalizing numeric values

UNIT II:
Splitting datasets one feature at a time-Decision trees: Introducing decision trees, measuring consistency in a dataset, using recursion to construct a decision tree, plotting trees in Matplotlib

UNIT III:
Classifying with probability theory-Naïve Bayes: Using probability distributions for classification, learning the naïve Bayes classifier, Parsing data from RSS feeds, using naïve Bayes to reveal regional attitudes

UNIT IV:
Logistic regression: Classification with logistic regression and the sigmoid function, Using optimization to find the best regression coefficients, the gradient descent optimization algorithm, Dealing with missing values in the our data

UNIT V:
Support vector machines: Introducing support vector machines, using the SMO algorithm for optimization, using kernels to "transform" data, Comparing support vector machines with other classifiers

TEXT BOOK:
1. Machine learning in action, Peter Harrington by Manning publications

B. Sc	Semester – V (Skill Enhancement Course-Elective)	Credits:1
Course: 6B	Supervised ML with Python Lab	Hrs/Wk:2

Details of Lab/Practical/Experiments/Tutorials syllabus:

1. Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.

2. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.

3. Write a program to demonstrate the working of the decision tree based ID3 algorithm.

4. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a CSV file.

5. Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.

6. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.

7. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.

8. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.

MODEL QUESTION PAPER (Sem-end. Exam)

B. Sc DEGREE EXAMINATION
SEMESTER –V (Skill Enhancement Course-Elective)

Course 6B: **Supervised ML with Python**

<u>Time:3Hrs</u>   <u>Max.Marks:75</u>

SECTION-A

Answer any FIVE of the following   **5x5=25M**

1. What is Machine Learning? Discuss its key terminology.

2. How to Normalize numeric values.

3. What is Decision tree? Explain.

4. Discuss how to reveal regional attributes.

5. Explain Logistic Regression

6. Define Support Vector Machine.

7. How to deal with missing values.

8. List some of the Numpy library functions.

SECTION-B

Answer ALL the following Questions.   **5X10=50M**

9.   A) Discuss the steps in developing Machine Learning.
                              (OR)
       B) Discuss k-Nearest Neighbours classification algorithm.

10. A) How to construct a decision tree.
                              (OR)
      B) What are the steps for plotting trees in Matplotlib..

11. A) What is Classification ? Discuss naïve Bayes classifier.
                              (OR)
     B) What is Parsing? How to Parse data from RSS feeds.

12. A) Discuss classification with logistic regression and the sigmoid function.
                              (OR)
     B) Discuss gradient descent optimization algorithm.

13.   A) Comparing support vector machines with other classifiers.
                              (OR)
       B) Discuss SMO algorithm for optimization.

B. Sc	Semester – V (Skill Enhancement Course- Elective)	Credits:4
Course:7B	Unsupervised ML with Python	Hrs/Wk:4

Aim and objectives of Course (Unsupervised ML with Python):
- Unsupervised Machine Learning involves finding patterns in datasets.
- The core of this course involves study of Clustering, feature extraction and optimization algorithms.
- The purpose of this course is to serve as an introduction to machine learning with Python.

Learning outcomes of Course:
- Able to do Clustering, feature extraction and optimization.
- Students will be able to understand and implement in Python algorithms of Unsupervised
- Machine Learning and apply them to real-world datasets.

Syllabus: (Total Hours: 90 including Teaching, Lab and internal exams, etc.)

UNIT I:
Unsupervised Learning: Clustering: k-means clustering algorithm, Improving cluster performance with post processing, Bisecting k-means, Example: clustering points on a map

UNIT II:
Association analysis : Apriori algorithm: Association analysis, The Apriori principle, Finding frequent item sets with the Apriori algorithm, Mining association rules from frequent item sets, uncovering patterns in congressional voting

UNIT III:
Finding frequent item sets: FP-growth –FP trees, Build FP-tree, mining frequent from an FP-tree, finding co-occurring words in a Twitter feed, mining a click stream from a news site.

UNIT IV:
Principal component analysis: Dimensionality reduction techniques, using PCA to reduce the dimensionality of semiconductor manufacturing data

UNIT V:
Singular value decomposition: Applications of the SVD, Matrix factorization, SVD in Python, Collaborative filtering–based recommendation engines, a restaurant dish recommendation engine

TEXT BOOK:

1. Machine learning in action, Peter Harrington by Manning publications

B. Sc	Semester – V (Skill Enhancement Course-Elective)	Credits:1
Course: 7B	Unsupervised ML with Python Lab	Hrs/Wk:2

Details of Lab/Practical/Experiments/Tutorials syllabus:

1. Implementation of K-Means Clustering

2. Implement the bisecting k-means clustering algorithm

3. Implement Apriori algorithm

4. Implement Association rule-generation functions

5. Implement FP-tree creation

6. Write a function to find all paths ending with a given item.

7. Implement Code to access the Twitter Python library

8. Implement the PCA algorithm

9. Write a program to find Rating estimation by using the SVD

10. Implement Image-compression functions using SVD.

MODEL QUESTION PAPER (Sem-end. Exam)

B. Sc DEGREE EXAMINATION
SEMESTER –V (Skill Enhancement Course-Elective)

Course 7B: **Unsupervised ML with Python**

<u>Time:3Hrs</u>   <u>Max.Marks:75</u>

SECTION – A

Answer any FIVE of the following Questions.   5 X 5 = 25M

1. What is Unsupervised Learning.

2. Define Clustering.

3. What is Associative analysis.

4. How to mine a click stream from a news site.

5. Explain mining frequent from an FP-tree

6. What are Dimensionality reduction techniques.

7. List Applications of the SVD.

8. Explain Matrix factorization.

SECTION – B

Answer ALL the Following Questions.   5 X 10 = 50M

9. a) Discuss k-means clustering algorithm.
               (OR)
    b) How to improve cluster performance with post processing.

10. a) Explain Apriori algorithm along with its principles.
               (OR)
    b) Discuss Mining association rules from frequent item sets.

11. a) Define Finding frequent item sets: FP-growth –FP trees, Build FP-tree
               (OR)
    b) List out steps to find co-occurring words in a Twitter feed

12. a) Discuss Principal component analysis to reduce dimensionality.
               (OR)
    b) How PCA is used to reduce the dimensionality of semiconductor manufacturing
        data

13. a) Discuss how Singular value decomposition(SVD) is implemented in Python.
               (OR)
    b) Discuss Collaborative filtering–based recommendation engines.

B. Sc	Semester – V (Skill Enhancement Course- Elective)	Credits:4
Course:6C	NLP with Python	Hrs/Wk:4

Aim and Objectives of Course:

This course introduces the fundamental concepts and techniques of natural language processing (NLP). Students will gain an in-depth understanding of the computational properties of natural languages and the commonly used algorithms for processing linguistic information. The course examines NLP models and algorithms using both the traditional symbolic and the more recent statistical approaches.

Learning outcomes of Course:

- Able to describe the fundamental concepts and techniques of natural language processing.
- Ability to distinguish among the various techniques, taking into account the assumptions, strengths, and weaknesses of each.
- Use appropriate descriptions, visualizations, and statistics to communicate the problems and their solutions.
- Analyze large volume text data generated from a range of real-world applications.
- Understanding semantics and pragmatics of English language for processing
- Writing programs in Python to carry out natural language processing

Syllabus: *(Total Hours: 90 including Teaching, Lab and internal exams, etc.)*

UNIT I:
Natural Language Processing: What is NLP? NLP and linguistics -Syntax and semantics, Pragmatics and context, Two views of NLP, Tasks and super tasks. Linguistic tools- Sentence delimiters and tokenizers, Stemmers and taggers, Noun phrase and name recognizers, Parsers and grammars.

UNIT II:
Document Retrieval: Information retrieval, Indexing technology Query processing: Boolean search, Ranked retrieval, Probabilistic retrieval, Language modeling Evaluating search engines: Evaluation studies Evaluation Metrics Relevance Judgments Total system evaluation
Attempts to enhance search performance: Table of contents Query expansion and thesauri, Query expansion from relevance information

UNIT III:
Information extraction: The Message Understanding Conferences, Regular expressions Finite automata in FASTUS: Finite State Machines and regular languages, Finite State Machines as parsers Pushdown automata and context-free grammars: Analyzing case reports
Context free grammars Parsing with a pushdown automaton, Coping with incompleteness and ambiguity

UNIT IV:
Text categorization: Overview of categorization tasks and methods , Handcrafted rule based methods Inductive learning for text classification : Naïve Bayes classifiers , Linear classifiers, Decision trees and decision lists Nearest Neighbor algorithms Combining classifiers : Data fusion, Boosting, Using multiple classifiers

UNIT V:

Text mining: What is text mining? Reference and coreference, Named entity recognition, The coreference task, Automatic summarization: Summarization tasks, Constructing summaries from document fragments, Multi-document summarization MDS) Testing of automatic summarization programs: Evaluation problems in summarization research, Building a corpus for training and testing.

TEXT BOOK:

1. Natural Language Processing for Online Applications, Text Retrieval Extraction & Categorization. Peter Jackson, Isabelle Moulinier, Thomson Legal & Regulatory.

B. Sc	Semester – V (Skill Enhancement Course-Elective)	Credits:1
Course:6C	NLP with Python Lab	Hrs/Wk:2

Details of Lab/Practical/Experiments/Tutorials syllabus:

1. INSTALLATION
2. WORD TOKENIZER
3. SENTENCE TOKENIZER
4. PARAGRAPH TOKENIZER
5. PROBABILISTIC PARSING
6. PROBABILISTIC CONTEXT FREE GRAMMER
7. LEARNING GRAMMAR
8. CONDITIONAL FREQUENCY DISTRIBUTIONS
9. LEXICAL ANALYSER
10. WORDNET
11. CONTEXT FREE GRAMMAR
12. LARGE CONTEXT FREE GRAMMAR AND PARSING
13. NAMED ENTITY RECOGNITION

TEXT BOOK:

1. Natural Language with Python, Steven Bird and Oreilly , First Edition.

MODEL QUESTION PAPER (Sem-end. Exam)

B. Sc DEGREE EXAMINATION
SEMESTER –V (Skill Enhancement Course-Elective)

Course 6C: **NLP with Python**

Time:3Hrs   Max.Marks:75

SECTION – A

Answer any FIVE of the following Questions.   5 X 5 = 25M

1. What is NLP? Explain its syntax and semantics.

2. Discuss two views of NLP.

3. Explain how information is retrieved.

4. Discuss Finite State Machines

5. Discuss Parsing with Pushdown Automata.

6. What are Handcrafted rule based methods.

7. What is Text mining? Explain.

8. Discuss Multi-document summarization (MDS).

SECTION – B

Answer ALL the Following Questions.   5 X 10 = 50M

9. a) Discuss Linguistic tools in detail.
                    (OR)
    b) What are the existing Parsers and grammars in NLP? Explain.

10. a) Explain methods in Indexing Technology Query processing.
                    (OR)
    b) Discuss in detail about Language modeling Evaluating search engines.

11. a) Finite State Machines as parsers Pushdown automata Discuss.
                    (OR)
    b) What is Parsing? Explain Context free grammars Parsing with a pushdown automaton.

12. a) Discuss Text categorization tasks and methods.
                    (OR)
    b) What is Naive Bayes algorithm? When we can use this algorithm in NLP?

13. a) Discuss the tasks involved in Automatic summarization.
                    (OR)
    b) How Testing of automatic summarization programs done explain.

B. Sc	Semester – V(Skill Enhancement Course- Elective)	Credits:4
Course:7C	Deep Learning Neural Networks With Python	Hrs/Wk:4

Aim and Objectives of Course:

Deep learning has resurged with the availability of massive datasets and affordable computing, enabling new applications in computer vision and natural language processing. This course introduces convolutional, recurrent, and other neural network architectures for deep learning. Students design, implement, and train these models to solve real-world problems**.**

Learning outcomes of Course:

- Solve problems in linear algebra, probability, optimization, and machine learning.
- The advantages and disadvantages of deep learning neural network architectures and other approaches.
- Implement deep learning models in Python using the PyTorch library and train them with real-world datasets.
- Design convolution networks for handwriting and object classification from images or video.
- Design recurrent neural networks with attention mechanisms for natural language classification, generation, and translation.

Syllabus: (Total Hours: 90 including Teaching, Lab and internal exams, etc.)

UNIT I:

Introduction to Deep Learning: Artificial intelligence, machine learning and deep learning, history of machine learning, Why deep learning? Why now?

The mathematical building blocks of neural networks: A first look at a neural network, Data representations for neural networks, The gears of neural networks: tensor operations, The engine of neural networks: gradient-based optimization.

UNIT II:

Getting started with neural networks: Anatomy of a neural network, Introduction to Keras, Setting up a deep-learning workstation, Classifying movie reviews: a binary classification Example, Classifying newswires: a multiclass classification example, Predicting house prices: a regression example.

Fundamentals of machine learning: Four branches of machine learning, Evaluating machine-learning models, Data preprocessing, feature engineering and feature learning, Overfitting and underfitting, The universal workflow of machine learning.

UNIT III:

Deep learning for computer vision: Introduction to convnets, Training a convnet from scratch on a small dataset, Using a pretrained convent, Visualizing what convnets learn.

UNIT IV:

Deep learning for text and sequences: Working with text data, Understanding recurrent neural networks, Advanced use of recurrent neural networks, Sequence processing with convnets.

UNIT V:

Advanced deep-learning best practices: Going beyond the Sequential model: theKeras functional API, Inspecting and monitoring deep-learning models using Keras callbacks and Tensor Board, Getting the most out of your models.

TEXT BOOKS:

1. "Deep Learning with Python" by Francois Chollet, , 2018 Edition, Manning Publications.
2. "Deep Learning with Python" by Nikhil Ketkar, JojoMoolayil, Second Edition, Apress.
3. "Python Deep Learning" by Ivan Vasilev, Daniel Slatter, Second Edition, Packt Publications.

B. Sc	Semester – V (Skill Enhancement Course-Elective)	Credits:1
Course:7C	**Deep Learning Neural Networks With Python Lab**	Hrs/Wk:2

Details of Lab/Practical/Experiments/Tutorials syllabus:

1. How to train a network using Keras in Python

2. Write programs to demonstrate Tensor Operations

3. Classifying movie reviews: a binary classification example

4. Predicting house prices: a regression example

5. Demonstrate Convnets by the following tasks

    i. Instantiating a Convnet

    ii. Adding classifier on top of the Convnet

    iii. Training the Convnet on MNIST images

6. Display curves of loss and accuracy during training

7. Word level one-hot encoding (Toy example)

8. Character level one-hot encoding (Toy example)

9. Using Keras for Word level one-hot encoding

10. Word level one-hot encoding with hashing trick

TEXT BOOKS:

1. "Deep Learning with Python" by Francois Chollet, , 2018 Edition, Manning Publications.

MODEL QUESTION PAPER (Sem-end. Exam)

B. Sc DEGREE EXAMINATION
SEMESTER –V (Skill Enhancement Course-Elective)

Course 7C: **Deep Learning Neural Networks with Python**

<u>Time:3Hrs</u>   <u>Max.Marks:75</u>

SECTION – A

Answer any FIVE of the following Questions.   **5 X 5 = 25M**

1. What is Machine Learning?

2. Write about the relationship between network, layers, loss function and optimizer.

3. Explain max poling operation.

4. Explain about word-level one-hot encoding with example.

5. Write about multi input model.

6. What are the tensor operations?

7. Write about feature engineering for reading the time on a clock.

8. Write how a bidirectional RNN works.

SECTION – B

Answer ALL the Following Questions.   **5 X 10 = 50M**

9. a) Explain how deep learning works in three figures.
           (OR)
    b) Explain about Data representations for neural networks.

10. a) Explain about binary classification example.
           (OR)
    b) Explain about Four branches of machine learning

11. a)Finite about Data preprocessing.
           (OR)
    b)Explain how to plot the results with an example.

12. a) Explain about LSTM and GRU layers.
           (OR)
    b) Explain about Combining CNNs and RNNs to process long sequences.

13. a) Explain about Directed acyclic graphs of layer
           (OR)
    b) Explain about Tensor Flow visualization framework.